DIABETES BEST PRACTICES IN CANADA

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Pediatric Endocrinologist
Clinical Professor of Pediatrics
Welcome to Toronto, Ontario!
OBJECTIVES

- Overview of Canada and Canadian health care
- Overview of the scope of diabetes in Canada and Ontario
- Highlights of Canadian research in diabetes
- Overview of standards of care for kids with T1D
- My own personal recommendations
- BCCH online resources
CANADA AND CANADIAN HEALTH CARE
OUR HOME AND NATIVE LAND

CANADA
- parliamentary democracy, constitutional monarchy
- 33,900,000 people (36th)
- 9,985,000 km² (2nd)
- 3.73 people/km² (226th)
- 10 provinces, 3 territories
- GDP $46,171/person
- 10% of GDP spent on health
- $3,899/person on health
- life expectancy: 81.2 years (8th)

USA
- federal constitutional presidential republic
- 309,000,000 people (3rd)
- 9,631,000 km² (3rd)
- 33.7 people/km² (178th)
- 50 states, 14 territories
- GDP $49,672/person
- 16% of GDP spent on health
- $7,291/person on health
- life expectancy: 78.1 (50th)
OUR HOME AND NATIVE LAND
CANADIAN HEALTH CARE

“socialized medicine”

Canada Health Act of 1962

- universally available to permanent residents
- comprehensive in the services it covers
- accessible without income barriers
- portable within and outside the country
- publicly administered (provincially)

covered: physician services, hospitalizations

not always covered: drugs, diabetes supplies, dental care, optometry, cosmetic surgery
POPULATION DENSITY

80% of Canadians live within 200 km (120 miles) of the border
THE SCOPE OF DIABETES IN CANADA
DIABETES IN CANADA

- 2.4 million Canadians (6.8%) diagnosed with diabetes
- Over 300,000 Canadians live with type 1 diabetes.
- About 26,000 Canadian kids (1 in 330) have diabetes.
- About 3,300 Canadian kids (1 in 2,500) will develop diabetes this year.
- Canada has the 6th highest incidence rate of T1D in children in the world.
- Diabetes and its complications cost the Canadian economy more than $10 billion a year.

### Table: Age-standardized prevalence (%)

<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newfoundland and Labrador</td>
<td>6.5</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>5.6</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>6.1</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>5.9</td>
</tr>
<tr>
<td>Quebec</td>
<td>5.1</td>
</tr>
<tr>
<td>Ontario</td>
<td>6.0</td>
</tr>
<tr>
<td>Manitoba</td>
<td>5.9</td>
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<tr>
<td>Saskatchewan</td>
<td>5.4</td>
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<tr>
<td>Alberta</td>
<td>4.9</td>
</tr>
<tr>
<td>British Columbia</td>
<td>5.4</td>
</tr>
<tr>
<td>Yukon</td>
<td>5.4</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>5.5</td>
</tr>
<tr>
<td>Nunavut</td>
<td>4.4</td>
</tr>
</tbody>
</table>

- <5.0
- 5.0<5.5
- 5.5<6.0
- 6.0<6.5
- ≥6.5
INCIDENCE OF TYPE 1 DIABETES

Map 2.5. New cases of type 1 diabetes (0-14 years per 100,000 children per year), 2011

- < 1.5
- 1.5-5.0
- 5.0-8.5
- 8.5-14.0
- 14.0-24.0
- > 24.0
- No data
DIABETES IN ONTARIO

- More than 1,169,000 people in ON (8.3%) have diabetes.
- Direct cost for diabetes in ON is about $4.9 billion/year.
- Out-of-pocket costs for T1D: $942.61 (6.5% income)
- 6,800 kids (1/450) have diabetes (T1D + T2D) in ON
  - 453 ages 0–4 years
  - 1,114 ages 5–9 years
  - 2,127 ages 10–14 years
  - 3,106 ages 15–19 years
- 867 kids will get diabetes in the next year in ON
- T1D is rising ~3–4% per year in ON
DIABETES RESEARCH IN CANADA
DIABETES RESEARCH IN CANADA

- Public funding:
  - Canadian Institutes of Health Research

- Private funding:
  - Canadian Diabetes Association
    - $95 million since 1975
  - Juvenile Diabetes Research Foundation
    - $13.9 million toward a Clinical Trial Network in 2009
  - Lawson Foundation

