


# Impacts of the COVID-19 Pandemic on Pediatric Type 1 Diabetes Management: A Qualitative Study

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## Abstract

**Purpose:** The purpose of this study was to understand impacts of the coronavirus (COVID-19) pandemic on pediatric type 1 diabetes management.

**Methods:** In-depth qualitative interviews were conducted with 15 parents of children (age 6–12 years) with type 1 diabetes. Parents responded to 8 open-ended questions about their experiences managing their children's type 1 diabetes during the COVID-19 pandemic. All interviews were transcribed, coded, and analyzed using qualitative thematic methods.

**Results:** Parents reported both positive and negative aspects of managing their children's type 1 diabetes during the COVID-19 pandemic. Facilitators of diabetes management included spending more time together at home and enhanced convenience of telehealth appointments and online supply ordering. Parents also described difficulties managing their children's type 1 diabetes during the COVID-19 pandemic, including a lack of structure in their child's daily routine, which led to increases in sedentary behavior. Furthermore, they reported psychosocial challenges of type 1 diabetes management, which were exacerbated by the pandemic.

**Conclusion:** While the COVID-19 pandemic was described as having overall positive impacts on pediatric type 1 diabetes management, efforts to support parents in increasing children's physical activity and reducing screen time are needed, along with readily accessible mental health resources for both parents and their children with type 1 diabetes.

The COVID-19 pandemic has caused unprecedented disruptions to daily life, which have markedly impacted children and young adults' physical and mental health.<sup>1,2</sup> These disruptions are of added concern for children with chronic conditions such as type 1 diabetes (T1DM) because social distancing and lockdown measures to control the spread of COVID-19 affect children's lifestyle behaviors and social interactions.<sup>3</sup> For parents, managing their child's T1DM is often associated with high reported levels of stress and anxiety.<sup>4</sup> The COVID-19 pandemic may have amplified these stressors due to COVID-19-related job loss and financial concerns,<sup>5,6</sup> the child being at higher risk of a severe COVID-19 infection,<sup>7</sup> and the added burden of managing their child's diabetes in light of new responsibilities associated with the pandemic.<sup>5,6</sup>

In addition, these restrictions may also challenge adherence to key aspects of diabetes management, such as participating in physical activity due to cancellation of organized sports and school closures. Furthermore, children with diabetes may be unable to attend activities that help to support their diabetes management (eg, diabetes camp) and mitigate psychosocial challenges associated with a T1DM diagnosis (eg, support groups). A recent article reported that parents rely on the structured school schedule to facilitate adherence to their child's T1DM

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management regimen, and therefore, unstructured time away from school during the pandemic may also adversely impact children's glycemic control.<sup>5</sup>

Nonetheless, several recent studies have reported that COVID-19 related closures resulted in better glycemic control among children and adolescents with T1DM.<sup>8-11</sup> Improved glycemic control may be attributed to greater parental supervision over T1DM management tasks<sup>8,10,11</sup> and/or the widespread use of telemedicine during the pandemic.<sup>9,10,12</sup> COVID-19-related restrictions (eg, shutdowns, school closures) may have also ameliorated some challenges of T1DM management due to spending less time outside of the home.

Herein, perceived impacts of the coronavirus (COVID-19) pandemic on pediatric T1DM are reported.

## Material and Methods

### *Study Design*

The study involved completion of brief questionnaires and participation in an in-depth, qualitative interview conducted by a trained interviewer (KF) using a semistructured guide. Qualitative interviews were conducted to understand parents' experiences managing their child's T1DM during the unprecedented COVID-19 pandemic.<sup>13</sup>

### *Study Participants/Setting*

Parents (N=15) of children 6 to 12 years old with T1DM were recruited from the Diabetes Care Clinic at Children's National Hospital, in conjunction with ongoing recruitment efforts for a larger study (DRINK-T1D, NCT04385888) examining effects of low-calorie sweeteners in children with T1DM.<sup>14</sup> Eligibility criteria for the present qualitative interview study were report that their child (1) was 6 to 12 years old and (2) had a diagnosis of T1DM for at least 1 year. Two research team members (JHK and HM) provided parents with information about the present qualitative interview study if their child was determined to be ineligible for DRINK-T1D or if they were eligible for DRINK-T1D but declined to participate. Parents of children enrolled in DRINK-T1D were also invited to participate in a qualitative interview when their child completed the DRINK-T1D study.

### *Data Collection Procedures*

The study procedures were reviewed and approved by the Institutional Review Board at Children's National Hospital (Pro00012436) and were completed virtually using Zoom Telehealth™ between April and August 2021. Data collection was carried out using surveys administered via RedCap™ during the Zoom Telehealth™ meeting and through conducting a qualitative interview using a semistructured interview guide (Table 1) developed collaboratively by the research team. The interview guide included questions about how the COVID-19 pandemic impacted various aspects of the child's T1DM management, including the child's diet, physical activity, screen time, parental involvement, and access to clinical diabetes care and diabetes management supplies. All interviews were recorded and ranged from 10 to 20 minutes in duration, and each participant received \$50 as compensation for participation.

