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Growth in different population groups

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Introduction

- Overview of nine growth reference studies in which I have been involved; not "*worldwide variations* revisited"

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Introduction

- Overview of nine growth reference studies in which I have been involved; not "*worldwide variations* revisited"
- Belgium, Norway, Luxemburg, Ecuador, Algeria, Ethiopia, D.R. Congo, (Greenland), (Iceland)
- WHO/MGRS standards (2006) and WHO/NCHS reference (2007) used as a common framework for comparison

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Introduction

- What makes a *study of growth* a *growth reference study*?
- A growth reference shows how children actually grow, in a certain time, place, (sub)population (= descriptive) which implies:
  - Based on a sample that is representative for that population
  - Covers a wide age range
  - Mostly cross-sectional data
  - Relatively large sample size (precision of extreme percentiles)
  - Collection of measurements and auxiliary data
  - Result are usually disseminated as a *growth charts*

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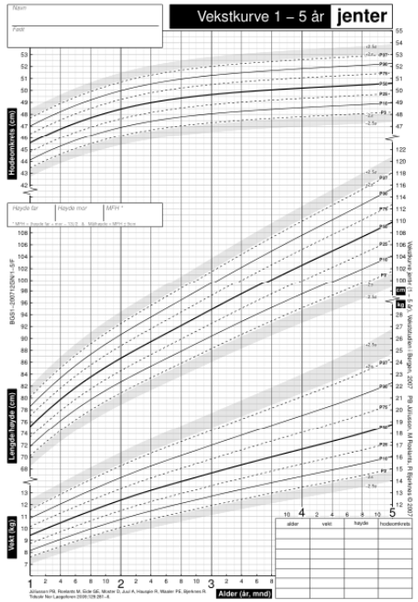

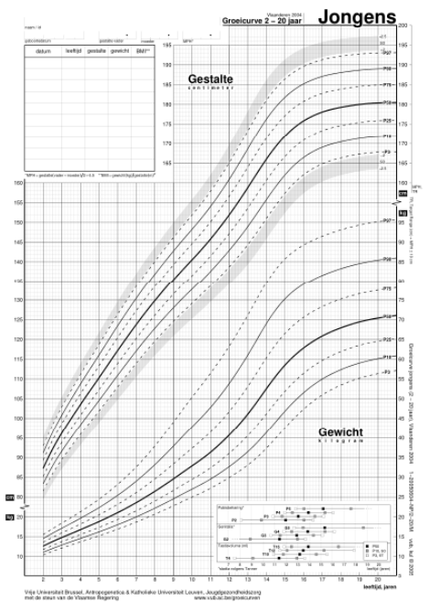

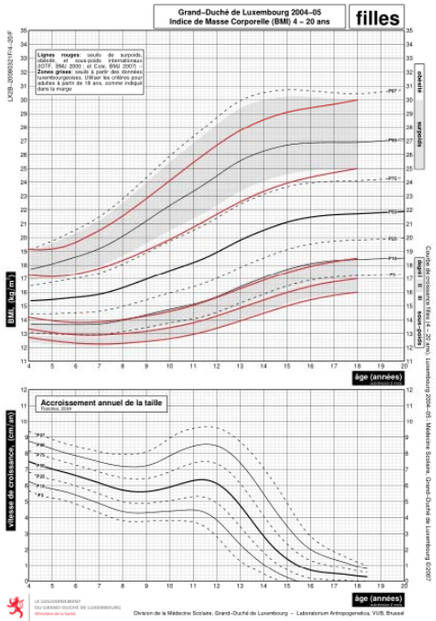

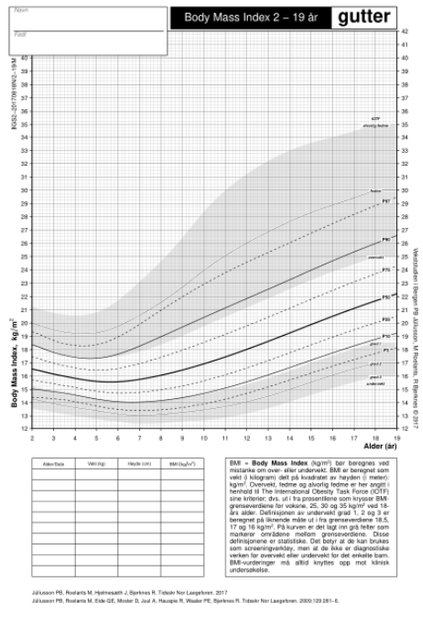

BMI – **Body Mass Index** (kg/m²) blir beregnes ved matematikk om over- eller undervekt. BMI er beregnet som vekt (kilogram) delt på kvadratet av høyden (i meter): kg/m². Overvekt, fedme og alvorlig fedme er her angitt i henhold til The International Obesity Task Force (IOTF) sine kriterier, dvs. ut i fra prosentilene som krysser BMI-grenseverdiene for voksne, 25, 30 og 35 kg/m² ved 18-års alder. Definisjonen av undervekt grad 1, 2 og 3 er beregnet på tilsvarende måte ut i fra grenseverdiene 18.5, 17 og 16 kg/m². På kurven er det lagt inn grå felter som markerer områdene mellom grenseverdiene. Disse definisjonene er statistiske. Det betyr at de kan brukes som screeningverktøy, men at de ikke er diagnostiske verken for overvekt eller undervekt for det enkelte barn. BMI-vurderinger må alltid knyttes opp mot klinisk undersøkelse.

