Journal of Diabetes Science and Technology
2017, Vol. 11(2) 224–232

DOI: 10.1177/1932296816663963
journals.sagepub.com/home/dst
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Evaluation of Pump Discontinuation and Associated Factors in the T1D Exchange Clinic Registry

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Abstract

Background: The objectives of this study were to examine factors associated with insulin pump discontinuation among children and adults followed longitudinally for 1 year in the multicenter T1D Exchange clinic registry, and to provide participant-reported reasons for stopping pump therapy.

Methods: We longitudinally followed 8935 participants of all ages using an insulin pump at the time of registry enrollment. Logistic regressions were used to identify demographic and clinical factors associated with pump discontinuation. Pump discontinuation was self-reported by participants on a first annual follow-up survey.

Results: The overall frequency of pump discontinuation was 3%. Discontinuation was higher in adolescents (4%) and young adults (4%) than in younger children (3%) or older adults (1%). In multivariate analysis of children between 6 and <13 and 13 and <18 years, participants who discontinued pump use were more likely to have higher HbA1c levels at baseline (adjusted $P < .001$ for both). The top participant-reported reasons for discontinuing the pump included problems with wearability (57%), disliking the pump or feeling anxious (44%), and problems with glycemic control (30%).

Conclusions: In T1D Exchange registry participants, insulin pump discontinuation is uncommon, but more prevalent among adolescents and young adults, and youth with poor glycemic control. Given the known benefits of pump therapy, these populations should be targeted for support and education on troubleshooting pump use. Common reasons for discontinuation should also be considered in future device design and technological improvement.

Keywords

continuous subcutaneous insulin infusion, discontinuation factors, pump use, adult, children, T1D Exchange

Insulin pump use can improve diabetes management for adults and children with type 1 diabetes (T1D) by improving glycemic control, decreasing severe hypoglycemia episodes, and improving quality of life.[1-13] In 1 meta-analysis, hemoglobin A1c (HbA1c) and quality of life were improved in adults with T1D using pumps compared to multiple daily injections.[14,15] In this study, described in an AHRQ technical report as well as a separate scientific report, the effects on glycemic control were more equivocal in children and adolescents, but there was a greater improvement in glycemic control in those with higher HbA1c.[14,15] Despite the potential benefits of insulin pumps, a small but significant proportion of pump users discontinue pump use over time.[12,16-22] In prior studies, factors associated with pump discontinuation in adolescents and young adults included shorter duration of pump use, age (highest discontinuation rates in adolescents 10-15 years of age), gender (higher discontinuation rates in females), and overall well-being (higher discontinuation rates among individuals with

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depressive symptoms).[17,21,22] Common reasons for pump discontinuation in adolescents include diabetes burnout (fatigue with needing to change pump sites, monitor blood glucose, and keep track of carbohydrate intake), concerns about body image and weight gain, interference with sports and other activities, and the desire to be free of a foreign device on the body.[22,23]

While studies have identified factors associated with pump discontinuation over the past decade or earlier in single clinic cohorts, only a few have explored the rates of pump discontinuation and the reasons associated with stopping use in the diabetic population using newer generations of insulin pumps in larger multicenter populations. A 2010 study using a prospective electronic diabetes documentation follow-up registry (Diabetes Patienten Verlausdokumentation, DPV) reported an overall pump discontinuation rate of 4% in children and young adults with T1D in Germany and Austria.[17] More recently, a multicenter study of pump discontinuation in children, based on administrative clinical database data, in Ontario, Canada, reported a pump discontinuation rate of 0.42 per 100 person-years and described clinic-related factors associated with pump discontinuation.[19] While these studies provide important data on discontinuation rates in Europe and Canada, no similar study has been done in the United States, where different insulin pump models are available, and pump use is higher (60%) compared to the DPV (41%) and in Ontario (38%).[19,24,25] In addition, these prior studies only focused on children and adolescents and used administrative data; no multisite studies have encompassed all ages or included participant-reported data.

The objective of this study was to describe insulin pump discontinuation rates, associated clinical and demographic factors, and reasons for stopping pump use in persons with T1D in a large, clinic-based cohort of children and adults with T1D in the United States. We used data from the T1D Exchange Clinic Network registry database[26] to (1) determine the frequency of pump discontinuation at 1 year from registry enrollment, (2) determine the factors associated with pump discontinuation among patients using recent generations of insulin pumps in the United States, and (3) summarize participant-reported reasons for pump discontinuation. The T1D Exchange Clinic Network was established to evaluate how advances in diabetes technology have impacted glycemic control and outcomes since the Diabetes Control and Complications Trial 20-30 years ago.[24] Registry participants include patients of all ages, from geographically diverse treatment centers; a study in this large population allowed identification of demographic factors associated with insulin pump discontinuation across the life span, which has not be previously reported. Understanding the reasons and factors contributing to pump discontinuation will help guide education and decisions regarding insulin pump use in clinical practice.