### *Data Analysis*

Descriptive statistics were used to summarize participants' demographic information and survey responses using means and frequencies as appropriate. Interview recordings were transcribed verbatim and subsequently coded by 2 coders (ACS and KF) using NVivo Pro (version 12; QSR International, Inc.; Burlington, MA, USA). The 2 coders independently coded an initial subset of 3 interviews, after which, a shared codebook was created. Both coders then independently coded the remaining transcripts, adding codes and meeting to refine the shared codebook as needed. Data collection and analysis continued until saturation of the data was reached, which occurred after 15 transcripts were coded, and was defined by repeated instances of the same code with no new codes emerging.<sup>15</sup> After all interviews were coded, the coders met to discuss any discrepancies and finalize the codebook. Both coders then recoded the 15 interviews using the final shared codebook. The agreement percentage between coders was 99.7% with a kappa coefficient of 0.8, indicative of a strong agreement.<sup>16</sup> After completion of coding, emergent themes and subthemes were identified. The coders met to discuss the themes identified, after which, representative quotations were selected by 1 coder (KF) for each theme and subtheme. The themes were then further refined and finalized through discussion with other research team members.

**Table 1.** Interview Guide

Interview questions
1. How has the COVID-19 pandemic impacted your child's management of their type 1 diabetes? a. Would you say that management of your child's type 1 diabetes has been easier or harder during the pandemic? Why? b. What, if any, aspects of type 1 diabetes management have been easier during the pandemic? c. What, if any, aspects of type 1 diabetes management have been more difficult during the pandemic?
2. Has your access to diabetes care changed? a. Has your child seen their provider via telehealth visits over the past few months? b. Have you had any difficulty in obtaining diabetes management supplies?
3. Have there been changes in your child's meals and eating behaviors? a. Why do you think this is? b. Has the preparation of meals changed? c. Has the healthfulness of meals changed? d. Have you noticed changes in your child's snacking behaviors?
4. Have there been changes in your child's physical activity? a. Why do you think this is? b. Have there been changes in your child's screen time (e.g., TV, social media, video games, etc)?
5. How much involvement do you typically have in your child's diabetes management? Has this changed during the COVID-19 pandemic? a. <i>[If yes]</i> how so? i. Would you say that you have more or less involvement? ii. Why?
6. What types of challenges do you face regarding your child's diabetes and have these challenges changed during the pandemic?
7. How has the COVID-19 pandemic impacted your child's experience with having type 1 diabetes? a. Has their diabetes management been influenced by remote schooling? b. Has their diabetes management been influenced by changes in how much time they spend in extracurricular activities or with their friends?
8. Is there anything else that you would like to add about your or your child's experience with type 1 diabetes management during the COVID-19 pandemic?

## Results

### *Demographic Characteristics and COVID-19 Survey Results*

Demographic characteristics of the study participants (parents of children with T1DM) are presented in Table 2. All parents were female, and the majority self-identified as White or Caucasian ( $n = 14$ , 93.3%).

On the survey evaluating parents' attitudes and feelings about the COVID-19 pandemic, most parents ( $n = 10$ , 66.7%) indicated that they were slightly or moderately worried or anxious about the pandemic, and 4 (26.7%) indicated being very or extremely worried or anxious. Most parents ( $n = 10$ , 66.7%) reported that their child was slightly or moderately worried or anxious about the COVID-19 pandemic, and some reported that their child was very worried or anxious ( $n = 3$ , 20%). Many parents ( $n = 11$ , 73.3%) indicated that they had seen their child's diabetes provider via telehealth over the past few months.

### *Qualitative Interview Results*

Two emergent themes pertaining to positive aspects of managing their children's T1DM during the COVID-19 pandemic were identified: (1) parents found it easier to manage their children's T1DM during the COVID-19 pandemic due to spending more time together at home and (2) enhanced convenience of telemedicine and ordering supplies online (Table 3). Parents explained that the increased time together at home enabled them to have more oversight over their child's diet and activities and respond to fluctuations in their child's glucose levels more easily, which improved T1DM management during the COVID-19 pandemic compared with prior to the pandemic.

**Table 2.** Demographic Characteristics of the Participants.

N	15
Gender, n (%)	
Female	15 (100)
Race/Ethnicity, n (%)	
Black or African American	1 (6.7)
Hispanic <sup>a</sup>	1 (6.7)
White or Caucasian <sup>a</sup>	14 (93.3)
Ethnicity, n (%)	
Hispanic or Latino	2 (13.3)
Not Hispanic or Latino	13 (86.7)

<sup>a</sup>One participant identified as both White or Caucasian and Hispanic.

Additionally, parents described that being at home enabled them to dedicate more time to healthier meal preparation. They perceived meal preparation at home as beneficial and described the school meals as having higher carbohydrate and sugar content. They also described feeling relieved to not have to rely on school professionals to help manage their child's diabetes. Many parents mentioned prior challenging experiences with school professionals, which caused them to worry about their child's diabetes management while at school.

Some parents also described improvements in their child's accountability when managing their own T1DM during the pandemic. They explained that having fewer outside distractions facilitated their child's learning of tasks associated with T1DM management, such as properly dosing insulin, counting carbohydrates, and monitoring their blood glucose levels.

