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Original Research

Evaluation of a Province-Wide Type 1 Diabetes Care Plan for Children in the School Setting

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Key Messages

- British Columbia is a leader in diabetes care at school; its current program is perceived to be safe and effective by parents and coordinators.
- There is near-unanimous support for the integration of continuous glucose-monitoring devices into the school care plan.
- Achieving optimal diabetes care for children at school is a fine balance between individualization, best clinical practices and safety.

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ABSTRACT

Objectives: The aim of this study was to identify perceptions of safety and effectiveness of a provincial type 1 diabetes school care plan, and to best inform future improvements in school care to accommodate the shifting needs of families, best clinical practices and new medical technologies.

Methods: A cross-sectional satisfaction and feedback questionnaire to inform quality improvement was offered to both families of children with type 1 diabetes who receive care at school through a Delegated Diabetes Care Plan and to their program coordinators during the 2017–2018 school year.

Results: The response rate was 29.8% (160 of 537) for families and 68.2% (45 of 66) for coordinators. The majority of parents and coordinators reported that the care plan is meeting both safety and diabetes management needs. On a 7-point Likert scale, the safety score, expressed as mean (standard deviation), was 6.0 (1.2) by families and 5.7 (1.3) by coordinators, with higher scores reflecting greater satisfaction. Diabetes management was rated 5.6 (1.2) out of 7 by families, and 5.4 (0.8) out of 7 by coordinators. Families and coordinators expressed the need for individualization of care, and suggested modifications to how information is presented. There was near-unanimous support for future integration of continuous glucose-monitoring devices into the school setting.

Conclusions: British Columbia's provision of diabetes care in the school setting is overall perceived to be safe and is generally well received by families and coordinators. In this study, we provide valuable information to improve the care of children with type 1 diabetes in schools, including support for further individualization of care and future integration of diabetes technology into the school setting.

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diabète sucré

insulinothérapie

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plan de soins en milieu scolaire

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R É S U M É

Objectifs : L'objectif de la présente étude était de cerner les perceptions en matière de sécurité et d'efficacité en ce qui concerne un plan provincial de soins aux diabétiques de type 1 en milieu scolaire, et de mieux contribuer aux améliorations à apporter aux soins en milieu scolaire pour s'adapter à l'évolution des besoins des familles, aux pratiques cliniques exemplaires et aux nouvelles technologies dans le domaine médical.

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Méthodes : Une enquête transversale de satisfaction et de rétroaction pour contribuer à l'amélioration de la qualité était présentée aux familles d'enfants atteints de diabète de type 1 qui recevaient des soins à l'école par le truchement du Delegated Diabetes Care Plan et à leurs coordonnateurs de programme au cours de l'année scolaire 2017–2018.

Résultats : Le taux de réponse était de 29,8 % (160 sur 537) pour les familles et de 68,2 % (45 sur 66) pour les coordonnateurs. La majorité des parents et des coordonnateurs rapportaient que le plan de soins répondait aux besoins de sécurité et de prise en charge du diabète. Selon une échelle de Likert de 7 degrés, les scores relatifs à la sécurité, exprimés par la moyenne (écart type), étaient de 6,0 (1,2) pour les familles et de 5,7 (1,3) pour les coordonnateurs, des scores plus élevés qui reflètent la plus grande satisfaction. La prise en charge du diabète était évaluée à 5,6 (1,2) sur 7 par les familles et à 5,4 (0,8) sur 7 par les coordonnateurs. Les familles et les coordonnateurs ont exprimé le besoin d'individualisation des soins et proposé des modifications à la façon dont l'information est présentée. Ils se sont prononcés de manière presque unanime en faveur de l'intégration future de dispositifs de surveillance de la glycémie en continu en milieu scolaire.

Conclusions : La prestation de soins aux diabétiques en milieu scolaire de la Colombie-Britannique est dans l'ensemble perçue comme sécuritaire et est généralement bien accueillie par les familles et les coordonnateurs. Dans cette étude, nous fournissons de précieuses informations pour améliorer les soins prodigués aux enfants atteints de diabète de type 1 dans les écoles, notamment nous encourageons une individualisation plus poussée des soins et une intégration de la technologie pour le diabète en milieu scolaire dans le futur.

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Introduction

Type 1 diabetes (T1D) is a chronic autoimmune disease leading to insulin deficiency. It is the most common chronic endocrine pathology in the pediatric population (1). The incidence of T1D is increasing worldwide, with some Canadian provinces having among the highest incidences of T1D reported worldwide (2). There are approximately 2,200 children from 1 to 19 years of age with T1D in British Columbia (BC), with an estimated 220 new cases per year (3). The most significant increase in incidence of T1D in Canadian children and youth is in school-aged children 10 to 14 years of age (4). Treatment includes mandatory insulin replacement therapy and daily adaptations to achieve optimal glycemic management and to avoid severe hypoglycemia and diabetic ketoacidosis (life-threatening conditions), as well as a multitude of potential long-term complications. T1D management can be very difficult for children and their families, potentially leading to psychosocial problems, such as anxiety, depression and eating disorders (1). Childhood and adolescence are critical times for intensive diabetes treatment to establish optimal health behaviours and practices (5). Because children and adolescents spend 30 to 35 hours per week at school, effective diabetes care at school is fundamental for short- and long-term health and well-being (6). Trained and knowledgeable staff in this area are essential to providing a safe environment for these children during school hours (7), and having trained personnel at school facilitates improved metabolic management (8).

