

Use of growth charts in Canada: A National Canadian Paediatric Surveillance Program survey

Sarah Lawrence MD¹, Elizabeth Cummings MD², Jean-Pierre Chanoine MD³, Daniel Metzger MD³,
Mark Palmert MD PhD⁴, Aul Sharma MD MSc⁵, Celia Rodd MD MSc⁶

S Lawrence, E Cummings, J-P Chanoine, et al. Use of growth charts in Canada: A National Canadian Paediatric Surveillance Program survey. *Paediatr Child Health* 2015;20(4):185-188.

BACKGROUND: In 2010, the WHO Growth Charts for Canada were recommended for use in Canada, while the US Centers for Disease Control and Prevention (Georgia, USA) charts remained in active use.

OBJECTIVE: To assess the availability, utilization of and satisfaction with growth charts in clinical practice in Canada.

METHODS: In October 2012, a one-time survey was sent through the Canadian Paediatric Surveillance Program (CPSP) to 2544 paediatricians and 280 family physicians with a stated interest in paediatrics.

RESULTS: The response rate was 24% (63% general paediatricians, 36% subspecialists, 1% family physicians). Of these respondents, 68% preferred the WHO charts for infants and 49% for children and youth. Regarding the WHO charts, 49.7% of respondents reported concerns with their inability to assess weight for children >10 years of age, and many believed that there were too few percentile lines between the third and 97th percentiles for infant (24%) and for child and youth measures (19%). The addition of extreme percentiles (0.1 and 99.9), shading on charts and lack of availability with electronic medical record providers were other concerns mentioned by 10% to 13% of respondents.

CONCLUSION: There is support for the use of the WHO data for monitoring the growth of Canadian children. Concerns regarding the design of the charts were raised. These survey results lend support to the redesign of the WHO Growth Charts for Canada, as was recently completed in 2014.

Key Words: *Body mass index; CDC; CPEG; Growth charts; Weight-for-age; WHO*

Until recently, the predominant set of growth charts used to monitor growth in Canadian children was the Centers for Disease Control and Prevention (CDC, Georgia, USA) growth charts published in 2000 (1). In 2006, the WHO published standard curves for children zero to five years of age based on their Multicentre Growth Reference Study (MGRS), which was intended to reflect growth under optimal conditions (2,3). To provide charts through to 19 years of age, the WHO also published growth reference charts for children five to 19 years of age in 2007 (4). These were primarily based on the 1977 US National Centre for Health Statistics/WHO growth reference data (5), which predated the obesity epidemic reflected in the CDC growth charts.

In 2010, a reformatted version of the new WHO growth charts was released for Canada, entitled 'WHO Growth Charts Adapted for Canada' (6). These charts were endorsed for use in Canada in

L'utilisation des courbes de croissance au Canada : une étude nationale du Programme canadien de surveillance pédiatrique (PCSP)

HISTORIQUE : En 2010, l'utilisation des courbes de croissance de l'OMS pour le Canada a été recommandée au pays, tandis que les courbes des *Centers for Disease Control and Prevention* de Géorgie, aux États-Unis, étaient toujours utilisées.

OBJECTIF : Évaluer la disponibilité et l'utilisation des courbes de croissance en pratique clinique au Canada et la satisfaction à cet égard.

MÉTHODOLOGIE : En octobre 2012, 2 544 pédiatres et 280 médecins de famille ayant un intérêt affirmé pour la pédiatrie ont reçu un sondage ponctuel transmis par le Programme canadien de surveillance pédiatrique (PCSP).