Many parents expressed that accessing clinical care and obtaining diabetes management supplies were more convenient during the pandemic due to the use of telemedicine and online ordering. This was particularly important to families who lived far away from their medical provider because telehealth eliminated long commute times. Additionally, it provided the opportunity for both parents to attend appointments because many parents worked from home during the pandemic. Some parents explained that they developed more proactive habits with online ordering, such as actively monitoring their inventory and scheduling supply orders in advance due to concerns regarding delivery times during the COVID-19 pandemic.

Despite parents describing many aspects of managing their child's T1DM as easier during the COVID-19 pandemic, several diabetes management difficulties were also reported. Two major themes were identified: (1) challenges adjusting to new or lack of daily routine and (2) psychosocial challenges making diabetes management more

**Table 3.** Facilitators of Diabetes Management During the COVID-19 Pandemic

Theme	Selected Representative Quotations
Theme 1: Diabetes management was easier due to being home together	
Closer physical proximity to child leading to perceived improvements in glycemic control	<p>"There were a lot of days that her numbers were just not what they should have been. One day her nurse accidentally forgot to give her insulin for lunch, and when I picked her up her blood sugar was like 450. So, now that she's with me all the time, I know exactly what's going on and I'm in full control of everything."</p> <p>"I would say, me being in charge, being able to manage her so closely when we were all home definitely gave us a lot more ability to bump and nudge little things that we saw... If she's going high, we could very easily react and give her a quarter unit... or very quickly respond to catch a low with a couple of grapes and a peanut butter cracker rather than a skittle when it was in the 50s."</p> <p>"I mean you can see him back there - within 20 feet of me at all times - I can have a much more hands-on approach. He's on a pump so I frequently will give him extra insulin if he needs it, and I can probably be a little more aggressive with giving him insulin because if he starts to go low I can just hand him something to eat."</p>

(continued)

Table 3. (continued)

Theme	Selected Representative Quotations
More parental oversight of child's meals and activities	<p>"One of the challenges we faced with her diabetes is just kind of the snacky culture... that was one of the biggest challenges and that has definitely been eased because of the pandemic.... I think being at home and not having as many of those things and not having the cupcakes being allowed to come into school for birthdays, or somebody bringing munchkins after a soccer game, it makes things easier."</p> <p>"If anything it kind of helped us control things a little bit better because he was here at home for school instead of us having to worry about meals at school, and parties in the classroom, things of that nature."</p>
Not needing to rely on school staff	<p>"I would say it's been easier for us. She just started pre-K last year, so we were getting used to someone else taking care of her other than us. So, getting used to having a nurse and trusting teachers to listen for her Dexcom going off and trusting them to know when to give her juice and when to give her insulin - it was very stressful."</p> <p>"His teacher had zero clue... you know he's at 70, his teacher doesn't quite get it - he runs out to play for PE, I call the school nurse 'it says 70' and she like ran out and got him and gave him smarties, like those kinds of things."</p>
Improved diet and meal preparation	<p>"No, for sure healthier. The school meals are just not the greatest. For breakfast they would have cereal bars and juice, which I didn't let her have. I told them not to give her juice because we don't do juice unless it's for lows and even the lunches, the carb counts could be in the 70s, which is not what we do. Normally we try to do 20 to 30 carbs per meal. So, it's definitely a lot healthier than when she was in school."</p> <p>"Yes, I actually learned how to cook a lot more meals with everybody being home all the time.... So it was like okay, we're gonna set out five meals for the week and which one is a new meal that you wanna try.... It's definitely brought, especially more vegetables, into our meals. They have gotten healthier."</p>
More child accountability in managing their own diabetes	<p>"Being in quarantine has positively affected him in the fact that it allows him to mature into giving himself his medicine himself. I really don't know how long that process would have taken had he been in school."</p> <p>"He's gotten better at using the receiver to dose himself and probably because we've been home and there's been fewer distractions. Over the past year, if we give him the carbs, he can dose himself. We check it but I would say that's happened during the pandemic which might not have otherwise because he may have been busier or not around as much."</p>
Theme 2: Enhanced convenience of care and ease of obtaining diabetes management supplies	
Reduced geographic barriers	<p>"Just because everything is easier. We live far away from everything.... I mean literally it takes us sometimes 3 hours to get to her doctor. Now with telehealth and all those types of things, it's much easier because we don't have to leave the house."</p> <p>"The telehealth switch for the regular check-ups has made it a lot easier. He has a Dexcom and the doctors are able to access that information so we can just touch base and say okay let's tweak this and tweak that and it makes it a lot easier for us. We live over an hour away from the main hospital, so the telehealth has been huge."</p>
Ease of online ordering	<p>"Easier because a lot of things that we used to have to go and pick up from the pharmacy... [now] everything is mail order."</p> <p>"Once we got everything switched over to the mail order pharmacy, it's made it a lot easier. It's a quick log into an app, click order, done and it shows up the next day or 2 days later. I have 4 kids, life is busy, so if I can do something like that... that's a great thing."</p>

difficult (Table 4). Some parents explained that the transition to virtual activities and online school disrupted their child's daily routine and made it difficult for their child to get enough physical activity. Additionally, parents overwhelmingly described drastic increases in their child's screen time.

Furthermore, some parents reported that their child became less independent when managing their T1DM during the pandemic and reverted to relying on their parents to manage their care. Parents believed this was a result of their child no longer attending school, while others explained that it was easier to manage their child's diabetes themselves when together at home.

