Diabetes Education and Support Tele-Visit Needs Differ in Duration, Content, and Satisfaction in Older Versus Younger Adults

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Abstract

Background: Diabetes education and support are critical components of diabetes care. During the COVID-19 pandemic, when telemedicine took the place of in-person visits, remote Certified Diabetes Care and Education Specialist (CDCES) services were offered to address diabetes education and support. Specific needs for older adults, including the time required to provide education and support remotely, have not been previously reported.

Methods: Adults with diabetes (primarily insulin-requiring) were referred to remote CDCESs. Utilization was individualized based on patient needs and preferences. Topics discussed, patient satisfaction, and time spent in each tele-visit were evaluated by diabetes type, age, sex, insurance type, glycated hemoglobin (HbA1c), pump, and continuous glucose monitor (CGM) usage. t-Tests, one-way analysis of variance, and Pearson correlations were employed as appropriate.

Results: Adults (n = 982; mean age 48.4 years, 41.0% age ≥55 years) with type 1 diabetes (n = 846) and type 2 diabetes mellitus (n = 136, 86.0% insulin-treated), 50.8% female; 19.0% Medicaid, 29.1% Medicare, 48.9% private insurance; mean HbA1c 8.4% (standard deviation 1.9); and 46.6% pump and 64.5% CGM users had 2203 tele-visits over 5 months. Of those referred, 272 (21.7%) could not be reached or did not receive education/support. Older age (≥55 years), compared with 36–54 year olds and 18–35 year olds, respectively, was associated with more tele-visits (mean 2.6 vs. 2.2 and 1.8) and more time/tele-visits (mean 20.4 min vs. 16.5 min and 14.8 min; p < 0.001) as was coverage with Medicare (mean 2.8 visits) versus private insurance (mean 2.0 visits; p = 0.001) and lower participant satisfaction. The total mean time spent with remote CDCESs was 53.1, 37.4, and 26.2 min for participants aged ≥55, 36–54, and 18–35 years, respectively. During remote tele-visits, the most frequently discussed topics per participant were CGM and insulin pump use (73.4% and...
49.7%). After adjustment for sex and diabetes type, older age was associated with lack of access to a computer, tablet, smartphone, or internet ($p < 0.001$), and need for more education related to CGM ($p < 0.001$), medications ($p = 0.015$), hypoglycemia ($p = 0.044$), and hyperglycemia ($p = 0.048$).

**Discussion:** Most remote CDCES tele-visits were successfully completed. Older adults/those with Medicare required more time to fulfill educational needs. Although 85.7% of individual sessions lasted <30 min, which does not meet current Medicare requirements for reimbursement, multiple visits were common with a total time of >50 min for most older participants. This suggests that new reimbursement models are needed. Education/support needs of insulin-treated older adults should be a focus of future studies.

**Keywords:** diabetes; diabetes support; older adults; tele-education

**Introduction**
Diabetes self-management education and support (DSMES) provided by qualified health care professionals, including Certified Diabetes Care and Education Specialists (CDCESs), has been shown to improve diabetes self-management and outcomes, but health care coverage is variable and many insurers will only reimburse for education sessions that last for at least 30 min. In addition to lack of access, barriers to participation include distance, cost, and convenience (i.e., taking time off from work).

Some barriers to receiving professional care for diabetes can be ameliorated by telehealth. Telehealth has the potential to reach many more people with diabetes (PWD), and numerous studies have demonstrated efficacy. Internet access as well as access to computers, tablets, and/or smartphones and technological acumen correlate with age and education level. The specific needs for education and support of older adults with insulin-requiring diabetes using telehealth have not been well studied. The time required to meet diabetes education and support needs of older adults using telemedicine, including needs related to the use of new and remote monitoring devices and insulin delivery systems, is important to understand but has not been previously reported.

With the onset of the COVID-19 pandemic, in-person adult diabetes care visits ceased, and remote provider and CDCES visits were started. The CDCESs provided remote education and support, including device education (insulin pump, continuous glucose monitor [CGM], and meter support), lifestyle, and psychosocial support, and addressed the management of hypoglycemia and hyperglycemia, financial concerns, sick day management, and the insulin injection technique.

Previous studies have shown patient satisfaction with provider telemedicine visits to be high. Patients preferred telemedicine for reasons such as convenience, illness, or wanting to avoid waiting rooms for risk of becoming infected with COVID-19 during the pandemic. However, there is a relative lack of data specifically pertaining to patient satisfaction with remote diabetes education and support across the lifespan.

In this study, real-world experience working with remote CDCESs to facilitate care for PWD on complex insulin regimens is reported, and differences in the duration and content of these tele-visits, and patient satisfaction are examined in older versus younger adults.

**Materials and Methods**

**Research design**
A cross-sectional design was used to assess the utilization, impact, and satisfaction related to remote diabetes education and support tele-visits.

**Participants**
One diabetes center in Syracuse, New York referred adults (ages ≥18 years) to a team of remote CDCESs to provide diabetes education, training, and support during the early months of the COVID-19 pandemic (from April 2020 to September 2020). Referrals were made for any English-speaking adult with type 1 diabetes (T1D) mellitus with an upcoming medical visit. Based on needs, providers could refer individuals with type 2 diabetes (T2D) mellitus, primarily using multiple daily insulin injections. Adults who were non-English speaking were provided services by the diabetes center using translation services that were previously in place. This study was reviewed by The Institutional Review Board for the Protection of Human Subjects at SUNY Upstate Medical University.

