The pediatrician’s options in managing childhood obesity in BC

Jean-Pierre Chanoine
Endocrinology and Diabetes Unit
British Columbia’s Children’s Hospital
Vancouver
Objectives

- Understand the development of the WHO growth charts for Canada with regards to body mass assessment
- Discuss a new algorithm for the assessment of childhood weight excess
- Learn about the available resources for childhood weight excess in BC
WHO growth charts for Canada
WHO growth charts for Canada

0-5 years: Growth Standard
- International (Oman, Norway, Brazil, USA, Ghana, India)
- Aims to describe optimal growth for all children in optimal conditions
- Strict criteria: BF 4 mo, healthy mothers and newborns, full term pregnancies

5-19 years: Growth Reference
- Refers to current growth of a population
- Based on CDC growth curves, adjusted
Reference Data Sets: 2 to 20 Years

Stature

Weight/BMI

Age in Years

NHANES III ('88-'94)  NHANES II ('76-'80)  NHES II ('63-65)

NHES III ('66-'70)  NHES II ('63-65)
1: Emphasis on BMI
- Dotted lines for weight curve above 10 years (warning box)
- Adiposity rebound

2: Transition to adulthood
97th centile is closest to 30 kg/m²
85th centile is closest to 25 kg/m²
WHO growth curves for Canada


or www.whogrowthcharts.ca

www.bcchildrens.ca/Services/SpecializedPediatrics/EndocrinologyDiabetesUnit/ForProfessionals/WHOGr owthCharts.htm

Set 1 vs set 2 (set 2 has percentiles similar to CDC)
Assessment of childhood weight excess
Assessment of the causes of obesity

- Monogenic defects (i.e. leptin deficiency): RARE
- Hormonal causes (i.e. growth hormone deficiency, hypothyroidism): RARE
  - (and not associated with severe obesity, if any...)
Myth 1

GH deficiency is associated with obesity
- Little evidence
- Abnormal body composition
- Registry studies (Roche): BMI at baseline: $Z$-score = -0.06
Baseline BMI in GHD children and adolescents

Girls

Boys

Z-score GHD at start of treatment: +0.09
(Subgroup with brain tumor: +1.03)

Baars et al, Horm Res 1998
Myth 2

- Treatment of hypothyroidism causes a decrease in weight
  - Overall no change
  - More severe, more weight loss with L-T4 treatment
  - “Water” loss?
Weight change following treatment of acquired hypothyroidism

![Graph showing correlation between initial TSH levels and change in weight at 2nd visit. The correlation coefficient is r=-0.42, p=0.0003.](image)
Assessment of the causes of obesity

- Monogenic defects (i.e. leptin deficiency): RARE
- Hormonal causes (i.e. excess cortisol, hypothyroidism): RARE
- Syndromes (i.e. Prader Willi Syndrome) UNCOMMON, easier to recognize
- Combination of a polygenic predisposition, epigenetic changes, environment: MOST COMMON
Congenital Anomalies and/or dysmorphic facies short stature, delayed psychomotor development

History of neonatal hypotonia with poor feeding followed by hyperphagia

- Methylation Studies of Prader-Willi Syndrome Critical Region (B.2.a)
- Consider FRAXA Gene Size analysis for Fragile X with PWS-like phenotype (B.2.e)

Normal or near-normal neonatal tone

Primary Genetic/Syndromic Cause Possible**

Development delay (B.1.i.f, B.1.i.g)

Hyperphagia, normal height velocity***

Normal psychomotor development

Linear growth failure

No hyperphagia

Normal height velocity

No apparent congenital anomalies

Hormonal deficiency (C.a, C.b, C.g)

Central nervous system lesions (D)

Hormonal excess (C.c, C.d, C.e, C.f)

Hormonal studies Imaging

Iatrogenic obesity associated with medications (F)

Obesity associated with defined conditions (E)

“Common” obesity

No etiological investigations (A)

Retinal Degeneration (B.1.ii)

BBSome Panel (B.1.ii.a)

Hormone resistance (e.g., parathyroid, thyroid)

Targeted Sequencing of GNAS Gene (B.2.d)

Targeted Sequencing of MC4R gene (B.1.i.e)

Targeted sequencing of Leptin Gene (B.1.i.a)

Targeted sequencing of PSK1 gene (B.1.i.d)

Targeted sequencing of POMC gene (B.1.i.c)

Normal/low leptin

N puberty

Delayed puberty

Adrenal insufficiency

Small bowel enteropathy, hypogonadotropic hypogonadism, postprandial hypoglycaemia

Chromosomal Microarray (first-line test) or Next-Generation Sequencing (Exome/Genome)(B.1., B.2.)

