



# Telemedicine and COVID-19 pandemic: The perfect storm to mark a change in diabetes care. Results from a world-wide cross-sectional web-based survey

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## Abstract

**Background:** Telemedicine for routine care of people with diabetes (PwD) during the COVID-19 pandemic rapidly increased in many countries, helping to address the several barriers usually seen.

**Objective:** This study aimed to describe healthcare professionals' (HCPs) experience on telemedicine use in diabetes care and investigate the changes and challenges associated with its implementation.

**Methods:** A cross-sectional electronic survey was distributed through the global network of JENIOUS members of ISPAD. Respondents' professional and practice profiles, clinic sizes, their country of practice, and data regarding local telemedicine practices during COVID-19 pandemic were investigated.

**Results:** Answers from 209 HCPs from 33 countries were analyzed. During the pandemic, the proportion of PwD receiving telemedicine visits increased from <10% (65.1% of responders) to >50% (66.5%). There was an increase in specific privacy requirements for remote visits (37.3% to 75.6%), data protection policies (42.6% to 74.2%) and reimbursement for remote care (from 41.1% to 76.6%). Overall, 83.3% HCPs reported to be satisfied with the use of telemedicine. Some concerns (17.5%) about the complexity and heterogeneity of the digital platforms to be managed in everyday practice remain, feeding the need for unifying and making interoperable the tools for remote care. Also, 45.5% of professionals reported to feel stressed by the need for extra-time for telemedicine consultations.

**Conclusions:** Telemedicine was rapidly and broadly adopted during the pandemic globally. Some issues related to its use were promptly addressed by local institutions. Challenges with the use of different platforms and for the need of extra-time still remain to be solved.

## KEYWORDS

COVID-19, pediatrics, telehealth, telemedicine, type 1 diabetes, virtual

## 1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic dramatically impacted health care systems worldwide, restraining the ability to maintain consistent consultations for people with chronic conditions.<sup>1,2</sup> This tremendous crisis put additional burden on most healthcare systems but, at the same time, created new opportunities for change, marking a historical revolution in the ways of seeking and supplying medical care.<sup>3</sup>

The adoption of telemedicine in a broad spectrum of medical specialties, including diabetes care, posed a major transition over the last 2 years.<sup>4,5</sup> This was facilitated by a continuous uptake of new technological tools to collect, transfer, and analyze diabetes data.<sup>4,6-8</sup>

Nevertheless, the use of telemedicine remained limited in the past years due to several barriers, including the lack of guidance for data management and privacy, inadequate reimbursement policies, challenges to access diabetes technologies, need for patients and healthcare to become familiar with various digital tools.<sup>9</sup> During the first year of the pandemic, the adoption of telemedicine increased rapidly and became a common practice in many diabetes centers,<sup>10</sup> making it possible to limit further negative implications of the COVID-19 on youths with diabetes.<sup>6,7</sup>

The aim of the present study was to describe healthcare professionals' (HCPs) experiences about telemedicine use in diabetes centers worldwide.

## 2 | METHODS

A cross-sectional electronic survey was conducted from October 2020 to April 2021 using Google Forms (Google LLC, Mountain View, CA). This allowed responses to be saved and subsequently downloaded in spreadsheet format.

The full version of the survey and answers are available in Appendix S1. Questions were developed by four JENIOUS members. A direct web link and consent to participate in the survey was sent to International Society for Pediatric and Adolescent Diabetes (ISPAD) and JENIOUS members by email and social media platforms.

The survey questions (34) were divided into four sections that captured information on responders' professional and practice profiles, sizes of their clinic, country of practice, and the impact of telemedicine regarding: (i) frequencies of use of different tools applied to telemedicine, (ii) perceived skills in the use of such technologies, (iii) perceived impact of telemedicine on diabetes care and (iv) HCPs' perceived attitudes towards and challenges with the use of telemedicine. The survey took about 15 min to complete.