**Diabetes care, education, and support tele-visits**
A remote team of CDCESs provided diabetes education, training, and support. This service was free of charge to participants, with the cost being covered by COVID relief funds given by the Leona M. and Harry B. Helmsley Charitable Trust. These funds
permitted the provision of unrestricted comprehensive DSMES based on participants’ needs and level of desire. Medical care provided by physicians and advanced practice practitioners was billed as usual.

The following information was made available to the remote CDCESs: participants’ age, sex, type of diabetes, medications, diabetes devices, most recent glycosylated hemoglobin (HbA1c; all HbA1c values ≥14.0% were recorded as 14.0%), and contact information. Additional information was provided as needed, including any known potential barriers to education, the presence of diabetes complications, and urgency of the referral. This information was uploaded to a secure cloud content management and file sharing service.

The initial contact attempt was made by phone, and follow-up communications between the remote CDCESs and the participant were performed by either phone or video. If the CDCES determined a video tele-visit would be helpful for the participant, this would be offered. The team of remote CDCESs were detailed and used talk-back methods to help the individual use their software and devices as needed. Video visits were used for the majority of individuals who were started on CGM. The CDCESs were also able to instruct individuals using the phone while also referring the participant to additional starter guides and videos as indicated. Up to three attempts were made to reach each participant.

Participants were considered to have a tele-visit with a CDCES when any diabetes education or medical information was reviewed or discussed. When tele-visits were performed by video, the platform Zoom for Healthcare was used. The remote CDCES team’s call center platform was used to obtain the duration of each tele-visit (minutes).

Information collected by the CDCESs included the frequency of visits, topics discussed, device data, any dosing changes made within approved parameters, and/or urgent recommendations made by the remote team. This information was uploaded into the EMR daily, and it was forwarded to the participant’s provider for review. A CDCES at the diabetes center was always available to receive calls from the remote CDCESs for urgent issues.

After the first 1–2 months, titration of insulin doses by the remote CDCES was initiated within pre-defined parameters. If the remote CDCES had high priority recommendations or concerns after contacting a participant, such as dose change recommendations outside of the set parameters, this information was communicated to the diabetes center CDCES to address. A virtual huddle between the primary site and remote CDCES teams was initially conducted daily, as new workflows and procedures were initiated, and then 1–3 times per week for the subsequent 2–3 months.

**Participant satisfaction with remote CDCES tele-visits**

Surveys were completed between May 2020 and August 2020 after at least one visit with a remote diabetes educator. Participants were asked to complete the survey electronically by using Research Electronic Data Capture (REDCap). If there was no response within 1 week or if there was no e-mail address available, the survey was administered by phone. Each participant was called a maximum of two times.

A phone script was used when calling participants to standardize survey administration. Special attention was given to ensure that little feedback was given by research assistants over the phone. Survey questions used a 5-point Likert scale: strongly disagree (1) through strongly agree (5). Participants could also provide additional comments. Questions were developed with guidance from previously used telehealth surveys such as the Telemedicine Satisfaction Questionnaire and Telehealth Usability Questionnaire.

**Data analyses**

Differences between age (in years), number of people in each insurance category (commercial, Medicare, or Medicaid), sex (male or female), and type of diabetes (T1D vs. T2D) were analyzed by using the t-test. The mean number of tele-visits by sex and differences in survey item mean scores by age was assessed by t-test or one-way analysis of variance, as appropriate. Pearson correlation coefficients were calculated to assess the associations between the number of tele-visits, the duration of all tele-visits for each participant, and average call time duration and age.

To assess the relationship between Likert scaled items and age, Pearson correlation coefficients were used. Bivariate correlation coefficients were calculated for all educational topics (number of times addressed) by age, and partial correlations were also calculated to adjust for sex and diabetes type. Statistical analyses were performed by using SPSS version 27.

**Results**

**Participant characteristics**

A total of 1301 referrals were made for 1269 adults, 1089 with T1D and 165 with T2D. Excluded from
these analyses were those with pre-diabetes \( (n = 7) \), cystic fibrosis-related diabetes \( (n = 4) \), and obesity without diabetes \( (n = 4) \). Of the 1254 participants with T1D and T2D, 982 (78.3%) had at least one visit with a remote CDCES. The others (21.7%) were unable to be reached or declined education services.

Participant characteristics are shown in Table 1. The mean age was 48.4 years (standard deviation [SD] 17.3). Approximately half of the participants were females (50.8%), and commercial insurance was the primary coverage for 48.9% of the participants. The mean HbA1c was 8.4% (SD 1.9; range 4.2–14.0%). There were 64.5% using CGM, 46.6% using insulin pumps, and 18.4% had no access to a computer, tablet, or smartphone.

Tele-visit characteristics

A total of 2203 tele-visits were conducted with 982 participants. Participants attended a mean of 2.2 tele-visits (SD 1.8; range 1–16 tele-visits; Table 2), and 2.5% of participants had seven or more tele-visits (Fig. 1). The mean (SD) length of time of an individual tele-visit was 17.6 min (SD 1.9; range 4.2–14.0%). There were 64.5% using CGM, 46.6% using insulin pumps, and 18.4% had no access to a computer, tablet, or smartphone.

