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## COVID-19, type 1 diabetes, and technology: why paediatric patients are leading the way



In the current coronavirus disease 2019 (COVID-19) crisis, families of children with diabetes are particularly dependent on technology devices and diabetes teams. Parents and care providers read in the news that patients with diabetes might be at higher risk for COVID-19 mortality. However, it is reassuring to hear that, at least according to some reports, young people, with or without diabetes, are coping better with COVID-19 infection.<sup>1</sup> Of 2572 laboratory-confirmed cases aged 18 years or younger in the USA, comorbidity information was available for 80 patients: 40 had chronic lung disease, 25 had cardiovascular disease, and ten had immunosuppression, but neither type 1 nor type 2 diabetes was mentioned.<sup>1</sup> By contrast, of 122 653 adults, including 7162 for whom data on underlying health conditions were available, the most frequent reported comorbidities were diabetes (784, 10.9%), chronic lung disease (656, 9.2%), and cardiovascular disease (647, 9.0%).<sup>2</sup>

Digital revolutions in type 1 diabetes management have often occurred initially in paediatric diabetes care, starting with pumps and now extending to the integration of sensors, automated insulin delivery, or dosage advisors. As in many other areas of health care, the COVID-19 crisis could offer the opportunity to put these tools into practice, establishing a virtual diabetes clinic to complement standard outpatient care.<sup>3</sup>

Historically, the field of paediatric diabetology has been ahead of adult medicine. The first patient with type 1 diabetes to receive Banting and Best's pancreatic extract, which they named insulin, nearly 100 years ago, was a 14-year-old boy. The first paediatric pump study was published in 1979, only shortly after the principle had been introduced in adult medicine.<sup>4</sup> The first multicentre trials of automated insulin delivery outside the research setting were performed in the typical paediatric setting of a diabetes camp.<sup>5</sup> Over time, the use of continuous subcutaneous insulin infusion has increased only modestly in adults but has become the standard of care for young children when it is readily available,<sup>6</sup> and paediatricians have been at the forefront of implementing continuous glucose monitoring metrics beyond A1c.<sup>7</sup>

In light of the COVID-19 pandemic, health care delivery has made a sudden transition to remote care. In paediatric diabetology, families are now gathering around the phone or video conference after uploading their pump, smart pen, or sensor data. On both sides of the screen, the younger generation is often helping the older to figure out issues with passwords, connections, and software versions to allow for communication while families are unable to visit the clinic. Clinics face the challenges of securing sufficient monitors, webcams, or tablets in times of high demand, and committees look at issues of secure data transfer and video consultation. In less regulated countries, patients and doctors communicate using their private telephones via WhatsApp or other messaging applications, which by most standards would not be compliant with data protection.

In addition to a multidisciplinary team, the setting of ambitious targets appears to be instrumental in achieving success with modern diabetes therapy.<sup>8,9</sup> These targets must also be communicated during remote care. For example, in our clinics, we recommend that families regularly check their glucose data uploads, look at the ambulatory glucose profile in which the time in range (3.9–10.0 mmol/L) should ideally be above 70% without increasing time below range (<3.9 mmol/L) to more than 4%. Sensor glucose should read 3.9–7.8 mmol/L (maximum of 10 mmol/L after meals) and the estimated HbA<sub>1c</sub> should be 6.9% or less, corresponding to an average sensor glucose value of less than 8.3 mmol/L. The need to upload the data for a meaningful telemedicine consultation motivates families to become more involved with digital diabetes data. The challenges of COVID-19 promote autonomy of both young people and their parents in interpreting the data and making decisions. The joint setting of individualised targets is crucial to maintain glycaemic control in periods of social isolation and weeks without school. Reduced exercise, changed routines, and increased food intake are frequent reasons for adapting the therapeutic regimen.

The exchange of experiences on social media is quickly increasing. One of the first cases of an individual with type 1 diabetes having COVID-19 was shared on the

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For the online platform Blood Sugar Lounge see <https://www.blood-sugar-lounge.de>

online platform Blood Sugar Lounge, giving important insight to patients and providers alike. Long before diabetes societies publish recommendations on what to do when an individual with type 1 diabetes contracts COVID-19 infection, advice is shared on type 1 diabetes platforms. Examples of this advice are to have insulin and consumables in stock in double quantity because insulin requirements can triple during an acute infection; to stop adjunct therapy with SGLT2 inhibitors; and to have enough sensors and ketone strips available because several cases of severe diabetic ketoacidosis with a delayed admission to hospital have been reported by diabetologists in Italy. Another example of advice on the platform is that people with type 1 diabetes and COVID-19 should not stay alone and should activate the follower-function in their continuous glucose monitoring system, so that remote supervision and advice becomes possible even in the context of quarantine.

Type 1 diabetes online advice platforms tend to reject the term self-help and prefer to speak of a community, as can be seen in the growing so-called do-it-yourself user group for automated insulin delivery. These patients have already reached a large degree of autonomy before the COVID-19 crisis and we speculate that more families will ask for rapid access to automated insulin delivery approaches as a consequence of their experience during this time. However, to build the much-needed trust between the diabetes team and the family, including many aspects of selection, handling, and placement of devices, diabetes education, inspection of the injection and sensor sites, and discussion of difficult psychosocial issues, face-to-face meetings will remain indispensable in the future.

Before the COVID-19 pandemic, it was thought that telemedicine approaches would only become established in Europe if it was possible to show in long-term studies that the use of telemedicine leads to significant savings in time and costs.<sup>10</sup> However, according to the COVID-19 forum on the International Society for Pediatric and Adolescent Diabetes (ISPAD) website, the establishment of these approaches is now happening within days in paediatric diabetes centres around the globe. Rules for access to telemedicine have become more relaxed, families and hospitals have fewer concerns regarding data safety, and remunerations appear to be less important. Once the technical issues are resolved, the flexibility and timeliness of the

telemedicine approach pleases both providers and parents alike and raises the question of who really profits from the increased complexity of the European General Data Protection Regulation (GDPR).

Because neither patients nor providers are likely to go back to exclusive outpatient clinic visits once the COVID-19 situation is over, several issues need to be considered. An important prerequisite for the development of a virtual diabetes clinic is easy data exchange between patients and health care providers, including raw data such as glucose values and insulin dosages, within a reasonable time limit. In particular, no restriction should be implemented from device industries on viewing or sharing data via common platforms. In the development and testing of digital applications, an iterative approach has been established that continuously incorporates the perspective of later users. Social media platforms offer options to implement this and compliance with GDPR needs to be clarified on a political level. European research support is required for strengthening the user-oriented development and testing of the virtual diabetes clinic.

Finally, the digital gap between paediatric and adult type 1 diabetes care needs to be addressed. A possible solution would be the creation of regional treatment centres with paediatric and adult medicine care for people with intensive diabetes therapy. The experience during the COVID-19 crisis will probably increase the number of patients of all ages who are willing to occasionally travel longer distances to a multidisciplinary team experienced in diabetes technology if these personal visits can be complemented by regular, effective telemedicine consultation. For the future after the COVID-19 crisis, telemedicine in the virtual diabetes clinic could be the solution and no longer the problem.

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For the ISPAD website see [www.ispad.org](http://www.ispad.org)

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