



Best Diabetes Practices in Canada


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Welcome to Vancouver, BC!






Objectives

- Overview of Canada and Canadian health care
- Overview of the scope of diabetes in Canada
- Highlights of Canadian research in diabetes
- Overview of standards of care for kids with T1D
- My own personal recommendations
- BCCH resources





Canada and Canadian Health Care

Our Home and Native Land

Canada	USA
<input type="checkbox"/> parliamentary democracy, constitutional monarchy	<input type="checkbox"/> federal constitutional presidential republic
<input type="checkbox"/> 34,224,000 people (36 th)	<input type="checkbox"/> 310,101,000 people (3 rd)
<input type="checkbox"/> 9,984,670 km ² (2 nd)	<input type="checkbox"/> 9,826,675 km ² (3 rd /4 th)
<input type="checkbox"/> 3.41 people/km ² (228 th)	<input type="checkbox"/> 32 people/km ² (178 th)
<input type="checkbox"/> 10 provinces, 3 territories	<input type="checkbox"/> 50 states, 14 territories
<input type="checkbox"/> GDP \$39,668/person	<input type="checkbox"/> GDP \$46,381/person
<input type="checkbox"/> 10.0% of GDP spent on health	<input type="checkbox"/> 15.3% of GDP spent on health
<input type="checkbox"/> \$3,672/person on health	<input type="checkbox"/> \$6,714/person on health
<input type="checkbox"/> life exp: 78 men, 83 women	<input type="checkbox"/> life exp: 75 men, 80 women






Our Home and Native Land

Canada	USA
	



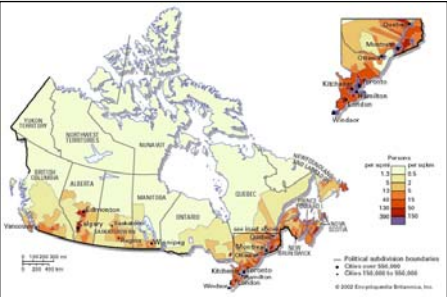
Canadian Health Care



- “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

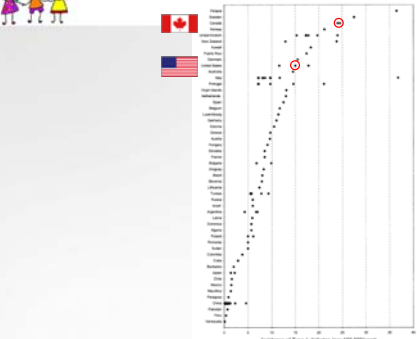
Diabetes in Canada

- More than 3 million Canadians have diabetes.
- Over 300,000 Canadians live with type 1 diabetes.
- About 1 in 320 Canadian kids has diabetes.
- About 1 in 2,350 Canadian kids 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 \$17.4 billion a year.



NDSS: Diabetes in Canada, 2009

Worldwide Incidence of Diabetes





WHO DiaMond Study, 2000

Diabetes in BC

- More than 300,000 persons in BC have diabetes.
- About 2,000 kids (1–19 years) in BC have T1D (1 in 450).
- About 200 kids (1–19 years) in BC have T2D (1 in 4,500).
- About 240 BC kids will develop T1D this year (1 in 4,000).
 - 35 ages 1–4
 - 71 ages 5–9
 - 88 ages 10–14
 - 46 ages 15–19
- Direct cost for diabetes in BC is about \$1 billion/year.

BC Ministry of Health, 2005–2009

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

- 1922
- University of Toronto

Discovery of Insulin

Left: Teddy Ryder, July 10, 1922 Right: Teddy Ryder, July 10, 1923

DEAR DR. PARTING, I WISH YOU COULD COME TO SEE ME. I AM A FAT BOY NOW AND I FEEL FINE. I CAN CLIMB A TREE. MARGARET WOULD LIKE TO SEE YOU. LOTS OF LOVE FROM TEDDY RYDER.

