Clinical Characteristics and Economic Burden of Diabetic Ketoacidosis in People With Type 1 Diabetes in the U.S.

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Background

- Diabetic ketoacidosis (DKA), characterized by hyperglycemia, hyperketonemia, and acidosis, is the most common acute complication of type 1 diabetes mellitus (T1DM)[1,2]
- While recent evidence has shown a rising DKA incidence among people living with type 2 diabetes mellitus (T2DM), in adults around two-thirds of episodes of DKA occur in people living with T1DM[1,3]

Objective

- To describe the national incidence, clinical characteristics, and economic burden of diabetic ketoacidosis (DKA) hospitalizations among people with type 1 diabetes mellitus (T1DM) in the United States.

Methods

Study Design, data source, study population

- This was a retrospective, cross-sectional analysis of the National Inpatient Sample (NIS)
  - NIS is the largest publicly available inpatient database in the U.S., containing data on over 7 million hospital stays
- Data were captured from January 1, 2019 to December 31, 2022
- Hospitalizations among both children and adults (all ages) with T2DM were included

Identification of admissions with DKA

- DKA hospitalizations were identified using International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10 codes) specific to T1DM (E10.1, E10.10, E10.11)[4]
- Hospitalizations with a T2DM diagnosis code (i.e. E.11.x) were excluded from the analysis

Data collected

- The primary endpoint was the incidence of DKA inpatient hospitalizations, reported as percent and rates per 1000 hospitalizations
- Secondary endpoints were length of stay, mortality and hospital charges

Results

Primary endpoint – incidence of DKA admissions

- As shown in **Figure 1**, among people with T1DM the total number of admissions with a primary diagnosis of DKA was generally stable between 2019 and 2022
- In total, 382,460 people living with T1DM were hospitalized in 2022
- Among these hospitalizations, 34.1% (n = 130,465) had DKA as the primary diagnosis

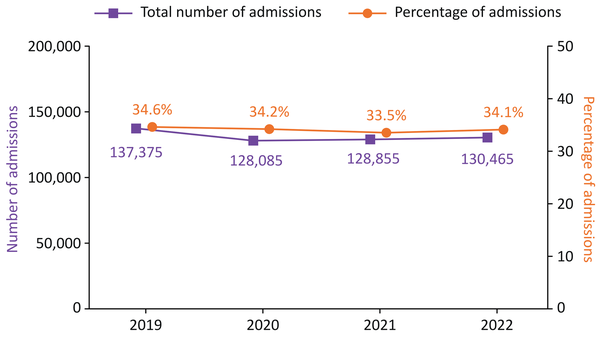
Population characteristics

- The characteristics of individuals with T1DM admitted to hospital with a DKA code are shown in **Table 1**

Secondary endpoints

- Mortality among people with T1DM who had primary DKA diagnosis codes is shown in **Figure 2**
- Mean length of stay and hospital charges are shown in **Figure 3** and **Figure 4**
- In 2022, the total hospital charges associated with a primary DKA diagnosis among people with T1DM were $5.22 billion

Figure 1. Incidence of hospitalization with primary DKA diagnosis codes among people living with T1DM, 2019–2022



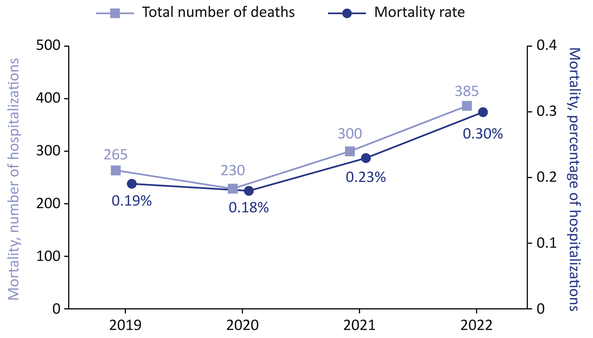
DKA, diabetic ketoacidosis; T1DM, type 1 diabetes mellitus.