**Table 4.** Challenging Aspects of Type 1 Diabetes Management During the COVID-19 Pandemic

Theme	Selected Representative Quotations
Theme 1: Challenges adjusting to new or lack of daily routine	
Lack of extracurricular activities and organized sports participation	<p>"I guess the most notable way is that it reduced what she did outside of the house. So last spring when we were quarantined from school, she had a lot less activity and of course all of her extracurricular activities like dance and gymnastics were cancelled so that made it a little bit trickier because activity is important for all kids, but you know diabetic kids especially."</p> <p>"You know, they've lost friends, their school activities, they played sports... I was watching them yesterday, they're really, both him and his brother, are just, they're just kinda out of shape."</p>
Lack of exercise built into school day	<p>"Gym class is virtual... So, there has been slightly less on the physical aspect of things... I think you run faster when you're playing dodgeball in a gym than the effort you put into when the teacher says okay everybody do 10 jumping jacks on the screen."</p> <p>"We used to walk to and from school and it's about 3 quarters of a mile so that's activity he's not getting... it's that walk to and from school and you know stopping at the playground on the way home and playing with some of his friends, that hasn't happened."</p> <p>"It's been harder because he's just sitting around and he's using a lot more insulin because he's sitting around... it's a big change in routine."</p>
Increased screen time	<p>"Screen time has definitely gone up because all his classes are a hundred percent online. So, he basically looks at the screen all day long but it's also gone up outside of school hours because the way he interacts with his friends is playing video games while they're talking on facetime on the phone. So, all of his scouts, all of his taekwondo, everything's on the screen. So, he spends a lot of time right now on the screen."</p> <p>"Oh my gosh holy moly yes [laughter]. We used to be a weekends only family and only a couple hours on weekends, and it exponentially has increased. I would say at the beginning of the pandemic it was honestly 10 to 12 hours a day with school plus games just because we needed to work and whatnot. It was kind of insane."</p>
Challenges with child's independence in managing their diabetes	<p>"Since he's at home he's reverted to mom gets to do all of his shots. I feel like he was more independent when he was at school - it was a point of pride... and since he's been home it's like okay mom can you do this? So, he's very capable of doing it all himself but he chooses to let me handle a lot of it."</p> <p>"I actually think he regressed in terms of taking personal responsibility for his diabetes, I think he went backwards... His dad feels like he has to do it, it's his thing he needs to deal with it and give his own shots. So, I started doing that but then I noticed too that he was starting to be like, 'Mom will you give me my shot mommy?' He wasn't doing it as much himself."</p>
Theme 2: Psychosocial aspects of pandemic impacted diabetes management	
Lack of social support with regards to diabetes	<p>"I just don't love doing everything virtually; I think it's also great to meet other families who have type 1 diabetes because we don't know anybody... it would be nice to interact with other kids and families who also have type 1 diabetes in person."</p> <p>"We have a neighbor who lives probably a quarter of a mile away and she has type 1. She was diagnosed when she was 3 so she's been living with it for several decades and I would see her at pickup at the school and we'd chat, and she'd ask how he was doing and that was really reassuring for me... so not having that shoulder to lean on certainly did make things a lot harder and there's only so much reassurance you can get from a text."</p> <p>"I think that not being able to go to diabetes camp last year, not being able to connect with some families in our county that have kids with type 1 diabetes and talk to them face to face and have playdates with them who have the same concerns about high blood glucose or playing so hard that your numbers go down and you have to stop for a minute, and you know those kinds of things; it was a missed opportunity because of freaking covid."</p>

(continued)

**Table 4.** (continued)

Theme	Selected Representative Quotations
Lack of face-to-face interaction	<p>“We found that after lunch, his blood sugar would go high right after he ate and he would have a really hard time focusing. So, the second half of the school day was kind of a wash for him. It would take a little bit for the insulin to catch up to what he ate and then by the time everything was back in line, it was the end of the school day. . . . The teachers weren’t able to see like what was happening. . . . it’s so two dimensional when you’re virtual, so they would just see that he wasn’t paying attention and he would get himself in trouble for it.”</p> <p>“I think the personal aspect of it is better to be in there. You need to be in there talking to your doctor - how can she check the sites on his body you know, that’s up to me to look and see. He has a tendency [to] want to give his injection over here in his leg and sometimes he gives it too much in that spot - I can kind of check that myself but I think the doctor also needs to be doing that. So, telehealth is okay, but I don’t think it can replace the face to face.”</p>
Limited social interaction due to being at higher risk for COVID-19 infection	<p>“I think because he doesn’t have the experience with his friends and that sort of thing, I think he has kind of internalized the diagnosis a little bit more than he probably would otherwise if he had other distractions. I think from a mental perspective that might have been to a detriment as far as the quarantine.”</p> <p>“I didn’t want them to go outside and play with other kids. I didn’t know where those kids’ families have been. Because [of] the diabetes, our risk tolerance was a lot lower than a lot of other people.”</p>
Parental concern about their child becoming infected with COVID-19	<p>“I think the biggest challenge for me is just worry. . . . I definitely worry more, especially with higher risk factors - him getting sick especially since he can’t get the vaccine yet. So, I feel like we’ve been more cautious than we would’ve been with the other kids.”</p> <p>“Hearing about all the complications and the risk factors with diabetes actually ended up causing me a lot of anxiety so my doctor prescribed me an anti-anxiety medication because it was just that snowball of worry and concern.”</p> <p>“So we isolated pretty significantly. I think in part because the first news of the pandemic was diabetes and they didn’t differentiate between type 1, type 2, or well managed. . . . she has never bounced back from any respiratory virus easily compared to my son who’s nondiabetic. . . . so that for me was an extra layer of hesitancy to return to school or whatever else.”</p> <p>“Obviously when the pandemic first started, we were very concerned when it came to our son’s health especially since he has type 1 and he’s immune compromised.”</p>