Karyotype (B.3.)****
Congenital Anomalies and/or dysmorphic facies, short stature, delayed psychomotor development

- History of neonatal hypotonia with poor feeding followed by hyperphagia
  - Methylation Studies of Prader-Willi Syndrome Critical Region (B.2.a)
  - Consider FRAXA Gene Size analysis for Fragile X with PWS-like phenotype (B.2.e)

  - Retinal Degeneration (B.1.ii)
  - Hormone resistance (e.g., parathyroid, thyroid)
    - Targeted Sequencing of GNAS Gene (B.2.d)
    - BBSome Panel (B.1.ii.a)
  - Normal/high leptin
    - Targeted sequencing of MC4R gene (B.1.i.e)
    - Normal puberty
  - Low/absent leptin
    - Delayed puberty
    - Targeted sequencing of Leptin Gene (B.1.i.a)
    - Targeted sequencing of POMC gene (B.1.i.c)
    - Targeted sequencing of PSK1 gene (B.1.i.d)

Normal or near-normal neonatal tone

- Primary Genetic/Syndromic Cause Possible**
  - Consider FRAXA Gene Size analysis for Fragile X with PWS-like phenotype (B.2.e)

Hyperphagia, normal height velocity***

- Development delay (B.1.i.f, B.1.i.g)
- Normal psychomotor development

- Normal height velocity
- Linear growth failure

No apparent congenital anomalies

- No hyperphagia

Adrenal insufficiency

- Small bowel enteropathy, hypogonadotropic hypogonadism, postprandial hypoglycaemia
- Hormonal deficiency (C.a, C.b, C.g)
- Central nervous system lesions (D)
- Hormonal excess (C.c, C.d, C.e, C.f)
- Imaging

Obesity associated with defined conditions (E)

- Iatrogenic obesity associated with medications (F)
  - “Common” obesity

No etiological investigations (A)

Obesity associated with defined conditions (E)
Resources in BC
Childhood Obesity Foundation

President: Tom Warshawski

The mission of the Childhood Obesity Foundation is to lead a societal shift toward healthy eating and active lifestyles to reduce childhood obesity and the resulting physical and emotional impacts.

Extensive list of resources for families, schools and Health professionals.

All listed resources are FREE.

http://childhoodobesityfoundation.ca/
Shapedown BC

Program coordinator: Arlene Cristall

ShapedownBC is a behavioural weight management program that helps children and teens and their families recognize and overcome their challenges to active living and healthy eating.

Provided by BC health authorities, in partnership with participating YMCAs and recreation centres.

Doctor’s referral needed

- [www.bcchildrens.ca/Services/SpecializedPediatrics/CentreHealthyWeights/default.htm](http://www.bcchildrens.ca/Services/SpecializedPediatrics/CentreHealthyWeights/default.htm)

Includes medical assessment and referral to appropriate subspecialists as necessary.
ShapedownBC

Locations:
- Vancouver (at BC Children’s Hospital)
- Nanaimo
- Langley/Surrey
- Kamloops

Languages:
- English
- Now being offered in Cantonese and Mandarin!
Shapedown BC

Criteria:
- 6-17 years of age
- BMI > 97% or 85% < BMI < 97% with risk factors

Age-clustered groups
- 6-8 years, 9-11 years, 12-13 years, and 14-17 years
- 10 weeks, two sessions per week

Children/teens and their parent(s) are often separated in order to facilitate age appropriate discussions
ShapedownBC

- Includes a free 6 month family pass/coaching session to the YMCA or recreation centre facilities
- Access to the team’s registered dietitian and mental health professional on an individual basis (and until 18 years)
- Opportunity to re-enroll in another age-based program if necessary
Mind, Exercise, Nutrition, Do it! (MEND program)

- MEND healthy living program for children aged 7-13 who are above a healthy weight
  - BMI >85th percentile for age & no medical limitations
  - 2 age groups

- 10 week (2-hour sessions twice a week), family-based education program.
Mind, Exercise, Nutrition, Do it! (MEND program)

Locations:
- Vancouver, North Vancouver, Powell River
- Coquitlam, Maple Ridge, Burnaby, Surrey, Langley, Abbotsford, Chilliwack
- Kamloops, Kelowna
- Prince George, Fort St. John
- Nanaimo, Campbell River, Saanich, North Cowichan
Mind, Exercise, Nutrition, Do it! (MEND program)