Juliusson PB, Roelants M, Hjelmesæth J, Bjerknes R. Tidsskr Nor Laegeforen. 2017
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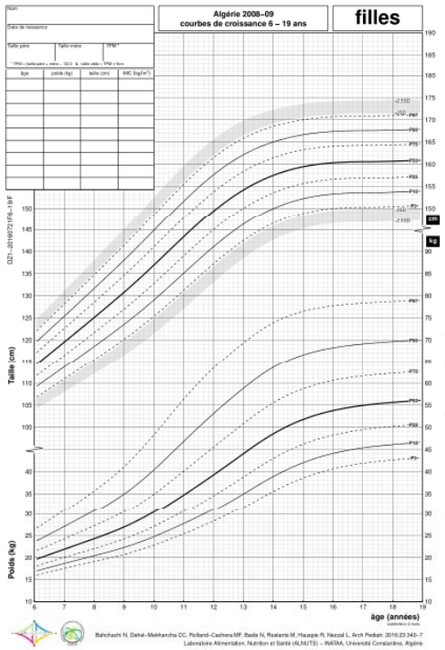

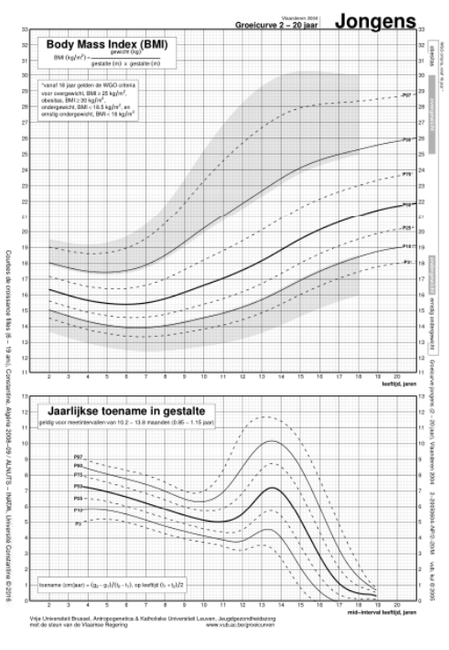

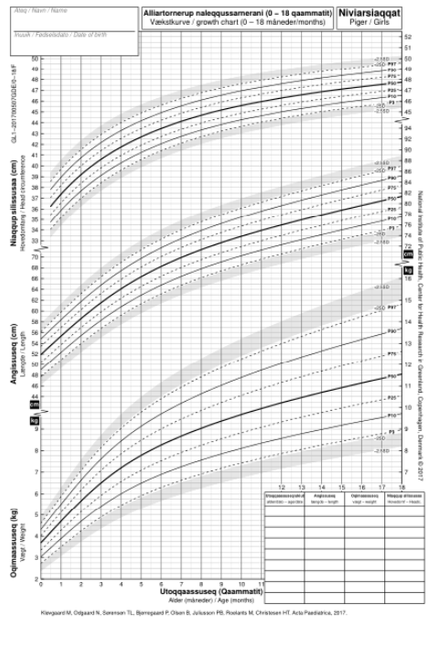

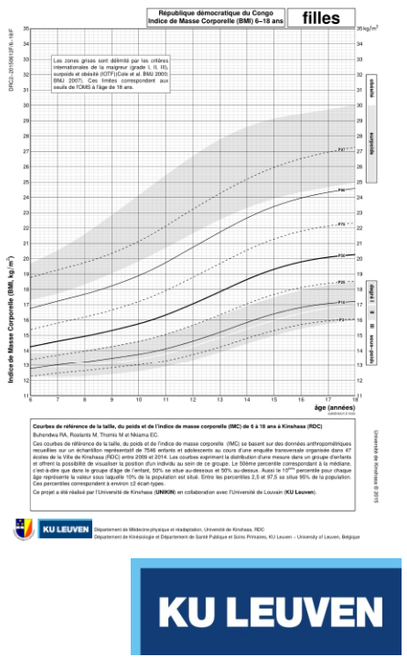

Courbes de référence de la taille, du poids et de l'indice de masse corporelle (IMC) de 6 à 18 ans à Kinshasa (RDC)

Buhendwa RA, Roelants M, Thomis M et Nkuma EC.

Ces courbes de référence de la taille, du poids et de l'indice de masse corporelle (IMC) se basent sur des données anthropométriques recueillies sur un échantillon représentatif de 7546 enfants et adolescents au cours d'une enquête transversale organisée dans 47 écoles de la Ville de Kinshasa (RDC) entre 2008 et 2014. Les courbes expriment la distribution d'une mesure dans un groupe d'enfants et offrent la possibilité de visualiser la position d'un individu au sein de ce groupe. Le 50ème percentile correspondant à la médiane, c'est-à-dire que dans le groupe d'âge de l'enfant, 50% se situe au-dessous et 50% au-dessus. Aussi le 10ème percentile pour chaque âge représente la valeur sous laquelle 10% de la population est situé. Entre les percentiles 2.5 et 97.5 se situe 95% de la population. Ces percentiles correspondent à environ ±2 écart-types.

Ce projet a été réalisé par l'Université de Kinshasa (**UNIKIN**) en collaboration avec l'Université de Louvain (**KU Leuven**).

KU LEUVEN Département de Médecine physique et réadaptation, Université de Kinshasa, RDC.
Département de Kinésiologie et Département de Santé Publique et Soins Primaires, KU Leuven – University of Leuven, Belgique

Klevgaard M, Odgaard N, Sorensen TL, Bjerregaard P, Olsen B, Juliusson PB, Roelants M, Christesen HT. Acta Paediatrica, 2017.

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Comparing reference dataset with common framework (WHO)

1. Compare reference curves
   - Two smoothed distributions (differences real or due to smoothing?)
   - Difficult to quantify
   - Difficult to test statistical significance (N = 2)
   - Usually graphical