RÉSULTATS : Le taux de réponse s'élevait à 24 % (63 % de pédiatres généraux, 36 % de surspécialistes, 1 % de médecins de famille). Parmi les répondants, 68 % préféraient les courbes de l'OMS pour les nourrissons et 49 % celles pour les enfants et les adolescents. À l'égard des courbes de l'OMS, 49,7 % des répondants étaient préoccupés par leur incapacité d'évaluer le poids des enfants de plus de dix ans, et bon nombre trouvaient qu'il y avait trop peu de percentiles entre le troisième et le 97^e percentile pour les mesures liées aux nourrissons (24 %) et aux enfants et adolescents (19 %). Par ailleurs, de 10 % à 13 % des répondants trouvaient l'ajout de percentiles extrêmes (0,1 et 99,9) et de parties ombragées ainsi que l'absence de version pour les dossiers médicaux électroniques préoccupants.

CONCLUSION : L'utilisation des données de l'OMS pour surveiller la croissance des enfants canadiens reçoit un appui. Des préoccupations ont été soulevées à l'égard de la conception des courbes. Les résultats de ce sondage soutiennent la restructuration des courbes de croissance de l'OMS pour le Canada, qui a d'ailleurs été effectuée en 2014.

a Collaborative Public Policy Statement that included the Dietitians of Canada, Canadian Paediatric Society (CPS), College of Family Physicians of Canada, Community Health Nurses of Canada and the Public Health Agency of Canada, (7). Online educational materials and modules were developed to inform users about the proper use and interpretation of these charts (8). We performed a survey through the Canadian Paediatric Surveillance Program (CPSP) to assess the availability, utilization of and satisfaction with growth charts used in clinical practice in Canada.

METHODS

In November 2012, a one-time paper survey was mailed to 2544 paediatricians and 280 family physicians with a stated interest in paediatrics through the CPSP. The CPSP is a well-established active surveillance system for rare paediatric conditions,

¹Pediatrics, University of Ottawa, Ottawa, Ontario; ²Pediatrics, Dalhousie University, Halifax, Nova Scotia; ³Pediatrics, University of British Columbia, Vancouver, British Columbia; ⁴Pediatrics, University of Toronto, Toronto, Ontario; ⁵Pediatrics and Child Health, University of Manitoba; ⁶Pediatrics, University of Manitoba, Winnipeg, Manitoba

Correspondence: Dr Sarah Lawrence, Children's Hospital of Eastern Ontario, Division of Endocrinology and Metabolism, 5109A – 401 Smyth Road, Ottawa, Ontario K1H 8L1. Telephone 613-737-7600 ext 2434, e-mail slawrence@cheo.on.ca
Accepted for publication February 2, 2015

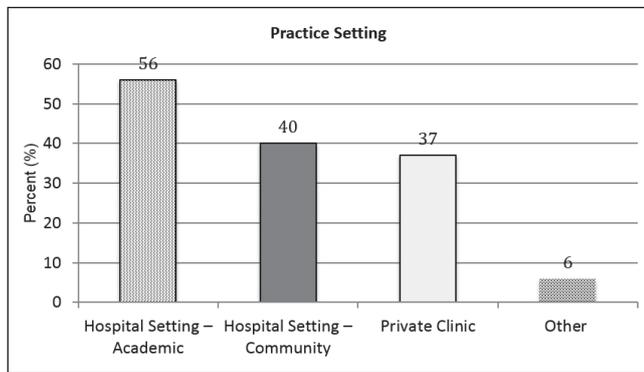


Figure 1) The percentage of respondents working in each practice location. Some physicians worked in more than one practice setting

in which monthly surveys are completed by the participants, with an excellent response rate. One-time surveys are included with the monthly form to assess specific issues, particularly those related to public health concerns. The present survey received approval from the CPSP Steering Committee and the Research Ethics Board at the Children's Hospital of Eastern Ontario (Ottawa, Ontario). Questions were developed by the authors based on a literature review, clinical experience and discussions with clinicians. The survey was reviewed and edited with the input of the CPSP Steering Committee. Respondents were asked which growth charts are available, currently used and preferred by them in practice. Other questions related to participation in education regarding the new WHO charts and respondents' opinions regarding perceived limitations, if any, of the WHO growth charts adapted for Canada. Not all questions were answered by all respondents; in these situations, the denominator is indicated in the results.