### Table 1. Participant Characteristics

| Total participants | Type of diabetes | Sex | Insurance | Ages (years) | Mean age (years), (SD) | Mean HbA1c % (SD) | CGM use | Pump use | No access to computer, tablet, smartphone |
|--------------------|------------------|-----|-----------|--------------|-----------------------|------------------|----------|----------|----------------------------------------|
| 982 (100)          | T1D 846 (86.2)   | Female 499 (50.8) | Commercial 480 (48.9) | 18–35 285 (29.0) | 48.4 (17.3) | 8.4 (1.9) | 633 (64.5) | 458 (46.6) | 181 (18.4) |
|                    | T2D 136 (13.8)   | 286 (29.1) | Medicare 286 (29.1) | 36–54 294 (29.9) |          |          |          |          |          |
|                    | Type 2 insulin treated 117 (86.0) | 187 (19.0) | Medicaid 187 (19.0) | 55+ 403 (41.0) |          |          |          |          |          |
|                    | Type 2 non-insulin treated 19 (14.0) | 21 (2.1) | Other Gov’t 21 (2.1) |          |          |          |          |          |          |
|                    |                  |                  | Uninsured 8 (0.8) |          |          |          |          |          |          |

- Fourteen percent includes >14%.
- CGM, continuous glucose monitor; HbA1c, glycosylated hemoglobin; SD, standard deviation; T1D, type 1 diabetes; T2D, type 2 diabetes.

### Table 2. Remote Diabetes Care and Education Visits by Participant Characteristics

| Variable (n) | Total number of tele-visits | Average length of tele-visits (in minutes) | Total time of tele-visits for each participant (in minutes) |
|--------------|----------------------------|------------------------------------------|----------------------------------------------------------|
| Totals       | 2203 (1–16)                | (1.02–158.3)                            | (1.02–644.4)                                             |
| Mean (SD)    | 2.2 (1.8)                  | 17.6 min (13.8)                         | 40.6 min (51.2)                                          |

| Variable (n) | Mean | Unadjusted, p-value | Mean | Unadjusted, p-value | Mean | Unadjusted, p-value |
|--------------|------|---------------------|------|---------------------|------|---------------------|
| Sex*         |      |                     |      |                     |      |                     |
| Female (499) | 2.3  | NS                  | 18.1 | NS                  | 44.3 | 0.02                |
| Male (483)   | 2.1  |                     | 17.7 |                     | 36.8 |                     |
| Type of diabetes* |   |                     |      |                     |      |                     |
| T1D (846)    | 2.1  | <0.001              | 17.4 | NS                  | 36.6 | <0.001              |
| T2D (136)    | 3.4  |                     | 19.2 |                     | 65.3 |                     |
| Insurance*   |      |                     |      |                     |      |                     |
| Commercial (501) | 2.0 | *                   | 16.4 | †                   | 32.4 | †                   |
| Medicare (286) | 2.8 | <0.001              | 21.1 | <0.001              | 58.4 | <0.001              |
| Medicaid (195) | 2.2 |                     | 15.7 |                     | 35.6 |                     |
| Age (years)* |      |                     |      |                     |      |                     |
| 18–35 (285)  | 1.8  | §                   | 14.8 | **                  | 26.2 | ††                  |
| 36–54 (294)  | 2.2  | <0.001              | 16.5 | <0.001              | 37.4 | <0.001              |
| 55+ (403)    | 2.6  |                      | 20.4 |                     | 53.1 |                     |

*Commercial versus Medicaid, \( p = 0.33 \).
*Commercial versus Medicaid, \( p = 0.83 \).
*Commercial versus Medicaid, \( p = 0.73 \).
*Eighteen to 35 years old versus 36–54 years old, \( p = 0.02 \); 36–54 years old versus 55+ years old \( p = 0.04 \).
**Eighteen to 35 years old versus 36–54 years old, \( p = 0.32 \).
††Eighteen to 35 years old versus 36–54 years old, \( p = 0.02 \).
*T-Test.
*Analysis of variance.
NS, not significant.

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Table 2), and 14.2% of participants had an average visit time greater than 30 min (Table 3). The average total visit time per participant was 40.6 min with a range of 1.0 to 644.4 min (SD 51.2 min). Females spent more total time (44.3 min) in remote tele-visits compared with males (36.8 min, \( p = 0.02 \); Table 2).

Adults with T2D comprised 13.8% of the participants. Those with T2D had a greater number of tele-visits compared with those with T1D (mean number of tele-visits: T2D = 3.4 vs. T1D = 2.1; \( p < 0.001 \)) and a longer total duration of tele-visits (T2D = 65.3 min vs. T1D = 36.6 min; \( p < 0.001 \)), respectively (Table 2). The discussions during the visits were categorized into topics shown in Table 4. A CDCES could discuss multiple topics with a participant within a single visit. The CGM education was discussed with 73.4% participants in a total of 1413 remote tele-visits. Preparation for provider telemedicine visits was the next most frequently discussed topic, with 58.7% of participants receiving instruction a total of 707 times.