On an international level, the extent of T1D support for children in the school setting varies, with many areas lacking medical care plans for students (9–11). However, previous findings have suggested that individualized care plans may improve self-management of diabetes in schools (12,13), and that these plans are necessary for children with T1D (14). Accordingly, the American Diabetes Association states that a diabetes medical management plan should be implemented for all students with T1D to outline their diabetes management needs during the school day (7). Similarly, the Canadian Paediatric Society and the Canadian Pediatric Endocrine Group recommend that all provinces and territories in Canada should implement a comprehensive policy on the support in schools for children with T1D (6). In Canada, BC is a leader nationally in providing diabetes care to children in the school setting. In 2015, the Canadian Paediatric Society reported that BC had established provincial standards for support for children with T1D in school by medically nonlicensed, but trained

school personnel, whereas many other Canadian school settings did not have policies to support management of T1D (15). Nursing Support Services (NSS) is a voluntary, province-wide program that provides support for children in the community with chronic, complex health conditions through in-home nursing respite care or while at school (prekindergarten to grade 12) through delegated care. NSS-delegated care supports students with T1D and other chronic health conditions who are not able to independently manage their own diabetes care in the school setting. The ultimate goal of NSS-delegated care is to support students to work toward independence in self-management, to the extent that is appropriate for their functional and cognitive ability, maturity and experience. With a “Delegated Diabetes Care Plan” (hereinafter referred to as “care plan”), NSS coordinators (NSSCs), who are registered nurses, train and monitor education assistants (nonmedical school personnel) and delegate to them the responsibility to perform diabetes-related tasks throughout the school day. The first standardized approach to diabetes care plans in BC occurred in 2000; however, it was not until 2014, when the most recent versions of the care plans were introduced, that insulin administration was supported in the school setting. These most recent insulin pump, insulin injection and blood glucose-monitoring care plans are presented in [Supplementary Files 1–3](#). The Canadian Paediatric Society report from 2015 suggested that BC implement a reporting and evaluation mechanism to demonstrate consistency and effectiveness of the care plan (15). In this study, we provide the first formal evaluation of this program.

The objective of this investigation was to evaluate perceptions of safety and effectiveness of the province-wide care plan for T1D. We also set out to inform future improvements to the care plan so they may accommodate the needs of families, incorporate best clinical practices and new medical technologies and ultimately support safe care at school.

Methods

Study design

A cross-sectional satisfaction and feedback questionnaire to inform quality improvement was offered to all 537 families with children in BC who were identified as receiving care from NSS (Provincial Health Services Authority, Sunny Hill Health Centre) via a care plan in school. A complementary satisfaction and feedback questionnaire was offered to all NSSCs working with children who

have a care plan. Both surveys were designed by an interdisciplinary team of NSS program leaders, pediatric endocrinologists, diabetes educators, medical and undergraduate student researchers and a family advisor. During their development, the surveys were piloted with both parent and coordinator representatives. Likert-scale questions addressed family and coordinator opinions on the effectiveness and safety of the care plan, overall satisfaction and overall ease of use of the care plan. The surveys also addressed family and coordinator understanding of the steps of diabetes care outlined in the care plan, ability to find information in the care plan and desired changes and suggested additions to the care plan document. In addition to Likert-scale questions, free-text comments were enabled for a number of questions to facilitate quality improvement of the NSS program. Survey data were collected from August 2017 to February 2018.

Care plan components

The care plan is a 9-page document. The main components of the care plan include the child's contact information; brief health history; emergency plan; protocol for hypoglycemic/hyperglycemic events; plan of action before physical activity and at various times of the day (e.g. start of school, before recess, etc); and detailed instructions on blood glucose monitoring care at school, carbohydrate counting and insulin administration (see [Supplementary Files 1–3](#)). Each student receives a care plan that is specifically tailored to their at-school insulin regimen: injection insulin, insulin pump therapy or blood glucose monitoring only (i.e. no insulin at school).

Research ethics

The study proposal was reviewed by the University of British Columbia research ethics board who determined it would be best classified as a quality improvement/quality assurance project and, therefore, did not require board approval. This proposal meets the A Project Ethics Community Consensus Initiative (ARECCI) Ethics Screening Tool criteria for Quality Improvement and Evaluation projects (16).

Study participants and recruitment

Participation in the study was offered to 537 families residing in BC with children who have or have recently had (within 1 year) a care plan at school, and 66 NSSCs working with children enrolled in the care plan program. Families enrolled in the care plan program were mailed a consent letter to introduce the study and gain participant consent. The introductory letter contained a link and unique participant code that could be entered into a computer to complete the survey online. To facilitate as many families as possible in participating, families were contacted within 2 weeks if they had not yet completed the survey online. If families preferred, they were sent an electronic or paper copy of the survey to complete. Coordinators were e-mailed the consent letter, which contained a link to access the survey online.