Responses were accepted until April 2013. Survey data were collected and managed using REDCap electronic data capture tools, hosted and supported by the Children's Hospital of Eastern Ontario Research Institute. Descriptive statistics were generated for the survey questions, including response rates and frequency distributions.

RESULTS

A total of 690 completed forms were received (response rate 24%), including forms from 429 (63%) general paediatricians, 242 (36%) paediatric subspecialists and six (1%) family physicians. There was a broad representation of practice settings, with 385 (56%) working primarily in an academic hospital, 277 (40%) in a community-based hospital and 255 (37%) in a private clinic, with some physicians having multiple affiliations (Figure 1).

A total of 472 (68.4%) respondents reported that WHO charts were available in their practice; for 215 (31%) respondents, the use of WHO charts was mandated by their institution or electronic medical record (EMR) provider (Figure 2). There was a tendency to use WHO charts mainly for new patients, although 289 (42%) and 259 (37.5%) had converted to the WHO charts for all patients in their practice for children zero to two years of age and two to 19 years of age, respectively. Of the respondents using WHO charts, 68% preferred the WHO charts for infants, and 49% preferred the WHO charts for children and youth two to 19 years of age.

Regarding the use of the WHO charts, the most common concern, expressed by nearly one-half of respondents (49.7%), related to the inability to assess weight, except as a function of body mass index (BMI), for children >10 years of age (Figure 2). Although many recognized the importance of monitoring BMI, particularly from a public health perspective, they indicated strongly in their

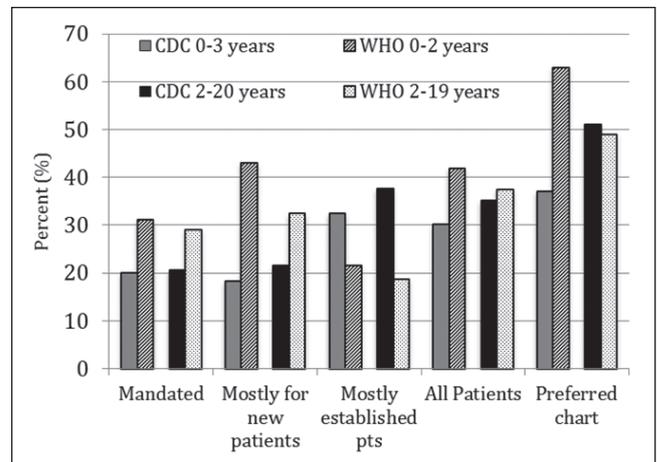


Figure 2) The usage profile by survey respondents of the two predominant growth charts in use in Canada; The Centers for Disease Control and Prevention (CDC, Georgia, USA) charts and the WHO Growth Charts Adapted for Canada

comments that clinicians needed to be able to track weight changes for individual patients, particularly in the context of acute and chronic illnesses.

The second most common concern was the change in percentiles presented in the WHO growth charts adapted for Canada (Figure 3). Twenty-four percent of all respondents believed that there were too few percentile lines between the third and 97th percentiles for infants, while 19% had similar reservations about the measures for older children. In the comments, they reported greater difficulty in identifying when patients were 'crossing centiles'. The addition of extreme percentiles (0.1% and 99.9%), shading on charts and lack of availability within the EMR were other concerns mentioned by 10% to 13% of respondents.

A total of 407 (61.9%) of 657 respondents indicated that they were aware of the educational materials developed by the CPS/Dietitians of Canada. In addition, 236 of 615 (37.2%) indicated that they were aware of the online educational modules developed by the Dietitians of Canada. Of these 615, 77 (12.5%) had already completed and another 74 (12.0%) planned to complete the modules, while 113 (18.4%) said that they were unlikely to complete the modules. An additional 116 (18.9%) had used other sources of education. Thirty-one percent of those who preferred the WHO charts had completed the educational modules.