Device download instructions were provided to 557 participants (Table 4). Other topics included prevention and treatment of hypoglycemia, sick day management, medication management, insulin injection techniques, and lifestyle support (for the full list see Table 5).

### Differences by age

The mean total number of tele-visits was greater among participants with Medicare (2.8) compared with Medicaid and commercial insurance (2.2, \( p = 0.001 \) and 2.0, \( p < 0.001 \), respectively; Table 2). Those aged \( \geq 55 \) years had a greater mean total number of tele-visits (2.6) compared with those aged 18–35 years (mean 1.8; \( p < 0.001 \)) and those aged 36–54 years (mean 2.2; \( p = 0.041 \)). The average duration of each visit in those aged \( \geq 55 \) years was 20.4 min compared with those 18–35 years old (14.8 min), and those aged 36–54 years old (16.5 min), \( p < 0.001 \).

Older age was correlated with a greater number of tele-visits \( (r=0.193; \ p<0.001) \), higher average time

### Table 3. Mean Duration of Diabetes Care and Education Remote Visits

| Average tele-visit time (in minutes) | Total number of tele-visits | Total number of participants, \( n \) (%) |
|--------------------------------------|-----------------------------|----------------------------------------|
| <1.0                                 | a                           | 272 (21.7)                             |
| 1.02–9.9                             | 631                         | 315 (32.1)                             |
| 10.0–19.9                            | 784                         | 343 (34.9)                             |
| 20.0–29.9                            | 451                         | 184 (18.7)                             |
| 30.0–39.9                            | 194                         | 78 (7.9)                               |
| 40.0–49.9                            | 95                          | 35 (3.6)                               |
| 50.0–59.9                            | 32                          | 13 (1.3)                               |
| 60.0–69.9                            | 7                           | 6 (0.6)                                |
| 70.0+                                | 9                           | 8 (0.8)                                |
| Total                                | 2203                        | 1254                                   |

*Could not be reached/did not receive education or support.*
Financial concerns: keeping appointments Unable to pay co-pay for appointment, felt telemedicine wasn’t covered

Financial concerns: medications Unable to afford medications

Appointment problems (re-schedule; cancellation)

Insulin injection techniques Smart pens, how to inject insulin, injection sites, insulin pen use

Sick day management Glucose monitoring, ketone monitoring

Psychosocial support Distress related to COVID-19, diabetes distress, diabetes burnout, general distress, food insecurity

Meter support Troubleshooting meter (time and date corrections)

Financial concerns: devices Issues with insurance coverage of diabetes devices and supplies

Medication management How medications work, medication adjustments, side effects, insulin storage, insulin titration

Management of glycemia Natural progression of diabetes (including insulin resistance), T1D management, general diabetes management

Lifestyle support Healthy eating, carbohydrate counting, gastroparesis, meal timing, physical activity

Hypoglycemia Awareness, prevention and treatment of low glucose, fear of hypoglycemia

Pump education Patient interest, benefits, features, warranty, settings and upgrade options, uploading, data review, troubleshooting including but not limited to issues related to automated insulin delivery systems

Provider telemedicine visit preparation Use of video telemedicine platforms, appointment confirmation (date, time, telemedicine, or in-person), prescription requests, BG log collection, setup of EHR patient portal

CGM education Provide telemedicine visit preparation

Device download instruction

Table 4. Frequency of Education Topics Discussed

| Topics                              | No. of participants, n (%) | Frequency of topic discussed |
|-------------------------------------|-----------------------------|-------------------------------|
| CGM education                       | 721 (73.4)                  | 1413                          |
| Provider telemedicine visit preparation | 576 (58.7)                  | 707                           |
| Device download instruction provided | 557 (56.7)                  | *                            |
| Pump education                      | 488 (49.7)                  | 841                           |
| Hypoglycemia                        | 357 (36.4)                  | 464                           |
| Lifestyle support                   | 321 (32.7)                  | 500                           |
| Management of glycemia              | 214 (21.8)                  | 309                           |
| Medication management               | 196 (20.0)                  | 346                           |
| Financial concerns: devices         | 143 (14.6)                  | 160                           |
| Meter support                       | 141 (14.4)                  | 188                           |
| Psychosocial support                | 109 (11.1)                  | 142                           |
| Sick day management                 | 87 (9.9)                    | 92                            |
| Insulin injection techniques        | 56 (5.7)                    | 67                            |
| Appointment problems (re-schedule; cancellation) | 45 (4.6) | 45 |
| Financial concerns: medications     | 48 (4.9)                    | 53                            |
| Financial concerns: keeping appoints | 11 (1.1)                    | 11                            |

*Only counted once for each participant receiving instruction; some may have received instructions multiple times.

for each remote visit ($r = 0.204; p < 0.001$), and greater total time spent in tele-visits ($r = 0.263; p < 0.001$). Participants of older age also had lower HbA1c values. The mean HbA1c for those aged 18–35 years was 8.8%, aged 36–54 years was 8.6%, and aged ≥55 years was 8.1% (≥55 vs. ≤54 years old, $p < 0.001$). Older adults compared with younger adults were less likely to have access to a computer, tablet, smartphone, or internet (Table 6). Older age also correlated with a greater need for education and support related to CGM use, medication management, hyperglycemia, hypoglycemia, lifestyle support, and psychosocial support (Table 6).