Data collection and management

Families and coordinators had the option of completing the survey online via an online database platform, Research Electronic Data Capture (REDCap), or with a hardcopy version. One hundred fifty-nine of the 160 families completed the survey electronically, whereas 1 family mailed a paper survey that was then entered into REDCap by the research coordinator. The coordinators all completed the survey electronically. REDCap is a secure, web-based application designed to support data capture for quality

improvement/quality assurance and research studies. REDCap was used to build and administer the family and coordinator surveys as well as store survey data.

Data analysis

Results are presented using descriptive statistics. Likert-scale results are presented as mean and standard deviation (SD) and as percent. Mean and SD were chosen over median and interquartile range, as we found they better described the central tendency and spread of the data. Assumptions of normality and parametric tests (e.g. t test) have been shown to be robust when applied to Likert scales (17). The sample size is sufficient to explore differences between groups using t tests (two-sample assuming unequal variances). A paired t test was used for within-subject comparisons. Microsoft Excel 2016 was used for the analyses. Statistical significance was considered for $p < 0.05$. Free-text comments were reviewed independently by 2 members of the study team. The results were reviewed to ensure data validation.

Results

Survey response

We received 160 survey responses from families (29.8%), and 45 survey responses from NSSCs (68.2%). The characteristics of survey respondents are presented in [Table 1](#). A comparison between the family participants and all families enrolled in the NSS program with respect to health authority and gender, as well as between NSSC participants and all NSSCs with respect to health authority, are also included in [Table 1](#). These comparisons suggest that the families and coordinators who responded to the survey are representative of the NSS program. The children represented in this study are widely distributed across BC, and nearly all students are between prekindergarten and grade 7. From 2016 to present, the majority of coordinators (93.5%) have worked with all 3 of the care plan regimens (i.e. conventional [blood glucose monitoring only], multiple daily injection routine and insulin pump therapy).

Effectiveness of care plan

Families believe their child's diabetes is better managed outside of school compared with during school on the care plan (Likert mean [SD]: out of school 6.2 [0.5], in school 5.6 [1.2] out of 7; $p < 0.001$; [Figure 1](#)). However, both families and coordinators believe the care plan manages T1D well in the school setting (Likert mean [SD]: families 5.6 [1.2], coordinators 5.4 [0.8] out of 7; [Table 2](#)). Families who perceive their child's care to be better or equal in school have higher satisfaction with the care plan document (Likert mean [SD]: 6.1 [1.2] out of 7), whereas families who perceive care to be better outside of school have a lower satisfaction with the care plan document (Likert mean [SD]: 5.2 [1.3] out of 7). Both groups also believe the care plan describes diabetes care needs well (Likert mean [SD]: families 5.6 [1.4], coordinators 5.2 [1.0] out of 7; [Table 2](#)). About half of the families (52%, 83 of 160) commented on a desire to further individualize their child's care plan. The majority of coordinators (78%, 35 of 45) commented on the need to individualize certain aspects of a child's care plan, with some noting the need to do so without compromising clinical practice guidelines. Although there is general support for the effectiveness of the care plan, a small number of families (1.3%) believe that diabetes is not managed at all on a care plan, but none of the coordinators held that position. These families commented on

Table 1
Characteristics of children with T1D enrolled in the Delegated Diabetes Care Plan, and characteristics of NSSCs

Characteristics	Children		NSSCs	
	Survey respondents (n=160)	All program participants (n=537)	Survey respondents (n=44)	All NSSCs (n=66)
Health region				
Northern	12 (7.5%)	45 (8.4%)	4 (9.1%)	6 (9.1%)
Interior	26 (16.3%)	78 (14.5%)	9 (20.5%)	12 (18.2%)
Vancouver Island	35 (21.9%)	100 (18.6%)	7 (15.9%)	11 (16.7%)
Vancouver coastal	20 (12.5%)	61 (11.4%)	7 (15.9%)	13 (19.7%)
Fraser	67 (41.9%)	253 (47.1%)	17 (38.6%)	24 (36.4%)
Child's gender	(n=159)	(n=537)	—	—
Female	90 (56.6%)	268 (49.9%)	—	—
Male	69 (43.4%)	269 (50.1%)	—	—
Child's grade	(n=160)	—	—	—
Pre-K, K, grade 1	38 (23.8%)	—	—	—
Grades 2–4	79 (49.4%)	—	—	—
Grades 5–7	41 (25.6%)	—	—	—
Grade 8 or above	2 (1.3%)	—	—	—
Child's length of time on care plan	(n=159)	—	—	—
<1 year	39 (24.5%)	—	—	—
1–3 years	72 (45.3%)	—	—	—
3–5 years	30 (18.9%)	—	—	—
>5 years	18 (11.3%)	—	—	—
Coordinator's time working with care plan	—	—	(n=44)	—
<1 year	—	—	3 (6.8%)	—
1–3 years	—	—	10 (22.7%)	—
3–5 years	—	—	7 (15.9%)	—
>5 years	—	—	24 (54.5%)	—
Child's diabetes care plan regimen	(n=159)	—	—	—
Pump therapy	95 (59.8%)	—	—	—
Lunch-time insulin injection	34 (21.4%)	—	—	—
BGM only	30 (18.9%)	—	—	—
Child's most recent A1C * (%)	(n=106)	—	—	—
Mean (SD)	7.7 (0.9)	—	—	—
Range	5.8–10.5	—	—	—