A total of 656 participants responded to questions about head circumference (HC). While assessing infants, 542 (83%) respondents reported routine HC measurement, another 69 (10%) monitored HC on an as-needed basis, and 45 (7%) did not routinely plot HC. In contrast, only 99 (16%) respondents routinely measured head circumference beyond infancy, with 381 (60.5%) measuring as needed. The Nellhaus head circumference charts (9) were used by 23% of respondents.

Respondents also noted the challenge of interpreting standard blood pressure tables, which are based on the CDC centiles. Other concerns included a pre-existing level of familiarity and ease of use associated with the CDC charts. Many reported that endorsement of the WHO charts by organizations such as the CPS was important. Several practical issues were also commonly raised, including access to their preferred chart through EMRs, the discontinuity of data collection associated with a change of growth chart (CDC versus WHO) and difficulty with faxing of WHO charts because of the shading used.

DISCUSSION

The most striking result from the present survey was that one-half of respondents believed that the inability to plot weight for age (WFA) for children >10 years of age on the WHO charts was a limitation. Even more notable than the percentages was the strength of the comments written by many respondents. Part of the value of growth charts lies in the ability to obtain a visual record of change over time in height and weight together. This is lost when clinicians cannot look for patterns of height and weight change simultaneously on one chart. It is clear from the literature that both height and weight must be tracked to correctly interpret changes in BMI (10-12). Moreover, WFA scores provide additional prognostic information that complements height-for-age and height-for-weight (eg, BMI) data – eg, the use of weight velocity to assist in defining failure to thrive (13).

The present survey also raised questions about the optimal centile choices for growth charts. The WHO growth charts adapted for Canada depict one, two and three SDs above and below the mean, corresponding roughly to centiles 0.1, 3, 15, 50, 85, 97 and 99.9 (2,3). This has resulted in fewer percentile lines between the 3rd and 97th percentile. In comparison, the CDC charts include a wider range of percentile lines (3 or 5, 10, 25, 50, 75, 90, and 95 or 97) (1), enabling a more precise description within the normal range. The addition of the 25th and 75th percentile lines enables health care providers to more easily detect aberrations in growth at an earlier stage. This is particularly critical for WFA, in which failure to thrive is often defined by crossing two percentile lines (14), and may avoid inadvertent delays in the detection of abnormal growth or weight gain (15). More specifically, the 10th and 90th percentiles on the CDC charts are critical for the definition of conditions such as fetal alcohol syndrome (16) and hypertension, respectively (17). Because the WHO and CDC height percentiles are extremely close, the two may be used interchangeably, but only if the charts include both the 10th and 90th percentiles. In addition, there was concern that the inclusion of extreme centiles (0.1 and 99.9) could lead to misinterpretation that a child is 'on the chart' (18). The authors have observed that this is an issue based on personal experience and on audience response recorded during continuing medical education events, even among paediatricians who have had some education and experience with the WHO charts.

Additional practical limitations of the WHO charts were noted. For instance, while pads of CDC charts are readily available through industry, WHO charts are not; this has the potential to limit access for community physicians in private offices. This was relevant to 10% of respondents. Slightly more than one-half of respondents (56%) practiced in an academic setting and, not accounting for overlapping practice settings, this infers that ≥44% of respondents are practicing in the community and, thus, were relatively well represented. Institutional policy and/or access through their EMR provider were also cited as limitations to their use. As more clinicians move to EMRs, it will be increasingly important to advocate for a menu of growth charts to support individual needs.

The CPS and Dietitians of Canada have developed informative teaching modules (8). The practical reality is that, while two-thirds of paediatricians were using the WHO charts in practice, less than one-third had received education about the charts. Even among those who preferred the WHO charts, uptake of formal education was low (31%). This underscores the importance of multiple avenues for education and for making growth charts as intuitive as possible.