Table 1. Cohort characteristics for 2022 admissions

Characteristic	Hospitalizations with primary DKA diagnosis code in 2022	DKA cases per 1000 T1DM admissions
All cases	130,465	341.1
Age, mean (SD)	32.07 (16.25)	
Sex, n (%)		
Female	64,600 (49.5)	334.6
Male	65,845 (50.5)	347.8
Age group, n (%)		
< 18 years	20,165 (15.5)	670.9
18–64 years	104,130 (79.9)	358.0
≥ 65 years	6085 (4.7)	99.1
Race, n (%)		
White	72,875 (57.5)	314.4
Black	31,645 (25.0)	397.6
Hispanic	15,940 (12.6)	367.4
Insurance, n (%)		
Medicare	16,830 (12.9)	144.6
Medicaid	58,845 (45.1)	461.5
Private	38,345 (29.4)	363.1

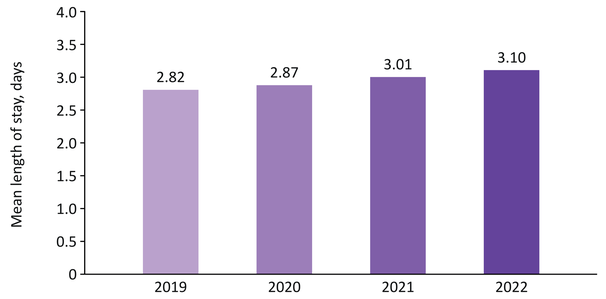
DKA, diabetic ketoacidosis; SD, standard deviation; T1DM, type 1 diabetes mellitus.

Figure 2. Mortality rate for patients with primary DKA diagnosis codes among people living with T1DM, 2019–2022



DKA, diabetic ketoacidosis; T1DM, type 1 diabetes mellitus.

Figure 3. Mean length of stay for admissions with primary DKA diagnosis codes among people living with T1DM, 2019–2022



DKA, diabetic ketoacidosis; T1DM, type 1 diabetes mellitus.

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Disclosures

RJG

NV, AL and YP are employees of Abbott.

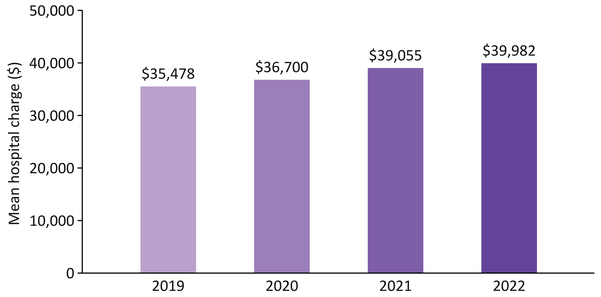
Acknowledgments

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Figure 4. Mean hospital charges for admissions with primary DKA diagnosis codes among people living with T1DM, 2019–2022



DKA, diabetic ketoacidosis; T1DM, type 1 diabetes mellitus.

Discussion

- This analysis provides recent U.S. national estimates of the incidence, length of stay, mortality and charges of hospitalizations for DKA events in people with T1DM
- The rate of admissions with a primary diagnosis of DKA was broadly constant between 2019 and 2022, despite advancements in technology and care
- In 2022 one-third of hospitalizations in people with T1DM in the U.S. were for a primary diagnosis of DKA, with total charges exceeding $5 billion, highlighting a significant burden to patients and the healthcare system
- Limitations include the possibility of residual confounding due to unmeasured variables such as glycated hemoglobin levels
  - In addition, administrative claims data are subject to data coding limitations and data entry error

Conclusions

- One in three hospitalizations among people with T1DM was attributable to DKA, with incidence remaining high over time despite advances in care.
- Rising DKA associated mortality and charges underscore a substantial and ongoing clinical and economic burden and a need for new strategies to prevent DKA and detect risk earlier.

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