



Diabetes Care in the School Setting:
Evidence-Informed Key Components, Care Elements and Competencies

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Child Health BC

4088 Cambie Street, Suite 305, Vancouver, BC, Canada V5Z 2X8

www.childhealthbc.ca

Executive Summary

In March 2013, Child Health BC (CHBC) organized a collaborative process with province-wide participation to gain consensus on the evidence-based key components and care elements of diabetes care in the school setting and the competencies required to deliver the care. Child Health BC, an initiative of BC Children's Hospital (BCCH) and funded by the BC Children's Hospital Foundation, is a network of partners which includes all health authorities, key child-serving ministries, health professionals, and provincial partners dedicated to improve the health status and health outcomes of British Columbia's children and youth.

This report describes the collaborative process undertaken by CHBC. It provides the evidence, care elements and competencies for each of the key components for diabetes care in the school setting. The information in this report was developed through the review of existing guidelines, relevant literature searches, and contributions from parents and providers. In addition, the report outlines recommendations regarding the need for evaluation, including the monitoring of child and youth outcomes, provider and parent satisfaction, and safety. The report can be used to inform policy and practice deliberations on diabetes care in the school setting.

Authors of this Report

Jennifer Scarr, RN MSN, Provincial Lead Health Promotion, Prevention & Primary Care, Child Health BC

Dr. Maureen O'Donnell, MD MSc FRCPC, Executive Director, Child Health BC; Associate Professor, Department of Pediatrics UBC

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INTRODUCTION

Background

Type 1 (insulin-dependent) diabetes is one of the most common chronic diseases of childhood.ⁱ Diabetes is a complex condition, which affects all aspects of children's lives. Since children with diabetes spend an average of 6 - 7 hours a day in school, appropriate diabetes care in the school setting is important for the child's immediate safety, long-term well-being, and optimal academic performance.ⁱ

Estimating the prevalence of diabetes in children and youth in British Columbia (BC) requires the use of an evidence-based algorithm given that BC does not have a provincial data source or diabetes registry for the children and youth population. Significant research has been undertaken to create an evidence-based algorithm that is suitable to BC's context. Using this research, there are approximately 2,200 children from 1 - 19 years of age with type 1 diabetes in BC (2006/07), with an estimated 220 new cases per year.ⁱⁱ Of the 2,200 children with diabetes in BC approximately half (1,100) are between the ages of 5-14 years.ⁱⁱ The age standardized rates for BC per 1,000 population indicates that the rates of diabetes in children and youth are highest in Northern and Interior Health Authorities.ⁱⁱ

Over the last number of years, advances in diabetes technology and management have changed the way children and youth manage their diabetes, including in the school setting. Insulin can be delivered more precisely using intensive diabetes management tools such as multiple daily injections and insulin pump therapy. These management regimens allow the student to match their insulin to their food intake, and correct significantly higher-than-target blood sugars without delay.ⁱ The Canadian Diabetes Association (CDA) reports that it is important to ensure that the blood glucose level of children with diabetes are maintained as close to the normal range for as much time as possible in order to reduce the risk of developing long-term complications.ⁱⁱⁱ

The care provided to children with diabetes in the school setting varies across Canada. Each province and territory has its own Ministry of Education or Department of Education which governs schools within its region. Some of Canada's provincial ministries are responsible for determining policies to promote and support the health and safety in their school setting for publicly funded schools only, while others also cover private schools. Many schools collaborate with health ministries or agencies to develop teaching and training resources that support the management and care required in the school setting. Some examples of the materials that have been developed include: New Brunswick's *A Handbook for Type 1 Diabetes Management in Schools*; Halton (Ontario) School District's *Diabetes Management: A Protocol for Schools*; and Nova Scotia Education's *Guidelines for Supporting Students with Type 1 Diabetes (and Other Diabetes Requiring Insulin) in Schools*.

In BC, similar to other parts of Canada, care provided to children with diabetes in the school setting varies across the province. A recent BC Medical Journal article stated that diabetes care provided to children in the school setting in BC may differ depending on five things: which school district they are in; which school within the district they attend; the nursing support available for that school; the principal in charge of that school; and whether the parents can advocate effectively for their child.^{iv} A range of services are used to support children with diabetes in BC. While a variety of health care and educational professionals may assist in planning and delivering the child or youth's health service, Nursing Support Services (NSS), which is funded by the Ministry of Children and Family Development (MCFD) often has an important school and community role. NSS assists

parents and caregivers to help children with special health care needs lead active, healthy lives in their communities, while facilitating safe, consistent care and appropriate health supports.^v

Growing up with diabetes adds challenges at every stage of growth and development. This chronic condition requires health attention from the time it is first diagnosed onward. In addition, the child and youth's needs with respect to the condition change with the child's changing physical health and developmental maturity. In BC, it has been identified that there is a need to provide guidance on the approach to care required for children in the school setting that maintains their health and safety and ensures that their school experience has minimal disruptions, in an effort to support an optimal learning environment.

Purpose

Child Health BC, which is a network of BC health authorities, BC government ministries, health professionals, and provincial partners dedicated to improve the health status and health outcomes of BC's children and youth, organized a process with province-wide participation to gain consensus for evidence-based diabetes care for the school setting. Through this collaborative process CHBC determined the evidence-based key components and care elements of diabetes care in the school setting and the competencies required to deliver the care.

Scope

When articulating the needs for diabetes care for children, the environments where they live their day to day lives must be considered. These can include home, school, community and healthcare settings. The information in this report focuses on the evidence related to the diabetes care in the school setting. Students with diabetes may require assistance due to their developmental level, experience with diabetes and hypoglycemic awareness. Even if the student is able to provide self-care, they will need help and assistance in a diabetes emergency. Whenever possible, the student should be encouraged to provide his or her own diabetes care at school to the extent that is appropriate based on the student's development and his/her experience with diabetes.^{vi}

Child Health BC (CHBC) led a staged approach to determine the best evidence regarding diabetes care in the school setting. A description of the staged approach is provided in this report.

METHODOLOGY

Stage One

An extensive literature search and jurisdictional scan was completed, as reflected in the [Bibliography](#). There were several evidence grading systems found in the literature search. Table 1 provides an overview of the evidence grading systems encountered: a Canadian Diabetes Association grading system based on commonly referenced Evidence-Based Practice criteria for assigning levels of evidence to published studies (CDA/EBP); Canadian Diabetes Association grading system which assigned grades of recommendations for clinical practice (CDA); and, the American Diabetes Association and the International Society for Pediatric and Adolescent Diabetes both of which utilized the same evidence grading system denoted below as ADA/ISPAD. It was decided that the evidence that was already graded for quality would be referenced according to the grading system in the source document. For all other evidence, after review, the CDA grading system was used. In this document if a specific grade of evidence is not explicitly reported for a key component or competency statement the evidence level is CDA grade D. This means that the evidence is from a case series, a case report, an observational study, or expert consensus.

	CDA/EBP	CDA	ADA/ISPAD
Systematic overview or meta-analysis or high quality RCT	1A	A	A
Large high quality RCT	1A	A	A
Well-designed cohort study (non-randomized) with indisputable results	1B	A	B
Methodologically flawed RCT (poorly controlled)	2	B	C
Cohort study	3	C	C
Case series/case report/ observation study	4	D	C
Expert consensus/other	4	D	E (no D)

Table 1

While reviewing the evidence, several key components of care for students with diabetes in the school setting emerged. The key components identified included: *providing a supportive environment; nutritional management and physical activity; blood glucose monitoring; insulin administration; and, emergency procedures and management*. The evidence for each of the key components was reviewed and evaluated to determine the care elements. These care elements represent the detailed care required for each of the key components for diabetes care in the school setting. Some of the original wording has been revised to more adequately reflect the school environment, however, the key themes are consistent with the original reference.

The information gathered through the jurisdictional scan and literature search was used to develop an initial draft document outlining the evidence-based care elements for each of the following key components: Providing a Supportive Environment; Blood Glucose Monitoring; Insulin Administration; Nutritional Management & Physical Activity; and, Emergency Procedures and Management.

Stage Two

A provincial working group was established. This Working Group which was co-led by a CHBC provincial lead and a BCCH pediatric endocrinologist, and included participation from multiple disciplines such as: pediatric endocrinologists, diabetes educators, pediatricians, a general practitioner, nursing support services, school administrator, and school support supervisor, as well as two parents of children with type 1 diabetes. In order to be as inclusive as possible and to ensure that all voices were heard, representatives on the Working Group included members from across the province of BC and had experience in urban, rural and remote settings. Refer to [Appendix B](#) for a complete list of Working Group members.

Over the course of three meetings, one in-person and two teleconferences, the evidence and care elements for each of the key components was discussed. The Working Group revised the original draft document to reflect the BC experience. This draft document provided the baseline information to support the discussion at a larger provincial meeting.

Stage Three

A Large Provincial Stakeholder meeting was held on May 24th, 2013 and included a broad representation from parents, non-governmental organizations, and service providers. The purpose of this meeting was to reach convergence and if possible consensus around the care elements for each of the key components required for evidence-based diabetes care in the school setting.

To support provincial inclusiveness and provide a multi-disciplinary perspective, participants in the Large Stakeholder meeting included parents, representatives from each of the Health Authorities, pediatricians, diabetes educators, nursing support services coordinators, school administrators, and BC ambulance services. The participants were from all areas across the province including urban, rural and remote communities. The Canadian Diabetes Association (CDA) and Juvenile Diabetes Research Foundation (JDRF) also sent representation to the meeting. For a complete list of participants please see Appendix A.

The meeting was facilitated by an independent facilitator and through small group discussions, large group reporting, and a voting process, convergence/consensus on each of the key care elements was established. Participants reached between 87 - 100% agreement on the care elements, which represents strong consensus.

Stage Four

The Provincial Working Group met following the Large Stakeholder meeting to review the results of the Large Stakeholder meeting and focused on the evidence related to competencies. The Working Group considered this evidence to determine the competencies required to deliver diabetes care in the school setting.