Another prominent theme was that the psychosocial challenges related to the pandemic made their child’s T1DM management more difficult. Parents perceived a lack of social support and reported feelings of isolation from the diabetes community. They described virtual diabetes training classes as having small class sizes and reported that activities such as diabetes camp were cancelled, which reduced opportunities for families to interact.

Some parents also struggled with the lack of face-to-face interactions, both with regards to virtual school and online medical appointments. They explained that virtual school made it difficult for the teacher to be aware of fluctuations in their child’s blood glucose levels that impacted their child’s attention span during class. Some parents also expressed that medical care was not as comprehensive during telehealth appointments because the provider could not physically examine their child.

Parents also described their families as having lower risk tolerance levels compared with those with children without medical conditions due to children with T1DM being at higher risk of severe COVID-19 infection, necessitating stricter lockdown measures. Parents expressed feelings of stress because they worried that their children would contract the virus and experience medical complications related to their T1DM diagnosis. They also described feeling fearful, particularly during the early months of the COVID-19 pandemic because news sources did not differentiate between type 1 or type 2 diabetes when describing at-risk populations. Additionally, exacerbated worry combined with stricter isolation measures intended to protect their child’s health were described as negatively impacting both the parent and child’s mental health.

## Discussion

These findings demonstrate that parents found many aspects of managing their child's T1DM to be easier during the COVID-19 pandemic, primarily due to the reduced time their child spent away from the home and the parent having more control of their child's daily meals and activities. This is not surprising given that the positive impact of parental involvement on management of pediatric T1DM is well established,<sup>8,10</sup> and previous studies have reported parental concern regarding teachers and nurses' abilities to manage their child's T1DM while at school.<sup>17,18</sup> Increased time at home together during the COVID-19 pandemic therefore provided an opportunity for parents to assume a more active role in their child's diabetes management, which allowed them to quickly respond to fluctuations in their blood glucose levels and facilitated perceived improvements in the child's glycemic control. These perceived improvements in glycemic control are consistent with findings of recent studies conducted among children and adults with T1DM during the COVID-19 pandemic in other countries,<sup>19</sup> such as Italy,<sup>8-10,19,20</sup> Spain,<sup>19</sup> the United Kingdom,<sup>19</sup> and Malaysia.<sup>11</sup> However, literature remains mixed<sup>19</sup> because several other studies, including those conducted in the United States,<sup>6,21</sup> Saudi Arabia,<sup>22</sup> Japan,<sup>23</sup> India,<sup>24</sup> and Italy,<sup>25</sup> reported either poorer glycemic control or no significant change during the pandemic.

Parents' perceptions that spending more time at home with their child enabled improvements in T1DM management during the pandemic is supported by previous literature, demonstrating the benefits of parental involvement in the management of pediatric T1DM.<sup>8,10</sup> Parental involvement may encompass parental monitoring, which involves awareness of the child's diabetes management tasks, and parental responsibility, which involves parental execution of the child's diabetes management tasks.<sup>26</sup> Diabetes-specific parental monitoring has been shown to increase adherence to diabetes management regimens and improve glycemic control in adolescents with T1DM,<sup>26-28</sup> and higher parental responsibility is predictive of improved glycemic control among children with lower reported levels of autonomy.<sup>29</sup> Conversely, deterioration in parental involvement is associated with lower adherence to diabetes management tasks among adolescents,<sup>30</sup> and transferring of diabetes management responsibilities from parent to child prior to the child feeling competent has shown to predict higher A1C values,<sup>29</sup> indicative of poorer glycemic control. This emphasizes the importance of encouraging continued parental involvement after the pandemic and gradually transferring diabetes responsibilities when the child feels prepared during the transition back to in-person activities.

An unexpected finding was that several parents in the study described deterioration in their child's ability to independently manage their own diabetes during the pandemic. This underscores the need to develop strategies to support families in transferring diabetes management responsibilities from parent to child while still maintaining parental monitoring to optimize glycemic control. These findings also call attention to the need to better educate school personnel about diabetes management tasks, especially as children return to school following a prolonged period of remote schooling.