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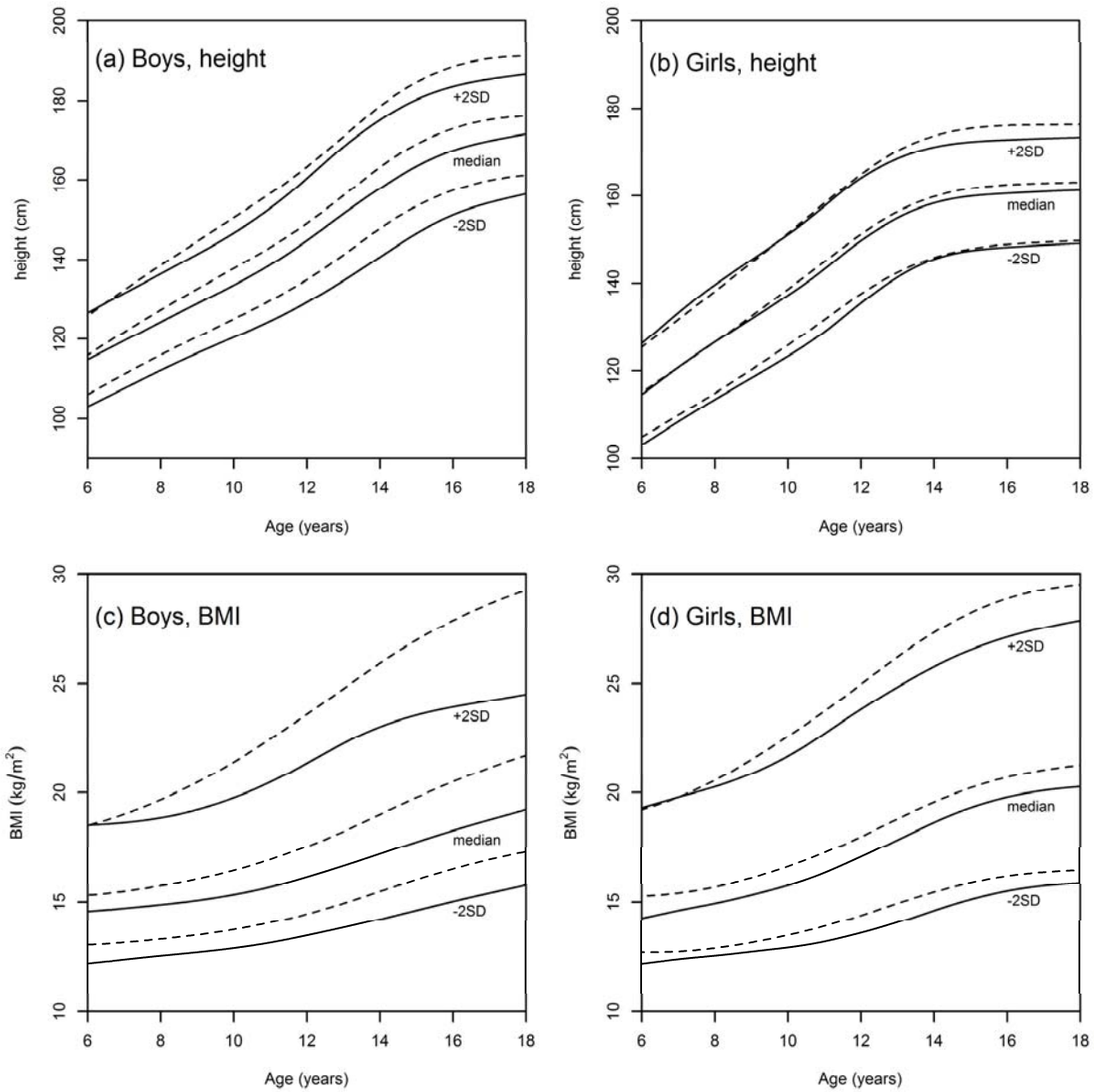

Broken line is WHO

Significant?

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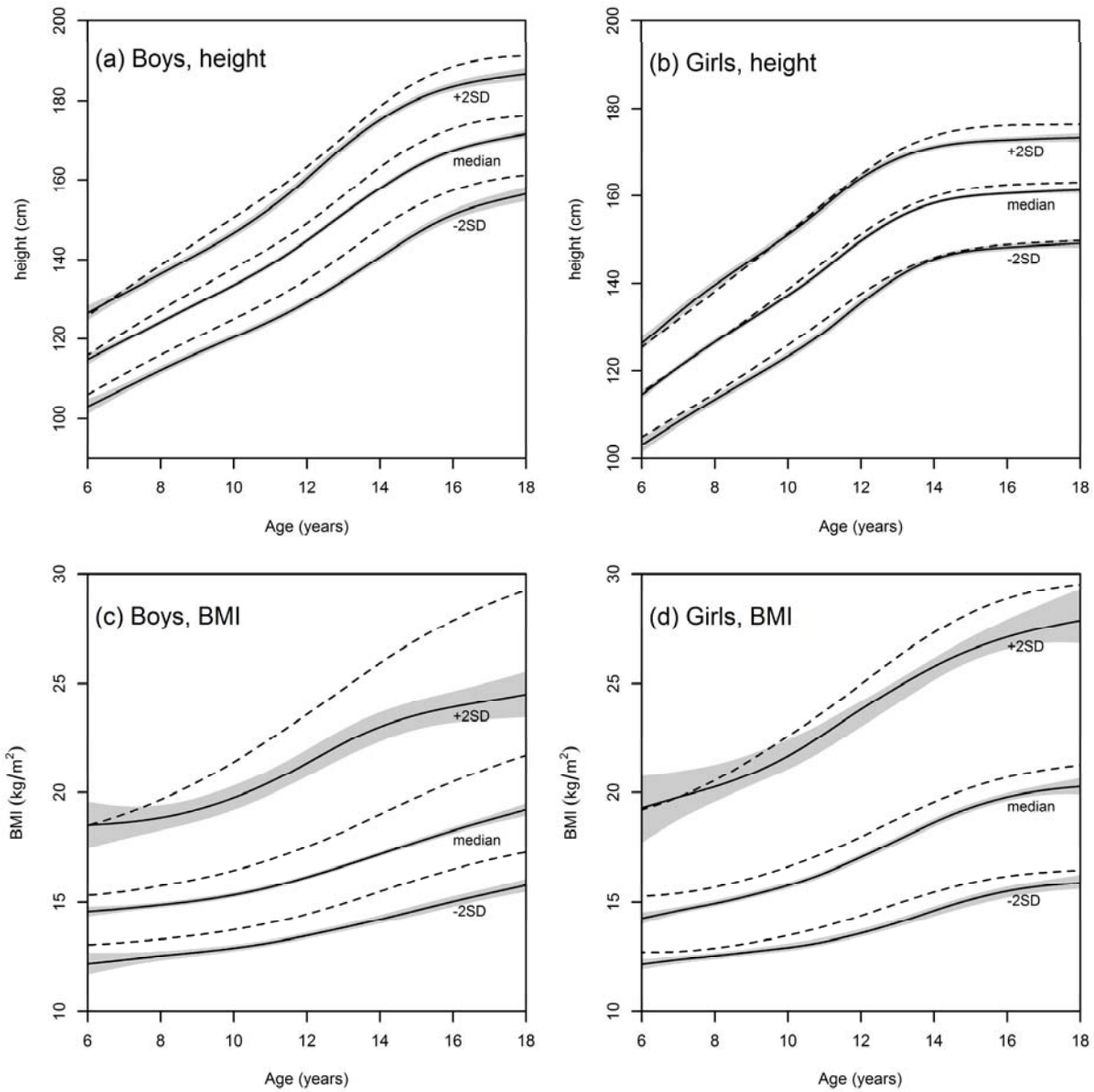

