

Letters

RESEARCH LETTER

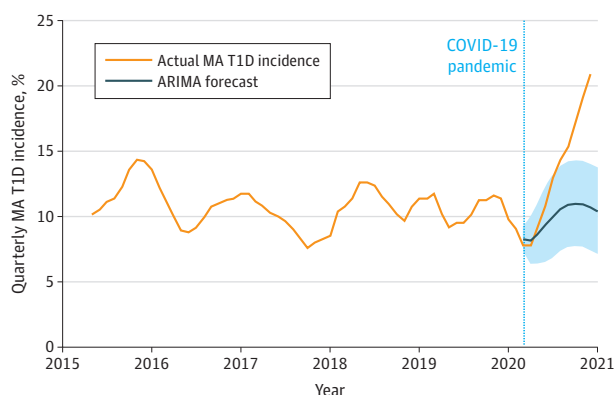
Incidence of New-Onset Type 1 Diabetes Among US Children During the COVID-19 Global Pandemic

Type 1 diabetes (T1D) is a disorder of autoimmune-mediated pancreatic β -cell destruction and decreased insulin production. Although the incidence of this disease is increasing globally each year,¹ our local experience at Rady Children's Hospital San Diego, the tertiary care center for children in San Diego, California, and surrounding counties, was that the incidence of new-onset T1D during the COVID-19 global pandemic in 2020 and 2021 appeared to have increased compared with previous years. We performed a 6-year retrospective review of the medical record to evaluate whether the perceived increased incidence was significant and whether or not more children had diabetic ketoacidosis (DKA) at presentation or required pediatric intensive care unit (PICU) admission (at our institution for altered mental status or severe acidosis only) as a measure of the severity of illness at diabetes onset.

Methods | For this cross-sectional study, we used a self-service reporting tool included in the electronic medical record at our institution (Epic Systems) to survey the patient population. Ethics board approval and a Health Insurance Portability and Accountability Act waiver were obtained from the University of California, San Diego because deidentified patient data were used. Inclusion criteria included admission to Rady Children's Hospital San Diego, patient age younger than 19 years, and at least 1 positive T1D antibody titer. Age, sex, hemoglobin A_{1c}, body mass index z score, COVID-19 infection results, DKA as evidenced by use of insulin infusion, and PICU admission were extracted from each patient's medical record. Patient race and ethnicity were not reported owing to concerns regarding missing data. Patients were tested for acute COVID-19 infection on admission (not for antibodies to diagnose prior infection). The COVID-19 year was defined as the year after California's stay-at-home orders, from March 19, 2020, to March 18, 2021. Five years of prior data from March 19, 2015, to March 18, 2020, were analyzed to ensure that the increase in new-onset T1D diagnoses was not due to previous annual rates of increase. An autoregressive integrated moving average was performed to forecast the predicted trend of new-onset T1D cases during the COVID-19 year. Data were analyzed using R, version 4.0.2 (R Core Team). All *P* values were 2-sided and calculated using a *t* test with significance set at *P* = .05.

Results | From March 19, 2020, to March 18, 2021, 187 children (mean [SD] age, 9.6 [4.2] years; 106 girls [56.7%]; 81 boys [43.3%]) were admitted for new-onset T1D compared with 119 children admitted the previous year, which represents an increase of 57%. For part of the COVID-19 year (July 2020 through

Figure. Autoregressive Integrated Moving Average (ARIMA) Forecast and Quarterly Moving Average (MA) of New Type 1 Diabetes (T1D) Cases



The shaded area indicates the 95% CI.

February 2021), the number of new diagnoses of T1D exceeded the number of patients anticipated within the 95% CI based on a quarterly moving average of the preceding 5 years (July 2020: 15 diagnoses; 10 forecasted diagnoses; 95% CI, 6.79-13.89; February 2021: 21 diagnoses; 10 forecasted diagnoses; 95% CI, 6.88-13.54) (Figure). Only 4 of 187 patients (2.1%) had COVID-19 infection at the time of presentation. There was an increase in the percentage of patients who presented with DKA, but no difference in mean (SD) age at presentation (9.6 [4.2] years vs 9.7 [4.2] years), body mass index z score (-0.39 [1.78] vs -0.43 [1.61]), hemoglobin A_{1c} (11.6% [1.8%] vs 11.7% [1.9%]), or percentage of children requiring PICU admission (16 of 187 [8.6%] vs 41 of 641 [6.4%]) between the COVID-19 year and any of the prior 5 years. We observed a significant increase in the frequency of DKA at the time of T1D diagnosis, with 93 of 187 patients (49.7%) requiring an insulin infusion during the COVID-19 pandemic, which increased from 261 of 641 patients (40.7%) in the 5 years before the COVID-19 pandemic (Table).

Discussion | To our knowledge, although a few prior studies have observed an increase in T1D and DKA during the COVID-19 pandemic, others have not, and most have been limited to a short time period.^{2,3} By measuring a 12-month interval after the onset of the COVID-19 pandemic, our cross-sectional study accounted for seasonal variation in the onset of new T1D cases. Additionally, we reviewed the 5-year period before the COVID-19 pandemic to account for annual increases in T1D cases to show that the case rate during the COVID-19 pandemic was higher than expected at our institution. As the only children's hospital in the greater San Diego area, we routinely admit children with new-onset diabetes who require initiation of insulin treatment, and we monitor almost all patients newly diagnosed with T1D.

Table. Patient Characteristics During the Year of the COVID-19 Pandemic^a Compared With Prior Years

Characteristic	COVID-19 Year ^a	Pre-COVID-19 by 5 years ^a	P value
Total children, No.	187	641	NA
Age, mean (SD), y	9.6 (4.2)	9.7 (4.2)	.82
HbA _{1c} at presentation, mean (SD), %	11.6 (1.8)	11.7 (1.9)	.52
Body mass index z score, mean (SD)	-0.4 (1.8)	-0.4 (1.6)	.72
Children requiring insulin infusion, % (95% CI)	49.7 (42.6-56.8)	40.7 ^b	.01
Children requiring PICU admission, % (95% CI)	8.6 (5.3-13.4)	6.4 ^b	.39

Abbreviations: HbA_{1c}, hemoglobin A_{1c}; NA, not applicable; PICU, pediatric intensive care unit.

^a The COVID-19 year includes March 19, 2020, to March 18, 2021; the pre-COVID-19 years include March 19, 2015, to March 18, 2020, and report aggregate means of the prior 5 years. P values were calculated using a t test for

the age, HbA_{1c}, and body mass index. The P values for the percentage of those requiring insulin infusion or PICU admission compared with the pre-COVID-19 group were calculated using normal approximation z testing with a 95% CI.

^b The 95% CI was not provided because this was the reference group.

In agreement with other studies, we observed a significant increase in the frequency of DKA at the time of T1D diagnosis during the COVID-19 pandemic.^{4,5} Study limitations include the lack of COVID-19 antibody testing at the time of diagnosis to investigate possible past infection. Additionally, we did not provide a population denominator for this study. However, the number of inpatient admissions at Rady Children's Hospital San Diego decreased by 19% from 2019 to 2020, and the number of children seen in our pediatric endocrine clinic and the number of children who reside in San Diego, Riverside, and Imperial counties did not change substantially.⁶ Therefore, the observed increase in diabetes diagnoses during the COVID-19 pandemic is unlikely to reflect changes in referral number or pattern.

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Author Contributions: Drs Gottesman and Kim had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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