Although parents overwhelmingly reported that management of their child's T1DM was easier during the COVID-19 pandemic, reduced physical activity and increased sedentary time were consistently described as key diabetes management challenges. This is consistent with an accumulating body of evidence in children, young adults, and adults with diabetes highlighting reductions in physical activity<sup>6,9-11,20,22-25,31</sup> and increases in screen time<sup>11,31</sup> during the COVID-19 pandemic. Given that health risks associated with excess screen time include poor sleep, insulin resistance, and cardiovascular disease,<sup>32</sup> marked increases in screen time during the pandemic are particularly concerning for children with T1DM, who are at a higher risk of cardiovascular disease compared to those without diabetes.<sup>33</sup> This emphasizes the need to support parents in establishing routines to promote healthy lifestyle behaviors central to diabetes management, especially during periods of prolonged unstructured and/or out-of-school time.

Another noteworthy finding was the negative impacts of the pandemic on both the parents' and their children's mental health. While adverse psychological implications of COVID-19 lockdowns and school closures have been widely reported,<sup>1,2,6,22,34</sup> parents explained that having a child with T1DM further exacerbated their own psychological distress. Parents described anxiety about their child contracting COVID-19 due to diabetes being a risk factor for severe COVID-19 morbidity and mortality.<sup>7</sup> Psychological distress among parents of children with T1DM is especially concerning because parental psychological distress can have a negative impact on T1DM management and is associated with higher child self-reported stress and depressive symptoms.<sup>4</sup> The prevalence of anxiety and mood deterioration has increased markedly among children and young adults with T1DM during the COVID-19 pandemic<sup>6,22,34</sup> and is worrisome for children with T1DM, who are already at increased risk of psychological disorders.<sup>34,35</sup>



Additionally, parents perceived their personal isolation measures during the pandemic to be stricter than those taken by others whose children did not have medical conditions. They described these lockdown measures as further limiting the child's social interactions and isolating them from their peers. Adverse consequences of social isolation during the COVID-19 pandemic on children's mental health are well described<sup>1</sup> and may be further exacerbated among children with diabetes. The data, along with a large body of existing literature,<sup>1,4-6,22,34,35</sup> highlight the need to provide mental health resources for both children with T1DM and their parents and to develop tailored strategies to better equip parents to support children with T1DM. This is important both to minimize the psychological burden associated with the COVID-19 pandemic<sup>1</sup> and to help parents and children cope with the psychosocial stress of a T1DM diagnosis.<sup>4,35</sup>

While the transition to telehealth appointments was generally viewed favorably, as has been reported in studies conducted prior to the pandemic<sup>36-38</sup> and during the pandemic,<sup>9,10,12</sup> parents explained that the cancellation of in-person activities was particularly detrimental with regards to diabetes-related social support, especially when their child was diagnosed with T1DM closer to the onset of the pandemic. These findings underscore the importance of providing children and families with opportunities for social support in the diabetes community, especially face-to-face, to ensure families feel connected to one another as lockdown measures continue to ease. Improvements to existing online platforms and development of new virtual means of providing support in the T1DM community are also needed.

### *Strengths and Limitations*

This is among the first qualitative studies exploring parental perspectives of pediatric T1DM management during the COVID-19 pandemic conducted in the United States. While the study provides important insights into parents' experiences with management of their child's T1DM during this unprecedented time, several limitations must be considered. Notably, most parents self-identified as White/Caucasian, which prevented us from examining impacts of the COVID-19 pandemic on pediatric diabetes management among minority populations. We also did not collect data on household income, which precluded the ability to compare findings based on socioeconomic status. These are important limitations because recent studies conducted during the COVID-19 pandemic reported that individuals from marginalized racial/ethnic groups have greater likelihood of job loss among employed workers<sup>39</sup> and are at increased risk of COVID-19 infection and mortality.<sup>40</sup> Therefore, it is important for future research to explore the experiences of these populations because the COVID-19 pandemic could potentially exacerbate preexisting T1DM health inequities.<sup>41,42</sup>

### **Conclusion**

The findings suggest that the COVID-19 pandemic had overall positive impacts on pediatric T1DM management, primarily due to parents being in close physical proximity to their children as a result of COVID-19-related closures. Being home together enabled parents to closely monitor their child's daily activities and dietary intake and quickly respond to fluctuations in their child's blood glucose levels. The findings also highlight the enhanced convenience of telemedicine and online supply ordering, especially for those residing far away from their medical provider, which can continue to be utilized as in-person activities and medical care resume. While T1DM management was nearly unanimously reported to be easier during the COVID-19 pandemic, challenges pertaining to reduced physical activity and increased screen time emphasize the importance of parents actively encouraging healthy behaviors during out-of-school time. Additionally, the significant psychological stressors described by parents underscore the extent to which it is essential for parents to monitor their own and their child's mental health and for medical providers and online platforms to have mental health and community resources readily accessible to support the diabetes community.

### **Declaration of Conflicting Interests**

The authors do not have any conflicts of interest to report.

