FREQUENTLY ASKED QUESTIONS
CANADIAN PEDIATRIC ENDOCRINE GROUP (CPEG)
GROWTH CHARTS:
offered at http://cpeg-gcep.net

1) Why are there discontinuities in the curves at 5 and 10 years?

Below age 5 tears, WHO standard curves are based on data collected by the WHO multicenter growth reference study (MGRS) from 8 international centers (birth-71 months). Reference curves for school-aged and adolescent children (5-19 years of age) are based on core data from the US National Center for Health Statistics (1-24 years) merged with data from the WHO MGRS (18-71 months). These two datasets create a discontinuity at age 5 years in the original WHO analysis.

One will notice a second discontinuity in the weight-for-age curve at age 10 (especially for girls). For the smoothed weight-for-age centiles for children 5-10 years of age, the WHO reference curves are based on core data from the US National Center for Health Statistics (NCHS, n=22917, ages 1-24 years). To smooth the transition between datasets, these were merged with data from the WHO Multicenter Growth Reference Study (MGRS, n=8306, ages 18-71 months), which tend to pull the North American centile curves downward. Since the MGRS is not in the public domain, only core data from the NCHS was used for the new CPEG weight-for-age reference curves (ages 10-19 years), analyzed and presented according to the standard WHO methods. The impact of the additional 8306 younger children from the MGRS on the best-fit WHO curves between 5-10 years create a second discontinuity at age 10.

2) Why another set of curves?

The WHO has produced height-for-age, BMI-for-age, and weight-for-age reference curves for school-aged and adolescent children, aged 5-19 years. Recognizing the importance of body mass index (BMI) in older children, the WHO weight-for-age curves did not extend beyond 10 years of age. While CPEG also recommends tracking body-mass-index (BMI) in all children after age 2, they recognize that many clinicians wish to track changes in weight and height concurrently. For this reason, complementary weight-for-age curves for children 10-19 years of age were generated through strict application of WHO methods to growth data on n=22917 North American children provided by the WHO.

The original WHO height, weight, and BMI for age curves have also been re-formatted to address practical concerns raised by the CPEG membership. These include additional percentile (3-10-25-50-75-90-97) and the elimination of shading that creates difficulties when curves are transmitted by fax or email. These new curves are based on the the original WHO analyses, with only minor changes in visual format.

3) What about curves for younger children (0-2 years)?

Here too, our membership was concerned about the selection of percentiles and the shading described above. CPEG has also reformatted the WHO curves for infants and younger children to address these concerns. These are currently being translated and will be available shortly.

4) What was the source of the data used to create these complementary weight-for-age curves for children 10-19 years of age?

All WHO reference curves for school-aged and adolescent children (ages 5-19 years) are based on core data from the US National Center for Health Statistics (NCHS, 1-24 years) merged with data from the WHO multicenter growth reference study (MGRS, 18-71 months). Since the MGRS is not in the public domain, only core data from NCHS were used for the new CPEG weight-for-age reference (10-19 yrs). These data (n=11507 girls, 11410 boys) were collected by the NCHS between 1963-1975 and shared with CPEG by Dr. Mercedes de Onis of the WHO.

5) What statistical methodology was used to generate the new CPEG weight-for-age curves (10-19 years)?

Great care was taken to apply the same exclusion criteria and curve-fitting methods used by the WHO and outlined in their published reports [1-3]: there were exclusions for 'outlying' heights-for-age (14 girls, 8 boys) and 'unhealthy' weights-for-height (300 girls, 321 boys), the latter defined by the WHO as weight-for-height <0.135th or > 97.7th percentiles. Smoothed centiles were based on the Box Cox Power Exponential (BCPE) model that explicitly models the time-evolution of 4 parameters i.e. μ (median), σ (coefficient of variation), ν (skew) and τ (kurtosis). Full details are available in the CPEG Statistical Methods and Models Manual, available at the CPEG website: http://cpeg-gcep.net/

6) Where do we find the raw data to produce our own electronic charts or paper charts with alternate percentiles?

To simplify life, we have compiled a collection of spreadsheet files (in comma separated variable format), which contain the LMS parameters published by the WHO for their various curves. From these 3 parameters, the formulae in the "Methods and Models Manual" can be used to calculate z-scores or percentile values for any age/ gender. In addition, the spreadsheets contain the following pre-calculated percentiles by age, which may be plotted directly: 0.1, 1, 3, 5, 10, 15, 25, 50, 75, 85, 90, 95, 97, 99, and 99.9.

Since the WHO weight-for-age curves do not extend beyond 10 years of age, the corresponding spreadsheets provide parameters and pre-calculated percentiles for ages

10-19 years, based on our re-analysis of N=22,917 North American children collected by the National Center for Health Statistics (NCHS) between 1963-1975 and shared with CPEG/GCEP by Dr. Mercedes de Onis of the WHO.

Both the spreadsheets and the methods manual are found at the CPEG/GCEP website at http://cpeg-gcep.net/

References:

[1] M. de Onis, A. W Onyango, E. Borghi, A. Siyam, C. Nishida, and J. Siekmann. Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World Health Organization, 85:660–667, 2007.

[2] WHO Multicenter Growth Reference Study Group. WHO child growth standards based on length/height, weight and age. Acta Paediatrica, Suppl 450:76–85, 2006.

[3] WHO Multicenter Growth Reference Study Group. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for- height and body mass index-for-age: Methods and development. World Health Organization Press, Geneva, 2006.