A1C, glycated hemoglobin; BGM, blood glucose monitoring; K, kindergarten; NSSCs, Nursing Support Services coordinators; Pre-K, prekindergarten; SD, standard deviation; T1D, type 1 diabetes.

* Self-reported.

unsatisfactory interactions with either school staff or NSS staff and requested more education for program staff.

Care plan safety

Both families and coordinators believe the care plan supports safe diabetes care in school (Likert mean [SD]: families 6.0 [1.2], coordinators 5.7 [1.3] out of 7; **Table 2**). They believe changes to a child's care plan are often made soon enough to support safe diabetes care (**Table 2**). Some coordinators (42.2%) were concerned that some families may instruct education assistants (EAs) to make changes to a child's care plan before notifying and consulting the coordinator. On a similar note, 15% of families and 62% of coordinators expressed that they would like to see more consistency in the role of the EA, ideally with EAs working consistently with the same children throughout the school year. Furthermore, 16% of families highlighted in their comments that all school staff should have basic T1D education. Although there is general support for the safety of the care plan, it is notable that a small minority of families (1.4%) and coordinators (5.3%) believe the care plan does not support safe care in the school setting at all. In their comments, these families requested integrated use of technology (including devices not approved by Health Canada) in school, and had an expectation that care at school should mirror care that can be provided in the home setting. Of the coordinators who had safety concerns, 1 had a concern about hypoglycemia treatment, whereas the other requested more support for EAs.

Care plan document satisfaction

Both families and coordinators reported satisfaction with the care plan document, with families more satisfied than coordinators (Likert mean [SD]: families 5.7 [1.3], coordinators 4.6 [1.4] out of 7; $p < 0.001$; **Table 2**). A small minority of families and coordinators expressed strong dissatisfaction with the care plan document (2.1% of families and 5.3% of coordinators rated satisfaction 1 or 2 out of 7). These families commented on the need for increased individualization. Interestingly, document satisfaction scores were nearly identical for families with a child on a blood glucose monitoring-only care plan and families with a child on an insulin administration care plan (**Table 3**). Of the coordinators who rated satisfaction with the document 1 or 2 out of 7, there were requests for a 1-page summary sheet and more visual cues on the care plan document.

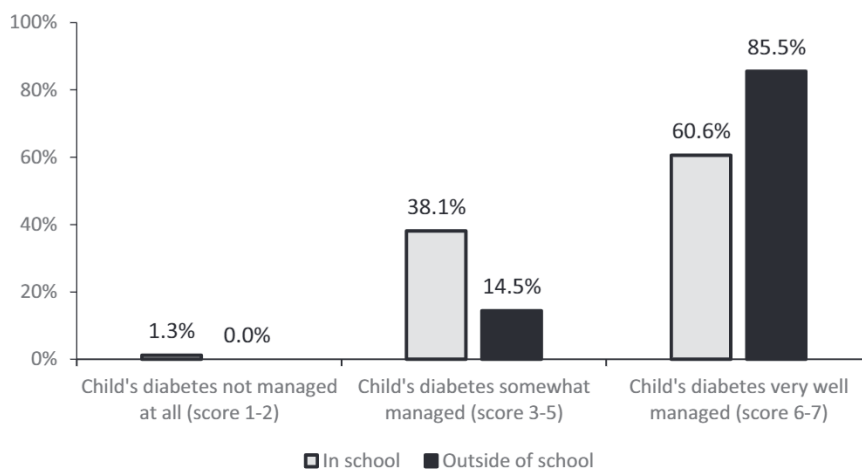


Figure 1. Families' perspectives on how well their child's diabetes is managed in school (n=160), and outside of school (n=159). Mean (SD) for 7-point Likert scale: in school 5.6 (1.2), out of school 6.2 (0.5) ($p < 0.001$). SD, standard deviation.