Broken line is WHO

Add ± 1SE or 95%CI (bootstrap)

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Comparing reference dataset with common framework (WHO)

1. Compare reference curves
   - Two smoothed distributions (differences real or due to smoothing?)
   - Difficult to quantify
   - Difficult to test statistical significance (N = 2)
   - Usually graphical
2. Convert to z-scores and analyse:
   - Mean = 0; Var = 1 expected (t-test for mean, χ^2 for Variance)
   - Within age groups (caveat multiple testing & statistical power)
3. Prevalence above/below cut-off percentile
   - E.g. percentage > +2 SD; < - 2 SD (2.3% expected)

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background of the growth surveys

- Belgium: Flanders Growth Study (2004);
  - Flanders region; n ≈ 16000, 0 – 21 years; BE origin
- Norway: Bergen Growth Study (BGS)(2006)
  - Bergen county; n ≈ 8000; 0 – 19 years; NO origin
- Luxemburg: School Health records (2008)
  - Whole region; n ≈ 50000; 4-20 years; mixed origin
- Ecuador: School survey (1999-2013)
  - Quito & Tulcan (andes), Santa Elena (coast), Tena (selva); n ≈ 6000; 4-19 years;
- Algeria: School survey (2008)
  - Constantine region; n ≈ 7800; 6-18 years;
- Ethiopia: hospital records (2013)
  - Addis ababa + 4 other cities; n ≈ 7800; 0 – 2 years
- Congo: School survey
  - Kinshasa region (2008); n = 7500; 6-18 years;

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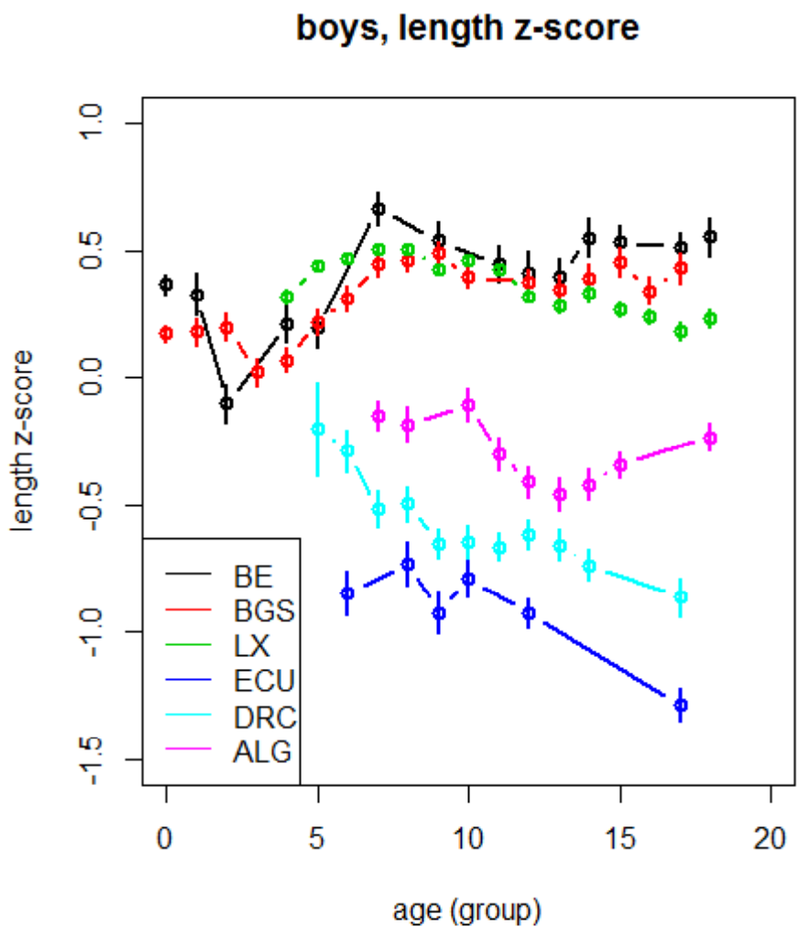
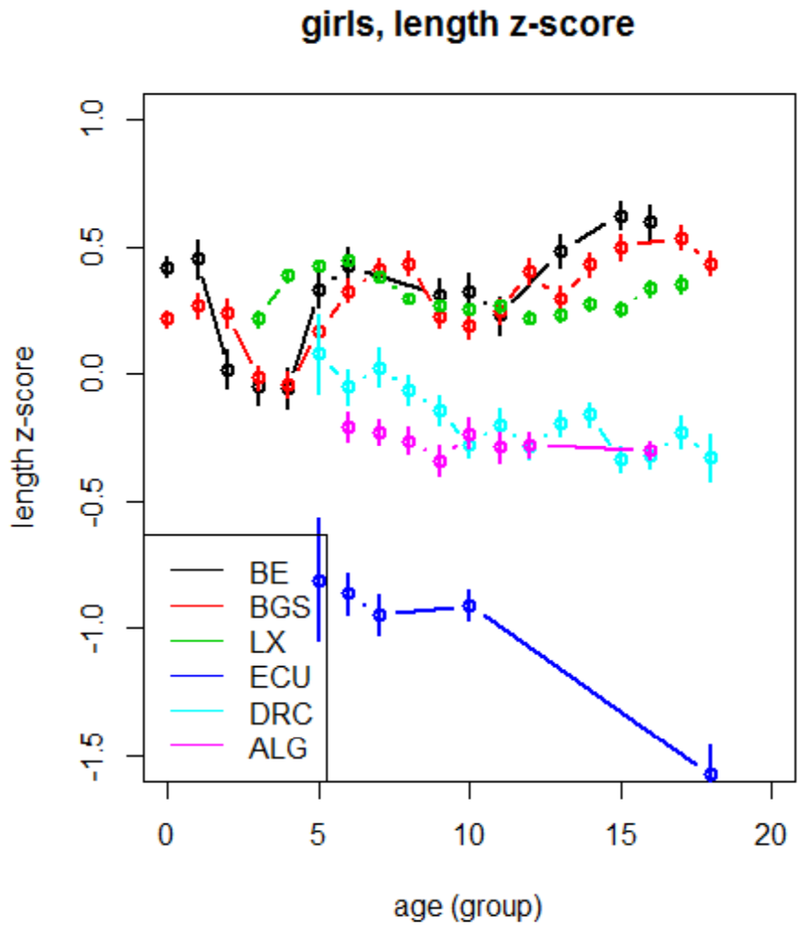
Length