Transplants: Edmonton Protocol

Donor: Islet isolation → Islet in Pancreas

Recipient: Islet in Portal Vein → Infusion of islets



Timeline: Islet infusion (> 8,000 IE/kg) at Day 0. Blood sugar levels: Normalized (10-12 mmol/L) from Day 0 to Day 1; Normalized (10-12 mmol/L) from Day 1 to Day 2; Normalized (10-12 mmol/L) from Day 2 to Day 3; Normalized (10-12 mmol/L) from Day 3 to Day 6; Normalized (10-12 mmol/L) from Day 6 to Day 12; Normalized (10-12 mmol/L) from Day 12 to Day 18; Normalized (10-12 mmol/L) from Day 18 to Day 24; Normalized (10-12 mmol/L) from Day 24 to Day 30; Normalized (10-12 mmol/L) from Day 30 to Day 36; Normalized (10-12 mmol/L) from Day 36 to Day 42; Normalized (10-12 mmol/L) from Day 42 to Day 48; Normalized (10-12 mmol/L) from Day 48 to Day 54; Normalized (10-12 mmol/L) from Day 54 to Day 60; Normalized (10-12 mmol/L) from Day 60 to Day 66; Normalized (10-12 mmol/L) from Day 66 to Day 72; Normalized (10-12 mmol/L) from Day 72 to Day 78; Normalized (10-12 mmol/L) from Day 78 to Day 84; Normalized (10-12 mmol/L) from Day 84 to Day 90; Normalized (10-12 mmol/L) from Day 90 to Day 96; Normalized (10-12 mmol/L) from Day 96 to Day 102; Normalized (10-12 mmol/L) from Day 102 to Day 108; Normalized (10-12 mmol/L) from Day 108 to Day 114; Normalized (10-12 mmol/L) from Day 114 to Day 120.

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

J Clin Invest 1996;98:1417-1422

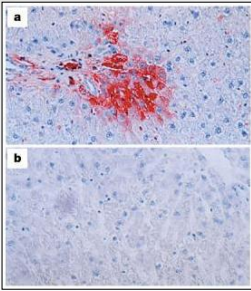
Generex Biotechnology

- Oral-lyn™
- RapidMist™ device
- “buccal delivery”
- absorbed from mouth
- Canadian (Toronto)
- in Phase 3 trials
- approved in some countries






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

Nature 2000;408:483-488






Gene Therapy: K Cells




- 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 sufficient to keep blood glucose normal if β cells are destroyed
- mice lived up to 6 months without insulin

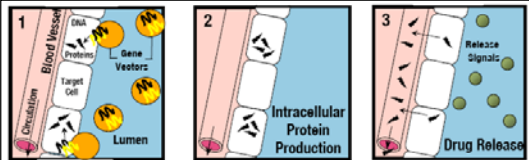
Science 2000;290:1959-1962






enGene Inc.



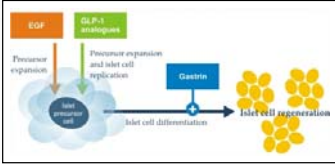

- GEMS™-Insulin (Gut Endocrine-cell Modification System)
- non-viral (chitosan- Φ C31) gene transfer
- large-animal trials (pigs) underway
- next: human trials!
- Canadian (Vancouver)





Transition Therapeutics Inc.

- E1-I.N.T.™ and GLP-1-I.N.T.™ (Islet Neogenesis Therapy)
- use of epithelial growth factor (E1) or GLP-1 and gastrin (TT-223) analogs to stimulate the growth of new islets
- E1-I.N.T.™ Phase 2a trials: lowers insulin needs in T1D and lowers A1C in T2D
- Canadian (Toronto)







Diabetes Research at BCCH

- Centre for Research on Childhood Diabetes
- CFRI Translational Research Building
- funding from CDA, JDRF, Canada Foundation for Innovation and the BC Knowledge Development Fund
- Research areas:
 - genetics of T1D
 - islet-cell biology and transplantation
 - viral pathogenesis of T1D
 - immunology of T1D
 - clinical diabetes research