Table 2

Family and NSSC perspectives and family participation in the current Delegated Diabetes Care Plan

	Families (n=160)	NSSCs (n=44)
How well is pediatric T1D managed on a care plan in the school?		
Not managed at all (score 1–2)	2 (1.3%)	0 (0.0%)
Somewhat managed (score 3–5)	61 (38.1%)	21 (47.7%)
Very well managed (score 6–7)	97 (60.6%)	23 (52.3%)
Mean (SD) for Likert scale 1–7	5.6 (1.2)	5.4 (0.8)
How well does the care plan describe diabetes care needs in the school?	(n=152)	(n=39)
Not well at all (score 1–2)	6 (4.0%)	0 (0.0%)
Somewhat well (score 3–5)	58 (38.2%)	23 (59.0%)
Very well (score 6–7)	88 (57.9%)	16 (41.0%)
Mean (SD) for Likert scale 1–7	5.6 (1.37)	5.2 (1.0)
How well does the care plan support safe diabetes care in the school?	(n=148)	(n=38)
Does not support at all (score 1–2)	2 (1.4%)	2 (5.3%)
Somewhat supports (score 3–5)	37 (25.0%)	11 (29.0%)
Completely supports (score 6–7)	109 (73.7%)	25 (65.8%)
Mean (SD) for Likert scale 1–7	6.0 (1.2)	5.7 (1.3)
Are changes to a child's care plan made soon enough to support safe diabetes care?	(n=141)	(n=38)
Never soon enough (score 1–2)	4 (2.8%)	2 (5.3%)
Sometimes soon enough (score 3–5)	39 (27.7%)	10 (26.3%)
Always soon enough (score 6–7)	98 (69.5%)	26 (68.4%)
Mean (SD) for Likert scale 1–7	5.9 (1.41)	5.4 (1.4)
Overall satisfaction with current care plan document	(n=144)	(n=38)
Not satisfied at all (score 1–2)	3 (2.1%)	2 (5.3%)
Somewhat satisfied (score 3–5)	52 (36.1%)	25 (65.8%)
Very satisfied (score 6–7)	89 (61.8%)	11 (29.0%)
Mean (SD) for Likert scale 1–7	5.7 (1.3)	4.6 (1.4)*
How well do you understand the steps of diabetes care outlined in the care plan?	(n=155)	(n=43)
Do not understand at all (score 1–2)	1 (0.7%)	0 (0.0%)
Somewhat understand (score 3–5)	12 (7.7%)	3 (7.0%)
Fully understand (score 6–7)	142 (91.6%)	40 (93.0%)
Mean (SD) for Likert scale	6.5 (0.8)	6.5 (0.6)
How easy is it to find information in the care plan?	(n=155)	(n=43)
Not easy at all (score 1–2)	8 (5.2%)	3 (7.0%)
Somewhat easy (score 3–5)	56 (36.1%)	28 (65.1%)
Very easy (score 6–7)	91 (58.7%)	12 (27.9%)
Mean (SD) for Likert scale	5.6 (1.43)	4.5 (1.4)*
How often do families participate in creating their child's care plan?	(n=147)	(n=38)
Never participate (score 1–2)	0 (0.0%)	0 (0.0%)
Sometimes participate (score 3–5)	14 (9.5%)	8 (21.0%)
Always participate (score 6–7)	133 (90.4%)	30 (79.0%)
Mean (SD) for Likert scale	6.6 (0.8)	5.6 (1.0)

NSSCs, Nursing Support Services coordinators; SD, standard deviation; T1D, type 1 diabetes.

Note: Data expressed as number (%) unless noted otherwise.

* p<0.001.

Structure of care plan and suggested changes

Families and coordinators fully understand the steps of diabetes care outlined in the care plan (Likert mean [SD]: families 6.5 [0.8], coordinators 6.5 [0.6] out of 7; [Table 2](#)). Families report that it is easier to find information in the care plan compared with coordinators (Likert mean [SD]: families 5.6 [1.4], coordinators 4.5 [1.4] out of 7; p<0.001; [Table 2](#)). Families and coordinators were asked if a 1-page summary sheet, which would include information such as a schedule for blood glucose (BG) checks, a target BG range and low/high BG protocols, would be a helpful addition to the care plan. The majority of families (80.8%) and coordinators (56.1%) support the addition of a summary sheet.

Families and coordinators were asked to select changes they would make if they could modify the way information is shared in the care plan. Many families (39.9%) do not want changes made to

Table 3

Family perspectives on diabetes management, safety and satisfaction with the Delegated Diabetes Care Plan stratified by insulin routine

	BGM only (n=28)	Insulin (pen or pump) (n=129)
How well is pediatric T1D managed on a care plan in the school?		
Not managed at all (score 1–2)	1 (3.6%)	1 (0.8%)
Somewhat managed (score 3–5)	12 (42.9%)	47 (36.4%)
Very well managed (score 6–7)	15 (53.6%)	81 (62.8%)
Mean (SD) for Likert scale 1–7	5.3 (1.2)	5.7 (1.2)
How well does the care plan support safe diabetes care in the school?	(n=25)	(n=120)
Does not support at all (score 1–2)	0 (0%)	2 (1.7%)
Somewhat supports (score 3–5)	10 (40.0%)	26 (21.7%)
Completely supports (score 6–7)	15 (60.0%)	92 (76.7%)
Mean (SD) for Likert scale 1–7	5.8 (1.2)	6.1 (1.2)
Overall satisfaction with current care plan document	(n=25)	(n=116)
Not satisfied at all (score 1–2)	0 (0%)	3 (2.6%)
Somewhat satisfied (score 3–5)	9 (36%)	40 (34.5%)
Very satisfied (score 6–7)	16 (64%)	73 (62.9%)
Mean (SD) for Likert scale 1–7	5.8 (1.2)	5.7 (1.2)

BGM, blood glucose monitoring; SD, standard deviation; T1D, type 1 diabetes.