Data were analyzed using STATA 14.0 for Windows (College Station, TX). Quantitative variables were described in the form of medians and ranges, and qualitative variables were described as numbers and percentages. Three open-ended questions were analyzed using a coding technique, where similar answers were summarized by approximation into similar semantic content.

## 3 | RESULTS

The online survey was completed by 209 HCPs from 33 countries. Most of the participants were females (74.6%), median age 42 years (range 26–80 years). Most HCPs were pediatric endocrinologists/diabetologists (67.5%), working in a healthcare setting providing care to more than 500 (32%) or between 200 and 499 (28%) people with diabetes (PwD).

Before the pandemic, one third of the HCPs used telemedicine for less than 10% of pediatric PwD, and another third did not use telemedicine at all.

During the local lockdowns, the use of telemedicine increased - about 40% HCPs adopted remote visits to the standard care for more than 75% of PwD.

The most frequently used tools included video call software (34.4%), phone calls (24.4%), digital data platforms (23.9%), and e-mails (10%).

The most frequently used platforms for remote data sharing were Medtronic CareLink (79.4% of participants), Abbott LibreView (69.4%), Dexcom Clarity (40.7%), Diasend (28.2%), Glooko (12%), and Tidepool (11.5%).

Data privacy rules specific for remote contacts were absent in most countries before the pandemic (62.7% of responders) and introduced afterwards (75.6%). Similarly, specific telemedicine data protection policies were not present earlier in most cases (57.4%) became available during the pandemic (74.2%).

Before COVID-19, telemedicine consultations were not reimbursed by the local health care systems or insurance companies in 58.9% of answers, while during the pandemic only 23.4% remained without reimbursement.

Most HCPs rated their skills "adequate" or "expert" in downloading data from glucometers (93%), pumps (86%), and sensors (86%); in the analysis of glucometer data (97%), pump data (92%), and sensor data (95%); in using platforms for data analysis (84%).

All participants agreed (36.4%) or strongly agreed (63.2%) that telemedicine may enhance in-person visits, and 43% agreed or strongly agreed that remote visits might even replace in-person contacts.

Most HCPs evaluated the impact of telemedicine as non-inferior or superior to in-person visits on pediatric PwD's ability to reach glycemic targets (83.7%), on the PwD's and their families' quality of life (82.3%), and on the quality of care provided to them (74.2%). Regarding interpersonal communications, 59% evaluated teleconsultations as non-inferior or superior to in-person visits.

About HCPs' personal attitudes and experiences in the use of telemedicine, most felt neutral (22%), comfortable (41.1%), or extremely comfortable (9.6%) in making remote diabetes consultations without being able to physically interview the patient. Only 17.3% considered technologies for telemedicine too complex to be managed in clinical practice. Nevertheless, 45.5% HCPs reported to feel stressed by the extra efforts caused by telemedicine. A comprehensive list of further challenges reported is available in Appendix S1.

About half of HCPs (56%) did not perceive telemedicine to increase inappropriate referrals.

Few (13%), experienced feelings of loneliness when using telemedicine because unable to share their concerns with colleagues.

The satisfaction using telemedicine in clinical practice during the pandemic was high (very satisfied 29.2%, completely satisfied 6.7%) or moderate (moderately satisfied 47.4%).

Suggestions from participants on how to improve their personal experience with telemedicine are summarized in Table 1. One of the most requested changes for a further and easier use of telemedicine is to unify the available platforms and make them interoperable.

