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Frequency of diabetes team contacts in children and adolescents using insulin pumps

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ABSTRACT

Background: The purpose of this study is to assess if a relationship exists between A1c within target (≤ 7.5%) and frequency of patient-initiated contact with diabetes team, in children with type 1 diabetes (T1DM) on an insulin pump. Additionally, to determine factors impacting frequency of contact.

Methods: This was a retrospective study of children with T1DM on an insulin pump. Frequency of contact, type of contact, and A1c were collected. Study participants filled out a questionnaire at study entry.

Results: One hundred and seventy-six participants were enrolled, with a mean age of 13 years. The median duration of T1DM was 6 years with a median duration of pump use, 3.6 years. One hundred and sixteen subjects (66%) contacted the diabetes team for insulin dose adjustments between clinic visits with a mean (standard deviation [SD]) of 1.2 (± 1.7) contacts, 90% of which were by e-mail. There was no significant relationship between achieving target A1c and frequency of contact. However, increasing age and longer duration of pump use were associated with decreased frequency of contact. Common barriers to contact included being too busy and technical problems with software.

Conclusions: There was no significant relationship between the frequency of patient-initiated contact with diabetes team and A1c. Overall, there was low frequency of contact in the cohort. Older children and children with longer duration of pump use had fewer contacts with low rates of self-directed pump adjustments. These results raise the importance of defining strategies to increase patient engagement and empower diabetes data review. (Clin Diabetol 2022, 11; 1: 6–10)

Keywords: type 1 diabetes, insulin pumps, pediatric, contact, A1c

Introduction

Routine management of type 1 diabetes mellitus (T1DM) requires daily administration of insulin and frequent glucose monitoring. Technology to support diabetes self-care has advanced significantly and includes insulin pump therapy, "smart" blood glucose meters, continuous glucose monitoring, and flash glucose monitoring. A unique feature of these resources is the ability to download data from insulin pumps, meters, and continuous glucose monitors instead of recording data in a logbook. This enables patients and health care providers to visually assess glycemic trends and make appropriate insulin changes to optimize glycemic control. Although these technologies are available, research shows they are underutilized by patients [1–3]. Thirty-three percent of adolescents with T1DM were non-adherent in downloading and communicating weekly blood sugars to health care providers in a randomized control trial assessing the effectiveness of a blood glucose monitoring system [2]. When emphasis was placed on caregivers, only 56% of caregivers of children in a cross-sectional survey reported downloading data from one or more diabetes devices at home [3].

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The Diabetes Control and Complications Trial Research Group, a randomized control trial with a mean follow up of 6.5 years, showed a 35–76% reduction in early stages of microvascular disease in patients receiving intensive diabetes treatment with a median A1c of 7% in the intensive treatment group in comparison to 9% median A1c in the control group [4, 5]. The majority of study participants were adults; however, a sub-analysis of the 195 adolescents showed similar results with a reduction in long-term sequelae of diabetes complications in the intensive treatment group compared to the control group [6]. This sub-analysis described the adolescents in the intensive treatment group having regular monthly visits at their diabetes clinic, as well as several telephone contacts between clinic visits [6]. The frequent contact with the health care team allowed close monitoring and titration of insulin dosing, promoting A1c within target [6]. Subsequent research studies with less intensive contact have also shown improvement in glycemic control when T1DM patients contacted their health care providers between clinic visits. A randomized controlled trial that assessed the impact of internet-based blood glucose upload methods on adolescents with T1DM using an insulin pump found a significant decrease in A1c in patients who communicated with their team minimum of once a month [1].

Most studies that have demonstrated a positive impact of team communication on glycemic control are prospective with active intervention of contact with the diabetes team. We are interested in performing a real-world study in our pediatric diabetes clinic cohort to determine the frequency of contact and to assess if a relationship exists between frequency of contact and optimal glycemic control. The primary objective was to assess if there was a relationship between A1c within target (≤ 7.5%) and frequency of contact with the diabetes team between clinic visits in children and adolescents with T1DM. We hypothesized that increased frequency of contact with the diabetes team would be positively correlated with A1c within target (≤ 7.5%). Secondary objectives were to determine factors impacting frequency of contact and change in A1c from baseline to end of study. Variables of interest potentially impacting frequency of contact were age, duration of pump use, and distance from the hospital.

Methods

This was a retrospective chart review assessing study participants' patient-initiated contact with their diabetes team and glycemic control over one year. Patients with T1DM using insulin pump therapy for one year or longer, attending the Pediatric Diabetes Clinic at Children's Hospital, London Health Sciences Centre were recruited to participate in the study. Children not on pump therapy or with oncological diagnoses were excluded. Data was collected from September 2017 to October 2019. The study was approved by the Human Research Ethics review board at Western University and informed consent was obtained from all study participants.