- Industry funding
DISCOVERY OF INSULIN

The Journal of Laboratory and Clinical Medicine

Vol. VII St. Louis, February, 1922 No. 5

ORIGINAL ARTICLES

THE INTERNAL SECRETION OF THE PANCREAS*

By F. G. Banting, M.B., and C. H. Best, B.A.
167AUXW-38 VIA HX OCT 25TH

STOCKHOLM

DOCTOR FREDERICK G BANTING
INSTITUTE OF PHYSIOLOGY
TORONTO CANADA

THE ROYAL CAROLINE INSTITUTE HAS PRESENTED TO YOU TOGETHER
WITH PROFESSOR W J R. MACLEOD THE NOBEL PRIZE OF THE
YEAR 1923.

YOURS SINCERELY HJALMAR FORSSNER PRINCIPAL OF THE INSTITUTE

1030PM
EDMONTON PROTOCOL

TRANSPLANTS: COATED ISLETS

- University of Toronto
- “microencapsulation” with seaweed-derived polymer
- have been shown to keep monkeys insulin-free for up to 3 years
- islet cells from pigs
Sernova Corp.

- Cell Pouch System™
- Matchbook size, goes under the skin
- 1st patient just transplanted!
- London, Ontario company
- Partnered with University of Alberta
Oral-lyn™

RapidMist™ device

GENEREX BIOTECHNOLOGY
**Gene Therapy: Viral Vectors**

- University of Calgary
- infected mice with a virus carrying a modified insulin gene
- this gene is integrated and expressed in liver
- liver insulin production is sufficient to keep blood glucose normal
University of Alberta used viruses to genetically modify mice, which can make human insulin in the K cells of their stomach and duodenum. Gut insulin production is sufficient to keep blood glucose normal if β cells are destroyed. Mice lived up to 6 months without insulin.

GENE THERAPY: K CELLS
GEMS™-Insulin (Gut Endocrine-cell Modification System)

- non-viral (chitosan-ΦC₃₁) gene transfer

Next: Human trials!
University of Calgary scientists attempt to turn off the specific immune response causing type 1 diabetes, not the entire immune system, by developing NavacimTD, a nanoparticle vaccine. Studies in mice showed prevention and cure of diabetes.

*Immunity* 2010;32(4):568–580
**STEM CELLS**

Dr. Tim Kieffer from UBC have converted commercial human embryonic stem cells into functional islet-like structures with development very similar to fetal pancreas development in humans.

*Diabetes* 2012;61(8):2016–22029
ENCAPSULATING STEM CELLS
STANDARDS OF CARE FOR CHILDREN WITH T1D
STANDARDS OF CARE

- Canadian Diabetes Association 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada
- evidence-based guidelines
- majority of diabetes specialists in Canada involved in development, review and dissemination of Guidelines
- revised every 5 years, next due out in next month
STANDARDS OF CARE
OTHER GUIDELINES
CDA: A1C AND Glucose Targets

A1C:
- under 8.5% for ages 0 to 5 years
- under 8.0% for ages 6 to 12 years
- 7% or under for ages 13 and up

Pre-meal blood glucose:
- 6–12 (108–216) for ages 0 to 5 years
- 4–10 (72–180) for ages 6 to 12 years
- 4–7 (72–126) for ages 13 and up

2-hour post-meal blood glucose:
- 5–10 (90–180) for ages 13 and up
ADA: A1C AND GLUCOSE TARGETS

- **A1C:**
  - under 8.5% for ages 0 to 5 years
  - under 8.0% for ages 6 to 12 years
  - under 7.5% for age 13 and up

- **pre-meal blood glucose:**
  - 100–180 (5.5–10) for ages 0 to 5 years
  - 90–180 (5–10) for ages 6 to 12 years
  - 90–130 (5–7.2) for age 13 and up
ISPAD: A1C and Glucose Targets