- Parents/caregivers join their children in each session to learn about how to choose healthier foods and spend more time being physically active.
- Practical demonstrations, games and tips about healthy foods, label reading and portion sizes.
- Non medical, networking, by trained community leaders, 10 week duration.
Health Link BC

- Questions about healthy eating, food, or nutrition
- 8-1-1 toll-free in B.C.
- 9am to 5pm, Monday to Friday
- [http://www.healthlinkbc.ca/](http://www.healthlinkbc.ca/)
Physical Activity Line (PAL)

Provides evidence based resources to support teachers, health professionals, and community health & fitness programs

toll free: 1-877-725-1149

current mainland: 604-241-2266

http://www.physicalactivityline.com/
KIDSPORTBC

- Community-based sport charity that provides grants for children 6-18 to participate in a sport season of their choice
- 40 community chapters in BC
- Phone: 604-333-3434

http://www.kidsportcanada.ca/index.php
Cardiac Prevention Clinic (BCCH)

- Dr. Kevin Harris

Patients >95th percentile for BMI + additional risk factors (including family history of early cardiovascular events, hypertension; dyslipidemia)

Evaluation includes
- cardiac consultation
- routine cardiac testing (ECG, echo, cardiopulmonary exercise test)
- specialized consultation with an exercise physiologist
- exercise prescription with individualized follow up plan

Referral required, Fax number: 604-875-3463
**Provincial Mental Health Metabolic Program**

- Dr. Dina Panagiotopoulos

- Provides specialized management for children and youth with mental health (and medicines such as antipsychotics) and complications such as:
  - Significant weight gain
  - High blood pressure
  - Abnormal lipid profile (elevated cholesterol, LDL, triglycerides and low HDL)
  - Elevated insulin and blood sugar levels.

- Referral required, [www.bcmhsus.ca/programs-and-services/provincial-mental-health-metabolic-program](http://www.bcmhsus.ca/programs-and-services/provincial-mental-health-metabolic-program)
SCOPE is an initiative that partners with communities across British Columbia to promote healthy weights among children. SCOPE endorses the evidence-based Live 5-2-1-0 message, and provides the expertise, support and tools local decision-makers need to make the healthy choice the easy choice for children.

A simple, easy-to-remember message to help kids and families adopt healthy habits. When supported consistently across a community, Live 5-2-1-0 can make it easier for kids to eat healthy and be active every day.

www.live5210.ca
What has SCOPE achieved thus far? (2009-2014)

Increased community capacity and competence in preventing childhood obesity:

- Multi-sectoral partnership creation, needs assessment, and action planning
- Creation and evaluation of sector-specific Live 5210 toolkits (i.e. family practice, recreation centers) that support programmatic, environmental and policy change
- Increased knowledge and awareness of how to support children in Living 5210 among a broad range of community stakeholders (i.e. early childhood, community services, recreation, health professionals, private business)
- A mechanism to share the successes of Live 5210 Pilot Communities (Chilliwack, Abbotsford) to more communities across BC (www.live5210.ca)
- Promotion of provincial programs (i.e. MEND, Shapedown, AS!)

What’s next?

- Expand to more BC communities
- Expand through organizational partners (i.e. FHA, AS!, Shapedown BC, Division of Family Practice, BCCH)
- Develop a sustainable model of knowledge exchange between BC communities
- Comprehensive population level impact evaluation

www.live5210.ca
Conclusions

- New WHO growth charts are being implemented with a focus on BMI
- New algorithms for the management of weight in youth have been developed in BC
- A number of free resources are now available for our children and families across BC, reflecting a major change compared to 10 years ago
Appendices
Congenital Anomalies and/or dysmorphic facies, short stature, delayed psychomotor development

- History of neonatal hypotonia with poor feeding followed by hyperphagia
  - Methylation Studies of Prader-Willi Syndrome Critical Region
  - Consider FRAXA Gene Size analysis for Fragile X with PWS-like phenotype

  - Primary Genetic/Syndromic Cause Possible**
    - Targeted sequencing of FRAXA Gene
      - Size analysis for Fragile X with PWS-like phenotype