Study participants were divided into two groups: A1c within target and A1c not within target. A1c within target was defined as hemoglobin A1c ≤ 7.5% as per the Canadian Diabetes Association guideline and International Society for Pediatrics and Adolescent Diabetes [7, 8].

Over the one-year study period, there were four data collection time points: baseline and then every three to four months, coinciding with routine diabetes clinic visits. Data collected were hemoglobin A1c, number of patient-initiated contacts with the diabetes team between clinic visits, and type of contact (phone or e-mail correspondence). Additionally, a questionnaire was completed at study entry to assess routine practices with diabetes data download, data review, and barriers to reviewing data.

Expecting 23% of patients to have A1c within target, determined by clinic data from previous years, we estimated a sample size, n = 180 accounting for 80% power and 5% alpha. Continuous variables were summarized using means and standard deviations (SD) or medians and interquartile ranges (IQR) for non-normal distributions. Comparisons were made using Mann-Whitney U tests, paired and unpaired t-tests, and Pearson correlations. Categorical variables were summarized using frequencies (%), and comparisons were made using chi-square tests (or Fisher's exact tests when appropriate). Analyses were conducted using SPSS v26 (IBM Corp., Armonk, NY), and p-values < 0.05 were considered statistically significant.

Results

The study comprised 176 participants, 54% male, with a mean (SD) age of 12.9 (± 3.8) years. Baseline characteristics are summarized in Table 1. The Median (IQR) duration of T1DM was 6 (4, 9) years with a median (IQR) duration of pump use of 3.6 (2.3, 6.2) years. 54% of the study participants were using a continuous glucose monitor at the time of study enrollment.

The mean (SD) A1C was 8.1% (± 1.0) and 28.5% of study participants had a mean A1c within the target ≤ 7.5%. The mean frequency of patient-initiated contacts between clinic visits comparing the group with A1C in target and the group with A1c not in target was similar (1.17 vs. 1.20). There was no significant

Table 1. Baseline data

	All study participants	Group 1: A1c within target	Group 2: A1c NOT within target	P
n	176	52	124	
Age, mean (± SD)	13 (± 3.8)	12.5 (± 3.8)	13 (± 3.8)	0.3
Gender (%)				0.76
Female	46	44.2	46.8	
Male	54	55.8	53.2	
Ethnicity (%)				0.82
Caucasian	96	96.2	96	
Black	0.6	0	0.8	
Indigenous	0.6	0	0.8	
Other	2.8	3.8	2.4	
Duration of T1DM diagnosis				0.25
Mean (SD)	6.7 (± 3.7)	6.4 (± 3.9)	6.9 (± 3.6)	
Median (IQR)	6 (4, 9)	5.5 (3, 9)	6 (4, 9)	
Duration of pump use				
Mean (SD)	4.5 (± 3.1)	4.4 (± 3.8)	4.5 (± 2.7)	0.07
Median (IQR)	3.6 (2.3, 6.2)	2.8 (1.5, 6.1)	4 (2.5, 6.2)	
Mean A1c (%)	8.1 (± 1.0)	7.0 (± 0.3)	8.5 (± 1.0)	0.35
Pump type (%)				0.07
Medtronic	80.1	71.2	83.9	
Omnipod	15.3	25	11.3	
Animas	4.5	3.8	4.8	
CGM use (%)				
Libre, Dexcom or Guardian	95 (54)	30 (32)	65 (68)	0.633

CGM — continuous glucose monitoring; IQR — interquartile ranges; SD — standard deviation; T1DM — type 1 diabetes mellitus

Table 2. Comparison of A1c within target with mean # of contacts/person at different time points during the study

	Group 1: A1c within target	Group 2: A1c NOT within target	P
Time 1[a]: n (%)	49 (28)	125 (72)	
Time 1: Mean # of contacts/person	1.35	1.34	0.88
Time 2[a]: n (%)	51 (29)	124 (71)	
Mean # of contacts/person	1.12	1.09	0.69
Time 3[a]: n (%)	32 (29)	77 (71)	
Mean # of contacts/person	1.03	1.19	0.93

[a]Time 1 — data between visit 1 and visit 2; time 2 — data between visit 2 and visit 3; time 3 — data between visit 3 and visit 4

correlation between A1c within target and frequency of contact at any of the 4 time points (Tab. 2). The initial A1c at study entry was 8.06% with a final A1c of 8.13%. There was no significant difference in change in A1c ($p = 0.35$). The preferred method of contact in this study population was e-mail at 90%, followed by both phone and e-mail at 9%, and then phone at 1%.

There was a negative correlation between age and mean number of contacts ($r = -0.20$, $p = 0.01$). There was also a negative correlation between the duration of pump use and the mean number of contacts ($r = -0.17$, $p = 0.02$). There was no significant relationship between distance from the hospital and frequency of contact ($r = 0.08$, $p = 0.30$). The most common barrier to diabetes data review identified by study participants was "being too busy" (41%). Other barriers were technical problems with software (39%) and limited access to the internet (3%). Thirteen percent of study participants chose a free text option to identify barriers. Common themes were forgetting, being distracted, uncertain/afraid to make mistakes.