Methods

The T1D Exchange clinic registry includes >27 000 individuals with T1D followed in a vast network of adult and pediatric diabetes clinics across the United States. Information about informed consent, assent, and institutional review board (IRB) processes, T1D diagnostic criteria for inclusion in the registry, and data collection methods have been previously published.[26] Data were collected for the clinic registry central database from participants' medical records in addition to comprehensive questionnaires completed by participants (or parents/guardians of participants if minors).[26] This report includes data on participants who enrolled in the T1D Exchange when enrollment was open (between September 2010 and July 2012) and for whom data regarding pump use at the 1-year follow up was available.

The analysis cohort included 8935 registry participants from 67 T1D Exchange clinics who completed the 1-year follow-up questionnaire. Insulin pump must have been the insulin modality at baseline and either a pump or injections/pens the usual insulin modality at year 1 for participants to be included in the cohort. To account for potential differences in results according to age, analyses were stratified into the following age groups: <6 years, 6 to <13 years, 13 to <18 years, 18 to <26 years, and ≥26 years. We planned to carry out detailed analyses in age subgroups in which pump discontinuation rates were >1%. Although participants of all ages were included in the initial cohort, only children, adolescents, and young adults were included in detailed analysis because the reported proportion of pump discontinuation among individuals older than 26 years was not large enough for analysis. The most recent HbA1c measurement within 6 months prior to registry enrollment was obtained from clinic medical record. HbA1c values were measured by point-of-care device or local laboratory. Occurrences of diabetic ketoacidosis (DKA) and severe hypoglycemia (SH) during the year prior to enrollment were reported by participants and analyzed as separate covariates in the analyses. DKA was defined by occurrence of ketoacidosis that resulted in overnight hospitalization, while SH was defined as severe hypoglycemia resulting in seizure or loss of consciousness. Demographic, socioeconomic, and diabetes management factors were obtained from participant or parent/guardian questionnaires at enrollment and 1 year. Reasons for pump discontinuation were queried using a static list of 21 potential discontinuation reasons from those who reported stopping use of pump therapy between the enrollment and 1 year time points (Supplementary Table 1); the options were grouped into 10 categories (plus "Other") based on expert opinion. Participants could select multiple reasons for discontinuation.

Statistical Analyses

The frequency of pump discontinuation 1 year after registry enrollment was tabulated according to age for all participants.

Table 1. Participant Characteristics at Registry Enrollment.[a]

	Age (years) at enrollment[b]					
	<6, n = 322	6 to <13, n = 2543	13 to <18, n = 2173	18 to <26, n = 1145	≥26, n = 2752	Overall, N = 8935
Female (%)	43	50	50	53	61	54
Race/ethnicity (%)						
White non-Hispanic	86	86	86	90	94	89
Insurance status (%)						
Private insurance	84	83	84	85	84	84
Other insurance	16	16	16	15	15	16
No insurance		<1	<1	<1	<1	<1
Annual household income (%)						
<$35 000	15	10	11	20	13	12
$35 000 to <$75 000	29	26	26	29	31	28
≥$75 000	56	64	64	51	57	60
Highest level of education (%)[b]						
High school diploma/GED or less	19	22	24		27	31
Associate's or bachelor's degree	46	46	43		46	42
Master's, doctorate, or professional degree	35	32	33		27	27
Mean duration of diabetes (years)[c]	1.6 ± 1.2	4.3 ± 2.7	6.9 ± 3.9	10.4 ± 5.2	25.3 ± 12.8	12.1 ± 11.9
Body mass index (%)						
Underweight	2	<1	<1	<1	<1	<1
Normal weight	65	70	62	51	33	56
Overweight	22	19	24	32	38	27
Obese	12	10	14	16	28	17
Mean duration of pump use (years)[c]	1.2 ± 1.1	2.8 ± 2.2	4.3 ± 2.9	6.0 ± 3.5	8.8 ± 5.6	5.3 ± 4.6
Mean enrollment HbA1c (%)[c,d]	7.8 ± 0.9	8.0 ± 1.0	8.4 ± 1.3	8.0 ± 1.3	7.5 ± 1.1	7.9 ± 1.2
Occurrence of at least 1 SH event in the year prior to enrollment (%)	7	3	5	5	10	6
Occurrence of at least 1 DKA event in the year prior to enrollment (%)	7	6	6	5	4	5
Self-monitoring of blood glucose <4 times per day (%)	<1	2	12	27	15	11
Pump manufacturer (%)						
Animas	57	35	26	17	11	24
Deltec	<1	2	3	3	1	2
Insulet	8	8	7	5	5	6
Medtronic	32	52	60	72	79	64
Other/unknown	2	3	4	3	3	3