Satisfaction survey results

In total, 211 surveys were collected and 198 were included for data analysis (response rate 35.5%). The mean age of responders was 52.7 years (SD 17.1); 78.0% had T1D, 56.1% were female, and 44.9% had commercial insurance. Participants had a mean HbA1c of 8.0% (SD 1.6), 64.1% used CGM, and 49.5% used an insulin pump. Participants who completed the survey had a mean of 2.7 (SD 2.2) tele-visits; the average visit was 19.5 min (SD 13.5 min), and the total average time was 54.3 min (SD 71.9 min). Surveys were excluded if: (1) the participant did not recall having a CDCES visit, (2) the survey was not fully completed, (3) the survey was a duplicate, or (4) the participant had a diagnosis other than T1D or T2D.

Although the majority of participants stated they were satisfied with the remote education visit (93.4%), those who were younger had greater satisfaction ($r = 0.175; p = 0.014$). Younger participants felt that the remote education visits were convenient ($r = -0.167, p = 0.019$) and that the remote visits saved them time ($r = -0.244, p = 0.001$; Table 7). Those with Medicaid were more likely to agree or strongly agree with the statement “In the past, cost was a barrier to receiving
diabetes education” compared with those with private insurance ($p=0.005$). Importantly, 86.9% of participants agreed with the statement “my concerns were addressed” during the remote visit and 81.3% agreed that the remote visit satisfied their diabetes education needs.

**Discussion**

Early in the pandemic, over 5 months, 78.3% of referred patients completed remote CDCES visits and most had two or more visits based on participant need for education and support. Older adults had more remote CDCES visits, the tele-visits on average lasted longer, and the total time with a CDCES was longer than in younger adults. Overall, 85.7% of the individual remote visits lasted <30 min. Importantly, almost none of these CDCES tele-visits would have been billable to insurance since most insurers will only reimburse for education sessions that last for at least 30 min. However, most participants had multiple tele-visits, which in total lasted >30 min.

Deficits in cognitive function are common in aging, especially in the presence of diabetes, and include impaired sustained and selective attention and working memory.29–32 Clinically significant cognitive impairment was found in 48% of a sample of individuals with diabetes‡ >60 years old.30 More frequent, shorter sessions may be more productive and provide more

**Table 6. Topics Discussed with Remote Certified Diabetes Care and Education Specialists: Association with Older Age**

| Education topic                                      | Bivariate $r$ | Bivariate $p$ | Adjusted $r$ | Adjusted $p$ |
|-----------------------------------------------------|---------------|---------------|--------------|--------------|
| CGM education*                                      | 0.149         | <0.001        | 0.105        | 0.001        |
| How to take medications/medication management*      | 0.148         | <0.002        | 0.078        | 0.015        |
| Lack of computer/tablet/smart phone/internet access-connectivity* | 0.13          | <0.003        | 0.120        | <0.001       |
| Lifestyle support                                   | 0.115         | <0.004        | 0.051        | NS           |
| Management of glycemia (hyperglycemia)*             | 0.079         | 0.01          | 0.063        | 0.048        |
| Psychosocial support                                | 0.066         | 0.04          | 0.027        | NS           |
| Hypoglycemia*                                       | 0.055         | 0.08          | 0.064        | 0.044        |
| Financial concerns: devices                         | 0.048         | 0.13          | 0.036        | NS           |
| Appointment preparation*                            | 0.023         | NS            | 0.061        | 0.058        |
| Financial concerns: medications                     | 0.015         | NS            | 0.007        | NS           |
| Financial concerns: keeping providers’ appointments | −0.003        | NS            | 0.003        | NS           |
| Meter support                                       | −0.004        | NS            | −0.015       | NS           |
| Sick day management                                 | −0.012        | NS            | 0.017        | NS           |
| Insulin injection techniques                        | −0.022        | NS            | −0.040       | NS           |
| Appointment problems (re-schedule; cancellation)    | −0.037        | NS            | −0.029       | NS           |
| Pump education                                      | −0.079        | 0.01          | −0.003       | NS           |

*Partial/controlled correlation coefficients only displayed if significant at $p<0.06$.

*Adjusted for sex and diabetes type.

