





## CLINICAL CARE AND TECHNOLOGY

# Children and youth with diabetes are not at increased risk for hospitalization due to COVID-19

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## Abstract

The severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2), responsible for the coronavirus disease COVID-19, was first identified in Wuhan, China in December 2019. Diabetes, as well as other cardiovascular comorbidities, has been recognized as a major risk factor for outcomes and mortality in adults with COVID-19, particularly in the elderly with type 2 diabetes. Based on these conclusions, COVID-19 data on adults have been generalized to youth with diabetes. Nevertheless, experience from pediatric diabetes practices in China (Wuhan), Italy, Spain (Catalonia), and the United States (San Francisco Bay Area) consistently report only a single severe case of COVID-19 in a 20-year-old female youth with type 1 diabetes (T1D) that was hospitalized for bilateral pneumonia and was subsequently discharged without complications. In Italy, information on COVID-19 in all children with diabetes is collected on a weekly basis and those with positive swab test or infection-related symptoms reported to a dedicated national registry. Of a total of 15 500 children tested, 11 subjects with T1D (age 8-17y) tested positive for COVID-19; 6/11 were asymptomatic and the rest presented with mild symptoms. In the rest of locations, youths with T1D diagnosed with COVID-19 were based on clinical suspicion and a confirmatory PCR test (Wuhan:0; Catalonia-HSJD:3; California-Stanford:2). All of them were asymptomatic or had a mild course. We suggest that COVID-19 data from adults should not be generalized to children, adolescents, and youth with diabetes as their outcomes and prognosis seem to be similar to their non-diabetic-peers and consistently milder than adults with diabetes.

## KEYWORDS

children, COVID-19, diabetes, outcome, prognosis, type 1 diabetes

The severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2), responsible for the coronavirus disease termed COVID-19, was first identified in Wuhan, China in December 2019. Since then, the disease has spread rapidly worldwide and the World Health Organization (WHO) declared it a pandemic on 11 March 2020.<sup>1</sup> At that time, Italy and Spain were the most affected European countries by COVID-19. By July 2020, more than 12 million confirmed cases and almost 600 000 deaths had been reported by WHO<sup>2</sup> and the disease

threatens healthcare systems worldwide. Since the beginning of the pandemic, diabetes, as well as other cardiovascular comorbidities such as obesity and hypertension, has been recognized as a major risk factor for outcomes and mortality of COVID-19.<sup>3</sup> A recent meta-analysis of observational studies on COVID-19 from China with data from both survivors and non-survivors showed that hyperglycemia is common in COVID-19 patients and suggested that diabetes increases the mortality of patients with COVID-19.<sup>4</sup> Other observational studies

outside China have found similar results.<sup>5</sup> A higher risk of intensive care unit admission with poorer outcomes<sup>6</sup> and a markedly longer stay<sup>5</sup> are reported in COVID-19 people with diabetes.

Although all these findings are in adults, particularly in the elderly with type 2 diabetes, health organizations, such as WHO and the Center for Disease Control, National Governments and expert panels have not distinguished the risk in children, adolescents, and young adults with diabetes<sup>7-9</sup> leading to an inappropriate extrapolation of adult data to pediatrics. Because of this generalization many children, adolescents, and youth with diabetes, as well as their caregivers, have felt scared or stigmatized during current easing of lockdown measures. In some cases, their daily life activities have been affected or limited due to diabetes.

We write this brief report to provide a pediatric perspective based on the experience from pediatric diabetes practices in China (Wuhan), Italy, Spain (Catalonia), and the United States (San Francisco Bay Area). This casuistic approach includes data of children, adolescents, and young adults from the Italian Society of Pediatric Endocrinology and Diabetes (ISPED) registry and large pediatric diabetes centers from China, Spain, and California (Table 1) that consistently report (as of 31 August, 2020) that youth with diabetes <25 years of age are not at an increased risk for hospitalization due to COVID-19 compared to their non-diabetic peers. These places have been recognized as early locations of the pandemic and among all of them cover a considerable number of children, adolescents, and youth with diabetes. Among our practices we have only a single case of a 20-year-old female youth from an urban area of Catalonia, Spain, with type 1 diabetes (T1D) admitted with COVID-19 for bilateral pneumonia requiring ventilation who was discharged without complications after 12 days of hospitalization (5 days in Intensive Care). Her hemoglobin A<sub>1c</sub> at hospital admission was 11.0% and she had a clinical history of an eating disorder.