[a]All variables were collected at enrollment.
[b]Highest education of parent was used if participant was younger than 18. Education level was not included for the 18 to <26 age group as it is not an accurate representation of socioeconomic status for this age range.
[c]Mean ± standard deviation.
[d]Most recent HbA1c available within 6 months prior to enrollment.

Additional analyses were limited to the age range 6 to <26 since pump discontinuation outside this range was rare. Within this age range, pump discontinuation rates were computed for various demographic and diabetes management characteristics. Univariate analyses of these variables were conducted using unadjusted logistic regression models to identify the demographic and clinical factors associated with pump discontinuation. Factors with a P value < .10 from the unadjusted univariate models were sequentially added to and removed from a multivariate model through a stepwise selection procedure, until only factors with P value < .001 remained. Duration of pump use was included in the multivariate models to account for potential confounding. Tests of significance were reported from models using continuous variables, and odds ratios (ORs) were reported from models using categorical variables.

Data analyses were performed using SAS version 9.4 (2011, SAS Institute Inc, Cary, NC). All P values are 2-sided.

In view of the multiple comparisons, only P values < .001 were considered significant.

Results

Participant Characteristics and Frequency of Insulin Pump Discontinuation

The average (± standard deviation [SD]) age of the 8935 participants was 23.3 ± 17.4 years. In this cohort, 54% were female, 89% were non-Hispanic white, and average duration of pump use at enrollment was 5.3 ± 4.6 years (range <1 year to 25 years). Additional cohort characteristics are shown in Table 1.

Two hundred forty registry participants (3%) reported discontinuation of insulin pump use during the year following registry enrollment. No participants younger than 6 years discontinued pump use, and the proportion of pump discontinuation in participants ≥26 years was low (1%). Frequencies of pump discontinuation were higher in adolescents and young adults than in younger participants (4% for both 13 to <18 years and 18 to <26 years, compared with 2% for 6 to <13 years, P < .001).

Characteristics Associated With Insulin Pump Discontinuation

In the 6 to <26 age range, participants living in households earning less than $35 000 annually were more likely to discontinue pump use (Table 2). In addition, there was a higher proportion of discontinuation among those who self-monitored their blood glucose less than 4 times per day. There was a trend toward higher frequency of discontinuation in participants with shorter duration of diabetes. There was no association between pump discontinuation frequency and race/ethnicity or body mass index. Self-report of at least 1 SH event in the year prior to enrollment did not change the likelihood of pump discontinuation. In addition, no relationship was found between specific diabetes clinics and pump discontinuation. Further relationships between various factors and pump discontinuation are shown in Table 2.

Univariate analyses uncovered several associations between participant characteristics and more frequent pump discontinuation that were specific to age subgroups. Within the 6 to <13 age group, the proportion of pump discontinuation was higher among those who had a change in insurance status (8% vs 2%, P = .008) and among those with parents with less than a high school/GED education (4% vs 2%, P = .03; Table 2). Participants with at least 1 DKA event in the year prior to enrollment were more likely to have discontinued pump use, particularly in the 13 to <18 age group, in which 13% of those having at least 1 DKA event discontinued pump use compared with 4% of those who did not experience DKA (P < .001; Table 2). The frequency of pump discontinuation was similar among males and females in the younger age groups, but in those aged 18 to <26 years, 6% of females, compared with 2% of males, discontinued pump use (P = .004). The proportion of participants between 6 and 18 years who discontinued pump use was higher in participants with higher enrollment HbA1c levels (P < .001 for both the 6 to <13 and 13 to <18 age groups), but this relationship was not seen in 18 to <26-year-old participants. The only difference among users of different pump manufacturers was in the 6 to <13 year group, in which discontinuation was highest in those using a Deltec pump (P = .01; Table 2).