- **A1C:**
  - under 7.5% for all ages
- **Pre-meal blood glucose:**
  - 5–8 mmol/L (90–145 mg/dL)
- **2-hour post-meal blood glucose:**
  - 5–10 mmol/L (90–180 mg/dL)
- **Bedtime blood glucose:**
  - 6.7–10 mmol/L (120–180 mg/dL)
- **Overnight blood glucose:**
  - 4.5–9 mmol/L (80–162 mg/dL)
Access to Care

- All children with diabetes should have access to an experienced pediatric diabetes health care team and specialized care starting at diagnosis.
**INITIAL MANAGEMENT**

- Children with new-onset diabetes should be started on at least 2 daily injections of short-acting insulin or rapid-acting insulin analogs combined with an intermediate- or long-acting insulin.
Insulin therapy should be assessed at each clinical encounter to ensure it still enables the child to meet A1C targets, minimizes the risk of hypoglycemia and allows flexibility in carbohydrate intake, daily schedule and activities. This assessment should consider:

- increased frequency of injections
- change in the type of basal (long-acting analog) and/or prandial (rapid-acting analog) insulin
- change to pump
In the home situation, severe hypoglycemia should be treated with glucagon:

- in children 5 years of age or under: use 0.5 mg
- in children over 5 years of age: use 1 mg

The episode should be discussed with the diabetes healthcare team as soon as possible and consideration given to reducing insulin doses for the next 24 hours to avoid further severe hypoglycemia.
In children, the use of mini-doses of glucagon should be considered in the home management of mild or impending hypoglycemia associated with inability or refusal to take oral carbohydrate.

- **10 μg per year of age**
- **minimum 20 μg (2 units)**
- **maximum 150 μg (15 units)**

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**MINI-DOSE GLUCAGON FOR PREVENTING SERIOUS HYPOGLYCEMIA**

Caring for a child with diabetes can be very challenging for parents, especially during periods of illness. When a child or youth has a stomach illness and is unable to keep any food or fluid down, blood glucose levels can drop very quickly. When these levels continue to drop and the child is unable to take anything orally, parents often resort to taking their child to the Emergency Room for intravenous glucose. This can be very traumatic for the child as well as the parents.

See also our handout *Managing Sick Days and Preventing Ketoacidosis.*

A recent study from the Texas Children’s Hospital® has proposed a new and creative way to help parents treat hypoglycemia during these times of stomach illness that might prevent a visit to the Emergency Room. The idea is to use very small (mini) doses of glucagon, given with a regular insulin syringe, rather than the much larger dose normally given to treat serious hypoglycemia.

The results were excellent. The mini-doses of glucagon raised the blood glucose levels approximately 3-5 mmol/L within the first 30 minutes, and the effect lasted approximately one hour. This study also found that glucagon, used in these smaller doses, did not increase the nausea or vomiting that is commonly associated with the larger dose, and that the number of visits to the Emergency Room was greatly reduced.

It is important to note that while this option works well during stomach illnesses, it is NOT effective for a severe low, which requires the full dose of glucagon. However, it may be used if your child refuses to eat anything after they have received insulin, and the blood sugar is dropping.

See also our handout *Glucagon for Severe Hypoglycemic Reactions.*

**YOU WILL NEED:**
- glucagon for injection
- a regular 30-, 50- or 100-unit insulin syringe
- blood glucose meter and strips

**HOW IT WORKS:**
1. Reconstitute the glucagon as per directions (inject 1 cc of diluent into the vial containing the glucagon powder).

April 13, 2007
**KIDNEY (NEPHROPATHY)**

- screen if age 12 years and above after 5 years or more of diabetes
- first-morning albumin-creatinine ratio (ACR)
- follow-up with timed overnight ACR
- treat as for adults if 3 or more high values
Eyes (Retinopathy)

- Screen if age 15 years and above after 5 years or more of diabetes
- Screen annually thereafter
- Can screen every 2 years if control good and duration under 10 years
NERVES (NEUROPATHY)

- screen if after 5 years or more of diabetes and poor control
- ask about numbness, pain, cramps and tingling
- examine for skin sensation, vibration sense, light touch and ankle reflexes
**CHOLESTEROL (DYSLIPIDEMIA)**

- screen kids under 12 years if family history and/or obesity (BMI >95th percentile)
- screen all kids at 12 and then again at 17 years
- do full lipid panel (total, HDL, LDL, triglycerides)
- treat abnormal results as for adults
BLOOD PRESSURE (HYPERTENSION)