Note: Data expressed as number (%) unless noted otherwise.

the way information is shared in the care plan; however, some families (28.1%) want a section with diabetes facts and resources added, and others (27.5%) want to be able to find information more quickly in the document. The majority of coordinators (64.3%) want to be able to find information more quickly; many coordinators (45.2%) also want there to be less information, and some (35.7%) want to rearrange the order of information in the care plan document. In their comments, coordinators (60.0%) and families (15.5%) express concerns about the repetitiveness and wordiness of the care plan document and suggest that the document could be more user-friendly if it were more succinct.

Families and coordinators were also asked to select changes they would make if they could change the way the care plan document looks. Many families (46.1%) do not want changes made to the way the care plan looks; however, only 5.1% of coordinators would leave the care plan unchanged. In terms of possible changes, the majority of coordinators (71.8%) would like colour to be added to the care plan, whereas 27.0% of families had the same request. Approximately half of the coordinators (51.3%) are also hopeful for a new layout of the care plan, and one-third (33.3%) would like pictures added to the care plan. In their comments for other suggested changes to the layout of the care plan, 2.5% of families and 37.8% coordinators recommend the addition of flowcharts to the care plan.

Continuous glucose monitoring and multiple daily injections

Families and coordinators were asked if they would like continuous glucose monitoring (CGM) devices included as an option in the care plan. Many families (74.8%) and 100% of coordinators are in favour of the inclusion of CGM devices in the care plan. Some families (29.6%) report that their child uses CGM at home. A similar number of families and coordinators (40.4% and 43.6%, respectively) express that they would like to see the option of more than a single dose of rapid insulin to be given at school as part of the care plan for children on injections.

Family participation in creating the care plan

Families believe that they are engaged and always participate in creating their child's care plan (Likert mean [SD]: 6.6 [0.8] out of 7; [Table 2](#)), whereas coordinators believe that families sometimes

Table 4

NSSC opinions on using Delegated Diabetes Care Plan as a tool when training and partnering with individuals involved in supporting a child's care plan

	NSSCs
Is the care plan a useful tool to facilitate communication and partnership with care planning?	(n=37)
Not useful at all (score 1–2)	2 (5.4%)
Somewhat useful (score 3–5)	19 (51.4%)
Very useful (score 6–7)	16 (43.2%)
Mean (SD) for Likert scale 1–7	5.1 (1.4)
How easy is it to use the care plan as a tool when training EAs who need to follow the care plan daily?	(n=38)
Not easy to use at all when training EAs (score 1–2)	2 (5.3%)
Somewhat easy to use when training EAs (score 3–5)	20 (52.6%)
Very easy to use when training EAs (score 6–7)	16 (42.1%)
Mean (SD) for Likert scale 1–7	5.1 (1.5)
Is the literacy level of the care plan appropriate for EAs to follow and understand?	(n=38)
Not easy at all for EAs to understand (score 1–2)	0 (0%)
Somewhat easy for EAs to understand (score 3–5)	19 (50.0%)
Very easy for EAs to understand (score 6–7)	19 (50.0%)
Mean (SD) for Likert scale 1–7	5.4 (1.1)

EAs, education assistants; NSSC, Nursing Support Services coordinator; SD, standard deviation.

Note: Data expressed as number (%) unless noted otherwise.

participate in doing so (Likert mean [SD]: 5.6 [1.0] out of 7; [Table 2](#)). Coordinators commented that the degree of family involvement often varies with some families participating solely in emergency plan development, whereas other families communicate regularly with their child's EA regarding the child's management, such as for any high/low BG readings or when management deviates from the child's care plan.

Use of care plan by coordinators

Coordinators believe the care plan is somewhat easy to use when training EAs who need to follow the care plan daily (Likert mean [SD]: 5.1 [1.5] out of 7; [Table 4](#)). A high number of coordinators (64.4%) commented that EAs and school staff have varying levels of education and knowledge about T1D, and only 50% of coordinators considered the literacy level of the care plan very easy for EAs to follow and understand.

Discussion

The care plan aims to provide safe, consistent and equitable care in school for all children living with T1D throughout BC. The care plan is founded upon the principles of providing safety to prevent severe hypoglycemic events, and to ensure timely responses to hypoglycemic and hyperglycemic events. The care plan and support through NSS are intended to facilitate a positive and safe school experience and optimal learning environment for the children, and to help facilitate their transition to independence in diabetes care. Care plans must meet practice standards as per the British Columbia College of Nursing Professionals.

To our knowledge, this is the first study to report on perceptions of effectiveness and safety of a province-wide Canadian diabetes care plan in the school setting. There was participation from across BC in this study, representing many families and coordinators working in a wide range of school settings in urban and rural/remote settings. Overall, both families and coordinators are satisfied with the care plan and perceive that it supports safe and effective diabetes care in the school setting.