We aim to highlight the differences in symptoms in youth with diabetes and COVID-19 compared to adults. In Italy, the ISPED collects information on COVID-19 on all children and adolescents with diabetes on a weekly basis from 1 March 2020. Children with positive swab test or infection-related clinical symptoms are reported to a dedicated national registry and followed-up until confirmation of clinical remission or two negative test swabs. A total of 11 subjects (age 8-17 years) tested positive for COVID-19 by 31 August 2020. Six of

eleven were asymptomatic and the rest presented with mild symptoms (Table 2). Only three cases required hospitalization. Two of these cases were asymptomatic and required hospitalization at onset for diabetes education, but not for COVID-19 complications. The other case required hospitalization due to diabetic ketoacidosis (DKA) with a routine COVID-19 test performed at Intensive Care Unit admission. These findings are consistent with reports that children and adolescents, when infected,<sup>10</sup> suffer a milder, and frequently asymptomatic clinical course and are at lower risk of hospitalization.<sup>11-13</sup>

A recent questionnaire-based study from the T1DX QI initiative that collected data on subjects with T1D from 49 endocrinology clinics at United States, reported that the most prevalent adverse outcome within COVID-19 positive patients was DKA. Two deaths were reported and both of these were in people >18 years of age.<sup>14</sup> Previous studies have described the importance of early detection of DKA in patients who were affected by COVID-19,<sup>14,15</sup> especially when an increase in DKA during the pandemic has been reported in observational studies from Italy and Germany<sup>16,17</sup> probably due to the presence of multifactorial factors such as fear of approaching healthcare centers or reduction in medical services, that may have altered the presentation and severity of DKA episodes.

It is important to convey that morbidity and mortality reports in adults with diabetes *should not be generalized to children, adolescents, and young adults*. This perspective was advanced in a recent commentary.<sup>18</sup> Our brief report, with an international perspective, adds to the current knowledge that children, adolescents, and youth with diabetes are not at increased risk for hospitalization due to COVID-19. A large multicenter European report on Covid-19 with 582 individuals with PCR-confirmed SARS-CoV-2 infection, reported no cases in children and adolescents with preexisting diabetes,<sup>19</sup> consistent with our report. We reiterate and update the following points from the International Society for Pediatric and Adolescent Diabetes Statement "Keep Calm and Mind your Diabetes Care and Public Health Advice"<sup>20</sup>:

1. We report a single case of a youth <25 years of age with diabetes hospitalized due to COVID-19 with a positive outcome.
2. Children, adolescents, and young adults with diabetes are not at an increased risk of COVID-19 infection compared to their peers

**TABLE 1** Children and adolescents managed in the different sites, confirmed COVID-19 cases, and cases with severe COVID-19 manifestations by 31 August 2020

	Total children and adolescents with type 1 diabetes followed-up	children and adolescents with type 1 diabetes who tested positive for COVID-19 by PCR	Hospitalizations due to severe COVID-19 manifestation
Wuhan, China (Tongji Hospital)	121	0	0
Catalonia, Spain (Hospital Sant Joan de Déu)	734	3	1
Italy (ISPED Registry)	15 500	11	0
California, United States (Stanford University)	755	2	0