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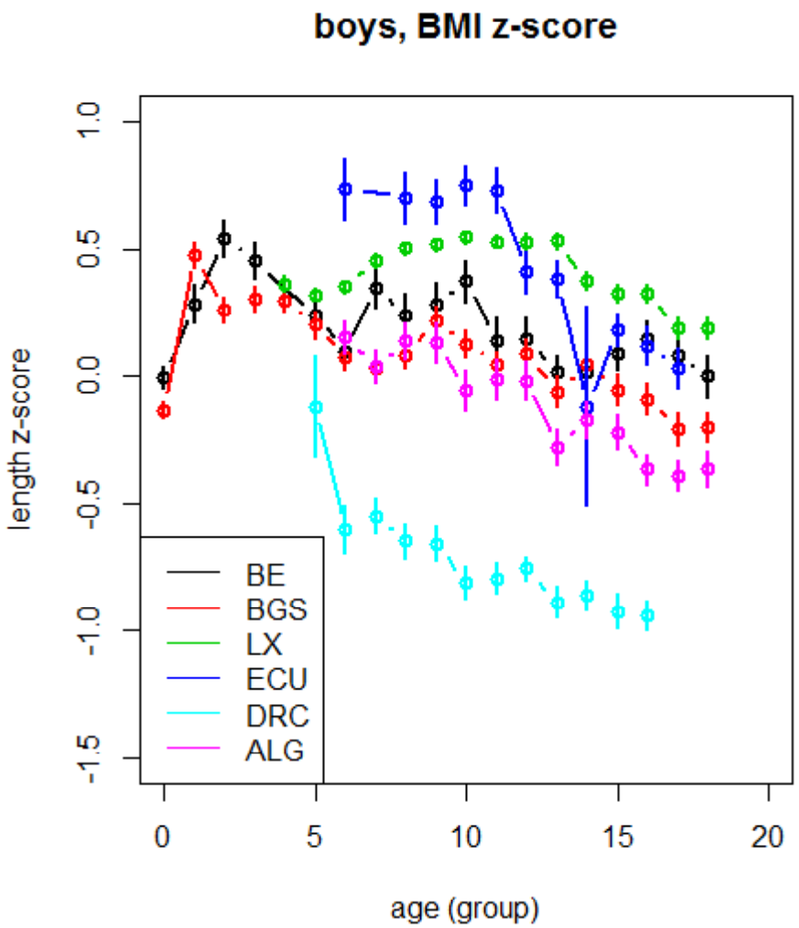
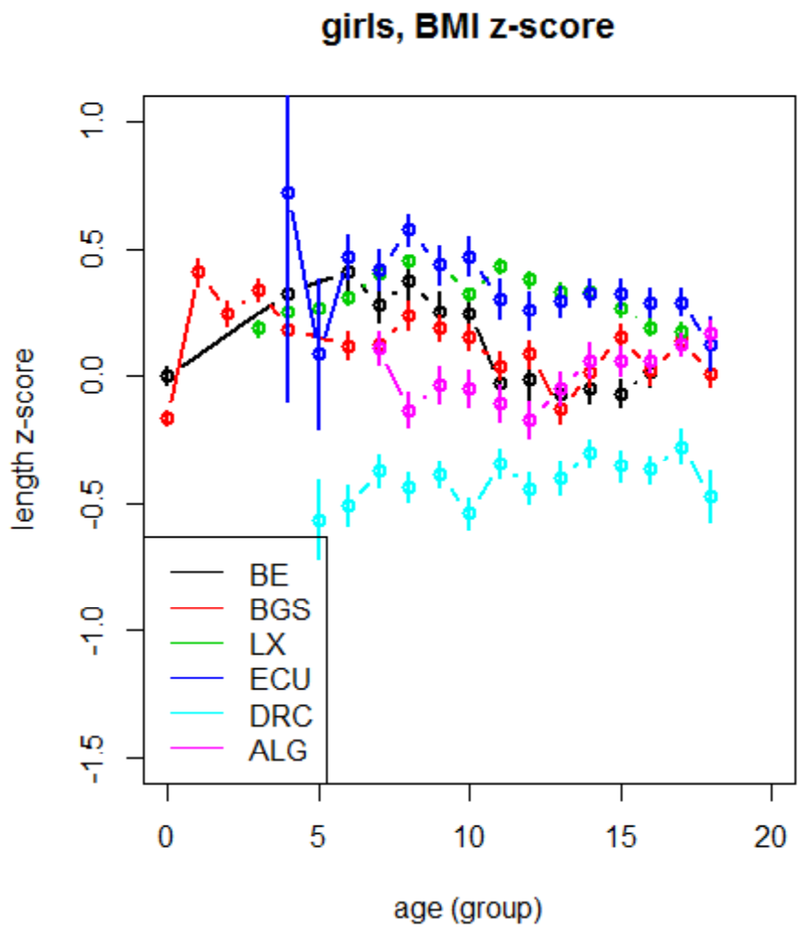
BMI





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Luxemburg: Heterogeneous data!