THE REPORT

This report provides the background information of evidence, care elements and competencies for each of the key components for diabetes care in the school setting. The information in this report was developed through the review of existing guidelines, relevant literature searches, and contributions from the stakeholder meeting of parents and providers. The report can be used to inform policy and practice deliberations on diabetes care in the school setting.

Considerations

The following information must be considered when reviewing the information in this report:

- Although there was convergence/consensus for the care elements, the strength of the evidence is low, with the majority at grade D (consensus).
- The evidence reviewed focused on the school setting; therefore information in this document should not be applied to populations in other settings such as preschools or daycares.
- Evidence for the care elements included information from jurisdictions outside of Canada, which have different health care service delivery models; this must be considered when applying to the BC context.
- And lastly, care for diabetes has changed considerably over the past years and more changes are expected in the future; therefore, care elements will need to be reviewed and revised based on changes in technology and new care delivery methods.

KEY COMPONENTS AND CARE ELEMENTS

SUPPORTIVE ENVIRONMENT

Relevant Evidence

General

1. Since a sizable portion of a child's day is spent in school, close communication with and cooperation of school is essential for optimal diabetes management, safety, and maximal academic performance.ⁱ
2. Children spend 40 - 50% of their waking hours in school. Diabetes care in school is an important part of their diabetes management plan.^{vii}
3. The needs of a student with diabetes should be provided for within the child's usual school setting with as little disruption to the school's and the child's routine as possible and allowing the child full participation in all school activities.ⁱ
4. Students with diabetes must be given the opportunity to participate fully and freely in day to day activities. With planning and support these students can participate safely in all school activities and have a productive and fun time at school.^{viii}
5. Reasonable adjustments that genuinely allow the student to participate in education and training on the same basis as other students must be made.ⁱ
6. School personnel must be supportive of providing diabetes care and encourage diabetes management during school hours [ISPAD, E].^{vii}
7. The child has a right to receive adult support for diabetes care from school personnel during school hours, outdoor school activities, when at school sponsored events away from school, and should natural disasters occur at school [ISPAD, E].^{vii}
8. Students need to be allowed to have access to their food and blood glucose monitoring equipment in case of hypoglycemic episodes during an exam or test.^{ix}

Individual Care Plan

1. An individual care plan should be developed with the appropriate health care provider and input from the parent/guardian.ⁱ
2. The individual care plan should address the specific needs of the child and provide specific instructions for each of the following: blood glucose monitoring; insulin administration; meals and snacks; symptoms and treatment of hypoglycemia; symptoms and treatment of hyperglycemia; participation in physical activity; and, emergency evacuation instructions.^{vi}
3. The school should never discourage or alter a medical treatment plan that is regarded by the diabetes team to be optimal for the child.^{vi}

Training and Education

1. Knowledgeable trained personnel are essential if the student is to avoid the immediate health risks of low blood glucose and to achieve the metabolic control required to decrease risks for later development of diabetes complications.^{vi}
2. Diabetes education must be targeted toward teachers, and other school personnel who interact with the child, including school administrators, school nurses, coaches, health aides, bus drivers, secretaries, etc.^{vi}
3. School personnel must be trained to provide or supervise all diabetes care prescribed by the diabetes (health care) team [ISPAD, E].^{vii}

Care Elements

General

1. The student wears medical identification at all times.^{ix}
2. A formal communication system is established with all school personnel who come into contact with the student with diabetes.^{ix}
3. Parents/guardians are provided with reasonable notice of any change in school routine or of upcoming special events.^{ix}
4. Phone numbers are available for the parent/guardian, emergency contacts, and the appropriate health care provider so that the school can contact these individuals with diabetes-related questions and/or during emergencies.^x

Care Plan

1. Individual care plans are developed with the appropriate health care provider and input from the parent/guardian.ⁱ
2. The information in the individual care plan of the student with diabetes is agreed upon before each school year begins (or upon diagnosis of diabetes or change in diabetes regimen).^{xi}
3. The individual care plan is documented and signed by a representative of the school, the parents/guardian and the appropriate health care provider.^{xi}

Education and Training

1. Current recommendations and up-to-date resources regarding appropriate care for children with diabetes in the school are universally available to all school personnel.^{vi}
2. Training for school personnel is provided and in keeping with the following:
 - a. **Level 1. All school personnel receive training** that provides a basic understanding of diabetes, how to recognize and respond to the signs and symptoms of low blood glucose (hypoglycemia) and high blood glucose (hyperglycemia), and who to contact immediately in case of an emergency.^x
 - b. **Level 2. Classroom teachers and all school personnel who have responsibility for students with diabetes throughout the school day** receive Level 1 training plus additional training to carry out their individual roles and responsibilities and know what to do in case of a diabetes emergency. For example: how to activate Emergency Medical Services in case of a diabetes emergency; expanded knowledge of diabetes (types of diabetes, the role of blood glucose monitoring, the importance of balancing insulin/medication with physical activity and nutrition); impact of hypoglycemia or hyperglycemia on behavior, learning and other activities; procedures and brief overview of the operation of devices/equipment commonly used by students with diabetes; tips and planning needed for the classroom and for special events.^x
 - c. **Level 3. One or more school staff members receive in-depth training about diabetes and routine and emergency care for each student with diabetes** from a diabetes trained health care professional. This training will help ensure that a school staff member is always available to help all students with diabetes in case of an emergency and to help younger or less experienced students or those with additional physical or mental impairments perform diabetes care tasks (e.g., administering insulin or checking their blood glucose).^x

Special Accommodations

1. Trained adult support for diabetes care during curricular activities is the responsibility of the school district. Trained adult support during extracurricular activities which occur away from school is consistent with education-related legislation and school district policy, requires parental authorization and consultation with the school/district.^{xii}

NUTRITIONAL MANAGEMENT AND PHYSICAL ACTIVITY

Relevant Evidence

Nutritional Management

1. Children with diabetes should follow a healthy diet as recommended for children without diabetes in *Eating Well with Canada's Food Guide*. This involves consuming a variety of foods from the 4 food groups (grain products, vegetables and fruits, milk and alternatives, and meat and alternatives).^{iii, vii} All students need a variety of healthy foods to maintain normal growth and development.^x Nutrition therapy should be individualized (based on the child's nutritional needs, eating habits, lifestyle, ability and interest) and must ensure normal growth and development without compromising glycemic control.ⁱⁱⁱ
2. Appropriate matching of insulin to carbohydrate content may allow increased flexibility and improved glycemic control.ⁱⁱⁱ
3. Regularity in meal times and routines helping to establish better eating practices and monitoring of food intake has been shown to be associated with better glycemic outcomes [ISPAD, A/C].^{vii}
4. There are two methods of meal planning using carb counting: following a consistent carb intake meal plan and adjusting insulin for changing carb intake.^x Monitoring carbohydrate, whether by carbohydrate counting, choices, or experience-based estimation, remains a key strategy in achieving glycemic control. [ADA, B].ⁱ
5. MDI (multiple daily injections) and CSII (continuous subcutaneous insulin infusion) increase flexibility by allowing more variable food intake at different meal times, decreasing the need for between meal snacks and enable greater insulin dose adjustments.^{vii}
6. There are no forbidden foods for people with diabetes.^x
7. Children with type 1 diabetes are at increased risk for classic or atypical celiac disease during the first 10 years of diabetes. There good evidence that treatment of classic or atypical celiac disease with a gluten-free diet improves intestinal and extraintestinal symptoms.ⁱⁱⁱ

Physical Activity

1. For health benefits, children aged 5-11 years and youth aged 12-17 years should accumulate at least 60 minutes of moderate- to vigorous – intensity physical activity daily.^{xiii}
2. Children and adolescents with diabetes should be encouraged to participate in regular physical activity because it promotes cardiovascular health and aids in weight management [ISPAD, E].^{vii} Students with diabetes should participate fully in physical education classes and team or individual sports.^x Daily physical activities should be a part of the normal routine for both health benefits and for consistency in blood glucose management.^{vii}
3. Young people with diabetes have variable blood glucose responses to exercise. The blood glucose response to 60 minutes of intermittent exercise is somewhat reproducible within a child if the timing of exercise, the amount of insulin and the pre-exercise meal remain consistent.^{vii} Nearly all forms of activity lasting greater than 30 minutes will be likely to require some adjustment to food and/or insulin.^{vii} For a small number of students, shorter duration of physical activity may cause hypoglycemia.^{xiv}
4. The amount of carbohydrate required for exercise is dependent on the blood glucose level at the start of exercise, the intensity of the exercise, the frequency of routine exercise, the prevailing insulin level at the time and the insulin regimen.^{vii}
5. Focus on adapting the diabetes regimen to fit within the school timetable and school specific issues such as physical education [ISPAD, E].^{vii}

6. Planned or unplanned physical activity is one of the most common causes of hypoglycemia in young people with type 1 diabetes, and intense physical activity sometimes causes hyperglycemia [ISPAD, E].^{vii} During moderate exercise, additional carbohydrate may be consumed to prevent hypoglycemia [ISPAD, C].^{vii}
7. For the prevention of hypoglycemia in type 1 diabetes strategies include the consumption of extra carbohydrates for exercise, limiting pre-meal bolus insulin doses and altering basal insulin for insulin pump users. These strategies can be used alone or in combination.^{vi}
8. Most team and field sports and also spontaneous play in children are characterized by repeated bouts of intensive activity interrupting longer periods of low to moderate activity or rest. This type of activity has been shown to produce a lesser fall in blood glucose levels compared to continuous moderate intensity, both during and after the physical activity in young adults [ISPAD, D].^{vii}
9. Rapidly absorbed sugar may be sufficient for sudden short duration exercise (for example, glucose or sucrose sweets) and should be consumed immediately before or during the activity.^{vii}
10. Participation in almost any sport or exercise is likely to be safer in company, but for the person with diabetes this is even more important. At least, one companion should know something about diabetes and how to recognize and manage hypoglycemia.^{vii}

