Telemedicine for the Care of Youth with Type 1 Diabetes

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Disclosures

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• Eli Lilly, Novo Nordisk, MannKind
Objectives

• Define the types of telemedicine and the roles for clinical care

• Discuss the experience with telemedicine implementation for pediatrics diabetes care at the Barbara Davis Center
• Telemedicine
  – Significance
  – Defining telemedicine
  – Role of telemedicine in diabetes care
  – Use of telemedicine for care of pediatric type 1 diabetes (T1D)
  – Summary
Why Focus on Telemedicine?

- The next major shift in the field is telemedicine.
- HCPs are embracing telemedicine
  - 90% report that their organizations have already begun developing or implementing telemedicine programs.
  - 64% offer remote monitoring
  - 54% store and forward technology
  - 52% real time interaction
  - 39% services that qualify as mHealth (patient driven apps and online portals)
- Global Use
  - The World Health Organization sees growing initiatives
  - Mongolia and Norway currently have a National telemedicine policy
  - Use for specific topics (28+ countries use for cardiology)

How Telemedicine Is Transforming Health Care

The revolution is finally here—raising a host of questions for regulators, providers, insurers and patients

• Over 1 million “virtual doctor visits” in US in 2015 with 1.2 million projected in 2016
• 72% of US hospitals with telemedicine programs
• Growing number of employers offering telemed benefits (48% in 2015 to 74% in 2016)

M. Beck, June 2016
Barriers to Implementation

- Adequate reimbursement
- Convincing healthcare professionals (HCPs) about credibility of telemedicine
- Licensure in state, across state and international
- Consent
- Privacy and security
Variations in State Telemedicine Laws

States with Parity Laws for Private Insurance Coverage of Telemedicine (2017)


States with proposed/pending legislation: In 2017, Idaho, Iowa, Kansas, Massachusetts, New Jersey, North Carolina, Ohio, and West Virginia

Coverage applies to certain health services.

Telehealth Definition

• The delivery of health-related services and information via electronic/telecommunications technologies to improve patient’s health status.
  – Electronic Health Record
  – Telemedicine (direct patient care, specialty clinic visit)
  – Consulting (providers or families)
  – Education (CME, conference)

American Telemedicine Association
www.americantelemed.org
Definitions

• Telehealth vs. Telemedicine vs. Virtual Health

  – Telemedicine includes use of information technologies to provide clinical health care at a distance

  – "Virtual health" – various definitions

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Telemedicine categories

- Store and forward
- Remote monitoring
- Real-time interactive services
Store and Forward

- Capturing an image and storing it to then be forwarded for review by a medical specialists
- Teleradiology (PACs images), telecardiology (ECHOs), telepathology and teledermatology
Remote Patient Monitoring

Monitoring critical care unit
Remote Monitoring of CGM or AP Systems
Real time (live) Interactive services

School based health clinic

Direct patient care – MFM monitoring
Education / Training / Administrative

Conferences
Care Coordination
Case Review
Consultation

Extension for Community Health Outcomes
- Created at UNM
- Adopted at CU
Telehealth in Medicine

• Videoconferencing
  – Education
  – Case review
  – Direct patient care
Telemedicine for Diabetes Care

• Diabetes care is different from other fields of medicine
  – Providers provide recommendations for the home management plan
  – Family and patient must implement the care plan in daily life
  – Insulin dose adjustment based on history from the patient/ family and data from glucose meters, insulin pumps and CGM
Telemedicine for Diabetes Care

Previous data

- Use of videoconferencing for adults with diabetes and for youth in the school setting indicate high patient satisfaction.
- Use of videoconferencing for pediatric T1D patients in rural areas may allow for more efficient outpatient visits for patients traveling several hours for in person visits.

Barriers To Care in Rural Wyoming & Colorado

- Travel time
- Cost of travel
- Geographic/ weather barriers
Telemedicine for youth with T1D

Distance from Denver:
- Cheyenne: 114 miles
- Casper: 289 miles
- Jackson: 540 miles
- Durango: 343 miles
- Rifle: 197 miles
- Grand Junction: 257 miles

- Must drive over mountain passes from Jackson, Durango, Grand Junction, Rifle to Denver
Goals of Telemedicine for T1D Care

• *Improve access to care*
• *Support for local providers*
• Reduce travel expenses for families and for providers
• Increase provider productivity
• Reduce travel “burnout”
Telemedicine for youth with T1D