- Data from School Health Records (2008)
- 50% foreigner (50% Portugese);
- Single reference curve (despite marked differences);
- = political decision (but makes sense in the context of public health/SHC?);

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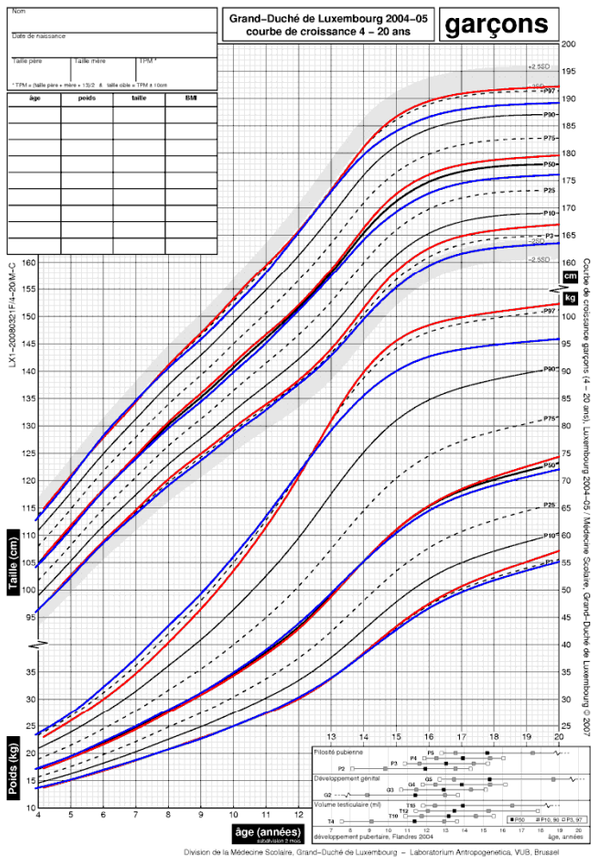
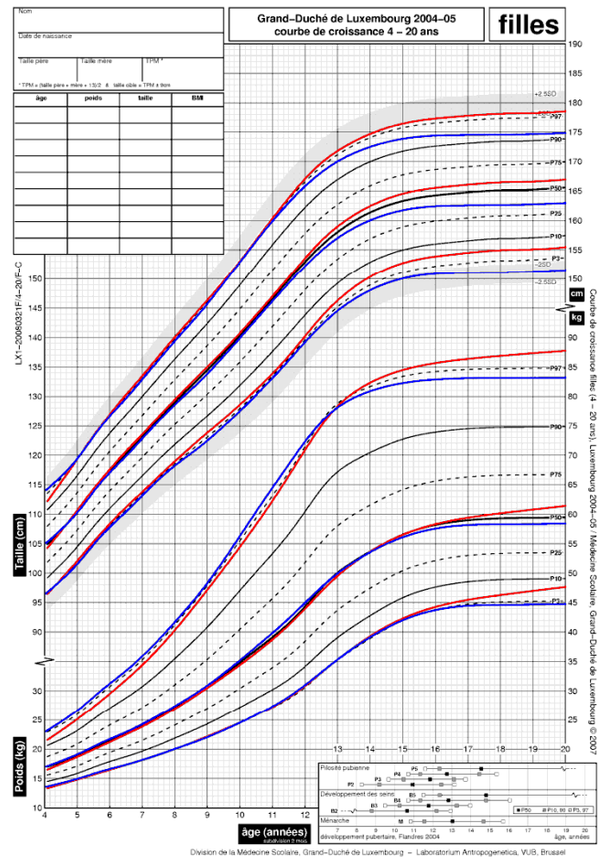
Luxemburg: Heterogeneous data!





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Ethiopia: Head Circumference