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## References

1. Loades ME, Chatburn E, Higson-Sweeney N, et al. Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. *J Am Acad Child Adolesc Psychiatry*. 2020;59(11):1218-1239.E3. doi:10.1016/j.jaac.2020.05.009
2. Giuntella O, Hyde K, Saccardo S, Sadoff S. Lifestyle and mental health disruptions during COVID-19. *Proc Natl Acad Sci U S A*. 2021;118(9):e2016632118. doi:10.1073/pnas.2016632118
3. Iughetti L, Trevisani V, Cattini U, et al. COVID-19 and type 1 diabetes: concerns and challenges. *Acta Biomed*. 2020;91(3):e2020033. doi:10.23750/abm.v91i3.10366
4. Whitemore R, Jaser S, Chao A, Jang M, Grey M. Psychological experience of parents of children with type 1 diabetes: a systematic mixed-studies review. *Diabetes Educ*. 2012;38(4):562-579. doi:10.1177/0145721712445216
5. Monzon A, Kahhan N, Marker A, Patton S. Challenges and considerations for reducing diabetes distress and fear of hypoglycemia in parents of youth with type 1 diabetes during the COVID-19 pandemic. *JMIR Pediatr Parent*. 2021;4(2):e25106. doi:10.2196/25106
6. March CA, Siminerio LM, Muzumdar RH, Libman IM. Implications of the school day on health behaviors for children with type 1 diabetes: a survey of parent perspectives during the COVID-19 pandemic. *Sci Diabetes Self Manag Care*. 2021;47(6):447-456. doi:10.1177/26350106211051298
7. Centers for Disease Control and Prevention. People with certain medical conditions. Centers for Disease Control and Prevention. Published March 30, 2022. Accessed April 5, 2022. <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>
8. Schiaffini R, Barbetti F, Rapini N, et al. School and pre-school children with type 1 diabetes during Covid-19 quarantine: the synergic effect of parental care and technology. *Diabetes Res Clin Pract*. 2020;166:108302. doi:10.1016/j.diabres.2020.108302
9. Minuto N, Bassi M, Montobbio C, et al. The effect of lockdown and physical activity on glycemic control in Italian children and young patients with type 1 diabetes. *Front Endocrinol*. 2021;12:690222. doi:10.3389/fendo.2021.690222
10. Predieri B, Leo F, Candia F, et al. Glycemic control improvement in Italian children and adolescents with type 1 diabetes followed through telemedicine during lockdown due to the COVID-19 pandemic. *Front Endocrinol* 2020;11:595735. doi:10.3389/fendo.2020.595735
11. Cheng HP, Wong JSL, Selveindran NM, Hong JYH. Impact of COVID-19 lockdown on glycaemic control and lifestyle changes in children and adolescents with type 1 and type 2 diabetes mellitus. *Endocrine*. 2021;73(3):499-506. doi:10.1007/s12020-021-02810-1
12. Umano GR, Di Sessa A, Guarino S, Gaudino G, Marzuillo P, del Giudice EM. Telemedicine in the COVID-19 era: taking care of children with obesity and diabetes mellitus. *World J Diabetes*. 2021;12(5):651-657. doi:10.4239/wjd.v12.i5.651
13. Sofaer S. Qualitative methods: what are they and why use them? *Health Serv Res*. 1999;34(5 Pt 2):1101-1118.
14. Sylvestsky AC, Moore HR, Kaidbey JH, et al. Rationale and design of DRINK-T1D: a randomized clinical trial of effects of low-calorie sweetener restriction in children with type 1 diabetes. *Contemp Clin Trials*. 2021;106:106431. doi:10.1016/j.cct.2021.106431
15. Saunders B, Sim J, Kingstone T, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. *Qual Quant*. 2018;52(4):1893-1907. doi:10.1007/s11135-017-0574-8
16. McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med*. 2012;22(3):276-282.
17. Jacques F, Stout S, Alvarez-Salvat R, et al. Parent perspectives of diabetes management in schools. *Diabetes Educ*. 2008;34(6):996-1003. doi:10.1177/0145721708325155
18. Amillategui B, Mora E, Calle JR, Giralt P. Special needs of children with type 1 diabetes at primary school: perceptions from parents, children, and teachers. *Pediatr Diabetes*. 2009;10(1):67-73. doi:10.1111/j.1399-5448.2008.00457.x
19. Eberle C, Stichling S. Impact of COVID-19 lockdown on glycemic control in patients with type 1 and type 2 diabetes mellitus: a systematic review. *Diabetol Metab Syndr*. 2021;13(1):95. doi:10.1186/s13098-021-00705-9
20. Capaldo B, Annuzzi G, Creanza A, et al. Blood glucose control during lockdown for COVID-19: CGM metrics in Italian adults with type 1 diabetes. *Diabetes Care*. 2020;43(8):e88-e89. doi:10.2337/dc20-1127
21. Nwosu BU, Al-Halbouni L, Parajuli S, Jasmin G, Zitek-Morrison E, Barton BA. COVID-19 pandemic and pediatric type 1 diabetes: no significant change in glycemic control during the pandemic lockdown of 2020. *Front Endocrinol*. 2021;12:703905. doi:10.3389/fendo.2021.703905