In 2012, the Canadian Pediatric Endocrine Group (CPEG) reanalyzed the National Centre for Health Statistics data using

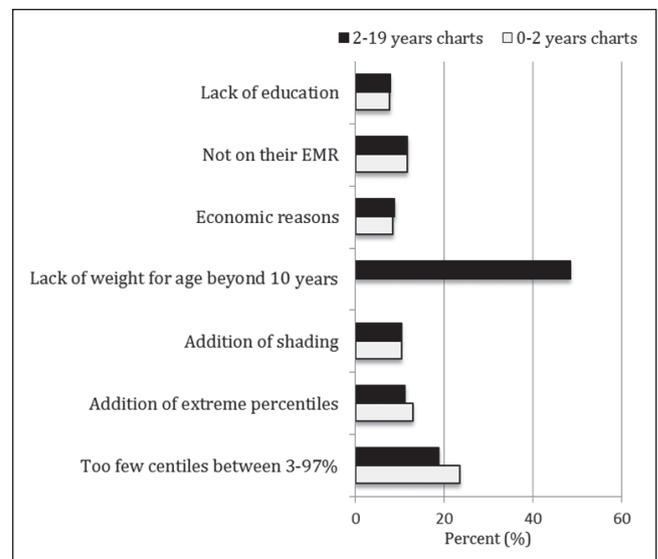


Figure 3) Percentage of respondents identifying limiting factors for use of the WHO Growth Charts Adapted for Canada. EMR Electronic medical records

WHO methodology and generated CPEG Growth Charts based on the WHO Growth Charts Adapted for Canada. These charts addressed concerns raised by CPEG members and, subsequently, many of those in the present survey.

In early 2014, the original Collaborative Committee was expanded to include CPEG. Collectively, they reviewed the 2010 WHO Growth Charts Adapted for Canada, with new recommendations passed on to the Public Health Agency of Canada, who agreed to redesign the charts (20). Based on reanalysis performed by CPEG, WFA for children >10 years of age has been added (21). Extreme percentiles have been removed or de-emphasized. In March 2014, the first set of 2014 WHO Growth Charts for Canada were released and are available at www.whogrowthcharts.ca (20). These maintained the five centile lines as seen on the 2010 version (3, 15, 50, 85, 97). A second set of 2014 WHO Growth Charts for Canada was released in September 2014; it is identical to the first set, with the exception that CDC-type centiles (3, 10, 25, 50, 75, 90, 97) are displayed. The increased granularity and more familiar CDC centile selection will allow these charts to be easily applied to the diagnosis of failure to thrive and in the diagnosis of some conditions that rely on CDC centile profiles, such as fetal alcohol syndrome and interpretation of blood pressure norms (14,17,18).

The main limitation of the present survey was the low response rate (24%). While this is typical for a CPSP one-time survey, it may not represent the global opinion of paediatricians in Canada. Family physicians, dietitians and nurses are also frequent users of growth charts; however, we were unable to survey these groups because they are not routinely part of the CPSP. While we attempted to extend the survey to family physicians, the number of responses was low.

CONCLUSIONS

There is support for the use of the WHO data for monitoring the growth of Canadian infants, but only one-half of respondents prefer the WHO charts for older children. Concerns about design of the WHO charts featured prominently in survey responses, particularly the inability to plot WFA for children >10 years of age, sparseness of the centiles in the normal range

and the specific choice of centiles. For obvious reasons, clinical tools, such as growth charts, must be constantly re-evaluated to ensure they meet the needs of frontline practitioners. In this case, the CPSP survey provided support for the need to develop two sets of alternative charts that are based on WHO data and methodology, but which address design and other concerns articulated by survey respondents. Prompted by these concerns, the 2014 revision of the WHO Growth Charts for Canada will provide more options for clinicians caring for children, without requiring additional education for practitioners familiar with existing growth charts (20).