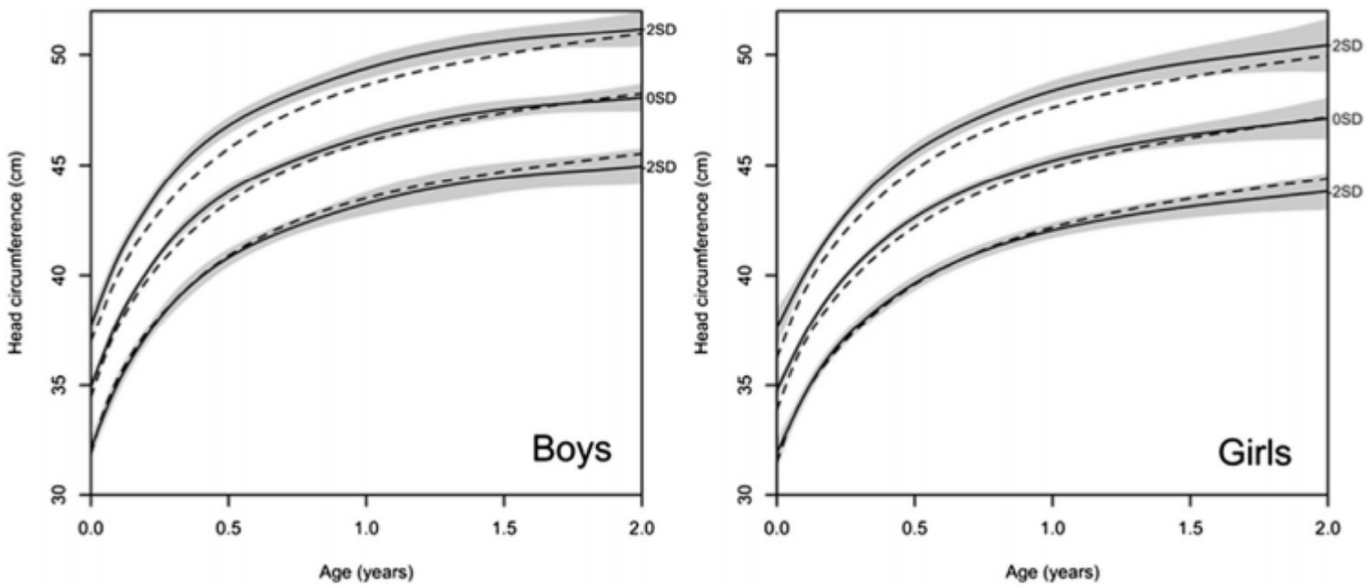

Figure 1. Reference curve for head circumference in Ethiopian infants compared with the World Health Organization (WHO) curves. Solid lines represent the median and ±2 SD lines in Ethiopian infant boys and girls; broken lines are the corresponding WHO percentiles; shaded areas are bootstrapped estimates of the 95% confidence interval around the Ethiopian median and ±2 SD lines.

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Standard vs. Reference: an auxological perspective

- A standard aims to show optimal growth, and should not (and indeed will not) match the population under study unless all (or a large majority of) children in this population also show optimal growth (following the criteria used to construct the standard).

- For most of the 20th century, positive secular trends in linear growth have been considered as an indicator of improved conditions in society (more = better).

- What if a population surpasses the standard?
  - “better” than optimal?
  - Should we slow down or diminish (linear) growth? No evidence!
  - Should we interfere with weight development when children are breastfed according to recommendations? Evidence?

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Standard vs. Reference: an auxological perspective

- WHO/MGRS has some important characteristics:
  - Universal
  - A standard based on input criteria, not (yet) on outcomes
  - Possibly highly selective regarding (growth) outcome
- The difference between the WHO/MGRS and a regular growth reference study is only in the sample selection. The data handling and statistical methods used to estimate the curves are exactly the same(LMS).
- The standards are thus a reference for children who grow up under optimal conditions.
- Belgian and Norwegian data allow to select a subsample that matches the MGRS inclusion criteria (breastfeeding, non-smoking mother, “high SES”).

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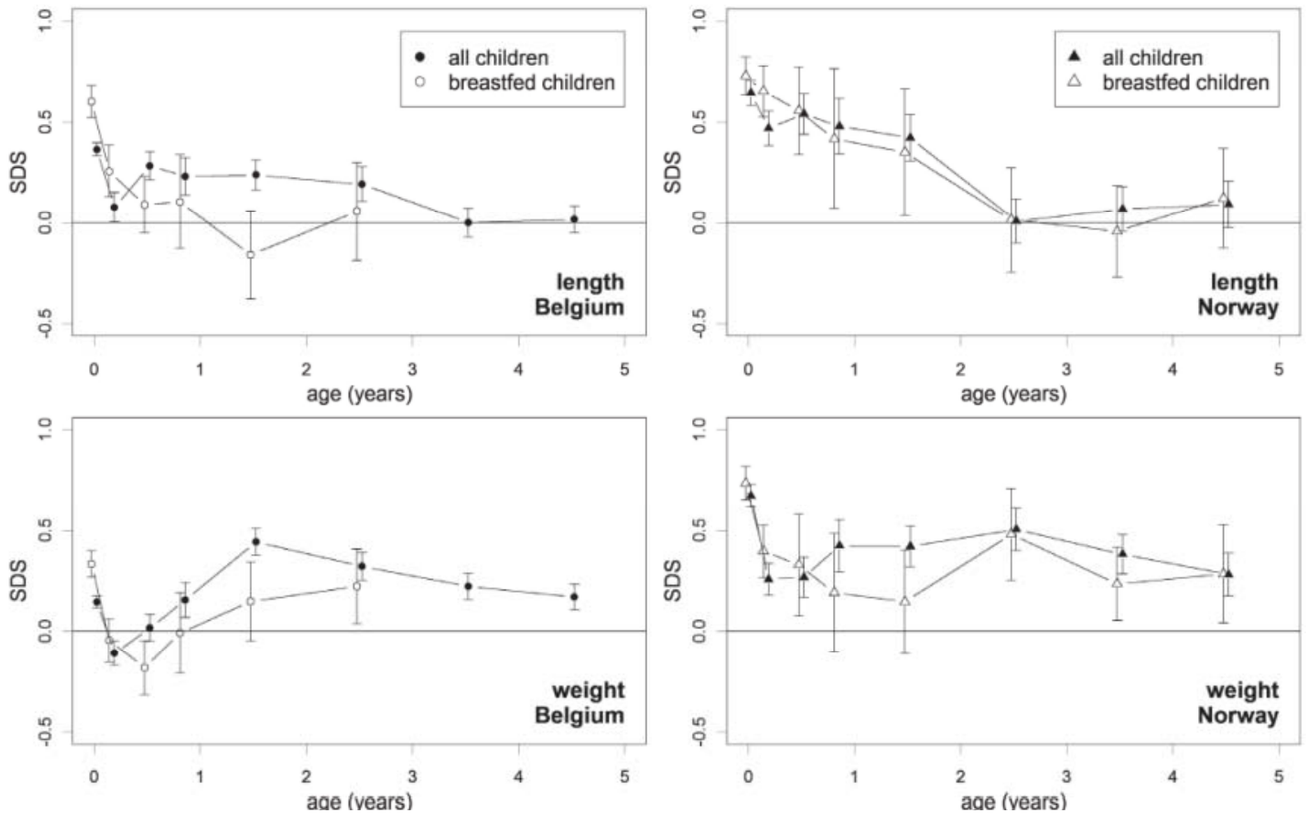

Figure 2 Mean SDS based on WHO growth standards from birth to 5 years of age for all children (open symbols) and children breastfed according to the WHO recommendations (filled symbols) in Belgium (left) and Norway (right). Observations are grouped per 4 months the first year and yearly thereafter. Error bars represent 95% confidence limits of the mean.