The care plan is found to lack flexibility by many families and coordinators who hope to have more personalized care of T1D in the school setting. Lack of individualization may well account for the fact that families believe care at home is superior to care

provided in the school setting. It may be that, if families were better able to individualize their child's care plan, they may have a different perspective on the effectiveness of diabetes care in the school. However, there are limitations with individualization of a child's care plan in the school setting, as the NSS program strives to provide equitable care across BC while simultaneously practicing in accordance with clinical practice guidelines and professional practice standards. In addition, it is important to be aware that the individualization desired by some families may require extensive support from school staff. In this regard, there must be a fair balance in the attention and care that all children receive in school, including those who do not live with diabetes. Moreover, the delegation of care to EAs, who are not medically trained, has additional challenges, as EAs vary in baseline competencies and it is outside of the NSS program's jurisdiction to assign specific EAs to students, further adding to the barriers to individualization. The extent of care plan individualization is an interesting intersection between the wishes of families living with T1D and a program responsible for ensuring safe, appropriate and equitable care for all children supported by these care plans across a broad spectrum of settings and local supports. The program will need to consider ways in which it can allow personal adaptations, while ensuring high-quality care that can be replicated for all students across the province.

It is apparent that changes to the care plan's formatting are desired by many families and coordinators to make it more user-friendly. The coordinators were a stronger voice in requesting change, which may reflect that they are the individuals who are working with the details of the care plan on a regular basis. On the basis of this feedback, more recent adaptations of the care plan since this survey have used colour and visual cues, and have received positive feedback (see [Supplementary Files 4–6](#)).

The majority of families and coordinators would like CGM devices and the data they provide integrated into the care plan. One-third of families reported using CGM at home, and there was near-unanimous support for CGM to be included in future care plans. In our experience, many families want diabetes care in school to more closely reflect care at home and, therefore, would like to see CGM technology and its data utilized in the school setting. It has been reported that the use of CGM has allowed for decreased caregiver worry and stress, providing increased comfort with diabetes management while at school ([18,19](#)), and is less disruptive to the classroom setting ([18](#)), providing that an education program and proper training on this technology is arranged for school staff ([18,20](#)). A provincial care plan such as the one in BC needs to be able to adapt to the ever-changing landscape of T1D care. As indicated by the high rate of CGM usage in this population, this landscape is rapidly changing, necessitating future modifications to the care plan to integrate the use of this technology.

Use of the care plan document by coordinators to educate and train EAs was assessed, and results suggested that the care plan document needs to be easier to understand and follow. Coordinators interact frequently with the care plan document and it must function well for them as a teaching aid. It also serves as a regular resource for EAs, as they are the ones directly caring for children in the school setting, so it is imperative that the document is both easy to use and easily understandable for EAs.

It is of interest to consider the BC care plan, and the feedback received in this study, in the context of the relatively recently developed national diabetes@school program ([21](#)). The diabetes@school website provides excellent school-related diabetes resources as well as a care plan template that can be used when there is not a local or provincial plan in place. Efforts to connect BC NSSCs, school staff and families to the resources available from diabetes@school should be enhanced. Much of the feedback and subsequent improvements made to the BC care plan in response to

this study are in line with the national care plan template, namely the use of colour and graphics alongside clear and concise language to improve use of the document. As T1D care continues to advance, it will continue to be important for collaboration and learning to occur between care providers from all parts of the country.

The strength of this study is that it represents the perspectives of a large number of families and coordinators from around the province. The collective experiences of these participants allow for valuable feedback on the safety, effectiveness and usability of the province-wide T1D school care plan, which can hopefully translate into better care for children across BC in the school setting. Limitations include a high risk of responder bias given the findings are self-reported by the families and coordinators who chose to participate, and they may not reflect the perspectives of those who did not participate. Further contributing to the risk of responder bias is the low response rate among families. The relatively low response rate from families may have been partially attributed to this being the first time families had ever been invited to participate in an evaluation of the program. It will be important to take steps to raise participation in future assessments of the program by encouraging family awareness and engagement. An additional limitation of the study is that the EAs and other school staff, who are the main users of the care plan, did not have the opportunity to provide their insight. To further understand and appreciate the effectiveness, safety, usability and overall satisfaction with the care plan, future initiatives should also collect the perspectives of other important stakeholder groups including the EAs, school staff, children and diabetes clinics working with NSS, in addition to the families and coordinators.

Insights from this study are already informing improved versions of the diabetes care plan in BC, with an aim to improve the readability and organization of the document, accommodate children's personal needs by offering families more options in the care plan while still following best practice guidelines, and continue to strive to provide equitable care across the province. This study has also informed the development of a CGM care plan, which will ultimately serve to support best care in the school setting for children living with T1D. These efforts are essential to enhance care for children living with T1D, as they deserve access to safe, consistent and inclusive care in school, empowering them to safely and comfortably participate in classroom learning.