On the assessment of the frequency of blood glucose review by self-report on the questionnaire, 6% of patients never reviewed, 30% reviewed prior to appointment, 18 % reviewed once a month. 21% reviewed every 2 to 3 weeks, 9% reviewed weekly and 21% reviewed daily. Changes to insulin pump settings were self-reported as being made by the patients 14%, caregiver 47%, and the diabetes team 66%, with some study participants choosing more than one option.

Discussion

There was no association between the frequency of patient-initiated contact with the diabetes team among patients using pump therapy and A1c within target in our pediatrics diabetes clinic. However, the frequency of contact in this study population was low regardless of whether A1c was within target, with an average of 1.2 contacts in three to four months. Most studies showing an improvement in A1c associated with diabetes team contact had a minimum of one contact per month [1, 3, 9]. In view of the low frequency of patient-initiated contact in this study population, the lack of an association of contacts with A1c was not unexpected. Rather, this study highlights the need to increase patient and family engagement with the diabetes team between clinic visits.

A pediatric study spanning 6 months with frequent contact of either daily, 2–3 times per week or twice a month showed a significant change in A1c from 8.30 ± 1.1.6% to 7.45 ± 0.87% [9]. The mean age of the study participants was 10.9 years and 17% were on pump therapy. Contact was by WhatsApp (57%), phone (29%), and by short message service (13%) [9]. This study demonstrated the impact frequency of contact can have on glycemic control but also showed patient engagement to be a contributing factor to the frequency of contact. Eighty-nine percent of individuals with A1c < 7.5% consulted the diabetes team frequently, whereas only 23% of individuals with A1c > 9% consulted frequently [9]. Highly motivated families were found to have a higher frequency of contact. In contrast, a randomized pediatric trial with an intervention of a bimonthly 15- to 30-minute phone call for 7 months duration did not show a difference in A1c [10]. There were concerns about lack of patient engagement as a contributing factor.

Insulin pumps, continuous glucose monitoring, and smart glucose monitoring are valuable devices and options for patients with T1DM; however, they require a moderate level of diabetes literacy and problem-solving skills for optimal use and glycemic control [11]. A randomized controlled pediatric trial incorporated three different texting contact topics: general information messages on diabetes, interactive component weekly reviewing data and collaborating with the family on insulin dose adjustments, and multimedia video clips on procedures such as pump site changes [12]. This study showed not only a significant decrease in A1c, fasting blood glucose, and post-prandial blood glucose, but also an increase in parents' diabetes knowledge test scores [12]. In our study questionnaire, some patients highlighted concerns and fears of making insulin dose adjustments as a barrier to data review. Research suggests that this barrier can be mitigated by contact with the diabetes team between clinic visits [12].

Increasing age and increasing duration of pump use were associated with a lower frequency of contact with the diabetes team in our study. There are unique challenges to diabetes care in younger patients, most notable with respect to insulin dosing and fear of hypoglycemia [13]. Patients with longer duration of pump use have longer experience with T1DM management and might be expected to be more comfortable with pump use and adjustments. However, this study's self-reported data showed that study participants, even those with longer duration of T1DM, infrequently made pump adjustments between clinic visits. There was a wide range of frequency of diabetes data review between clinic visits, with 50% reviewing either once a month, prior to a clinic appointment, or never. Also, 66% of study participants reported pump adjustments being made by the diabetes team. Conversely, 61% of study participants (14% patients and 47% caregivers) reported making pump adjustments. The most commonly reported barrier to diabetes data review and patient-initiated adjustments was "being too busy". These results emphasize the importance of active patient engagement and consideration of the time required by families for optimal diabetes care. There have been several studies assessing the mode of contact between clinic visits with patients [9, 14]. The preferred mode of contact in our study was e-mail at 90%; however, other studies have found text messages to be preferred over e-mail due to its convenience and fast correspondence [9, 14]. Unfortunately, a secure method of text messaging between patients and the diabetes team was not available at our diabetes clinic; this should be considered in future research.

A limitation of this study was continuous glucose monitoring (CGM) data, such as time in range was not collected. The study population was 96% Caucasian, thereby limiting the generalizability.

Conclusions

In conclusion, this study did not show a correlation between the frequency of diabetes team contact and A1c within target. Increasing age and increasing duration of pump use was associated with reduced frequency of contact in this study population. There were variable rates of diabetes data review and insulin pump adjustments in between clinic visits. This study highlights the importance of engagement of patients with diabetes between clinic visits. Patients should be empowered to make self-directed changes to insulin pump settings between clinic visits. For patients requiring additional support or with poor glycemic control, consideration should be given to developing an individual structured plan for frequent scheduled contact with the diabetes team between clinic visits.

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Conflict of interest

None declared.

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