Arch Dis Child 2011;**96**:916–921. doi:10.1136/adc.2009.166157

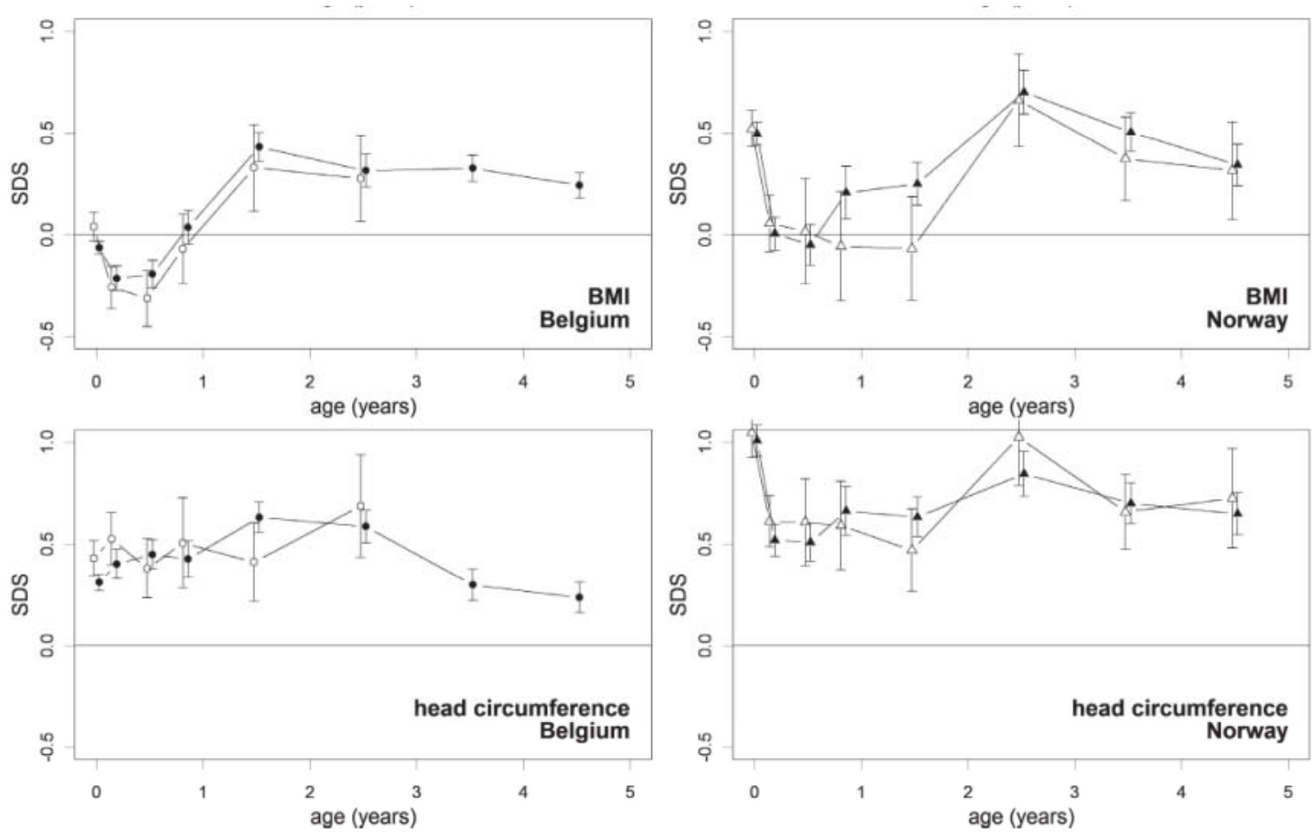

Figure 2 Mean SDS based on WHO growth standards from birth to 5 years of age for all children (open symbols) and children breastfed according to the WHO recommendations (filled symbols) in Belgium (left) and Norway (right). Observations are grouped per 4 months the first year and yearly thereafter. Error bars represent 95% confidence limits of the mean.

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Conclusions

- Belgian, Norwegian and Luxemburg (“northern European cluster”) fairly comparable o each other, and above WHO/NCHS reference;
- Algeria, Ecuador and Congo are below this reference for height, but not BMI!
- “Selection criteria matched” groups of Belgian and Norwegian children do not match the WHO/MGRS growth standards.

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ANNALS OF HUMAN BIOLOGY, 2017
https://doi.org/10.1080/03014460.2017.1389335

OBITUARY

Roland Hauspie (April 8, 1948–April 25, 2017)

Professor Roland Hauspie, former co-editor of the Annals of Human Biology, died on April 25th 2017, shortly after his 69th birthday. He was a highly regarded human biologist, specialised in the field of human growth and development, scientific standards. The leading figures in this unofficial club included Frank Falkner, Alex Roche, Darrel Bock, Francis Johnston and Bob Malina from North America; Jim Tanner, Reg Whitehouse, Bill Marshall, Harvey Goldstein, Michael Healy (all UK), Charles Susanne, Marcel Graffar (Belgium), Peta Karlberg (Sweden), Andrea Prader, Theo Gasser, David Thissen, Luciano Molinari (Switzerland), Zev Laron (Israel), Birte Prahl-Andersen, Maggie Roede, Hans van Wieringen (The Netherlands) and Olga Neyzi (Turkey). This group met every two years at the Centre International de l'Enfance in Paris to discuss their findings and share the advances in the field. The audience for these meetings were the young researchers and graduate students who were to form the second generation of Auxologists.

Roland Hauspie was to become a distinguished member of that second generation of modern Auxologists, trained not just in the collection of research quality data but in the importance of appropriate data analysis. His cohort of the same or similar ages included Noël Cameron and Mike Preece in the UK; Linda Adair, Cameron Chumlea, John Himes, Michelle Lampl, Laurence Schell and Babette Zemel in the USA; and Johan Karlberg and John Taranger from Sweden. What this class had in common, in addition to tuition from an exceptional generation of Human Biologists, Anthropologists and Paediatricians who developed Auxology after WWII, was their ability to exploit the newly available computing power to analyse growth data, in a fraction of the time it had taken their predecessors, using sophisticated ana-