Multivariate regression showed that only a few of the significant univariate factors were associated with pump discontinuation after adjustment. In the 6 to <13 age group, those who discontinued pump use were more likely to have higher enrollment HbA1c (adjusted P < .001; OR [99% CI] 1.89 [1.47, 2.44]). In the 13 to <18 age group, HbA1c and occurrence of at least 1 DKA event in the year prior to enrollment were found to be significantly associated with pump discontinuation. Discontinuers in this age group were more likely to have had a recent DKA event (adjusted P < .001, OR [99% CI] 2.75 [1.27, 5.97]) and higher enrollment HbA1c (adjusted P < .001, OR [99% CI] 1.46 [1.22, 1.75]). Although no factors remained in the final adjusted model for the 18 to <26 age group, a trend for increased odds of discontinuation among females compared to males was evident (adjusted P = .005; OR [99% CI] 3.46 [1.30, 9.21])

Reported Reasons for Pump Discontinuation

Reported reasons for discontinuing pump use were relatively similar across the age range (Table 3). Table 3 shows the distribution of reasons for discontinuing pump use across age and gender. Among participants who discontinued pump use, 57% reported the reasons for pump discontinuation were issues with wearability, including insertion problems, pump discomfort, skin reactions, adhesive problems, and interference with sports and activities. Other common reasons include disliking the pump or feeling anxious (44%), having problems with glycemic control while on pump (30%), recommendation by the health care practitioner (20%), not finding the pump helpful (19%), and having problems with the pump working properly (19%).

Compared with males, more females between the ages of 6 and 18 years reported discontinuing pump due to issues with wearability. Interestingly, although the frequency of discontinuation was lower in males in the 18 to <26 age group, a higher proportion of those men that discontinued did so because of issues with wearability, compared to young adult women. Across all ages, more females than males discontinued pump use due to disliking the pump or feeling anxious. Participants aged 6 to <13 were more likely to discontinue due to glycemic control problems compared with older age groups.

Table 2. Frequency of Pump Discontinuation and Factors Associated With Discontinuation.

	Age at enrollment					
	6 to <13 years		13 to <18 years		18 to <26 years[a]	
	Percentage discontinued pump	Univariate *P* value[b]	Percentage discontinued pump	Univariate *P* value[b]	Percentage discontinued pump	Univariate *P* value[b]
Gender[c]		.87		.22		.004
Female (%)	2		5		6	
Male (%)	2		4		2	
Race/ethnicity		.11		.13		.45
White non-Hispanic (%)	2		4		4	
Other (%)	4		6		3	
Change in insurance status from enrollment[c,d]		.008		.46		.65
No (%)	2		4		4	
Yes (%)	8		2		6	
Annual household income[c,e]		<.001		.04		.35
<$35 000 (%)	5		8		6	
$35 000 to <$75 000 (%)	4		3		3	
≥$75 000 (%)	1		4		4	
Highest level of education[a,c]		.03		.30		
High school diploma/GED or less (%)	4		5			
Associate's or bachelor's degree (%)	2		4			
Master's, doctorate, or professional degree (%)	2		3			
Duration of diabetes (years)[c,e]		.81		.32		.07
<3 (%)	3		5		10	
3 to <6 (%)	2		4		4	
6 to <15 (%)	2		4		3	
≥15 (%)			4		4	
Body mass index[e]		.89		.83		.75
Underweight (%)			6			
Normal weight (%)	3		4		4	
Overweight (%)	2		5		4	
Obese (%)	2		5		2	
Duration of pump use (years)[c,e]		.98		.14		.43
<2 (%)	2		4		8	
2 to <3 (%)	3		6		4	
3 to <6 (%)	2		4		2	
≥6 (%)	3		3		4	
Enrollment HbA1c (%)[c,e]		<.001		<.001		.08
<7 (%)	1		2		4	
7 to <8 (%)	<1		2		3	
8 to <9 (%)	3		4		5	
≥9 (%)	6		8		4	
Occurrence of at least 1 SH event in the year prior to enrollment		.60		.75		.27
No (%)	2		4		4	
Yes (%)	3		3		8	
Occurrence of at least 1 DKA event in the year prior to enrollment[c]		.13		<.001		.31
No (%)	2		4		4	
Yes (%)	4		13		6	

(continued)

Table 2. (continued)