**TABLE 1** HCPs' suggested strategies to improve the use of telemedicine

<b>Improve technical aspects</b>
A single integrated platform to download all devices
A platform that includes the possibility for video-consultations
A platform with the possibility to share screen to analyze downloads together with the patient
An integrated platform for the visit itself, for pumps, glucometers and sensors uploads and review, for screening questionnaires, for sharing of anthropometrics and blood test results
Automatic download of the data without the need for patient to do it
Interoperability among devices
Availability of a single video-platform recognized and protected by privacy policies
Possibility of using Wapp for video-calls
<b>Improve training and education for caregivers</b>
Quick tutorials for platforms use available for all diabetes caregivers (doctors, nurses, dieticians, psychologists)
Support available for caregivers from industries to use platforms
Easier connection tools to download, send information, and keep in contact
Better equipment available for caregivers to use telemedicine
Training for data interpretation
Increase experience within the team
Possibility to share experiences with other teams
More time available for analyzing patients data
<b>Improve logistic aspects</b>
Better and quicker internet connection in the hospital
Multiple computer screens to allow for charting concurrently with the video portion of the tele-consultation
Better electronic health records platforms available in the hospital and integrated with patients' data download platforms
IT available in the team
Time reserved to telemedicine
More administrative staff dedicated to managing data downloads prior to tele-consultations, to ensure the connection to the platforms prior to Consultations, to integrate video-calls, phone-visits, mails and in person visits, to schedule the tele-consultations
More nurses in the team
<b>Improve training and education for patients and families</b>
Multi-language resources available for patients
Pre-existing standard forms for patients to be completed before the tele-consultation including all health records (e.g., weight and blood pressure)
Pre-existing tests to check the patient's knowledge on several diabetes aspects made available in the platforms
Specific and easy to understand instructions about data download systems and platforms use available for foreign patients and for patients with low socio-cultural level
Better trainings from companies for families to understand how to download data
Short videos of diabetes self-care prior to consultation and discussing them with families during consultation
Short therapeutic education sessions focused on the current main problem of the patient made available in the platform
<b>Improve regulatory, policy and reimbursement</b>
Adequate reimbursement
Adequate privacy rules to connect all the data of a patient in a single server
Improve specific government policies
Reduction of costs
High speed internet made available for all patients with diabetes from the healthcare system

## 4 | DISCUSSION

This study reports HCPs experiences on the rapid shift in diabetes care towards telemedicine worldwide. The COVID-19 pandemic accelerated an already ongoing process of digital transformation in healthcare and posed new challenges and opportunities to patients, their families, and HCPs alike.<sup>4</sup> Practical solutions to overcome institutional barriers and technical issues related with remote consultations were made available in several countries. HCPs reported changes in local regulations for data protection and privacy for telemedicine, as well as the introduction of specific reimbursements.<sup>11</sup> Lee JM et al. documented the increase of telemedicine visits from <1% before the pandemic to 95.2% in April 2020 with most sites reporting reimbursement for video and telephone visits.<sup>12</sup> Similar data were published internationally.<sup>7,13</sup>

Appropriate devices and platforms to facilitate teleconsultations were also quickly made available in majority of the settings. Most HCPs felt confident using the digital tools and the general satisfaction with telemedicine in everyday practice resulted high, especially considering the short timeframe in which this change happened, and the ongoing pandemic. One possible explanation is that telemedicine actually overcame the physical distance imposed by pandemic-related lockdown and made it possible to maintain a connection with PwD and their families.<sup>14</sup>

Telemedicine was reported supportive and non-inferior to in-person visits in maintaining patients' compliance while targeting glycaemic control and maintaining a good quality of life for patients and families, similarly to recent studies which demonstrated telemedicine as effective as standard care in PwD<sup>15-18</sup> improving self-management, reducing costs, and saving time.<sup>15</sup> Concerns have been risen by some HCPs about the lack of personal relationship with PwD (Appendix S4). In particular, during the childhood and the adolescence, in-person visits may play a key role in evaluating behavioral features, body perceptions, eating habits, attitudes in the relationship with peers, while providing social and psychological support.<sup>14</sup> In addition, in-person visits are important for periodically evaluating growth-patterns and performing a clinical examination for the screening of diabetes-related complication.<sup>12</sup> Thus, strategies on how to integrate telemedicine with in-person visits in an ideal proportion tailored on PwD perceptions remain a concern.