REFERENCES

- Ogden CL, Kuczmarski RJ, Flegal KM, et al. Centers for Disease Control and Prevention 2000 growth charts for the United States: Improvements to the 1977 National Center for Health Statistics version. *Pediatrics* 2002;109:45-60.
- WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr Suppl* 2006;450:76-85.
- WHO Multicentre 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. Geneva: World Health Organization Press, 2006.
- de Onis MI, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 2007;85:660-7.
- Hamill PVV. NCHS growth charts for children – National Center for Health Statistics. *Vital Health Stat* 1977;111-74.
- WHO Growth Charts Adapted for Canada. <www.dietitians.ca/secondarypages/public/who-growth-charts.aspx> (Accessed March 2014).
- Promoting optimal monitoring of child growth in Canada. Using the new WHO Growth Charts. Collaborative Public Policy Statement. <www.dietitians.ca/Downloadable-Content/Public/tcg-positionpaper.aspx> (Accessed September 30, 2012).
- Dietitians of Canada, Canadian Paediatric Society, College of Physicians and Surgeons of Canada, Community Health Nurses of Canada. WHO Growth Chart Training. <www.dietitians.ca/Knowledge-Center/Live-Events/Online-Courses/WHOGrowth-Chart-Training.aspx> (Accessed April 2012).
- Nellhaus G. Head circumference from birth to eighteen years. Practical composite international and interracial graphs. *Pediatrics* 1968;41:106-14.
- Epifanio M, Marostica PC, Mattiello R, et al. A randomized, double-blind, placebo-controlled trial of cyproheptadine for appetite stimulation in cystic fibrosis. *J Pediatr (Rio J)* 2012;88:155-60.
- Jonas MM, Balistreri W, Gonzalez-Peralta RP, et al. Pegylated interferon for chronic hepatitis C in children affects growth and body composition: Results from the pediatric study of hepatitis C (PEDS-C) trial. *Hepatology* 2012;56:523-31.
- Farfel A, Derazne E, Tzur D, Linder N, Laron Z. Anthropometric indices of adolescents who at birth were full-term long and/or overweight for gestational age. *Isr Med Assoc J* 2012;14:93-5.
- McDonald CM, Olofin I, Flaxman S, et al. The effect of multiple anthropometric deficits on child mortality: Meta-analysis of individual data in 10 prospective studies from developing countries. *American Journal of Clin Nutr* 2013;97:896-901.
- Olsen EM. Failure to thrive: Still a problem of definition. *Clin Pediatr* 2006;45:1-7.
- Marchand V; Canadian Paediatric Society, Nutrition and Gastroenterology Committee. The toddler who is falling off the growth chart. *Paediatr Child Health* 2012;17:447-50.
- National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Department of Health and Human Services. Fetal Alcohol Syndrome: Guidelines for Referral and Diagnosis, July 2004.
- National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics* 2004;114(Suppl 2):555-76.
- Lawrence S, Cummings E2, Chanoine JP, et al. Canadian Pediatric Endocrine Group extension to WHO growth charts: Why bother? *Paediatr Child Health* 2013;18:295-7.
- CPEG Working Committee for National Growth Charts Position statement of the Canadian Pediatric Endocrine Group (CPEG) on the WHO growth curves. 2011. <<http://cpeg-gcep.net>> (Accessed March 2012).
- WHO Growth Charts. <www.whogrowthcharts.ca> (Accessed September 2014).
- Rodd C, Metzger DL, Sharma A; for the CPEG Working Committee for National Growth Charts. Extending World Health Organization weight-for-age reference curves to older children. *BMC Pediatr* 2014;14:32.

ACKNOWLEDGEMENTS: The authors thank the CPEG membership for their support of the work on the CPEG Position Statement and Growth Charts, Dr Daniele Grenier and the CPSP for making this survey on growth charts possible, and all those who completed the survey. The authors also acknowledge members of the Collaborative Group with representatives from the Canadian Paediatric Society, Canadian Pediatric Endocrine Group, The College of Family Physicians of Canada, Community Health Nurses of Canada, Dietitians of Canada and the Public Health Agency of Canada, who redesigned the 2014 WHO Growth Charts for Canada to ensure that all clinicians would have access to the best possible tools.
