Biostatistics Group

July 28, 2015

Atul Sharma MD, MSc, FRCPC

Biostatistics Group, George and Fay Yee Center for Health Care Innovation

Department of Pediatrics and Child Health, University of Manitoba
The **Biostatistics Group** is one of three expert groups within the **Data Science Platform** in the **George and Fay Yee Centre for Healthcare Innovation**. The two others groups are: Clinical Research Data and Bioinformatics/Computational Biology

- Platform Director: Lisa Lix PhD

**Biostatistics Group Members:**

- Group Leader: Depeng Jiang PhD
- Rasheeda Rabbani PhD
- Brenden Dufault MSc
- Atul Sharma MD, MSc, FRCPC
- Kristine Kroecker, BSc (Trainee)
Our Mission:

• Support for clinical investigators and patient-oriented clinical research (consulting service)
• Independent ‘innovative and cutting edge’ research
• Training and education of the next generation of health-care researchers
Training Initiatives: Established Investigators

• Workshop series in advanced statistical methods
  • Propensity score methods for non-randomized, observational data (A. Sharma)
  • Hierarchical/ longitudinal models (D. Jiang)
  • Latent class models (B. Dufault, L. Lix)
Training Initiatives: Clinical Trainees

• Academic half-day teaching for clinical trainees to satisfy the new Royal College ‘scholarly competency’ (CanMEDS 2015)

I. Introduction to biostatistics
II. Study design and sample size calculations
III. Introduction to data analysis with the generalized linear model
IV. Introduction to statistical computing (computer lab)
Training Initiatives: Clinical Trainees

• Open House:
  • Each month, our consultants meet with trainees
  • Opportunity to discuss their research design and analysis questions in an informal setting with multiple consultant

• One-on-one advisory sessions with trainees
Anatomy of a Consultation

• Canadian Pediatric Endocrine Group (CPEG) working committee for national growth charts and its methodology subcommittee, now a permanent member of the PHAC’s Growth Chart Collaborative Group

CPEG working committee:
• J.P. Chanoine BC Children’s (Vancouver)
• Dan Metzger, BC Children’s (Vancouver)
• Mark Palmert, Hospital Sick Children (Toronto)
• Sarah Lawrence, CHEO (Ottawa)
• Celia Rodd, HSC (Winnipeg)
• Beth Cummings, IWK (Halifax)
• Atul Sharma, HSC (Winnipeg)
Anatomy of a Consultation

• 1977 CDC growth charts → revised 2000

• Public Health Agency of Canada (PHAC) released “2010 WHO Growth Charts adapted for Canada”

• A collaborative process involving Canadian Pediatric Society (CPS), College of Family Physicians of Canada, Community Health Nurses of Canada, Dietitians of Canada
Reaction from clinicians was immediate

- *Position statement of the Canadian Pediatric Endocrine Group (CPEG) on the WHO growth curves.* Canadian Pediatric Endocrine Group; 2011


No weight-for-age >age 10y, to promote BMI:

- Charts are tools for both population health (obesity screening) and individual patient care (longitudinal surveillance, simultaneous ht/wt)

- Assessment of medical conditions like IBD, CRF

- Even for population, BMI is not sufficient; weight Z is an independent predictor of mortality
WHO charts include centiles 0.1, 99.9% (-3, +3 SD)
Fewer centiles in normal range

- CDC 3, 10, 25, 50, 75, 90, 97
- WHO 3 15 50 85 97
- \( z = -2 \ -1 \ 0 \ +1 \ +2 \)

CDC centiles for diagnosis of FTT, hypertension, FASD...
Reaction from clinicians was immediate

- *Position statement of the Canadian Pediatric Endocrine Group (CPEG) on the WHO growth curves.* Canadian Pediatric Endocrine Group; 2011


CPSP SURVEY: Limitations of WHO curves

- Lack of education: 2-19 years vs. 0-2 years
- Institutional policy
- Not on their EMR
- Economic reasons
- Lack of weight for age > 10 years: 50%
- Addition of shading: 13%
- Addition of extreme percentiles: 24%
- Too few centiles between 3-97%
Reaction from clinicians was immediate