22. Al Agha AE, Alharbi RS, Almohammadi OA, Yousef SY, Sulimani AE, Alaama RA. Impact of COVID-19 lockdown on glycemic control in children and adolescents. *Saudi Med J* 2021;42(1):44-48. doi:10.15537/smj.2021.1.25620
23. Hosomi Y, Munekawa C, Hashimoto Y, et al. The effect of COVID-19 pandemic on the lifestyle and glycemic control in patients with type 1 diabetes: a retrospective cohort study. *Diabetol Int.* 2022;13(1):85-90. doi:10.1007/s13340-021-00507-4
24. Verma A, Rajput R, Verma S, Balania VKB, Jangra B. Impact of lockdown in COVID 19 on glycemic control in patients with type 1 diabetes mellitus. *Diabetes Metab Syndr.* 2020;14(5):1213-1216. doi:10.1016/j.dsx.2020.07.016
25. Assaloni R, Pellino VC, Puci MV, Ferraro OE, Lovecchio N, Vandoni M. Coronavirus disease (Covid-19): how does the exercise practice in active people with type 1 diabetes change? A preliminary survey. *Diabetes Res Clin Pract.* 2020;166:108297. doi:10.1016/j.diabres.2020.108297
26. Berg CA, Butler JM, Osborn P, et al. Role of parental monitoring in understanding the benefits of parental acceptance on adolescent adherence and metabolic control of type 1 diabetes. *Diabetes Care.* 2008;31(4):678-683. doi:10.2337/dc07-1678
27. Ellis DA, Podolski CL, Frey M, Naar-King S, Wang B, Moltz K. The role of parental monitoring in adolescent health outcomes: impact on regimen adherence in youth with type 1 diabetes. *J Pediatr Psychol.* 2007;32(8):907-917. doi:10.1093/jpepsy/jsm009
28. Horton D, Berg CA, Butner J, Wiebe DJ. The role of parental monitoring in metabolic control: effect on adherence and externalizing behaviors during adolescence. *J Pediatr Psychol.* 2009;34(9):1008-1018. doi:10.1093/jpepsy/jsp022
29. Palmer DL, Berg CA, Wiebe DJ, et al. The role of autonomy and pubertal status in understanding age differences in maternal involvement in diabetes responsibility across adolescence. *J Pediatr Psychol.* 2004;29(1):35-46. doi:10.1093/jpepsy/jsh005
30. King PS, Berg CA, Butner J, Butler JM, Wiebe DJ. Longitudinal trajectories of parental involvement in type 1 diabetes and adolescents' adherence. *Health Psychol.* 2014;33(5):424-432. doi:10.1037/a0032804
31. Grabia M, Markiewicz-Żukowska R, Puścion-Jakubik A, et al. The nutritional and health effects of the COVID-19 pandemic on patients with diabetes mellitus. *Nutrients.* 2020;12(10): 3013. doi:10.3390/nu12103013
32. Lissak G. Adverse physiological and psychological effects of screen time on children and adolescents: literature review and case study. *Environ Res.* 2018;164:149-157. doi:10.1016/j.envres.2018.01.015
33. Liese AD, Ma X, Maahs DM, Trilk JL. Physical activity, sedentary behaviors, physical fitness, and their relation to health outcomes in youth with type 1 and type 2 diabetes: a review of the epidemiologic literature. *J Sport Health Sci.* 2013;2(1):21-38. doi:10.1016/j.jshs.2012.10.005
34. Wade C, Akinseye L, Anderson T, et al. Youth with type 1 diabetes experienced a higher level of anxiety during the COVID-19 pandemic compared to healthy control; a cross-sectional study. *J Endocr Soc.* 2021;5(suppl 1):A664. doi:10.1210/jendso/bvab048.1355
35. Kovacs M, Goldston D, Obrosky DS, Bonar LK. Psychiatric disorders in youths with IDDM: rates and risk factors. *Diabetes Care.* 1997;20(1):36-44. doi:10.2337/diacare.20.1.36
36. Wood CL, Clements SA, McFann K, Slover R, Thomas JF, Wadwa RP. Use of telemedicine to improve adherence to American diabetes association standards in pediatric type 1 diabetes. *Diabetes Technol Ther.* 2016;18(1):7-14. doi:10.1089/dia.2015.0123
37. McDonnell ME. Telemedicine in complex diabetes management. *Curr Diab Rep.* 2018;18(7):42. doi:10.1007/s11892-018-1015-3
38. Faruque LI, Wiebe N, Ehteshami-Afshar A, et al. Effect of telemedicine on glycated hemoglobin in diabetes: a systematic review and meta-analysis of randomized trials. *CMAJ.* 2017;189(9):E341-E364. doi:10.1503/cmaj.150885
39. Gemelas J, Davison J, Keltner C, Ing S. Inequities in employment by race, ethnicity, and sector during COVID-19. *J Racial Ethn Health Disparities.* 2022;9(1):350-355. doi:10.1007/s40615-021-00963-3
40. Kim SJ, Watson K, Khare N, Shastri S, Da Goia Pinto CL, Nazir NT. Addressing racial/ethnic equity in access to COVID-19 testing through drive-thru and walk-in testing sites in Chicago. *Med Res Arch.* 2021;9(5):2430. doi:10.18103/mra.v9i5.2430
41. Gesuita R, Maffei C, Bonfanti R, et al. Socioeconomic inequalities increase the probability of ketoacidosis at diagnosis of type 1 diabetes: a 2014–2016 nationwide study of 2,679 Italian children. *Frontiers Pediatr.* 2020;8:575020. doi:10.3389/fped.2020.575020
42. Addala A, Auzanneau M, Miller K, et al. A decade of disparities in diabetes technology use and HbA1c in pediatric type 1 diabetes: a transatlantic comparison. *Diabetes Care.* 2021;44(1):133-140. doi:10.2337/dc20-0257