**Table 7. Correlation of Patient Satisfaction Survey Items with Age**

| Item                                                                 | Total % agreed | Total mean score | $r$ ($p$)  |
|---------------------------------------------------------------------|---------------|-----------------|------------|
| I would participate in remote education again                       | 84.3          | 4.07            | −0.263 (<0.001) |
| The remote visit satisfied my diabetes education needs              | 81.3          | 3.94            | −0.260 (<0.001) |
| Would recommend remote diabetes education to a friend or family member | 76.8          | 3.93            | −0.257 (<0.001) |
| Remote education visit saved me time                                | 89.4          | 4.18            | −0.244 (0.001) |
| I felt comfortable using telehealth                                  | 82.3          | 3.89            | −0.234 (0.001) |
| Used language I could understand                                    | 97.0          | 4.44            | −0.225 (0.001) |
| Lack of physical contact was not a problem                           | 84.3          | 4.05            | −0.218 (0.002) |
| In general, satisfied with the remote education visit               | 93.4          | 4.28            | −0.175 (0.014) |
| Remote education visit was convenient                               | 91.4          | 4.26            | −0.167 (0.019) |
| As satisfying as in-person visits                                    | 61.6          | 3.52            | −0.152 (0.033) |
| Could see clearly                                                    | 28.8          | 1.45            | −0.138 (0.052) |
| Could hear clearly                                                   | 92.9          | 4.37            | −0.136 (0.057) |
| My concerns were addressed                                          | 86.9          | 4.12            | −0.134 (NS)   |
| Helped me better prepare for the provider visit                     | 73.7          | 3.67            | −0.102 (NS)   |
| I was satisfied with my in-person education before this visit        | 77.3          | 3.58            | −0.088 (NS)   |
| In the past, cost was a barrier to receiving education              | 19.7          | 2.20            | −0.009 (NS)   |
| Helped me better manage my diabetes                                 | 63.1          | 3.60            | −0.002 (NS)   |
opportunities for reinforcement than longer sessions in older adults since attention tends to fade and information overload is more common with longer remote education visits.

Frequent but shorter tele-visits are easier to schedule and attend than frequent in-person visits, given transportation, staffing, and other operational and social considerations. This experience suggests that Medicare and other insurers should re-evaluate their policies that preclude reimbursement for individual DSMES visits with a duration of <30 min. We believe that shorter, more focused remote discussions can improve comprehension and self-management, but this was not tested. Studies evaluating the efficacy of shorter and longer DSMES visits are needed in older adults, but they are difficult to perform in real-world settings.

Remote CDCES visits have been used successfully to initiate and train adults in the use of CGM. The CGM has been shown to reduce hypoglycemia in older adults with both T1D and insulin-treated T2D and increases the sense of safety for the PWD. Since initiating and sustaining CGM use in people with T1D is a priority, it was requested that the remote CDCESs discuss CGM with all individuals with T1D not using CGM. It is, therefore, not surprising that CGM use was a frequent topic. We have previously shown that older adults with T1D have more barriers to starting CGM, many of which can be addressed with more education and support.

We were not able to assess whether individuals started and sustained CGM use as a result of a CDCES remote visit since providers were also recommending CGM and, simultaneously, there were other policy changes that made CGM more available and affordable for many older adults. However, anecdotally, participants told providers that their sessions with the CDCESs were helpful in better understanding and using CGM.

The needs of PWD vary over time due to changes in life circumstances, the development of complications, and the availability of new technologies and medications that require education and training for proper use and optimal benefit. The Consensus report of the American Diabetes Association, the Association of Diabetes Care and Education Specialists, the Academy of Nutrition and Dietetics, the American Academy of Family Physicians, the American Academy of Physician Assistants, the American Association of Nurse Practitioners, and the American Pharmacists Association recommend DSMES services at initial diagnosis, annually, when new complicating factors affect self-management and during transitions.

Medicare covers 10 h of DSMES in the 1st year that beneficiaries receive this service and 2 h/year for each year thereafter. Although individuals usually require more education initially, there are times in subsequent years, such as when new diabetes technologies are prescribed or when complications develop, that ≥2 h of education per/year are needed. This is especially true for older adults who are experiencing cognitive decline, when more education is needed for both the PWD and their caregivers to ensure safety.

In the short time that many older adults interacted with the remote CDCESs, it was found that they needed more instruction related to technology when compared with those in younger age groups. Data are not available spanning a full year, but it is likely that 2 h of education time is insufficient for many older adults, especially if starting CGM or a new insulin delivery system.

All staff have the necessary technology to complete remote DSMES visits (computer with secure remote video capability). Although some PWD only have telephone access, increasingly they are obtaining access to a smartphone, tablet, or computer technology. Since our results suggest that PWD benefit from remote telephone and/or video DSMES visits as well as in-person visits, both should be equally reimbursed.

Adults with T2D had more DSMES tele-visits and longer total time was spent with the CDCESs. This is likely due to the fact that individuals with T2D were referred by their medical providers, because they identified specific education needs. In contrast, all adults with T1D and upcoming provider visits were referred without consultation with their providers. It is hypothesized that, if a selection process was used for referral of those with T1D, the total duration of tele-visits would also be longer.

Lower participant satisfaction with remote diabetes education in older adults was observed. Reasons for this may include less knowledge and comfort with using devices than those who are younger. It is possible that, over time and with more experience and use of technology, this will change. Other contributing factors were lesser availability of computers and video equipment in the home, concern for privacy, and visual and/or hearing impairments.

This report has several limitations. Remote CDCESs were only available for a limited period of time (5 months). These data are from a single center, glycemia data and quality of life data were not collected, and potential long-term benefits could not be measured.
A “control” (in-person) group was not possible since the use of the remote CDCESs was triggered by the start of the COVID-19 pandemic and the inability to conduct routine in-person visits.

These data are mostly from adults with T1D or T2D on complex insulin regimens, so these results cannot be generalized to others with T2D. The remote DSMES was provided without charge so that all adults could participate without incurring a cost, acknowledging that some would not have participated if there had been a charge. The relatively small number of participants who completed the satisfaction survey was also a limitation. There are also strengths of this article. Importantly, it is the first real-world study, to our knowledge, involving a large number of PWD (n = 1254), to present data related to the length of time needed for remote CDCES visits, and included PWD over the adult lifespan.