- After much discussion with PHAC, Collaborative Group, WHO:
  - WHO agrees to share core NCHS data for re-analysis of weight-for-age
  - In Dec 2012, CPEG releases 2012 CPEG growth charts
2012 CPEG Growth Charts for Canada


Re-analysis of NCHS data, N = 22917

- Strict applications of WHO exclusions and LMS methods to extend weight-for-age to ages 10-19y
- Increased granularity of centiles in the normal range (7 vs 5)
- Dropped centiles 0.1, 99.9%
• Question: How precise are estimates of 1:1000 centile based on only 673 ± 204 boys 646 ± 185 girls/yearly interval?
How precise are the extreme centiles

- Fitted smoothed centiles to 1000 non-parametric bootstrap replicates; N = 11106 boys, 11193 girls
- Estimated bias and 95% CI (0.1, 3, 50, 97, 99.9th) at biannual intervals
- Demonstrated sample size requirement of 60k of each gender

BMI, weight, height: Bootstrap confidence intervals
LMS PARAMETERS

- *AnthroCalcCPEG* to calculate percentiles, Z scores

```plaintext

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Birth</td>
<td>02/04/1998</td>
</tr>
<tr>
<td>Date of Measurement</td>
<td>21/01/2013</td>
</tr>
<tr>
<td>Total Age (years)</td>
<td>14.81</td>
</tr>
<tr>
<td>Completed Age (months)</td>
<td>177</td>
</tr>
<tr>
<td>Age (years &amp; months)</td>
<td>14 9/12</td>
</tr>
<tr>
<td>Weight</td>
<td>31.50</td>
</tr>
<tr>
<td>Weight SD</td>
<td>-3.25</td>
</tr>
<tr>
<td>Weight %</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Height</td>
<td>135.6</td>
</tr>
<tr>
<td>Height SD</td>
<td>-4.12</td>
</tr>
<tr>
<td>Height %</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>BMI</td>
<td>17.1</td>
</tr>
<tr>
<td>BMI SD</td>
<td>-1.20</td>
</tr>
<tr>
<td>BMI %</td>
<td>11%</td>
</tr>
<tr>
<td>BSA</td>
<td>1.09</td>
</tr>
<tr>
<td>SBP</td>
<td>105</td>
</tr>
<tr>
<td>SBP SD</td>
<td>+0.01</td>
</tr>
<tr>
<td>SBP %</td>
<td>50%</td>
</tr>
<tr>
<td>DBP</td>
<td>67</td>
</tr>
<tr>
<td>DBP SD</td>
<td>+0.45</td>
</tr>
<tr>
<td>DBP %</td>
<td>67%</td>
</tr>
</tbody>
</table>
```

[http://www.cpeg-gcep.net](http://www.cpeg-gcep.net)
CPEG Growth Charts: Boys 2-19 years

For plotting height and weight using growth charts from the Canadian Paediatric Endocrine Group Working Committee for National Growth Charts. Send questions to Anil Sharma MD MSc FRCP(C)

- **Date of birth (YYYY/MM/DD)**: 2000/01/01
- **Date of visit** 2011/01/01: Height (cm) 130  Weight (kg) 27  **Plot Visit**
- **Date of visit** 2009/03/15: Height (cm) 126  Weight (kg) 24  **Plot Visit**
- **Date of visit** 2004/12/30: Height (cm) 110  Weight (kg) 18  **Plot Visit**
Response to CPEG efforts:

- Feb 2014: PHAC re-convenes Growth Chart Collaborative Group, adding CPEG to permanent membership

- Sept 2014: PHAC released 2014 WHO Growth Charts for Canada, adding weight-for-age 10-19y, de-emphasizing centiles 0.1 and 99.9, and restoring 7 centiles familiar to CDC chart users

- June 2014: CPEG receives CPS’s Noni MacDonald Award for clinical impact
A collaborative effort

- Canadian Paediatric Society (Growth and Nutrition)
- College of Family Physicians of Canada
- Community Health Nurses of Canada
- Dietitians of Canada
- Canadian Pediatric Endocrine Group
- Canadian Association of Pediatric Nephrologists
- Public Health Agency of Canada
- World Health Organization
“My question is: Are we making an impact?”