	Age at enrollment					
	6 to <13 years		13 to <18 years		18 to <26 years[a]	
	Percentage discontinued pump	Univariate *P* value[b]	Percentage discontinued pump	Univariate *P* value[b]	Percentage discontinued pump	Univariate *P* value[b]
Frequency of self-monitoring of blood glucose (per day)[e,f]		.005		.02		.11
<4 (%)	10		7		6	
≥4 (%)	2		4		3	
Pump manufacturer[c]		.01		.20		.72
Animas (%)	3		5		6	
Deltec (%)	10		5			
Insulet (%)	1		7		3	
Medtronic (%)	2		3		4	
Other/unknown (%)	4		6		3	

[a]Education data not provided for 18 to <26 year category due to poor data quality.
[b]*P* values from the univariate logistic regression on pump discontinuation. Missing values for variables were excluded from the univariate models, but were included in the multivariate model. Inclusion or exclusive from the final model was based on the *P* value for the effect of the variable excluding the missing values.
[c]Variables included in the final multivariate model. The final model was determined by a stepwise selection procedure that tested variables from the univariate models with a *P* value < .1. Such variables were added and removed from the model until only variables with a *P* value < .001 remained. Duration of pump use was included in all models to adjust for confounding. HbA1c was included in the final model for the 6 to <13 year age group. Both HbA1c and occurrence of DKA prior to enrollment were included in the final model for the 13 to <18 age group.
[d]Change in insurance status is defined as any change in private, other, or no insurance from 1 type to another within these 3 categories.
[e]*P* value obtained by treating as continuous variable.
[f]Frequency of self-monitoring blood glucose was not included in the model selection procedures, as HbA1c is a better representation of glycemic control.

Discussion

We analyzed a large cohort from the T1D Exchange Clinic Network to assess the frequency of pump discontinuation and determine factors associated with discontinuation by age and gender. In contrast to previous studies using data collected prior to 1994,[12,18] this study analyzed data from T1D patients using new-generation insulin pumps and represents the first multisite, patient- and clinic-reported data on pump discontinuation from a US-based population.

Relatively low frequencies of pump discontinuation were observed during the year following enrollment in the T1D Exchange Clinic Registry (3% overall). This frequency is similar to prior reports on the discontinuation of insulin pump use in children, adolescents, and young adults. In the 2010 report from the DPV in Germany and Austria, the overall frequency of pump discontinuation was 4% among the 11 710 patients in the registry.[17] Discontinuation rate among children in Ontario, Canada was 0.42 per 100 person-years.[19] In addition, in single-center studies of children and adolescents, discontinuation rates ranged from <5% to 6% over the course of 1-2 years,[21,22] and 11.3% over a total follow-up period of 9 years.[16] Overall, the higher proportions of pump discontinuation that we observed among adolescents, young adults, and females in these older age groups are similar to the results from previous studies.[16,17,21,22]

We found a higher proportion of pump discontinuation in adolescents and young adults. As children progress through adolescence, peer influences increase due to desire to conform. At the same time, parental impact decreases as adolescents have increased autonomy in medical decision-making. The attempt to balance these 2 expectations may contribute to the higher pump discontinuation rates observed among participants older than 13 years. Another factor that may influence the increased likelihood of pump discontinuation during and after adolescence is participation in sports or activities in which pump use is more difficult or less acceptable.[17] The higher frequency of discontinuation observed among young adult females has been postulated to be due to greater concern with body image and weight gain in young women.[17] Given the potential benefits of pump therapy on glycemic control there is a need for targeted educational and supportive efforts to guide those most at risk for discontinuing insulin pump therapy, in particular adolescents, young adults, and females. We agree with other researchers who have called for ongoing pump education that is individualized to meet different needs, not only to prevent discontinuation, but to prevent complications such as DKA while using pump therapy.[27]

The clinical factors that were identified through multivariate regression analysis can help us understand and

Table 3. Frequencies of Participant-Reported Reasons for Discontinuing Pump Use.[a]

		Age at enrollment					
		6 to <13 years		13 to <18 years		18 to <26 years	
	Overall, N = 199	Female, n = 31	Male, n = 30	Female, n = 52	Male, n = 41	Female, n = 34	Male, n = 11
Issues with wearability (%)	57	65	47	60	51	56	82
Disliked pump/felt anxious (%)	44	55	27	56	27	50	45
Glycemic control problems while on pump (%)	30	42	40	21	27	29	27
HCP recommended stopping use (%)	20	26	23	17	22	18	
Didn't feel pump was helpful (%)	19	23	27	12	12	26	18
Problems with pump working properly (%)	19	32	7	15	22	15	27
Found pump too complicated (%)	11	19		19	7	6	9
Issues with cost (%)	7	10	7	2	5	9	27
Not enough support from HCP (%)	1			2		3	
Not enough support from family (%)	1			2		3	
Other (%)	23	13	13	29	22	35	9