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

Standards of Care



Type 1 Diabetes in Children and Adolescents

Canadian Diabetes Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada

INTRODUCTION

EDUCATION

INSULIN THERAPY

Other Guidelines

Pediatric Diabetes

VOLUME 10 • SUPPLEMENT 1 • SEPTEMBER 2008

WILEY-BLACKWELL

Diabetes Care



Volume 33

September 2010

Clinical Practice Recommendations 2010

AMERICAN DIABETES ASSOCIATION



INTERNATIONAL SOCIETY OF PEDIATRIC AND ADOLESCENT DIABETES

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


CDA 2008 Clinical Practice Guidelines





ADA: A1C and Glucose Targets

- A1C:
 - 7.5–8.5% 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


ADA 2010 Clinical Practice Recommendations






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)


ISPAD 2009 Clinical Practice Consensus Guidelines 



Access to Care


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


CDA 2008 Clinical Practice Guidelines 



Initial Management


- Children with new-onset type 1 diabetes who are medically stable should receive their initial education and management in an outpatient setting, providing appropriate personnel and daily telephone consultation service are available in the community.


CDA 2008 Clinical Practice Guidelines 



Transition


- To ensure ongoing and adequate metabolic control, pediatric and adult diabetes care services should collaborate to prepare adolescents and young adults for the transition to adult diabetes care.


CDA 2008 Clinical Practice Guidelines 



A1C >10%


- Children with persistently poor diabetes control (e.g. A1C >10%) should be referred to a tertiary pediatric diabetes team and/or mental health professional for a comprehensive interdisciplinary assessment.
- Intensive family and individualized psychological interventions aimed at improving glycemic control should be considered to improve chronically poor metabolic control.


CDA 2008 Clinical Practice Guidelines 



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.


CDA 2008 Clinical Practice Guidelines 



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


CDA 2008 Clinical Practice Guidelines 



Glucagon


- ❑ 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.


CDA 2008 Clinical Practice Guidelines 



Mini-Dose Glucagon


- ❑ 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)


CDA 2008 Clinical Practice Guidelines 



DKA Prevention


- ❑ To prevent DKA in children with diabetes:
 - Targeted public awareness campaigns should be considered to educate parents and other caregivers (e.g. teachers) about the early symptoms of diabetes.
 - Comprehensive education and support services, as well as 24-hour telephone services, should be available for families of children with diabetes.


CDA 2008 Clinical Practice Guidelines 



Kidney Complications (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

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Eye Complications (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


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Nerve Complications (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



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Lipid Problems (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



CDA 2008 Clinical Practice Guidelines

High Blood Pressure (Hypertension)

- check all kids' blood pressure twice a year
- treat BP \geq 95th percentile for age with lifestyle modification, weight loss
- treat persistent high blood pressure as for non-diabetic kids



CDA 2008 Clinical Practice Guidelines

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/hypothyroidism



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Celiac Disease

- celiac disease occur 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


CDA 2008 Clinical Practice Guidelines

Other Recommendations

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

CDA 2008 Clinical Practice Guidelines



My Recommendations

[Empty space for notes]

My Recommendations

Learn as much as you can about diabetes.

CWD

JDRF

CDA

My Recommendations

Get the A1C in target.

A1C	Kidneys (Relative Risk)	Eyes (Relative Risk)	Nerves (Relative Risk)
6	1.0	1.0	1.0
7	1.5	1.5	1.5
8	2.5	2.5	2.5
9	4.0	4.0	4.0
10	7.0	6.0	5.0
11	12.0	10.0	8.0
12	16.0	14.0	12.0

My Recommendations

Fear hyperglycemia as much as you fear hypoglycemia.

normal

hypoglycemia

hyperglycemia

Differential effects of lows and highs on developing brains.

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.



Canadian
Diabetes
Association



children with **DIABETES**




JDRF Juvenile
Diabetes
Research
Foundation
dedicated to finding a cure




**American
Diabetes
Association**




BC Children's Hospital Resources



BCCH Online Insulin Dose-Adjustment Program







BCCH MDI Handout

Basal-Bolus Insulin
with Multiple
Daily Injections

Focus on Children & Youth





BCCH EDU Website



<http://endodiab.bcchildrens.ca>





**Enjoy the conference!
Have fun and make new friends!**