Conclusions
Older adults with T1D or T2D on complex insulin regimens needed a greater number and duration of remote visits. This population may do better with more frequent, shorter tele-visits. Since the majority of the remote visits lasted <30 min, these services would not have been reimbursed under current insurance policies. Changes in reimbursement for needed remote education and support services should be considered. Reimbursement should be based on cumulative time rather than by time spent in an individual visit.

The level of satisfaction was high with diabetes education tele-visits, supporting this method of intervention. However, although there are many benefits associated with the use of remote visits, there are disparities in the ability to access these services. Further studies are needed to examine the adaptations and approaches that could improve the use of telehealth for older adults.

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Authorship Contribution Statement
M.G. was responsible for data curation, investigation, validation, visualization, writing, review, and editing. D.S. and D.S.B. were responsible for investigation and writing. K.K. was responsible for investigation, project administration, supervision, writing, review, and editing. B.M. was responsible for investigation, project administration, supervision, and writing. C.B.F.-S. and P.S. were responsible for investigation. B.W. was responsible for supervision and project administration. T.M. was responsible for supervision, project administration, and writing. C.P.M. was responsible for formal analysis. R.S.W. was responsible for conceptualization, methodology, funding acquisition, writing, review, and editing.

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References
1. American Diabetes Association. Facilitating behavior change and wellbeing to improve health outcomes: standards of medical care—2021. Diabetes Care 2021;44(Suppl 1):S53–S72.
2. Cochran J, Conn VS. Meta-analysis of quality of life outcomes following diabetes self-management training. Diabetes Educ 2008;34:815–823.
3. Robbins JM, Thatcher GE, Webb DA, et al. Nutritionist visits, diabetes classes, and hospitalization rates and charges: the urban diabetes study. Diabetes Care 2008;31:655–660.
4. Cooke D, Bond R, Lavton J, et al. Structured type 1 diabetes education delivered within routine care: impact on glycemic control and diabetes-specific quality of life. Diabetes Care 2013;36:270–272.
5. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: a systematic review of the effect on glycemic control. Patient Educ Couns 2016;99:926–943.
6. Strawbridge LW, Lloyd JT, Meadow A, et al. One-year outcomes of diabetes self-management training among Medicare beneficiaries newly diagnosed with diabetes. Med Care 2017;55:391–397.
7. Piatt GA, Anderson RM, Brooks MM, et al. 3-Year follow-up of clinical and behavioral improvements following a multifaceted diabetes care intervention: results of a randomized controlled trial. Diabetes Educ 2010;36:301–309.
8. Marinicic PZ, Salazar MV, Hardin A, et al. Diabetes self-management education and medical nutrition therapy: a multisite study documenting the efficacy of registered dietitian nutritionist interventions in the management of glycemic control and diabetic dyslipidemia through retrospective chart review. J Acad Nutr Diet 2019;119:449–463.
9. Johnson TM, Murray MR, Huang Y. Associations between self-management education and comprehensive diabetes clinical care. Diabetes Spectr 2010;23:41–46.
10. He X, Li J, Wang B, et al. Diabetes self-management education reduces risk of all-cause mortality in type 2 diabetes patients: a systematic review and meta-analysis. Endocrine 2017;55:712–731.
11. van Elkendorst L, Taxis K, van Dijk L, et al. Pharmacist-led self-management interventions to improve diabetes outcomes. A systematic literature review and meta-analysis. Front Pharmacol 2017;8:891.
12. Tshiananga JKT, Kocher S, Weber C, et al. The effect of nurse-led diabetes self-management education on glycosylated hemoglobin and cardiovascular risk factors: a meta-analysis. Diabetes Educ 2012;38:108–123.
13. Li R, Shrestha SS, Lipman R, et al. Diabetes self-management education and training among privately insured persons with newly diagnosed diabetes—United States, 2011–2012. MMWR Morb Mortal Wkly Rep 2014;63:1045–1049.
14. Strawbridge LM, Lloyd JT, Meadow A, et al. Use of medicare’s diabetes self-management training benefit. Health Educ Behav 2015;42:530–538.

15. Kaminski Leduc JL. Insurance coverage of diabetes-related goods and services in New York and Connecticut. 2012. Available at https://www.cga .ct.gov/2012/rpt/2012-R-0284.htm/ Accessed November 22, 2021.

16. Peyrot M, Rubin RR, Funnell MM, et al. Access to diabetes self-management education: results of national surveys of patients, educators, and physicians. Diabetes Educ 2009;35:246–248, 252–256, 258–263.

17. Siminerio L, Ruppert K, Huber K, et al. Telemedicine for reach, education, access, and treatment (TREAT): linking telemedicine with diabetes self-management education to improve care in rural communities. Diabetes Educator 2014;40:797–805.

18. Jain SR, Sai Y, Ng CH, et al. Patients’ and healthcare professionals’ perspectives towards technology assisted diabetes self-management education. A qualitative systematic review. PLoS One 2020;15: e0237647.

