No Summer Vacation From Diabetes: Glycemic Control in Pediatric Participants in the T1D Exchange Registry Based on Time of Year

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Seasonal variation in glycemic control has been postulated to occur in school-aged children with type 1 diabetes, with higher HbA_{1c} levels during summer months than during the school year because of lack of structure and less stringent adherence to a prescribed medical regimen during summer vacation (1). To address this question, we used data obtained in 1,972 youth with type 1 diabetes enrolled in the T1D Exchange (T1DX) at 56 clinical centers in the U.S. between 2010 and 2012 (2).

To be included in these analyses, participants had to be 8 to <18 years of age, have a type 1 diabetes duration >3 years to minimize the influence of changes in residual endogenous insulin secretion over time, and have HbA_{1c} measurements in each of three predefined periods: prior to the start of summer (March, April, May), end of summer vacation (August and September), and back in school (November and December). HbA_{1c} values were compared across the three time periods using a Kruskal-Wallis test to account for the skewed distribution of HbA_{1c} within each time period. Because of multiple comparisons and large sample size only *P* values < 0.01 were considered statistically significant.

The mean age was 13.2 ± 2.7 years, mean duration of diabetes was 7.4 ± 2.8 years (range 4–17 years), 51% of participants were female, and the majority of participants were non-Hispanic whites (79%). Frequencies of pump (66%) and continuous glucose monitor (8%) use were similar to rates described for use of these technologies in the entire pediatric cohort of the T1DX (3). Across the entire population studied, no difference in HbA_{1c} was observed before (8.5 ± 1.4% [69.6 ± 15.0 mmol/mol]), during (8.5 ± 1.4 [69.4 ± 15.4]), or after (8.5 ± 1.4% [69.6 ± 15.0]) summer vacation. Similarly, as shown in the Table 1, there were no differences in HbA_{1c} levels after stratifying by age, sex, race/ethnicity, region, and device use. Only ~24% had an HbA_{1c} of ≤7.5% (58 mmol/mol) within each time period.

In summary, these data do not support the conventional wisdom that the changes in activity patterns and mealtimes during summer vacation are associated with a worsening of control in school-aged children with type 1 diabetes. As the T1DX is a contemporary cohort utilizing modern-day methodologies for diabetes management, our results are likely more generalizable than older, smaller studies. It has previously been postulated that there is worsening of glycemic control in winter months, and some have suggested this was correlated with either lower temperatures or greater variability in temperature (4,5). However, there were no differences in HbA_{1c} levels in the four regions (Midwest, Northeast, South, and West) of the country, despite the marked differences in regional climates. Application of our findings may be limited in minority patients as the cohort studied was predominately non-Hispanic white; yet, the demographics of our cohort are consistent with the epidemiology of the disease. However, our findings highlight the need for improving control in most youngsters with type 1 diabetes regardless of the time of year as targeted HbA_{1c} levels of ≤7.5% were not achieved in the vast majority of youngsters. It will be important to determine whether new treatments for the management of type 1 diabetes, such as closed-loop insulin delivery systems, will allow a greater percentage of patients to achieve and maintain target HbA_{1c} levels throughout the year.

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Table 1—Seasonal HbA_{1c} averages by demographic characteristics

	Prior to start of summer vacation	End of summer vacation	Back in school	*P*
Age				
8 to <13 years (n = 778)	8.2 ± 1.1 (66.0 ± 11.7)	8.3 ± 1.2 (66.8 ± 12.6)	8.2 ± 1.1 (66.3 ± 11.7)	0.61
13 to <18 years (n = 1,194)	8.7 ± 1.5 (71.9 ± 16.4)	8.7 ± 1.5 (71.1 ± 16.8)	8.7 ± 1.5 (71.8 ± 16.5)	0.15
Sex				
Female (n = 1,001)	8.6 ± 1.4 (70.1 ± 15.5)	8.5 ± 1.4 (69.9 ± 15.3)	8.6 ± 1.4 (70.1 ± 15.3)	0.81
Male (n = 971)	8.5 ± 1.3 (69.0 ± 14.5)	8.5 ± 1.4 (68.9 ± 15.5)	8.5 ± 1.3 (69.1 ± 14.7)	0.61
Race/ethnicity				
White non-Hispanic (n = 1,561)	8.4 ± 1.3 (68.2 ± 14.1)	8.4 ± 1.3 (68.3 ± 14.5)	8.4 ± 1.3 (68.5 ± 14.0)	0.63
African American (n = 95)	9.7 ± 1.7 (83.0 ± 18.7)	9.6 ± 1.7 (81.6 ± 18.9)	9.8 ± 1.6 (83.8 ± 18.0)	0.56
Hispanic or Latino (n = 160)	8.7 ± 1.5 (72.1 ± 16.2)	8.7 ± 1.6 (71.8 ± 17.7)	8.7 ± 1.6 (71.9 ± 17.4)	0.78
Other (n = 150)	8.7 ± 1.4 (71.8 ± 15.8)	8.6 ± 1.4 (70.2 ± 15.2)	8.5 ± 1.3 (69.1 ± 14.1)	0.42
Region				
Midwest (n = 480)	8.6 ± 1.3 (70.1 ± 13.8)	8.6 ± 1.4 (70.0 ± 14.8)	8.6 ± 1.3 (70.4 ± 14.0)	0.59
Northeast (n = 755)	8.4 ± 1.4 (68.8 ± 14.8)	8.4 ± 1.4 (68.5 ± 15.1)	8.4 ± 1.4 (68.7 ± 15.2)	0.81
South (n = 242)	8.6 ± 1.5 (71.0 ± 16.4)	8.7 ± 1.4 (71.3 ± 15.8)	8.7 ± 1.4 (71.5 ± 15.9)	0.81
West (n = 495)	8.5 ± 1.4 (69.6 ± 15.7)	8.5 ± 1.5 (69.3 ± 16.1)	8.5 ± 1.4 (69.3 ± 15.1)	0.76
Insulin delivery method				
Pump (n = 1,299)	8.2 ± 1.1 (66.2 ± 11.9)	8.2 ± 1.1 (66.1 ± 11.7)	8.2 ± 1.1 (66.1 ± 11.7)	0.95
Injection (n = 658)	9.1 ± 1.6 (76.0 ± 18.0)	9.1 ± 1.7 (75.6 ± 19.0)	9.1 ± 1.6 (76.2 ± 18.0)	0.39
Continuous glucose monitor use				
Yes (n = 163)	8.1 ± 1.1 (64.9 ± 12.4)	8.1 ± 1.0 (64.6 ± 11.5)	8.0 ± 1.1 (64.0 ± 12.2)	0.83
No (n = 1,809)	8.6 ± 1.4 (70.0 ± 15.2)	8.5 ± 1.4 (69.8 ± 15.6)	8.6 ± 1.4 (70.1 ± 15.1)	0.45

Data are mean ± SD % (mmol/mol), unless stated otherwise.

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