Conclusions

Although the province of BC has been acknowledged as a leader in Canada in providing diabetes care to children in the school setting, the care in schools has not been formally evaluated. This study has provided the first evaluation of the current care plan in BC schools. Our results demonstrate that parents and coordinators perceive the care plan to be supporting safe and effective diabetes care. This evaluation led to updates to the care plan and integration of new technology for diabetes care at school. Ongoing evaluation is, therefore, needed to support further improvement of the program in the interest of providing optimal care for children in the school setting.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Diabetes* at www.canadianjournalofdiabetes.com.

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Author Disclosures

A.A.S., B.H. and T.C. are involved in the provision of care through the diabetes-at-school program in British Columbia. No other authors have conflicts of interest to declare.

Author Contributions

T.E.A., A.F., A.A.S., T.C. and B.H. contributed to the study design. T.E.A. and A.F. administered the survey. T.E.A. and B.H. prepared the manuscript. All authors participated in manuscript review.

References

- Henriquez-Tejo R, Cartes-Velasque R. Psychosocial impact of type 1 diabetes mellitus in children, adolescents and their families: Literature review. *Rev Chil Pediatr* 2018;89:391–8.
- Newhook L, Penney S, Fiander J, Dowden J. Recent incidence of type 1 diabetes mellitus in children 0–14 years in Newfoundland and Labrador, Canada climbs to over 45/100,000: A retrospective time trend study. *BMC Res Notes* 2012;5:628.
- Scarr J, O'Donnell M. Diabetes in the school setting: Evidence-based key components, care elements and competencies. September 2013. https://childhealthbc.ca/sites/default/files/diabetes_care_in_the_school_setting_evidence-informed_key_components_care_elements_and_competencies_september_2013.pdf. Accessed September 8, 2018.
- Fox D, Islam N, Sutherland J, Reimer K, Amed S. Type 1 diabetes incidence and prevalence trends in a cohort of Canadian children and youth. *Pediatr Diabetes* 2018;19:501–5.
- McIntosh B, Khatchadourian K, Amed S. British Columbian healthcare providers' perspectives on facilitators and barriers to adhering to pediatric diabetes treatment guidelines. *Can J Diabetes* 2017;41:224–40.
- Lawrence S, Cummings E, Pacaud D, Lynk A, Metzger D. Managing type 1 diabetes in school: Recommendations for policy and practice. *Paediatr Child Health* 2015;20:35–9.
- Jackson CC, Albanese-O'Neill A, Butler KL, et al. Diabetes care in the school setting: A position statement of the American Diabetes Association. *Diabetes Care* 2015;38:1958–63.
- Stefanowicz A, Stefanowicz J. The role of a school nurse in the care of a child with diabetes mellitus type 1—The perspectives of patients and their parents: Literature review. *Zdr Varst* 2018;57:166–74.
- Marks A, Wilson V, Crisp J. The management of type 1 diabetes in Australian primary schools. *Issues Compr Pediatr Nurs* 2014;37:168–82.
- Amillategui B, Calle JR, Alvarez MA, Cardiel MA, Barrio R. Identifying the special needs of children with type 1 diabetes in the school setting. An overview of parents' perceptions. *Diabet Med* 2007;24:1073.
- Hellems MA, Clarke WL. Safe at school: A Virginia experience. *Diabetes Care* 2007;30:1396–8.
- Nabors L, Lehmkuhl H, Christos N, Andreone TL. Children with diabetes: Perceptions of supports for self-management at school. *J Clin Psychol Med Settings* 2003;73:216–21.
- Ottosson AB, Akesson K, Ilvered R, Forsander G, Sarnblad S. Self-care management of type 1 diabetes has improved in Swedish schools according to children and adolescents. *Acta Paediatr* 2017;106:1987.
- Jacquez F, Stout S, Alvarez-Salvat R, et al. Parent perspectives of diabetes management in schools. *Diabetes Educ* 2008;34:996–1003.
- Canadian Pediatric Society. Managing type 1 diabetes in school: Recommendations for policy and practice. February 6, 2015. <https://www.cps.ca/en/documents/position/type-1-diabetes-in-school>. Accessed August 8, 2019.
- Alberta Innovates. ARECCI Ethics Guideline Tool. 2017. <https://albertainnovates.ca/programs/arecci>. Accessed March 1, 2020.
- Norman G. Likert scales, levels of measurement and the "laws" of statistics. *Adv Health Sci Educ* 2010;15:625–32.
- Benassi K, Drobny J, Aye T. Real-time continuous glucose monitoring systems in the classroom/school environment. *Diabetes Technol Ther* 2013;15:409–12.
- Erie C, Van Name MA, Weyman K, et al. Schooling diabetes: Use of continuous glucose monitoring and remote monitors in the home and school settings. *Pediatr Diabetes* 2018;19:92–7.
- Bratina N, Battelino T. Insulin pumps and continuous glucose monitoring (CGM) in preschool and school-age children: How schools can integrate technology. *Pediatr Endocrinol Rev* 2010;7(Suppl. 3):417–21.
- Canadian Paediatric Society. diabetes@school. <https://www.diabetesatschool.ca> 2020. Accessed March 9, 2020.