• BDC started telemedicine May 2012
• Current sites:
  – WY: Casper, Cheyenne, Jackson Hole
  – CO: Durango, Rifle, Grand Junction
• All pediatric T1D patients eligible for study*
• Study participants complete a questionnaire regarding:
  – Their experience with telemedicine
  – Their child’s diabetes control over the previous year
Telemedicine for Pediatric T1D at BDC

- Number of patients seen with telemedicine has grown since inception
- Response from families and partner sites has been positive
- Data shown do not include clinical research (visits from studies in 2014-present)

- 136 visits completed in 2017 (over 270 visits projected for 2017)
How it Works

- Patient and family arrive at their local diabetes center (Cheyenne, Casper, etc.)
- Patients upload data from meter, pump, CGM from office or home
- Provider receives reports at office via fax or secure email
How it Works

• Height, weight, BP, HbA1C, and blood glucose are obtained by a local nurse or medical assistant

• Patient and family are taken to a room with videoconferencing equipment
How it Works

• Diabetes provider in the telemedicine room at the BDC with a camera attached to the computer
• BDC provider conducts a routine visit, adjusts insulin doses, and identifies topics to review with local certified diabetes educator (CDE)
How it Works

- Patient and family may meet with a local CDE to discuss injection technique, pump/CGM technology, sick day management, hypoglycemia, etc.
- The family receives an after visit summary (AVS) with provider recommendations
- Prescriptions are e-prescribed if needed
- Routine labs are drawn at a local lab if needed
AIM: To determine if (telehealth visits) for pediatric T1D patients in Wyoming are comparable to previous in-person visits with regard to A1c, change in A1c over 1 year and number of clinical visits.

Conclusions: Our study suggests telemedicine is equivalent to in-person visits to maintain A1c, whereas families increase the number of visits in line with ADA recommendations. Patients and families miss less school and work. Decreased financial burden and increased access may improve overall diabetes care and compliance for rural patients. Further study is needed to detect long-term differences in complications screenings and the financial impact of telemedicine on pediatric diabetes care.
### Patient Demographics

**Table 1. Baseline Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>All telemedicine subjects</th>
<th>Telemedicine subjects seen for at least 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of T1D youth enrolled</td>
<td>70</td>
<td>54</td>
</tr>
<tr>
<td>Age (years) (mean±SD)</td>
<td>12.1±4.1</td>
<td>12.7±3.7</td>
</tr>
<tr>
<td>Gender male [n (%)]</td>
<td>49 (70%)</td>
<td>43 (80%)</td>
</tr>
<tr>
<td>Baseline A1C (mean±SD)</td>
<td>9.4±1.7</td>
<td>9.5±1.7</td>
</tr>
<tr>
<td>Diabetes duration (years) (mean±SD)</td>
<td>5.4±4.1</td>
<td>5.9±4.2</td>
</tr>
<tr>
<td>BMI (kg/m²) (mean±SD)</td>
<td>20.8±6.1</td>
<td>21.0±6.3</td>
</tr>
<tr>
<td>BMI percentile (mean±SD)</td>
<td>65.5±27.4</td>
<td>63.5±26.7</td>
</tr>
<tr>
<td>Telemedicine location [n]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheyenne [n (%)]</td>
<td>42 (60%)</td>
<td>32 (59.26%)</td>
</tr>
<tr>
<td>Casper [n (%)]</td>
<td>28 (40%)</td>
<td>22 (40.74%)</td>
</tr>
<tr>
<td>Average distance (miles) (mean±SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDC</td>
<td>205.1±109.1</td>
<td>218.5±117.5</td>
</tr>
<tr>
<td>Telemedicine site</td>
<td>47.1±66.9</td>
<td>59.9±64.8</td>
</tr>
<tr>
<td>Ethnicity [n]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White [n (%)]</td>
<td>61 (87%)</td>
<td>48 (89%)</td>
</tr>
<tr>
<td>Other [n (%)]</td>
<td>9 (13%)</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Insurance [n]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private [n (%)]</td>
<td>44 (63%)</td>
<td>40 (74%)</td>
</tr>
<tr>
<td>Medicaid [n (%)]</td>
<td>13 (19%)</td>
<td>10 (19%)</td>
</tr>
<tr>
<td>Self-pay [n (%)]</td>
<td>13 (19%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>Insulin pump use [n (%)]</td>
<td>37 (52.8%)</td>
<td>29 (53.7%)</td>
</tr>
<tr>
<td>Average number of times a patient was seen in the year prior to telemedicine</td>
<td>2.1±1.3</td>
<td>2.2±1.3</td>
</tr>
</tbody>
</table>

A1C, hemoglobin A1C; BDC, Barbara Davis Center; BMI, body mass index; T1D, type 1 diabetes.