Care Elements

General

1. Regular and ongoing communication is established between the student, family, and school staff so an effective response can be made to changes in activities, special events, snacks at school, or to the student's diabetes management requirements.^{ix}
2. Students with celiac disease should not eat any food products that contain gluten or that have been prepared in a gluten-contaminated environment. These dietary restrictions are outlined in the individual care plan.^x

Nutritional Management

1. Parents provide all snacks, as well as an ongoing supply of fast-acting glucose for treating hypoglycemia.^{ix}
2. The student is given permission to eat a snack anywhere, including the classroom or the school bus, if necessary to prevent or treat hypoglycemia.^{vi}
3. For young children, instructions are given by parent for food provided during school parties and other activities.^{vi}
4. The nutrition management information outlined in the student's individual care plan is implemented. Nutritional requirements are clearly identified and the plan addresses deviations from expected intake.^{xiv}

Conventional Therapy

1. Ensure all snacks and meals are eaten on time. Students require adequate time to finish their meals.^{vii}
2. Supervision of snacks and meals may be required.^{vii}
3. Conventional insulin regimes require day-to-day consistency in carbohydrate intake (often as three regular meals with snacks between) to balance the insulin action profile and prevent hypoglycemia.^{vii} Students should eat lunch at the same time each day. Snacks are often necessary to achieve a balance.^x

Multiple Daily Injections (MDI)

1. Regularity in meal times and eating routines are important for optimal glycemic outcomes.^{vii}
2. Parents/guardians are responsible for providing carbohydrate content of the student's food.^{xii}
3. With the provided insulin-to-carbohydrate ratios for each individual child, the insulin dose is determined based on the estimated carbohydrate content of the meal or snack.^{vii, xii}
4. Administration of doses of rapid-acting insulin, as stated by parent/guardian in the individual care plan, are given to cover the carbohydrate in a meal or snack,^x and to lower blood glucose levels that are above target [ISPAD, A].^{vii, xii}

Continuous Subcutaneous Insulin Infusion (CSII)/Insulin Pump Therapy

1. Regularity in meal times and eating routines are important for optimal glycemic outcomes.^{vii}
2. Parents/guardians are responsible for providing carbohydrate content of the student's food.^{xii}
3. With the provided insulin-to-carbohydrate ratios for each individual child, the insulin dose is determined based on the estimated carbohydrate content of the meal or snack.^{vii, xii}
4. Administration of doses of rapid-acting insulin, with dosing calculated using a bolus calculator, is given to cover the carbohydrate in a meal or snack,^x and to lower blood glucose levels that are above target, as stated by parent/guardian in the individual care plan [ISPAD, A].^{vii, xii}

Physical Activity

1. Blood Glucose (BG) monitoring is performed prior to exercise. The student's individual care plan at school specifies when physical activity should be restricted because the blood glucose level is either too high or too low.^x
2. After BG monitoring is performed prior to exercise, extra carbohydrates are considered based on the BG level and the expected intensity and duration of the exercise.^{vii}
3. During periods of physical activity, student with diabetes need to have rapidly absorbed carbohydrate readily available.ⁱⁱⁱ Glucose tablets, glucose gel or some form of rapidly absorbed sugar are carried by the student or kept within a reasonable distance of the activity.^{vii} During moderate exercise additional carbohydrate may be required to prevent hypoglycemia. For many, all that will be required is a small snack of 10-15g carbohydrate. For example, a fruit or fruit juice, dried fruit, a cereal, fruit or granola bar or sports bar.^{vii}
4. Physical education teachers and coaches are able to recognize the symptoms of hypoglycemia and be prepared to call for help.^x
5. If a pump is used, the individual care plan includes specific instructions regarding pump use during physical activity.^x If the pump is removed during physical activity, a safe storage place is provided.^x

BLOOD GLUCOSE MONITORING

Relevant Evidence

General

1. Monitoring of blood glucose (BG) is an essential part of management of type 1 diabetes.^{xv}
2. The aims of monitoring glycemic control are:
 - To assess with accuracy and precision the level of glycemic control achieved by each individuals that they may benefit from attaining their most realistic glycemic targets [ISPAD, A].^{vii}
 - To help in preventing both the acute complication of hypoglycemia and the chronic complications of microvascular and macrovascular diseases [ISPAD, A].^{vii}
 - To minimize the effect of hypoglycemia [ISPAD, A] and hyperglycemia [ISPAD, B/C].^{vii}
3. Monitoring of blood glucose provides immediate documentation of hyperglycemia and hypoglycemia, allowing implementation of strategies to optimally treat, as well as to avoid, out of range glucose values.^{vii}
4. CDA's ideal pre-meal targets are: under 6 years of age, 6-10 mmol/L; 6-12 years of age, 4-10 mmol/L and 13-18 years of age, 4 - 7 mmol/L.ⁱⁱⁱ
5. Treatment goals and strategies must be tailored to each child, with consideration given to individual risk factors.ⁱⁱⁱ
6. It is impossible to determine accurate blood glucose levels by how the student looks or feels.^{viii}

Frequency and Timing

1. The child's health care provider/team may order blood glucose checking with a meter several times during the school day.^x
2. Timing of self-monitoring blood glucose (SMBG) is best measured at different times in the day to show levels of BG, in response to action profiles of insulin, after food intake (1.5 – 2 h after a meal), and in association with vigorous sport or exercise [ISPAD, B].^{vii}
3. Successful application of intensified diabetes management with multiple injection therapy or insulin infusion therapy require frequent SMBG (four to six times a day) and regular, frequent review of the results to identify patterns requiring adjustment to the diabetes treatment plan.^{vii}
4. An increase in SMBG frequency up to 5/d was associated with a significant improvement in metabolic control in all treatment groups.^{xvi}
5. The association between SMBG and A1C levels appeared to level-off at approximately 10 SMBG measurements per day, with adjusted mean A1C being similar in participants testing 10-12 times as in those testing >13 times per day.^{xvii}
6. SMBG is best measured to confirm hypoglycemia and to monitor recovery [ISPAD, E].^{vii}
7. BG monitoring should be performed prior to exercise.^{vii}
8. Checking BG does not present a danger to other students or to staff when there is a plan for proper disposal of lancets and other materials that come into contact with blood.^x

Record Keeping

1. It is common practice for a monitoring diary, logbook, or some type of electronic memory device to be used to record patterns of glycemic control and adjustments to treatment. Monitoring record should not be used as a judgment but as a vehicle for discussing the causes of variability and strategies for improving glycemic control [ISPAD, E].^{vii}

Care Elements

General

1. Elementary school-aged children, depending on length of diagnosis and level of maturity, may be able to perform their own blood glucose checks, but usually will require supervision.^{vi}
2. All students, even those who can independently perform blood glucose monitoring (BGM), may need assistance when experiencing low blood glucose.^x
3. School personnel can only perform blood glucose monitoring if there is mutual agreement with parents or caregivers and training is provided.^{ix}

Equipment and Environment

1. BGM equipment is provided to the school. Blood glucose monitoring equipment is maintained and replaced as required by parents/guardians.^{vi}
2. Equipment for BG measurement is available to the student with diabetes for immediate confirmation of blood glucose [ISPAD, B/E].^{vii}
3. Students are permitted to check blood glucose levels and respond to the results in the classroom, at every school location or at any school activity.^x However, if preferred by the student, a private location to do blood glucose monitoring is provided.^{ix}
4. Arrangements are made for safe disposal of sharps.^{ix}
5. “Universal precautions” are implemented as per school policy.^{xiv}

Frequency/Timing

1. Blood glucose monitoring is recommended at midmorning/recess, lunchtime, 2 hours after lunch/nutrition (midafternoon), before sport or exercise, and if there are concerns regarding low blood sugar (hypoglycemia)/high blood sugar (hyperglycemia).^{xii}
2. Special considerations regarding blood glucose monitoring may be required for students that have long commutes to and from school.^{xii}
3. Student specific schedules for blood glucose monitoring are included in the individual careplan.^{xii}

Record Keeping

1. Blood glucose results are recorded in a separate logbook that is kept at school.^{xii}
2. Blood glucose values are communicated to the parent/guardian for review on a mutually agreed upon schedule, outside of episodes of hypoglycemia and hyperglycemia.^{vi}

INSULIN ADMINISTRATION

Relevant Evidence

General

1. Insulin therapy is the mainstay of medical management of type 1 diabetes and can be administered by syringe, pen or pump.ⁱⁱⁱ
2. Insulin regimes should be tailored to the individual's treatment goals, lifestyle, diet, age, general health, motivation, hypoglycemia awareness status and ability for self-management.ⁱⁱⁱ
3. The choice of insulin regimen depends on many factors, including the child's age, duration of diabetes, lifestyle (dietary patterns, exercise schedules, school, etc.), targets of metabolic control, socioeconomic factors, and family, patient, and physician preferences.^{iii, vii}
4. Daily insulin dosage varies greatly between individuals and changes over time; it therefore requires regular review and reassessment.^{vii}
5. Day-to-day insulin adjustments may be necessary for variations in lifestyle routine especially exercise or dietary changes.^{vii}
6. The high risk time (for hypoglycemia) after rapid-acting insulin is between 40 and 90 minutes [ISPAD, B].^{vii}
7. People with type 1 diabetes should be taught how to match insulin to carbohydrate intake [CDA, C, Level 2] or should maintain consistency in carbohydrate intake [CDA, D, Level 4].ⁱⁱⁱ
8. Extra carbohydrates together with adjustments of insulin doses are especially important when the activity is of longer duration than 60 minutes [ISPAD, E].^{vii} In the normal school week most young people will have at least one period of physical education. For many, all that will be required is a small snack of 10-15g carbohydrate, for example a fruit or fruit juice, dried fruit, a cereal, fruit or granola or sports bar.^{vii} Where a multi-injection regimen or pump therapy is being used, a reduction in the pre-exercise bolus or setting a temporary basal rate may be appropriate.^{vii}
9. Insulin is dosed based on food consumption (carbohydrates) and deviation from a target blood glucose.^{vii}
10. An insulin pen holds a cartridge of insulin. A needle is screwed onto its tip just before use. The user dials the pen to the prescribed dose and injects the insulin. Pen injector technique requires careful education including the need to ensure that no airlock or blockage forms in the needle [ISPAD, B].^{vii}