[a]Reasons for discontinuation are not mutually exclusive; participants can record more than one.

identify patients at risk of stopping pump use. In the 13 to <18 age group, the association between recent hospitalization for DKA and pump discontinuation highlights the need for additional insulin pump training in adolescents who are at higher risk for pump failure and DKA. In the age subgroups of 6 to <13 years and 13 to <18 years, the frequency of pump discontinuation was greatest in participants with worse glycemic control, as determined by HbA1c and lower reported frequency of self-monitoring of blood glucose. The association found between higher HbA1c and pump discontinuation for these subgroups suggests that in practice, inadequate glycemic control may indicate the need for additional education on the use and management of insulin pumps. Differences in pump discontinuation were less significant for HbA1c and self-monitoring of blood glucose among participants between 18 and 26 years old, suggesting that as glycemic control improves with maturity, the likelihood of a participant discontinuing pump use decreases. The trend toward increased odds of discontinuation in females versus males in the 18 to <26 year age group suggests that the focus on insulin pump management and education is particularly important in this demographic group.

The majority of the participants who discontinued pump use in this study reported issues with wearability, including problems with insertion, pump discomfort, skin reactions, adhesive problems, and interference with sports and activities. These reasons are similar to those given in previous studies, in which the pump interfered with physical activity or sports, or felt too much like a foreign body.[23] Other common reasons for pump discontinuation included disliking the pump or feeling anxious, discontinuation recommended by health care practitioner, problems with glycemic control and the pump working properly, and not finding the pump helpful. These results are similar to previous studies, which confirmed diabetes burnout, concern with body image and weight gain, clinical and technical difficulties with the device as common reasons for pump discontinuation based on questionnaires similar to those completed in this study.[16,22] One study of German adolescents and young adults found that although technical and clinical reasons for pump discontinuation were common, social and psychological factors seemed to be more prevalent, as many found the pump bothersome and a constant reminder of diabetes.[23] However, when asked what would prompt resuming pump therapy, numerous participants described technical solutions, including improvement of catheters, reduced size of the device, water resistance, reduction in noise level, and integration of blood glucose measurement with the pump. Our results support the findings of these interviews, creating the need for social and psychological solutions to lower pump discontinuation rates for reasons beyond technical issues. Understanding the predominant reasons for pump discontinuation for different ages and gender can generate more specialized care and attention by clinics worldwide. In addition, device and software manufacturers may be able to use this information to improve pump features, perhaps

increasing participant satisfaction and continued use of pumps and their associated software.

One strength of this study includes the size of the overall cohort, which has allowed the exploration of factors associated with pump discontinuation, a relatively rare event, in more detail than smaller studies from single diabetes centers. Another strength is that the cohort includes data from participants using newer generations of pumps. A limitation of this study is the short follow-up period of 1 year. We plan to continue to follow participants and their use of insulin pumps with annual surveys and with further longitudinal analyses to assess the impact of these and other technological improvements. Information on the exact date of pump discontinuation was also not collected. In addition, the participants in the registry are clinic-based instead of population-based, which may affect the generalizability of the findings. Finally, we were only able to include participants who completed the 1-year follow-up, which excludes those lost to follow-up or unable or unwilling to complete the follow-up questionnaire. It is possible that the frequency of pump discontinuation is higher in these nonresponders, leading us to underestimate the true frequency of pump discontinuation in our T1D cohort.

Although discontinuation of insulin pump use is rare, it should be a concern for clinics to monitor and for which to prepare, especially among adolescents and young adults, particularly females. Efforts should be made to provide education and guidance for these populations. In addition, it would be beneficial for device manufacturers to take participant-reported reasons for discontinuation into consideration while developing the next generation of insulin pump technology.

Abbreviations

DKA, diabetic ketoacidosis; DPV, Diabetes Patienten Verlausdokumentation; HbA1c, hemoglobin A1c; HCP, health care provider; IRB, institutional review board; OR, odds ratio; SD, standard deviation; SH, severe hypoglycemia; T1D, type 1 diabetes.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: SA is a shareholder of Tandem Diabetes and Dexcom.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Supported through the Leona M. and Harry B. Helmsley Charitable Trust.

Supplemental Material

The supplemental materials are available at http://journals.sagepub.com/doi/suppl/10.1177/1932296816663963.

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