- Data from Casper, Cheyenne sites

### Visit Frequency

<table>
<thead>
<tr>
<th></th>
<th>Pre-Telemedicine</th>
<th>Post-Telemedicine</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#Visits/Year</td>
<td>2.0 ± 1.3</td>
<td>2.9 ± 1.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Seen 0 Times in Year</td>
<td>7/33 (21%)</td>
<td>0/33 (0%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Seen 1-3 Times in Year</td>
<td>19/33 (58%)</td>
<td>22/33 (67%)</td>
<td></td>
</tr>
<tr>
<td>Seen ≥4 Times in Year</td>
<td>7/33 (21%)</td>
<td>11/33 (33%)</td>
<td></td>
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- Telemedicine increased the total number of patient visits per year
- More patients were seen 4 or more times per year after starting telemedicine (per ADA guidelines)

Decreased time off work/ school

HbA1c at baseline and 1-yr

- Median A1c 9.0%
- Of 70 with baseline A1c, 6 with A1c < 7.5% (5 within 1 yr of dx)
- HbA1c not significantly different at 1-year
- Includes 1 patient with A1c 6.7% at baseline (in honeymoon) with A1c 12.1% at 1 year

2-Year Follow Up Data

- 34 subjects at 2 sites with 2 years of telemedicine use

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<table>
<thead>
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<tbody>
<tr>
<td>N</td>
<td>34</td>
</tr>
<tr>
<td>Age, years</td>
<td>11.0 ± 3.9</td>
</tr>
<tr>
<td>Gender (n(%) male)</td>
<td>24 (71%)</td>
</tr>
<tr>
<td>T1D Duration, years</td>
<td>4.3 ± 3.6</td>
</tr>
<tr>
<td>Baseline A1c, %</td>
<td>9.2 ± 1.7</td>
</tr>
<tr>
<td>One Year A1c, %</td>
<td>9.2 ± 1.5</td>
</tr>
<tr>
<td>Two Year A1c, %</td>
<td>9.3 ± 1.6</td>
</tr>
<tr>
<td>Follow up duration (years)</td>
<td>2.2 ± 0.4</td>
</tr>
<tr>
<td>Telemedicine Location</td>
<td></td>
</tr>
<tr>
<td>Casper [n (%)]</td>
<td>16 (47%)</td>
</tr>
<tr>
<td>Cheyenne [n (%)]</td>
<td>18 (53%)</td>
</tr>
<tr>
<td>Pump Use [n (%)]</td>
<td>12 (35%)</td>
</tr>
<tr>
<td>Visits per year</td>
<td>2.8 ± 1.1</td>
</tr>
</tbody>
</table>

Wadwa et al, ISPAD 2016
2-Year Follow Up Data

- Glycemic control varied greatly in cohort
  (A1c range 7.1-13.7% at 2-yr follow up)
- 94% of patients not achieving A1c targets
  (< 7.5% per ADA & ISPAD guidelines)
- 50% of patients had no increase in A1c at follow up
- A1c change over 2-years:
  - Not significantly associated with age or T1D duration
  - Inversely correlated with insulin pump use (r=-0.36, p=0.04) and A1c at first telemedicine visit (r = - 0.57, p<0.001)

Wadwa et al, ISPAD 2016
Summary

• Access to care for rural pediatric T1D patients is increased with telemedicine.

• Patient/ family satisfaction is high for telemedicine experience and most return for future visits.

• Glycemic control equivalent to previous care.

• Further study is needed to determine:
  – modifiable factors associated with glycemic control and
  – if telemedicine utilization can help to reduce the risk of T1D complications for rural patients/ families.
Future Plans

• Improve outcomes
• Expand BDC telemedicine program
  – New sites to reach patients who need it most
  – Exploring other uses (education, provider consultation, acute care (DKA), etc.) – Example: 670G HCL Training
  – Sustainability
• Home use – Patient contacts team from home
  – College students – dorms/ campus
  – Study for high risk patients (Driscoll, PI)
“Take Away Messages”

• Telehealth and telemedicine are broad terms and include multiple methods of using technology to deliver care

• Use of technology for telemedicine is growing rapidly in the United States

• Access to care for rural pediatric T1D patients is increased with telemedicine
Acknowledgements

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Questions?

www.barbaradaviscenter.org