Management Regimens

1. Two methods of intensive diabetes management have been used: MDI and CSII/pump therapy.ⁱⁱⁱ
2. Improvements in glycemic control, particularly when provided by intensive insulin treatment with MDI or CSII/pump therapy reduces the risks of complications.^{vii}
3. Neither MDI or CSII/pump therapy regimens can be optimized without frequent assessment by blood glucose monitoring.^{vii}

Conventional Insulin Therapy (insulin given 2 - 3 times a day)

1. Rapid-acting insulin is used in combination with an intermediate-acting insulin (before breakfast and dinner, sometimes before bedtime).^{vii}
2. Use of conventional insulin therapy requires an individualized meal and activity plan that can and will be followed.ⁱⁱⁱ

Multiple Daily Injections (MDI) or Basal-Bolus Therapy

1. Most people with type 1 diabetes should be treated with MDI injections (three to four injections per day) [ADA, A].ⁱ
2. Rapid-acting insulin is given immediately before (or after) each main meal to match the amount of carbohydrates eaten [ISPAD, A].^{vii}
3. Meal insulin must take into account the carbohydrate content, the glycemic index of food, exercise around mealtime and that the carbohydrate to insulin ratio may not be the same at each meal.ⁱⁱⁱ
4. Pen injector devices containing insulin in prefilled cartridges have been designed to make injections easier and more flexible.^{iii, vii}

Continuous Subcutaneous Insulin Infusion (CSII); Insulin Pump Therapy

1. Pump use is increasing in the younger age group as clinicians become more comfortable with it as a more physiological insulin replacement therapy [ISPAD, C/E].^{vii}
2. CSII is safe and effective and can be initiated at any age.ⁱⁱⁱ
3. Newer “smart” pumps that automatically calculate meal or correction boluses based on insulin to carbohydrate ratios and insulin sensitivity factors have enabled alternate providers to participate in management tasks [ISPAD, E].^{vii}
4. Pump treatment may be hazardous when education and adherence to therapy is inadequate or the insulin supply is interrupted [ISPAD, C].^{vii}
5. The use of pumps requires special education for users.^{vii} The pump user or the family should be taught how to switch to multiple injections with pens or syringes in case of emergency.^{vii}
6. Insulin pumps can be disconnected for short periods (1-2 hours) during the day for showers, swimming or contact sports.^{viii}

Care Elements

Support and Assistance

1. The age at which the child can self-inject is determined by the child's health care provider and reflected in the child's individual care plan and agreed upon by the parent/guardian. There is great individual variation in the appropriate age for children to self-inject [ISPAD, B].^{vii} The appropriate age related to developmental maturity rather than chronological age [ISPAD, B].^{vii}
2. School personnel supervise the student who is performing self-injection if there is mutual agreement with the parent or caregiver and training has been provided to the school personnel.^{ix}
3. Designated school personnel who assist with the student's diabetes care tasks are knowledgeable about and trained in using and operating each student's insulin delivery system.^{xi}
4. The student is provided a clean and comfortable environment in which to administer insulin.^{ix}

Equipment/Materials/Medications

1. All children should have rapid-acting or regular insulin available for crisis management.^{vii}
2. Parents must provide an emergency supply kit for use in the event of natural disasters or emergencies when the students need to stay at school.^x
3. Emergency insulin storage needs to be considered in the school setting. It should never be stored in a locked cupboard or safe. It should be stored below 30 degrees C and away from direct sunlight and heat sources but not allowed to freeze if placed in a refrigerator.^{viii}
4. Insulin that the student uses on a daily basis is stored in a designated safe space at room temperature, not stored in a locked cupboard.^{xi}
5. "Universal precautions" are implemented as per school policy.^{xiv}

Dosing Insulin

1. Parents or adolescents determine daily doses of insulin based on support from their treating medical team.^{viii}
2. Insulin dose is determined after consideration of carbohydrate intake and blood glucose level.^{viii}
3. If school staff is involved in administering/supervising insulin, the parents are responsible for informing the school staff of the dose requirements.^{viii} This information must be included in the individual care plan.^{xi}

Conventional Therapy

1. This regimen usually doesn't require an extra injection of insulin at school.^{xi}

Multiple Daily Injections

1. Administration of doses of rapid-acting insulin, as stated by parent/guardian in the individual care plan, are given to cover the carbohydrate in a meal or snack, and to lower blood glucose levels that are above target [ISPAD, A].^{vii, x, xii}
2. Insulin at school should be given using an insulin pen rather than syringe.^{xii}

CSII/Insulin Pump Therapy

1. Administration of doses of rapid-acting insulin, with dosing calculated using a bolus calculator, is given to cover the carbohydrate in a meal or snack, and to lower blood glucose levels that are above target, as stated by parent/guardian in the individual care plan [ISPAD, A].^{vii, x, xii}
2. Overriding the calculated dose on the pump is not recommended.^{xii}

EMERGENCY PROCEDURES AND MANAGEMENT

Relevant Evidence

General

Emergency management in Type 1 Diabetes in children includes the recognition, assessment and treatment of hypoglycemia (low blood glucose) and hyperglycemia (high blood glucose).^{iii, vii}

Hypoglycemia

General

1. Hypoglycemia occurs when a student's blood glucose level falls too low, usually as a result of: too much insulin; missing or delaying meals or snacks; not eating enough food (carbohydrates); getting extra intense or unplanned physical activity; being ill particularly with gastrointestinal illness.^x
2. Hypoglycemia can impair the student's cognitive abilities which can affect their academic performance.^x
3. The blood glucose level at which hypoglycemia signs and symptoms begin to occur may vary among individuals and within the same individual at different times and in different situations.^{vii}
4. Hypoglycemia occurs more frequently in younger children and when the treatment regime is altered.^{iii, vii}
5. A student should never be left alone or sent to another location alone or with another student when experiencing hypoglycemia.^x
6. Symptoms of Hypoglycemia:

Symptoms of hypoglycemia

Neurogenic (autonomic)	Neuroglycopenic
Trembling	Difficulty concentrating
Palpitations	Confusion
Sweating	Weakness
Anxiety	Drowsiness
Hunger	Vision changes
Nausea	Difficulty speaking
Tingling	Headache
	Dizziness

ⁱⁱⁱ

7. Hypoglycemia can range in severity from mild to severe.^{iii, vii} Severe hypoglycemia is life-threatening.^{iii, vi, ix, x}
8. Severity of Hypoglycemia is described as follows:
 - **Mild:** autonomic symptoms are present. The individual is usually able to self-treat but younger children will almost always need to be treated by a parent or caregiver.ⁱⁱⁱ
 - **Moderate:** autonomic and neuroglycopenic symptoms are present. The individual needs help to treat.ⁱⁱⁱ
 - **Severe:** individual requires assistance of another person. Child is having altered mental status and cannot assist in their care, is semiconscious or unconscious or in coma +/- convulsions and may require parenteral therapy (glucagon or IV glucose).^{vii}

Treatment

1. The goals of treatment for hypoglycemia are to detect and treat a low BG level promptly by using an intervention that provides the fastest rise in BG to a safe level, to eliminate the risk of injury and to relieve symptoms quickly.ⁱⁱⁱ

2. In addition to ongoing monitoring, treatment of hypoglycemia involves provision of quick-acting glucose (sugar) for mild to moderate hypoglycemia and provision of glucagon (a hormone that raises blood glucose levels by injection for severe cases).^x
3. Treatment of hypoglycemia should be provided promptly and should provide immediate oral, rapidly absorbed, simple carbohydrate. The amount of carbohydrate required will depend on the size of the child, type of insulin therapy, and proximity to recent insulin dosage as well as the vigorousness of the immediate antecedent exercise.^{vii}
4. Amount of carbohydrate needed to treat mild to moderate hypoglycemia: under 15 kg, use 5 g carbohydrate; 15 - 30 kg, 10 g carbohydrate; over 30 kg, 15 g carbohydrate.ⁱⁱⁱ

Examples of 15 g carbohydrate for treatment of mild to moderate hypoglycemia

- 15 g glucose in the form of glucose tablets
 - 15 mL (3 teaspoons) or 3 packets of table sugar dissolved in water
 - 175 mL (3/4 cup) of juice or regular soft drink
 - 6 LifeSavers (1 = 2.5 g carbohydrate)
 - 15 mL (1 tablespoon) of honey
-

iii

5. Treatment of Severe Hypoglycemia:
 - a. Severe hypoglycemia in a **conscious** person should be treated by oral ingestion of 20g of carbohydrate, preferably as glucose tablets or equivalent. BG should be retested in 15 minutes and then re-treated with another 15g glucose if the BG remains <4.0mmol/L [CDA, D].ⁱⁱⁱ
 - b. Urgent treatment is required.^{vii} Severe hypoglycemia with **loss of consciousness** is most safely and rapidly reversed by injection of glucagon.^{vii} Glucagon is the only first line treatment for severe hypoglycemia that can be administered in a non-medical environment.^{xviii}
 - c. Provision of glucagon is a potentially life-saving treatment that, while it can cause nausea and vomiting when the student regains consciousness, cannot harm a student.^x
 - d. For individuals at risk of severe hypoglycemia, support persons should be taught how to administer glucagon by injection [CDA, D].ⁱⁱⁱ
 - e. Glucagon is given either subcutaneously or intramuscularly.^{vii} 0.5 mg if under 5 years of age, 1 mg if over 5 years of age [CDA, D].ⁱⁱⁱ
 - f. Caregivers or support persons should call for emergency services and the episode should be discussed with the diabetes healthcare team as soon as possible [CDA, D].ⁱⁱⁱ
 - g. School personnel should be trained to administer glucagon, particularly if the emergency response time is not guaranteed to be less than 20 minutes.^{ix}