In this survey, burden in the use of telemedicine was related with the difficulties to integrate the use of telehealth in everyday practice, the complexity and lack of interoperability of the platforms and the need of extra-time, as reported by Frielitz et al.<sup>18</sup> Recommendations from the virtual diabetes care expert panel identified the poor data integration among devices and the limited interoperability of platforms as major barriers concurring to clinicians' burnout.<sup>9</sup>

Moreover, inadequate or inconsistent reimbursements and local disparities remain an obstacle to the wider adoption of telemedicine.<sup>9,11</sup>

The strength of this study is to represent HCPs' experience and challenges with telemedicine worldwide. HCPs suggestions on how to enhance telemedicine can help tailoring new healthcare models to

support the implementation of telehealth also after the pandemic. A limitation is that respondents were primarily active members of an international medical society, from large care centers, therefore, the results may not be generalizable. However, our results align with other studies including different target populations.<sup>11-13,18,19</sup> We acknowledge a broad data collection time frame, which allowed to reduce the differences in the time of COVID-19 recurrence/relapse in different countries. Despite this it may represent only the initial stage of a process still ongoing in some areas.

In conclusion, this international survey reports the rapid changes made in most countries to overcome some of the barriers to telemedicine during the pandemic. Telemedicine has been experienced positively and adopted by most of the HCPs who participated in this survey and may constitute an alternative to the standard care. Several obstacles still need to be addressed for bringing telemedicine as a standard of care.

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### CONFLICT OF INTEREST

Katarina Braune received grants from the European Commission, the Berlin Institute of Health and the Wellcome Trust; and received fees for medical consulting and public speaking from Roche Diabetes Care, Dexcom, Medtronic Diabetes, Diabeloop, Novo Nordisk, Sanofi Diabetes and BCG Digital Ventures; all outside the submitted work. Katarina Braune received honoraria for participation on the speaker's bureau of Pfizer, Novo Nordisk and Eli Lilly. Agata Chobot has spoken for Medtronic, Eli Lilly and Novo Nordisk. No conflict of interest with this paper. Roque Cardona-Hernandez has received honoraria for participation on the speaker's bureau of Eli Lilly, Medtronic, Novo-Nordisk and Sanofi and advisory boards of Abbott and Novo-Nordisk. No conflict of interest with this paper. Carine De Beaufort has contributed to the Medtronic e learning tool development. No conflict of Interest with this paper. Andrea E Scaramuzza has spoken for Sanofi and Abbott, has received support for attending meeting from Movi and has served on the advisory board for Medtronic and Movi. No potential conflicts of interest relevant to this article were reported.

### AUTHOR CONTRIBUTION

Elisa Giani, Agata Chobot, Tiago Jeronimo Dos Santos, and Klemen Dovc drafted and approved the survey. Elisa Giani, Agata Chobot, Tiago Jeronimo Dos Santos researched data, analyzed data, and wrote the manuscript. Klemen Dovc researched data and reviewed and edited the manuscript. Elisa Giani, Agata Chobot, Tiago Jeronimo Dos Santos, Katarina Braune, Klemen Dovc, Roque Cardona-Hernandez, Andrea E Scaramuzza and Carine De Beaufort further edited and discussed the manuscript and approved the final version. Elisa Giani, Agata Chobot, Tiago Jeronimo Dos Santos, and Klemen Dovc are

guarantors of this work and, as such, had full access to all the data in the study and take the responsibility for the integrity of the data and the accuracy of the data analysis.

**DATA AVAILABILITY STATEMENT**

The data that supports the findings of this study are available in the supplementary material of this article.