- No apparent congenital anomalies

  - Hyperphagia, normal height velocity***
    - Adrenal insufficiency
      - Small bowel enteropathy, hypogonadotropic hypogonadism, postprandial hypoglycaemia
        - Targeted sequencing of PSK1 gene
      - Normal psychomotor development
        - Hormonal deficiency
          - Central nervous system lesions
          - Hormonal excess
            - Hormonal studies
              - Imaging
                - Iatrogenic obesity associated with medications
                - Obesity associated with defined conditions
                - “Common” obesity
      - Linear growth failure
        - Normal height velocity
          - Hormonal studies
            - Imaging
              - Iatrogenic obesity associated with medications
              - Obesity associated with defined conditions
              - “Common” obesity

- Normal or near-normal neonatal tone
  - Development delay
    - Hormonal studies
      - Imaging
        - Iatrogenic obesity associated with medications
        - Obesity associated with defined conditions
        - “Common” obesity

- Retinal Degeneration
  - BBSome Panel
    - Targeted Sequencing of GNAS Gene
      - Chromosomal Microarray (first-line test) or Next-Generation Sequencing (Exome/Genome) Karyotype****
Classification of disorders associated with overweight and obesity

A. “COMMON” OBESITY: A combination of suspected polygenic, environmental and epigenetic factors

B. GENETIC OBESITY

B.1. Monogenic disorders

i. Melanocortin pathway defects

a. Congenital leptin deficiency or dysfunctional leptin
b. Leptin receptor deficiency
c. Pro-opiomelanocortin (POMC) deficiency
d. Proprotein convertase 1/3 (PCSK1) deficiency
e. Melanocortin 4 receptor (MC4R) deficiency
f. Brain-derived neurotrophic factor (BDNF) deficiency
g. Neurotrophic tyrosine kinase receptor type 2 (NTRK2) deficiency

ii. Obesity with Retinitis Pigmentosa

a. Bardet-Biedl syndrome
b. Alström syndrome
c. Cohen syndrome

iii. Other monogenic Obesity Disorders (SIM1 deficiency)

Adapted from the International Classification for Pediatric Endocrine Disorders (ICPED)
B2. Oligogenic Genomic Disorders (including Disorders of Imprinting)

a. Prader-Willi syndrome
b. Beckwith-Wiedemann syndrome
c. WAGRO syndrome (Wilms tumor, Aniridia, Genitourinary anomalies, mental Retardation, Obesity)
d. Albright hereditary osteodystrophy (Pseudohypparathyroidism)
e. Fragile X syndrome with Prader-Willi phenotype
f. Maternal Uniparental Disomy Chromosome 14
g. Chromosomal Microdeletion 16p11.2
h. Oligogenic (microdeletion, microduplication, other structural genomic variants)

B3. Polygenic Genomic Disorders (Aneuploidies)

a. Turner syndrome
b. Down syndrome

c. OBESITY PRIMARILY ASSOCIATED WITH ENDOCRINE MANIFESTATIONS WITH OR WITHOUT AN IDENTIFIED GENETIC CAUSE

a. Growth hormone deficiency
b. Hypothyroidism
c. Cushing syndrome
d. Insulinoma/Hyperinsulinism
e. Diabetes mellitus inappropriately managed (eg, insulin omission) including Mauriac syndrome
f. Polycystic ovary syndrome
g. ROHHAD syndrome (Rapid-onset obesity with hypothalamic dysfunction, hypoventilation, and autonomic dysregulation)

Adapted from the International Classification for Pediatric Endocrine Disorders (ICPED)
D. OBESITY ACCOMPANYING CENTRAL NERVOUS SYSTEM LESIONS

a. Cranio-cerebral trauma
b. Post-neurosurgical lesions
c. Intracranial neoplasms, including craniopharyngioma
d. Meningitis/Encephalitis
e. Infiltration

E. OBESITY ASSOCIATED WITH OTHER DEFINED CONDITIONS

a. Muscular dystrophy
b. Spina bifida with myelomeningocele
c. Immobilization after trauma and/or orthopaedic surgery, etc.
d. Mental retardation
e. Psychological/psychiatric disturbances (bulimia)
f. Malignancy (leukemia, other)

F. IATROGENIC OBESITY ASSOCIATED WITH MEDICATION

a. Corticosteroids
b. Sodium valproate
c. Insulin
d. First generation antipsychotics (i.e. chlorpromazine)
e. Second generation antipsychotics (i.e. risperidone, quetiapine, clozapine, olanzapine)
f. Cyproheptadine

Adapted from the International Classification for Pediatric Endocrine Disorders (ICPED)