Post Treatment

1. After treatment of mild to moderate hypoglycemia:
 - a. Blood glucose should be retested in 10 - 15 minutes [CDA, D].ⁱⁱⁱ
 - b. If no response or inadequate response, re-treat.^{iii, vii}
 - c. Once hypoglycemia is reversed, the next meal or snack due at that time of day should be eaten.^{iii, vii} If a meal is more than an hour away, a snack (including 15 g carbohydrate and a protein source) should be eaten [CDA, D].ⁱⁱⁱ

2. After treatment for severe hypoglycemia:
 - a. Observe closely.^{vii}
 - b. Monitor blood glucose because vomiting and recurrent hypoglycemia may occur.^{vii}
 - c. Once hypoglycemia is reversed, the next meal or snack due at that time of day should be eaten.^{iii, vii} If a meal is more than an hour away, a snack (including 15 g carbohydrate and a protein source) should be eaten [CDA, D].ⁱⁱⁱ

Hyperglycemia

General

1. Is defined as high blood glucose. Hyperglycemia does not usually result in a medical emergency.^x
2. Hyperglycemia occurs when the body gets too little insulin, too much food, or too little exercise; it may also be caused by stress or an illness such as a cold.^{vi}
3. Symptoms of hyperglycemia include: increased thirst and or dry mouth; frequent or increased urination; change in appetite and nausea; blurry vision; fatigue.^x
4. Short term hyperglycemia can impair the student's cognitive abilities and will affect their school performance. Long term moderately high blood glucose increases the risk for serious complications.^{iii, vi, x}

Treatment

1. As soon as symptoms are recognized, notify the trained diabetes personnel.^x
2. Check student's blood glucose level to determine if it is above the target range.^x
3. If the student uses a pump, check to see if it is connected and functioning properly.^x
4. Administer supplemental insulin in accordance with individual care plan.^x
5. Give the student extra water or non-sugar-containing drinks.^x
6. Allow unrestricted access to the washroom.^x
7. Modify physical activity as per individual care plan.^x

Care Elements

HYPOGLYCEMIA

Support and Assistance

1. All school personnel are trained to recognize hypoglycemia symptoms, initiate treatment, and when to call for assistance or how to treat severe hypoglycemia [ISPAD, E].^{vii}
2. Hypoglycemia emergency care plans are developed and include information regarding early recognition of hypoglycemia symptoms and treatment protocols and is provided to all school personnel who have responsibility for the student with diabetes during the school day.^x
3. Trained designated school personnel are available and able to check the student's blood glucose level to determine if it is low or high.^{x, xi}
4. Provide safe and readily accessible storage of the student's snack supply.^{ix}
5. If blood glucose levels are low, as outlined as low in the student's individual care plan, trained personnel should administer fast acting glucose according to the emergency/individual care plan, rechecking blood glucose and contacting the parent/guardian.^{x, xi}

Treatment of Severe Hypoglycemia for Students Unable to Swallow

1. Provisions are made for administration of glucagon at schools.^{xii}
2. Designated school personnel are trained to administer glucagon, with parental/guardian authorization in the individual care plan.^{xii}
3. Emergency medical assistance (911) will be called while glucagon is being administered and parents/guardians will be notified.^{x, xii}
4. School personnel will not give student anything orally if they are concerned about the student's ability to swallow. The student is positioned on his/her side to prevent choking.^{x, xii}

Equipment/Materials/Medications

1. Equipment for blood glucose measurement is available to all children with diabetes for immediate confirmation and safe management of hypoglycemia [ISPAD, B/E].^{vii} *Refer to Blood Glucose Monitoring section for more information on the care elements required for blood glucose monitoring.*
2. An immediate source of glucose or sucrose is always available to young people with diabetes [ISPAD, A].^{vii}
3. As per the emergency/individual care plan for the child mild to moderate hypoglycemia is treated by the oral intake of 10-15 g carbohydrate, preferably as glucose, sucrose tablets, glucose gel, fruit juice or soda (not diet) [CDA, B, Level 2].^{iii, x}
4. Parents/guardians supply the school with glucagon emergency kit. Kit is stored at room temperature. Expiration date is documented on the kit.^x
5. The designated school staff knows where the emergency kit is stored and has access to it at all times.^{x, xi} Glucagon is readily accessible to designated school personal, especially when there is a high risk of severe hypoglycemia [ISPAD, E].^{vii, xi}
6. Children and teens should wear some form of identification of their diabetes [ISPAD, E].^{vii}

Education/Training

1. Attention is given to train children, parents, school teachers, and other caregivers to recognize the early warning signs of hypoglycemia and treat low blood glucose immediately and appropriately.^{vii}
2. Education on administration of glucagon is essential [ISPAD, E].^{vii}

Record Keeping/Communication

1. Parent/guardian is notified immediately when treatment of moderate or severe hypoglycemia is required.^{ix}

HYPERGLYCEMIA

Support and Assistance

1. A hyperglycemia emergency/individual care plan exists at school and all school personnel who have responsibility for the student with diabetes receive a copy and are prepared to recognize and respond to signs and symptoms of hyperglycemia.^x
2. Trained designated school personnel are available and able to check the student's blood glucose level to determine if it is low or high.^{x, xi}
3. Immediately notify parent/guardian if the student is unable to eat or vomits at school. If the student vomits and parents/guardians or emergency contacts are unavailable, the student is taken to the nearest hospital.^{ix}
4. Trained diabetes personal may administer supplemental insulin in accordance with the emergency/individual care plan and parental permissions.^x
5. Permission is granted for the student to use restroom and have access to fluids (i.e. water) as high blood glucose levels can cause increased urination and may lead to dehydration if the student cannot replace the fluids.^{vi, x}

Equipment/Materials/Medications

1. Children and teens should wear some form of identification of their diabetes [ISPAD, E].^{vii}

Education/Training

1. Attention is given to train children, parents, school teachers, and other caregivers to recognize the early warning signs of hyperglycemia and treat appropriately.^{vii}

Record Keeping/Communication

1. Documentation of blood glucose testing and retesting of glucose is essential to ensure adequate, and not excessive, treatment of hyperglycemia.^{vii}

COMPETENCIES

In order to support a provincial approach to diabetes care in the school setting it is required that the care is delivered by competent providers. Competency is defined as a cluster of related knowledge, skills, and attitudes that correlate with job performance, can be measured, and can be improved by training and development.^{xix} The College of Registered Nurses of British Columbia (CRNBC) state that competency is the integration and application of knowledge, skills, attitudes, and judgment required to perform safely, ethically and appropriately as a nurse or in a designated role or setting.^{xxix} Whether the care is provided by a registered nurse, licensed healthcare provider, or unregulated care provider (care providers who are neither registered nor licensed by a regulatory body),^{xxix} it is important to ensure that the care provided to the child with diabetes in the school setting is done competently.

Recognizing that there is much to be learned from other areas, an extensive literature search and jurisdictional review was completed. It was discovered that although there has been a significant amount of work describing diabetes care in the school setting there is little information articulating the competencies required to deliver the care. Various approaches to diabetes care in the school setting have been undertaken in jurisdictions across Canada and internationally, with most of them describing the roles and responsibilities of providers but not the knowledge and skills required by these providers to deliver the care.

The jurisdictional scan revealed that diabetes care in the school setting is provided in a variety of ways: a registered nurse delegating care to an unregulated care provider; a registered nurse assigning care to school personnel; or, a parent authorizing care to trained school personnel (unregulated care providers). While some jurisdictions have established processes, education and competency training curriculums, and supporting materials and resources, many others have not. Table 2 provides an overview of the jurisdictions that were reviewed and a general sense of the amount of information available related to roles and responsibilities, established processes, competency curriculums and supporting materials.

Although the information in Table 2 is not an exhaustive list, it clearly identifies that Colorado and Alaska provide a comprehensive approach to supporting diabetes care in the school setting. It must be noted that none of the jurisdictions reviewed had completed an evaluation of their processes, supporting materials and/or care provided as a result of their approach.

JURISDICTIONAL REVIEW

TABLE 2:

Element	Canadian Diabetes Assoc. ^{ix}	Manitoba ^{xx}	New Brunswick ^{xxi}	Juneau Alaska ^{xxii}	Colorado	Texas ^{xxiv}	UK ^{xxv}	Leeds ^{xxvi}	Australia	Queensland ^{viii}
Established Roles & Responsibilities	***		***	***	***	**		**		**
Established process for assessing child's needs		***	**	***	***	*			**	
Established process for training & delegation/authorizing care to UCPs			*	***	***	**		*	*	*
Established competency statements							***		*	
Provides documents containing general information about diabetes care	**		**	***	***	**		**	**	***
Established competency training curriculum (knowledge & skills)				***	***	***				
Established competency supporting materials – tests, checklist, etc.	**		*	***	***	**				
Established evaluation of process, supporting materials and care provided										

Grading System – amount of information available/comprehensiveness of the available information:

*limited

**moderate

***detailed

Upon further review and discussion with the Working Group, it was determined that the approaches outlined by Alaska, Australia, and United Kingdom (UK) were closest to being suitable to the BC context. The information from these jurisdictions was used to develop a draft document outlining the knowledge and skills required to deliver diabetes care in the school setting. The Working Group reviewed the draft to validate its content and identify any BC specific issues or opportunities.

While the three jurisdictions considered in the development of the knowledge and skills focused primarily on unregulated care providers, the information listed is also relevant to other care providers such as registered nurses and others who support diabetes care in the school setting. The knowledge and skills outlined in the following tables are strongly interrelated and therefore must be considered together for the provision of diabetes care in the school setting.