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**REFERENCES**

1. Pfiester E, Gomber A, Rojas D, et al. Implications of the covid-19 pandemic on chronic care: global perspectives from people with type 1 diabetes. *BMJ Opin.* 2020;06:26.
2. Ferrara P, Albano L. COVID-19 and healthcare systems: what should we do next? *Public Health.* 2020;185:1-2.
3. Wake DJ, Gibb FW, Kar P, et al. Endocrinology in the time of COVID-19: remodelling diabetes services and emerging innovation. *Eur J Endocrinol.* 2020;183:G67-G77.
4. Danne T, Limbert C. COVID-19, type 1 diabetes, and technology: why pediatric patients are leading the way. *Lancet Diabetes Endocrinol.* 2020;8:465-467.
5. Gomez T, Anaya YB, Shih KJ, Tarn DM. A qualitative study of primary care physicians' experiences with telemedicine during COVID-19. *J Am Board Fam Med.* 2021;34:S61-S70.
6. Zeller WP Jr, DeGraff R, Zeller W. A novel telemedicine protocol improved outcomes for high-risk patients with type 1 diabetes: a 3-month quality improvement project during the COVID-19 pandemic. *J Clin Transl Endocrinol Case Rep.* 2021;19:100078.
7. Garg SK, Rodbard D, Hirsch IB, Forleza GP. Managing new-onset type 1 diabetes during the COVID-19 pandemic: challenges and opportunities. *Diabetes Technol Ther.* 2020;22(6):431-439.
8. Crossen S, Raymond J, Neinstein A. Top 10 tips for successfully implementing a diabetes telehealth program. *Diabetes Technol Ther.* 2020;22(12):920-928.
9. Phillip M, Bergenstal RM, Close KL, et al. The digital/virtual diabetes clinic: the future is now—recommendations from an international panel on diabetes digital technologies introduction. *Diabetes Technol Ther.* 2021;23(2):146-154.

10. Yengar K, Jain VK, Vaishya R. Pitfalls in telemedicine consultations in the era of COVID 19 and how to avoid them. *Diabetes Metab Syndr.* 2020;14(5):797-799.
11. Tornese G, Schiaffini R, Mozzillo E, Franceschi R, Frongia AP, Scaramuzza A. Telemedicine in the time of the COVID-19 pandemic: results from the first survey among Italian pediatric diabetes centers. *Healthcare.* 2021;9(7):815.
12. Lee JM, Carlson E, Albanese-O'Neill A, et al. Adoption of telemedicine for type 1 diabetes care during the COVID-19 pandemic. *Diabetes Technol Ther.* 2021;23:642-651.
13. Sarteau AC, Souris KJ, Wang J, et al. Changes to care delivery at nine international pediatric diabetes clinics in response to the COVID-19 global pandemic. *Pediatr Diabetes.* 2021;22:463-468.
14. Scott SN, Fontana FY, Zuger T, Laimer M, Stettler C. Use and perception of telemedicine in people with type 1 diabetes during the COVID-19 pandemic—results of a global survey. *Endocrinol Diabetes Metab.* 2021;4:e00180.
15. Tcherro H, Kangambega P, Briatte C, Brunet-Houdard S, Retali GR, Rusch E. Clinical effectiveness of telemedicine in diabetes mellitus: a meta-analysis of 42 randomized controlled trials. *Telemed J E Health.* 2019;25(7):569-583.
16. De Guzman KR, Snowswell CL, Taylor ML, et al. A systematic review of pediatric telediabetes service models. *Diabetes Technol Ther.* 2020; 22(8):623-638.
17. Bertuzzi F, Stefani I, Rivolta B, et al. Teleconsultation in type 1 diabetes mellitus (TELEDIABE). *Acta Diabetol.* 2018;55(2):185-192.
18. Frielitz FS, Dördelmann J, Lemke S, et al. Assessing the benefits and challenges of video consultations for the treatment of children with type 1 diabetes—a qualitative study among diabetes professionals. *Exp Clin Endocrinol Diabetes.* 2020;129:831-836.
19. Braune K, Boss K, Schmidt-Herzel J, et al. Shaping workflows in digital and remote diabetes care during the COVID-19 pandemic via service design: prospective, longitudinal, open-label feasibility trial. *JMIR Mhealth Uhealth.* 2021;9(4):e24374.

**SUPPORTING INFORMATION**

Additional supporting information may be found in the online version of the article at the publisher's website.

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