19. Scott Kruse C, Karem P, Shifflett K, et al. Evaluating barriers to adopting telemedicine worldwide: a systematic review. J Telemed Telecare 2018; 24:4–12.

20. Ramaswamy A, Yu M, Drangsholt S, et al. Patient satisfaction with telemedicine during the COVID-19 pandemic: retrospective cohort study. J Med Internet Res 2020;22:e20786.

21. Tenforde AS, Borgstrom H, Polich G, et al. Outpatient physical, occupational, and speech therapy synchronous telemedicine: a survey study of patient satisfaction with virtual visits during the COVID-19 pandemic. Am J Phys Med Rehabil 2020;99:977–981.

22. Mustafa SS, Yang L, Mortezavi M, et al. Patient satisfaction with telemedicine encounters in an allergy and immunology practice during the coronavirus disease 2019 pandemic. Ann Allergy Asthma Immunol 2020;125:478–479.

23. Kanc K, Komel J, Kos M, et al. H(ome)bA1c testing and telemedicine: high satisfaction of people with diabetes for diabetes management during COVID-19 lockdown. Diabetes Res Clin Pract 2020;166:108285.

24. Byrne E, Watkinson S. Patient and clinician satisfaction with video consultations during the COVID-19 pandemic: an opportunity for a new way of working. J Orthod 2021;48:64–73.

25. Al-Sofiani ME, Alyusuf EY, Alharthi S, et al. Rapid implementation of a diabetes telemedicine clinic during the coronavirus disease 2019 outbreak: our protocol, experience, and satisfaction reports in Saudi Arabia. J Diabetes Sci Technol 2021;15:329–338.

26. Holtz BE. Patients perceptions of telemedicine visits before and after the coronavirus disease 2019 pandemic. Telemed J E Health 2021;27: 107–112.

27. Yip MP, Chang AM, Chan J, et al. Development of the Telemedicine Satisfaction Questionnaire to evaluate patient satisfaction with telemedicine: a preliminary study. J Telemed Telecare 2003;9:46–50.

28. Parmanto B, Lewis AN Jr, Graham KM, et al. Development of the telehealth usability questionnaire (TUQ). Int J Telehabil 2016;8: 3–10.

29. Zanotto TP, Gazzaley A. Aging of the frontal lobe. Handb Clin Neurol 2019;163:369–389.

30. Chaytor NS, Barbosa-Leiker C, Ryan CM, et al. Clinically significant cognitive impairment in older adults with type 1 diabetes. J Diabetes Complications 2019;33:91–97.

31. Jacobson AM, Ryan CM, Braffett BH, et al; DCC/EDIC Research Group. Cognitive performance declines in older adults with type 1 diabetes: results from 32 years of follow-up in the DCC and EDIC Study. Lancet Diabetes Endocrinol 2021;9:436–445.

32. Callisaya ML, Beare R, Moran C, et al. Type 2 diabetes mellitus, brain atrophy and cognitive decline in older people: a longitudinal study. Diabetologia 2019;62:448–458.

33. Gal RL, Cohen NJ, Kruger D, et al. Diabetes telehealth solutions: improving self-management through remote initiation of continuous glucose monitoring. J Endocrine Soc 2020;4:bvaa076.

34. Pratley R, Kanapka LG, Rickels MR, et al. Effect of continuous glucose monitoring on hypoglycemia in older adults with type 1 diabetes: a randomized clinical trial. JAMA 2020;323:2397–2406.

35. Litchman ML, Allen NA. Real-time continuous glucose monitoring facilitates feelings of safety in older adults with type 1 diabetes: a qualitative study. J Diabetes Sci Technol 2017;11:988–995.

36. Polonsky WH, Peters AL, Hessler D. The impact of real-time continuous glucose monitoring in patients 65 years and older. J Diabetes Sci Technol 2018;12:892–897.

37. Ruedy KJ, Parkin CG, Riddlesworth TD, et al. Continuous glucose monitoring in older adults with type 1 and type 2 diabetes using multiple daily injections of insulin: results from the DIAMOND trial. J Diabetes Sci Technol 2017;11:1138–1146.

38. Divan V, Greenfield M, Morley CP, et al. Perceived burdens and benefits associated with continuous glucose monitor use in type 1 diabetes across the lifespan. J Diabetes Sci Technol. December 2022;16:88–96.

39. Powers MA, Bardsley JK, Cypress M, et al. Diabetes self-management education and support in adults with type 2 diabetes: a consensus report of the American Diabetes Association, the Association of Diabetes Care & Education Specialists, the Academy of Nutrition and Dietetics, the American Academy of Family Physicians, the American Academy of PAs, the American Association of Nurse Practitioners, and the American Pharmacists Association. Diabetes Educator 2020;46:350–369.

40. Diabetes Self-Management Education and Support (DSMES) Toolkit. Available at https://www.cdc.gov/diabetes/dsmses-toolkit/ reimbursement/medicare.html/ Accessed November 22, 2021.

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Abbreviations Used

CDCES = Certified Diabetes Care and Education Specialist
CGR = continuous glucose monitor
DSMES = Diabetes self-management education and support
HbA1c = glycosylated hemoglobin
PWD = people with diabetes
SD = standard deviation
T1D = type 1 diabetes
T2D = type 2 diabetes

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