In the following section of the report, for each of the Key Components and their associated Care Elements, Competencies are noted.

KEY COMPONENTS: COMPETENCIES

SUPPORTIVE ENVIRONMENT

	Knowledge & Skills
General Information	<p>Demonstrate knowledge of diabetes including:</p> <ul style="list-style-type: none"> • What is diabetes?^{xxii} • Identifies the types of diabetes.^{xxii} • Describes short and long-term consequences.^{xxii} • Describe the basic components of diabetes care at school.^{xxii}
Special Considerations	<p>Demonstrates an understanding of how to manage diabetes in different situations:</p> <ul style="list-style-type: none"> • Describes appropriate accommodations for long commutes to and from school, field trips, school sponsored activities and standardized testing (for curricular related activities and extracurricular activities as authorized by school district and parent).^{xxii, xxviii}

BLOOD GLUCOSE MONITORING

	Knowledge & Skills
Blood Glucose Testing	<p>Demonstrates Blood Glucose (BG) Testing:</p> <ul style="list-style-type: none"> • Describes blood glucose monitoring, its importance and equipment needed.^{xxii} • Discusses when a student’s blood glucose should be checked.^{xxii} • Demonstrates blood glucose test: <ul style="list-style-type: none"> ○ Review equipment used to monitor blood glucose.^{xxii} ○ Describe how student’s glucose meter operates.^{xxii} ○ Perform a blood glucose check.^{xxii} ○ Document and report the result according to local guidelines.^{xxii} ○ Interpret results and acts appropriately according to individual care plan and emergency procedures.^{xxii}
Interpreting and Acting on the BG Test Results	<p>Demonstrates interpretation of the BG results and appropriate actions:</p> <ul style="list-style-type: none"> • Describes how to document and report the result according to local guidelines.^{xxv} • Demonstrates the ability to interpret results and act on results appropriately according to individual care plan and emergency procedures.^{xxvii, xxviii}
Universal Precautions	<p>Demonstrates an understanding of the principles of universal precautions:</p> <ul style="list-style-type: none"> • Describes appropriate infection control prior to and following a BG test.^{xxvii}
Sharps Disposal	<p>Demonstrates an understanding of the principles of correct sharps disposal</p> <ul style="list-style-type: none"> • Describes care when handling sharps.^{xxvii} • Demonstrates correct disposal of sharps.^{xxvii}

NUTRITION & PHYSICAL ACTIVITY

	Knowledge & Skills
General Information	<p>Understands how to manage diabetes in different situations</p> <ul style="list-style-type: none"> • Describes relationship between food intake and blood glucose levels.^{xxii, xxviii} • Describes how physical activity affects blood glucose levels.^{xxii, xxviii} • Describes general concept of carbohydrate counting and how it is used to calculate insulin dose.^{xxii, xxviii}

INSULIN ADMINISTRATION

	Knowledge & Skills
General Information	<p>Demonstrates understanding of Insulin Basics:</p> <ul style="list-style-type: none"> • Describes the effect of insulin on blood glucose levels.^{xxv} • Describes insulin administration and delivery methods.^{xxii}
Supervising Injections	<p>Demonstrates an understanding of how an insulin injection is given:</p> <ul style="list-style-type: none"> • Identifies the appropriate equipment and how it is used to inject insulin.^{xxii, xxviii} • Demonstrates supervision of student giving injection - watch student dial up insulin dose check it's correct and watch them give their injection.^{xxvii, xxviii}
Injecting Insulin	<p>Demonstrates an understanding of how to give an insulin injection:</p> <p>Insulin by Pen:</p> <ul style="list-style-type: none"> • Identifies correct pen and insulin.^{xxvii} • Discusses injection sites and site rotation.^{xxvii} • Demonstrates preparation steps for insulin administration by pen.^{xxvii} <ul style="list-style-type: none"> ○ Check individual care plan for correct dose.^{xxvii} ○ How to prime pen with insulin to remove air from needle tip.^{xxviii} ○ How to dial the correct dose of insulin with an insulin pen.^{xxvii} ○ How to check dose dialed up with 2 people.^{xxvii, xxviii} ○ How to administer insulin via insulin pen.^{xxvii}
Insulin Pump	<p>Demonstrates an understanding of how an insulin pump works:</p> <ul style="list-style-type: none"> • Identifies supplies students using a pump need to have available.^{xxii} • Demonstrates basic operation functions of the pump.^{xxii} <ul style="list-style-type: none"> ○ Check individual care plan for correct dose.^{xxii} ○ How to select the correct insulin dose.^{xxii} ○ How to trouble shoot pump alarms appropriately.^{xxii}
Universal Precautions	<p>Demonstrates an understanding of the principles of infection control:</p> <ul style="list-style-type: none"> • Demonstrate appropriate infection control prior to and following giving an insulin injection.^{xxvii}
Sharps Disposal	<p>Demonstrates an understanding of the principles of correct sharps disposal:</p> <ul style="list-style-type: none"> • Describes care when handling sharps.^{xxvii} • Demonstrates correct disposal of sharps.^{xxvii}
Storage of Equipment & Insulin	<p>Demonstrates an understanding of how insulin and equipment is stored safely:</p> <ul style="list-style-type: none"> • Describes proper insulin storage, including:^{xxvii} <ul style="list-style-type: none"> ○ Store insulin and insulin delivery device in a safe place.^{xxvii} ○ Insulin to be used is at room temperature.^{xxvii} ○ Insulin is in date.^{xxvii}

EMERGENCY PROCEDURES & MANAGEMENT – HYPOGLYCEMIA

	Knowledge & Skills
General Information	<p>Demonstrates Understanding of Hypoglycemia (low blood glucose):</p> <ul style="list-style-type: none"> • Defines hypoglycemia.^{xxii} • Discusses how it can be prevented.^{xxii} • Lists the symptoms of hypoglycemia.^{xxii} • Describes how hypoglycemia should be treated.^{xxii}
Treatment	<p>Recognises and understands the importance of prompt treatment of hypoglycemia:</p> <ul style="list-style-type: none"> • Recognizes hypoglycemia and be able to administer glucose.^{xxv} • Describes appropriate treatment as per guidelines including accessing emergency services and glucagon administration.^{xxv, xxviii} • Knows where treatment for hypoglycemia is stored.^{xxv}
Glucagon Administration	<p>Recognises a severe hypoglycemia:</p> <ul style="list-style-type: none"> • Describes: <ul style="list-style-type: none"> ○ The purpose of glucagon.^{xxii} ○ How it should be stored.^{xxii} ○ When it is used.^{xxii} • Discusses injection sites.^{xxii} • Demonstrates preparation steps for administering glucagon.^{xxii} <ul style="list-style-type: none"> ○ Steps for preparation of medication.^{xxii} ○ How to administer it.^{xxii} • Discusses further care for the student and next steps.^{xxii}

EMERGENCY PROCEDURES & MANAGEMENT – HYPERGLYCEMIA

	Knowledge & Skills
General Information	<p>Demonstrates Understanding of Hyperglycemia (high blood glucose):</p> <ul style="list-style-type: none"> • Defines hyperglycemia.^{xxii} • Discusses how it can be prevented.^{xxii} • Lists the symptoms of high blood glucose.^{xxii}
Treatment	<ul style="list-style-type: none"> • Describes how hyperglycemia should be treated.^{xxii}

SYSTEMS APPROACH

The assessment, education, and evaluation of the knowledge and skills of unregulated care providers are not done in isolation. A broader system perspective is required to ensure that the processes, resources, training and monitoring are in place to support that diabetes care in the school setting is delivered competently. Competencies for each aspect of this comprehensive system need to be clearly articulated. The *Integrated Career and Competency Framework for Diabetes Nursing* from the UK describes the progression of knowledge and skills across the following five competency levels of unregistered providers and registered nurses: (1) Unregistered practitioner (2) Competent nurse (3) Experienced or proficient nurse (4) Senior practitioner or expert nurse (5) Consultant nurse.^{xxv} The Framework lists specific competencies for a suitably trained person to deliver diabetes care at a particular level and assumes general care is given competently. Key to this approach is the support of the other providers in the system so that none stand alone in reaching or providing their competencies. An example of the competency statements for Blood Glucose Monitoring is provided in Table 3.

TABLE 3:

Provider	Competency Statements ^{xxv}
Unregistered practitioner	<ul style="list-style-type: none"> • Perform the test according to manufacturers' instructions and local guidelines • Perform the test unsupervised, at the request of a registered nurse • Document and report the result according to local guidelines • Recognize and follow local quality assurance procedures, including disposal of sharps • Understand the normal range of glycemia and report readings outside this range to the appropriate person
Competent nurse	<p>As above, and:</p> <ul style="list-style-type: none"> • Actively seek and participate in peer review of one's own practice • Interpret the results and report readings outside the acceptable range to the appropriate person • Teach the test procedure to a person with diabetes or their carer (care provider)
Experienced or proficient nurse	<p>As above, and:</p> <ul style="list-style-type: none"> • Teach people with diabetes or their carer (care provider) to interpret test results and take appropriate action.
Senior practitioner or expert nurse	<p>As above, and:</p> <ul style="list-style-type: none"> • Develop specific guidelines for use in different situations • Assess the competencies of other HCPs.
Consultant nurse	<p>As above, and:</p> <ul style="list-style-type: none"> • Work with stakeholders to develop and implement local guidelines, promoting evidence-based practice and cost-effectiveness in the use of blood glucose monitoring.

While the UK model of care is different from the BC experience, the UK document demonstrates the importance of how each of the levels, in this case nursing, support the preceding level and all the levels together support a comprehensive system of care.

From a systems perspective it is also important to consider the training and education of school personnel. Table 4 provides an overview of the training provided to school personnel.