**TABLE 2** COVID-19 infection cases in children with diabetes in Italy (updated 31 August 2020)

Region	Age (y)	Sex	Date of diabetes onset	1st swab Covid-19 positive	Swab justification	Clinical signs	HbA <sub>1c</sub> (%)	Hospital admission	Blood glucose disturbances
Emilia Romagna	14.0	F	Nov-10	Mar-20	Mother affected	Fever, cough	8.0	No	Mild postprandial hyperglycemia for 2 days
Trentino Alto Adige	14.0	F	Mar-20	Mar-20	Parent tested positive	None	13.2	Yes	COVID-19 positive at diabetes diagnosis; no DKA; no variation of hospital duration due to COVID-19
Puglia	7.9	F	Jan-19	Mar-20	Fever, cough	Fever, cough	7.1	No	None
Emilia Romagna	6.5	F	May-18	Apr-20	Parent tested positive	Mild conjunctivitis	7.0	No	Mild hyperglycaemia for one day
Lombardia	17.0	F	Sep-12	Apr-20	Parent tested positive	None	6.9	No	None
Calabria	8.3	M	Aug-18	Apr-20	Parent tested positive	None	8.9	No	None
Emilia Romagna	11.7	F	Jan-15	Apr-20	ICU admission	Abdominal pain, diarrhea and vomiting	7.8	Yes	Moderate DKA
Sicilia	16.8	M	Jan-13	Apr-20	Parent tested positive	None	-	No	None
Lombardia	15.3	M	Apr-20	Apr-20	Onset of diabetes	None	11.8	Yes	COVID-19 positive at diabetes diagnosis; DKA; no variation of hospital duration due to COVID-19
Trentino Alto Adige	23	M	Oct-10	Jun-20	Parent tested positive	Fever, anosmia	7.9	No	None
Trentino Alto Adige	15.5	F	Apr-09	Jun-20	Parent tested positive	None	6.6	No	None

without diabetes. If they do contract COVID-19, the outcomes and prognosis seem to be similar to their non-diabetic-peers and consistently milder than adults with diabetes.

3. COVID-19 has imposed a huge stress on the healthcare system.
4. Continue attentiveness to standard diabetes care to avoid the need for hospitalization and emergency or urgent care visits, but utilize these resources if needed.<sup>15</sup>
5. There has been a rapid increase in telehealth as a way to continue to care for youth with diabetes and decrease risk for infection. Communication between patients, families, and healthcare teams is essential. Methods to do so that avoid visits to clinics or hospitals can provide needed diabetes advice and reduce risk for COVID-19 transmission. The historical use of digital tools in pediatric diabetes predisposes pediatric clinics to lead the telehealth approach.<sup>21</sup> A recent global survey including a large number of responders from pediatric diabetes centers from 75 countries, showed that many health care providers adapted to the pandemic by resorting to telemedicine.<sup>22</sup>
6. It is extremely important that as healthcare providers we support our patients and families as well as our colleagues in this stressful time.

In our analysis, we report that the number of children and adolescents with type 1 diabetes who are diagnosed of COVID-19 is anecdotal and likewise, the hospitalizations due to severe COVID-19 manifestations are practically absent. Nevertheless, this is an observational study and with this approach we are not able to estimate an incidence rate of COVID-19 in children, adolescents, and youths with diabetes. In conclusion, we emphasize that COVID-19 infection in youth with diabetes differs from adults. Youth, their families, and healthcare providers should not generalize COVID-19 data from adults to youth with diabetes.

#### ACKNOWLEDGEMENTS

The authors acknowledge the active collaboration of the Italian Study Group on Pediatric Diabetes in this project.

#### CONFLICT OF INTEREST

No potential conflicts of interest relevant to this article were reported.

#### AUTHOR CONTRIBUTIONS

All authors collected data and participated in data interpretation. Roque Cardona-Hernandez, Valentino Cherubini, and David M Maahs, wrote the first draft of the manuscript. All authors edited and reviewed the manuscript and approved the final version. Roque Cardona-Hernandez, Riccardo Schiaffini, and David M Maahs are the guarantors of this work, and as such, 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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**How to cite this article:** Cardona-Hernandez R, Cherubini V, Iafusco D, Schiaffini R, Luo X, Maahs DM. Children and youth with diabetes are not at increased risk for hospitalization due to COVID-19. *Pediatr Diabetes*. 2021;22:202–206. <https://doi.org/10.1111/pedi.13158>