- check all kids’ blood pressure twice a year
- treat BP ≥95th percentile for age with lifestyle modification
- treat persistent high blood pressure as for non-diabetic kids
THYROID DISEASE

- thyroid problems occur in 15–30% of people with T1D
- TSH and thyroperoxidase antibodies at diagnosis
- repeat every 2 years
- more frequent if goiter, positive antibodies, or symptoms of hyper/hypo-thyroidism
Celiac Disease

- Celiac disease occurs in 4–9% of people with T1D.
- 60–70% of these have no symptoms.
- Screen for celiac disease (IgA-tissue transglutaminase antibodies) if classical or atypical symptoms.
- Gluten-free diet if affected.
- Screening in asymptomatic cases remains controversial.
OTHER RECOMMENDATIONS

- offer the influenza vaccine
- smoking prevention/cessation
- contraception (especially) for girls
- screen girls for eating disorders
  - 2-fold increase
MY RECOMMENDATIONS
MY RECOMMENDATIONS

- Learn as much as you can about diabetes.
**MY RECOMMENDATIONS**

- Get the A1C in target.

![Graph showing relative risk for diabetes complications increases with A1C. The graph displays three curves for Kidneys, Eyes, and Nerves, indicating a positive correlation between A1C levels and risk.](image)
MY RECOMMENDATIONS

- Test more, at least 5 times a day.

![Graph showing the relationship between frequency of daily SMBG and HbA1c levels.](image)
MY RECOMMENDATIONS

- Fear hyperglycemia as much as you fear hypoglycemia.
- Differential effects of lows and highs on developing brains.

Pediatric Diabetes 2008;9(2):87–95

normal hypoglycemia hyperglycemia

Pediatric Diabetes 2008;9(6):531–539
MY RECOMMENDATIONS

- Intensify the insulin regimen as much as possible.
  - Go from two shots day to three, from three to four.
  - Add in extra shots for extra food or high blood sugars.
  - Move to multiple daily injections or a pump.
  - Fine-tune the carb counting, adjust for protein and fat
  - Use the advanced features of the pump (combo/dual-wave bolus, patterns, temp basals)
  - Consider CGMS, at least intermittently.
  - Download, analyze, and implement changes frequently.
MY RECOMMENDATIONS

- Maximize your clinic visits by being prepared.
  - Work with your team, they’re nice people!
  - Come prepared: logbook, meter and/or pump downloads.
  - Write down questions.
MY RECOMMENDATIONS

- Send your kid to camp—you both need a break!
MY RECOMMENDATIONS

- Advocate for your child/yourself.
- Lend financial and emotional support.
BC CHILDREN’S HOSPITAL
ONLINE RESOURCES
Insulin Dose Adjustment: An Online Education Program for Parents of Children with Diabetes (continued)

Video Introduction to the Modules by Dr. Dan Metzger

Module 1: Insulin Adjustment: Getting Started

Module 2: Guidelines for Adjusting Insulin

Module 3: Adjusting Insulin for Physical Activity

Module 4: Adjusting Insulin for Illness and Ketones

Module 5: Carbohydrate Counting

Module 6: Multiple Daily Injections

Module 7: Insulin Pump Therapy
Basal-Bolus Insulin with Multiple Daily Injections

Focus on Children & Youth

Heather Nichol RN, MScN, CDE
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A Guide for Families:
Diabetes Care for Children and Teens
Endocrinology & Diabetes Unit

The BC Children’s Hospital Endocrinology & Diabetes Unit is a diagnostic, treatment and education centre for children and families affected with diabetes and other endocrine conditions. The endocrine conditions include variations and abnormalities of normal growth and puberty, as well as both over- and under-production of thyroid, parathyroid, adrenal, and antidiuretic hormones.

Helping our patients and families:

Visit the For families section for the following and more:

- Diabetes handouts and helpful links
- Endocrine handouts and helpful links
- Booklets available from the C&W Bookstore
- Insulin dose adjustment help
- Coming to our clinics – what to expect

Collaborating with health care professionals:

http://endodiab.bcchildrens.ca
ENJOY THE CONFERENCE!
HAVE FUN AND MAKE NEW FRIENDS!