TABLE 4:

<p>Level 1. All school personnel</p>	<p>Receive training that provides a basic understanding of diabetes, how to recognize and respond to the signs and symptoms of low blood glucose (hypoglycemia) and high blood glucose (hyperglycemia), and who to contact immediately in case of an emergency.^x</p>
<p>Level 2. Classroom teachers and all school personnel who have responsibility for students with diabetes throughout the school day</p>	<p>Receive Level 1 training plus additional training to carry out their individual roles and responsibilities and know what to do in case of a diabetes emergency. For example: how to activate Emergency Medical Services in case of a diabetes emergency; expanded knowledge of diabetes (types of diabetes, the role of blood glucose monitoring, the importance of balancing insulin/medication with physical activity and nutrition); impact of hypoglycemia or hyperglycemia on behavior, learning and other activities; procedures and brief overview of the operation of devices/equipment commonly used by students with diabetes; tips and planning needed for the classroom and for special events.^x</p>
<p>Level 3. One or more school staff members receive in-depth training about diabetes and routine and emergency care for each student with diabetes from a diabetes trained health care professional.</p>	<p>This training will help ensure that a school staff member is always available to help all students with diabetes in case of an emergency and to help younger or less experienced students or those with additional physical or mental impairments perform diabetes care tasks (e.g., administering insulin or checking their blood glucose).^x</p>

The literature and experience of diabetes experts indicates that there are important critical success factors that should be considered in the development of a comprehensive system of care. These critical success factors include quality, accessibility and availability of training, ongoing monitoring and maintenance of competent care providers, and school as well as parental involvement. Examples from the literature and other jurisdictions include: training materials; skills checklists; procedural handouts; educational resources; documentation of authorization; reassessment of training effectiveness. It is essential that these and other tools and resources are considered when determining a comprehensive system of diabetes care in the school setting for BC.

MONITORING & EVALUATION

Health services require monitoring for quality with resultant and ongoing quality improvement strategies. In the preparation of this report, and in reviewing the key components, care elements and competencies required to deliver health services for children with diabetes, there were challenges in finding the results of program evaluation or the strategies recommended by other authors. In addition, data or analysis for child and youth outcomes related to these key components and care elements were difficult to find, including the child and youth and/or family outcomes.

As with other health services, a comprehensive evaluation plan crossing the domains of quality must be in place. Such a plan needs to be systematic, provincial in nature and inclusive to assure meaningful results. An evaluation plan should include components representing both process evaluation (Is the system being implemented as planned?) and outcome evaluation (Does the system have an impact on the target population – students, teachers, administrators, and parents?). While the health outcomes of children and youth (“students”) are dependent on many factors apart from the care received at school, an evaluation model that includes at least one outcome measure related to the child’s health should be considered.

In order to ensure the key domains of quality are represented in such an evaluation, measures could include but not be limited to the areas of: safety; accessibility of care; provider satisfaction; client and parent satisfaction; and, a potential child health outcome, hemoglobin A1C levels of children who are receiving the care (pre- and post-system implementation). With respect to the competencies, evaluating program integrity and success in implementation will be important. The monitoring and reporting on these and other measures will assist in determining how the system is responding to the needs of children with diabetes in the school setting.

No matter how the system is delivered, because of the relative low level of evidence regarding the key components care elements and competencies, it is required and vital that a valid and appropriate approach to ongoing monitoring and evaluation be in place and that resultant quality improvement strategies be implemented.

CONCLUSION

In summary, management of diabetes care in the school setting requires an organized, systematic approach and involvement of a coordinated team of dedicated providers working in an environment where evidence based care is a priority. The information in this report provides the guidance regarding the key components of care with the care elements and competencies required to deliver that care. In addition, the report outlines recommendations regarding the need for evaluation, including the monitoring of child and youth outcomes, provider and parent satisfaction, and safety. Considering all of these factors, a comprehensive approach to diabetes care for children in the school setting, which maintains their health and safety, ensuring that their school experience has minimal disruptions, while supporting an optimal learning environment, is possible.

APPENDIX A: GLOSSARY

Assignment	Assignment occurs when the required task falls within the unregulated care provider’s role description and training, as defined by the employer/supervisor. The employer is responsible and accountable for developing role descriptions that clearly outline the tasks that can be assigned to an unregulated care provider in that agency/health authority. Employers should ensure the unregulated care provider has completed an appropriate training program and supplement this training, if needed, with on-the-job training. The unregulated care provider is accountable to her/his supervisor for the performance of tasks within the role description. ^{xxix}
Authorization	“giving permission”: To confer authority upon (someone to do something); empower. To permit (someone to do or be something) with official sanction (<i>Webster’s Dictionary</i>).
Basal insulin	A long or intermediate-acting insulin that is delivered once or twice a day and is used to control blood glucose levels overnight and in between meals. ^x
Basal-bolus insulin plan	An insulin plan that mimics the way a normally functioning pancreas produces insulin by using a coordinated combination of different types of insulin to achieve target blood glucose levels at meals and snacks, during periods of physical activity, and throughout the night. ^x
Blood glucose	The amount of glucose (sugar) in the blood at a given time. ^{ix}
Blood glucose meter	A small, portable machine that measures how much glucose is in the blood. A drop of blood is placed onto a special test strip and inserted into the machine. The meter (or monitor) then gives the blood glucose level as a number on the meter’s digital display. ^x
Blood glucose monitoring, or self-monitoring of blood glucose	People with diabetes must monitor their blood glucose regularly as part of the process for achieving their target blood glucose level. Levels will change depending on food consumption, physical activity, stress, illness, problems with the insulin delivery system and many other unknown factors. To test blood glucose, the individual pricks his or her finger with a lancing device and places a drop of blood on a blood glucose strip, which is inserted into a blood glucose meter to obtain a reading. ^{ix}
Bolus Calculator	Takes into account the patient's current blood glucose, target blood glucose, amount of carbohydrate consumed, and other factors such as insulin sensitivity and insulin-to-carbohydrate ratio as well as duration of insulin action (“insulin on board”). ^{xxx}
Bolus insulin	A dose of rapid or short-acting insulin given to cover the carbohydrate in a meal or snack and to lower blood glucose levels that are above target. ^x
Carbohydrate (carb)	One of the main sources of energy (calories). All forms of carbohydrate are broken down into glucose during digestion and increase blood glucose. Carbohydrates are found in fruits, vegetables, milk and grains/starches such as rice, potatoes, corn and legumes, and refined sugars. ^{ix}

Carbohydrate ratio	Used to determine the number of units of insulin needed to cover the number of grams of carbohydrates in the food the student plans to eat. These are individualized for the child and are provided by the diabetes health care provider/team and included in the child’s individualized health plan at school. ^{vii}
Celiac disease	A condition in which a person cannot eat any food products that contain gluten or that have been prepared in a gluten-contaminated environment. Gluten is found in many grains, including rye, wheat, and barley, which are found in many breads, pastas, cereals, and processed foods. Ingestion of gluten can cause gastrointestinal side-effects such as bloating, abdominal pain, or diarrhea. ^x
Continuous glucose monitor (CGM)	A device that records glucose levels throughout the day. The CGM is a sensor inserted under the skin that measures interstitial glucose levels (the glucose found in the fluid between cells) at regular intervals. The CGM sends the current glucose level wirelessly to a pump or separate monitor that the student carries or wears in a pocket, a backpack, or purse. When glucose levels are too high or too low, the CGM sets off an alarm. ^x
Conventional therapy	A combination of both rapid- (or short-) and intermediate- (or longer-) acting insulin, given 2-3 times a day, which requires day-to-day consistency in carbohydrate intake (often as 3 regular meals with snacks between) to balance the insulin action profile and prevent hypoglycemia. ^{vii}
Competency	<p>“a cluster of related knowledge, skills, and attitudes that: affect a major part of one’s job, correlate with job performance, can be measured, and can be improved by training and development”^{xxix}</p> <p>The integration and application of knowledge, skills, attitudes and judgment required to perform safely ethically and appropriately within an individual’s nursing practice or in a designated role or setting.^{xxix}</p>
Correction factor or insulin sensitivity factor (ISF)	The amount of insulin the student needs to lower blood glucose to the target level. These are individualized for the child and are provided by the diabetes health care provider/team and included in the child’s individualized health plan at school. ^x
Curricular	All the courses offered by an educational institution (<i>Free Dictionary</i>)
Delegation	Delegation occurs when the required task is performed primarily by registered nurses and is outside the role description and training of an unregulated care provider. The delegated task is client-specific and the delegation is determined to be in that client’s best interests. The delegating registered nurse is responsible and accountable for the decision to delegate and the process of delegation including the ongoing supervision to assess the ability of the unregulated care provider to perform the delegated task. The unregulated care provider is accountable to the delegating registered nurse for the performance of the delegated task. ^{xxix}
Diabetic ketoacidosis (DKA)	An acute and severe complication of diabetes that is the result of high levels of blood glucose and ketones. It is often associated with poor control of diabetes or occurs as a complication of other illnesses. It can be life-threatening and requires emergency treatment. Signs and symptoms include fruity odour on the breath, shortness of breath, confusion, nausea, vomiting, and weight loss. ^{ix}

Exercise	30 minutes of moderate to vigorous activity ^{vii, xiv}
Extra-curricular	1: not falling within the scope of a regular curriculum; <i>specifically</i> : of or relating to officially or semiofficially approved and usually organized student activities (as athletics) connected with school and usually carrying no academic credit <extracurricular sports> 2a : lying outside one's regular duties or routine (http://www.merriam-webster.com/dictionary/extracurricular)
Fast-acting carbohydrate	A carbohydrate to eat or drink for the treatment of mild-to-moderate hypoglycemia (e.g. juice, glucose tablets) to quickly raise the blood glucose level. ^{ix}
Glucagon	A hormone that raises blood glucose. An injectable form of glucagon is used to treat severe hypoglycemia. ^{ix}
Glucose	The fuel that the body needs to produce energy. Glucose (sugar) comes from carbohydrates such as breads, cereal, fruit and milk. ^{ix}
Hyperglycemia, or high blood sugar	A situation that occurs when the amount of blood glucose (sugar) is <i>higher</i> than an individual's target range. ^{ix}
Hypoglycemia, or low blood sugar	Occurs when the amount of blood glucose (sugar) is <i>lower</i> than 4.0 mmol/L. Hypoglycemia can be mild, moderate or severe. ^{ix} It is not always preventable, and is the greatest immediate danger to students. ^x
Hypoglycemia (severe)	Typically occurs when the amount of blood glucose (sugar) is lower than 2.8 mmol/L. Severe hypoglycemia requires the assistance of another person, as seizures or unconsciousness may occur. Guardians should call emergency services immediately. Symptoms of severe hypoglycemia include fainting, a seizure and difficulty speaking. ^{ix}
Hypoglycemia unawareness	A condition in which students do not experience early physical warning signs of hypoglycemia (low blood glucose) such as jitteriness, shaking and sweating. ^x
Insulin	A hormone that facilitates the conversion of glucose to energy. Since people with type 1 diabetes cannot produce their own insulin, glucose builds up in the blood instead of being used for energy. They must therefore administer insulin by syringe, insulin pen or insulin pump. ^{ix}
Insulin injections	The process of putting insulin into the body with a needle and a syringe or with an insulin pen. ^x
Insulin pen	A cartridge pen-like device used to inject insulin into the body. ^x
Insulin pump	A computerized device that is programmed to deliver small, steady doses of insulin throughout the day. Additional doses are given when needed to cover food intake and to lower high blood glucose levels. The insulin is delivered through a system of plastic tubing (infusion set). ^x

Ketones	Chemicals made by the body when there is not enough insulin in the blood and the body must break down fat for energy. Ketones are usually associated with high blood glucose, but may also occur when a student is ill and blood glucose levels fall below the student's target range. ^x
Lancet	A small needle, inserted into a spring-loaded device, used to poke the skin and obtain a drop of blood for checking blood glucose levels. ^x
Medical alert identification	An identification card, necklace, or bracelet indicating the students has diabetes and giving emergency numbers to call for help. ^x
Multiple daily injections (MDI) therapy	A more dynamic approach to insulin administration using individualized insulin-to-carbohydrate ratios, which enable insulin dose to be matched to carbohydrate intake. ^{vii}
Physical Activity	30 minutes of moderate to vigorous activity ^{vii, xiv} The term "physical activity" is used in the same manner as the term "exercise".
Rapid-acting Insulin	A rapid-acting insulin is one whose chemical structure has been change so that the insulin is more quickly absorbed into the bloodstream. This change to the chemical structure of the insulin does not affect its ability to lower blood sugar (glucose) but it does affect the rate at which the insulin is absorbed. Rapid-acting insulin is absorbed into the bloodstream within minutes and has many potential benefits for people with diabetes. ^{xxxix}
Sharps	Used syringes, insulin pen needles, and lancets. These items must be carefully disposed of in appropriate containers. ^{ix}
Syringe	A device used to inject medications such as insulin into body tissue.
Target blood glucose range	Acceptable blood glucose levels based on the Canadian Diabetes Association's <i>Clinical Practice Guidelines</i> and personalized for the student by their diabetes care team and their parent or guardian. ^{ix}
Test strips	Specifically designed strips used in blood glucose meters to check blood glucose levels or in urine testing for ketones. ^x
Trained diabetes personnel	Non-medical personnel who have received in-depth training about diabetes and diabetes management. They can perform student-specific diabetes care tasks, including blood glucose monitoring, insulin administration, recognition and treatment of hypo- and hyperglycemia, and urine or blood glucose testing under supervision of the school nurse or a diabetes-trained health care professional. They also may be called unlicensed assistive personnel, assistive personnel, paraprofessionals, or trained non-medical personnel. ^x
Type 1 diabetes	An autoimmune disease that occurs when the pancreas no longer produces any insulin or produces very little insulin. Type 1 diabetes usually develops in childhood or adolescence and affects approximately 10% of people with diabetes. There is no cure. It is usually treated with lifelong insulin injections and careful attention to diet and physical activity. ^{ix}

<p>Type 2 diabetes</p>	<p>A disease that occurs when the pancreas does not produce enough insulin to meet the body’s needs and/or the body is unable to respond properly to the actions of insulin (insulin resistance). Type 2 diabetes usually occurs later in life (although it can occur in older children) and affects approximately 90% of people with diabetes. There is no cure. It is treated with careful attention to diet and exercise and usually requires medication (oral anti-hyperglycemic agents) and/or insulin.^{ix}</p>
<p>Unregulated Care Provider</p>	<p>Unregulated care providers are paid care providers who are neither registered nor licensed by a regulatory body and who have no legally defined scope of practice. Unregulated care providers do not have mandatory education or practice standards. Unregulated care providers include, but are not limited to, resident care aides, home support workers, and special education assistants. Their work settings include client homes, group homes, residential care facilities and schools.^{xxix}</p>

APPENDIX B: ACKNOWLEDGEMENTS

Diabetes Care in the School Setting Provincial Working Group

We gratefully acknowledge the contributions of the following individuals:

Amodeo, Kelly	District Principal Special Services, Vancouver Island Health, School District # 85, Port Hardy
Arockiasamy, Vincent	Pediatrician, Prince George
Bester, Trina	Parent
Guild, Kathy	Director, Special Programs, Fraser Health Authority, School District #37 Delta
Herrmann, Sharleen	Diabetes Nurse Educator, Provincial Health Services Authority, BC Children's Hospital
Irvine, Shelley	Diabetes Nurse Educator, Northern Health Authority
Jacob, June	Pediatric Nurse Clinician, Certified Diabetes Educator, Vancouver Island Health
Matthews, Mary Lou	Provincial Lead, Network Operations, Provincial Health Services Authority, Child Health BC
Mele, Shazia	Nursing Support Services Coordinator, Fraser Health Authority
Metzger, Dan	Pediatric Endocrinologist, Provincial Health Services Authority, BC Children's Hospital
O'Donnell, Maureen	Executive Director, Provincial Health Services Authority, Child Health BC
Roeck, Kyra	General Practitioner, Vancouver Coastal Health
Scarr, Jennifer	Provincial Lead, Health Promotion, Prevention and Primary Care, Provincial Health Services Authority, Child Health BC
Shatz, Esther	Director of Instruction – Student Services, Vancouver Island , School District # 71, Comox
Simak, Deborah	Director of Instruction, District Principal, Learning Support Services, Fraser Health Authority, School District #41 Burnaby
Smith, Trent	Pediatrician, Kamloops
Stock, Sue	Pediatric Endocrinologist, Vancouver Coastal Health

**Diabetes Care in the School Setting
Provincial Meeting - May 24, 2013**

MEETING PARTICIPANTS (including Provincial Working Group members)

This project would not have been possible without the participation and cooperation of all the following individuals in the meeting:

Abram, Connie	Regional Director, Vancouver Coastal, Canadian Diabetes Association
Anderson, Kari	Nursing Support Services Coordinator , Dawson Creek, Northern Health Authority
Arsenault, Diane	Care Coordinator, Nursing Support Services, Diabetes Educator, Vancouver Island Health
Baba, Carolyn	Pediatrician, Interior Health Authority
Brooke, Rebecca	Diabetes Educator, Surrey Diabetes Clinic, Fraser Health Authority
Chanoine, JP	Pediatric Endocrinologist, Provincial Health Services Authority, BC Children’s Hospital
Christensen, Laurie	Nursing Support Services Coordinator, Interior Health Authority
Collier, Nancy	Manager, Fundraising and Development, Juvenile Diabetes Research Foundation
Collis, Michael	Flight Paramedic, BC Children’s Hospital Ambulance Infant Transport Team, Provincial Health Services Authority
Draeger, Jamie	Register Nurse, Clinical Practice Educator Pediatrics, Interior Health Authority
Galazka, Dan	Special Ed Directors , Fraser Health Authority, School District #37 Delta
Lefebvre, Louise	Diabetes Centre Dietitian, Registered Dietitian, Northern Health Authority
Lowe, Chris	Regional Manager, Juvenile Diabetes Research Foundation
Maio, Amy	Nursing Support Services Supervisor, Fraser Health Authority
Murphy, Janet	Regional Clinical Planner, Program Planning Leader, Fraser Health Authority
Price, Jacki	Diabetes Educator, Campbell River, Vancouver Island Health
Ribic, Robert	Parent
Rosolowsky , Elizabeth	Pediatric Endocrinologist, University of Alberta, Alberta Health
Salmon, Margaret	Nursing Support Services Manager, Courtenay, Vancouver Island Health
Samra, Maneet	Clinical Practice Consultant, Professional Practice, Fraser Health Authority
Shiells, Heather	Nursing Support Services Coordinator, Vancouver Island Health
Smith, Fred	North East Preventive Public Health Manager, Northern Health Authority
Spring, Truman	District Principal of Student Support Services, Northern Health Authority, School District # 57, Prince George
Stanwick, Richard	Chief Medical Health Officer, Vancouver Island Health
Tatlock, Jan	Prevention Director, Vancouver Island Health
Thomson, Susan	District Coordinator - Low Incidence Student Support , Interior Health Authority, School District # 23, Central Okanagan
Thorson, Tom	Principal, Vancouver Island, School District # 61, Victoria
Ukpeh, Henry	Consultant Pediatrician, Interior Health
Waite, Darnell	Nursing Support Services Coordinator, Vancouver Coastal Health
Waldner, Brianna	Parent
Weatherman, Kris	Nursing Support Services Manager, Interior Health Authority
Wilcox, Don	Special Education Director , Interior Health Authority, School District # 22, Vernon
Woo, Paula	Dietitian, Provincial Health Services Authority, BC Children’s Hospital
Yewchuk, Scott	Parent

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Child Health BC
4088 Cambie Street, Suite 305
Vancouver BC, V5Z 2X8
T: (604) 877 6410
F: (604) 874 8702
www.childhealthbc.ca
info@childhealthbc.ca