Management of type 1 diabetes mellitus in adolescents

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Definition

• Type 1 diabetes mellitus, one of the most common chronic diseases in childhood, is caused by insulin deficiency resulting from the destruction of insulin-producing pancreatic beta cells.
challenges

Type 1 diabetes mellitus in adolescents presents two challenges:

- diagnostic
- management
Diagnostic challenge

• The prevalence of type 2 diabetes is significantly increased in the pediatric population, which is affected by obesity worldwide.

• In the last two decades, type 2 diabetes, once thought to be a metabolic disorder exclusively of adulthood, has become increasingly more frequent in obese adolescents.

In the SEARCH study, the incidence rate (per 100,000 person-year) of type 2 diabetes among children and adolescents varies greatly by ethnicity, with the highest rates observed among youths aged 15–19 years in minority populations. In particular, the reported incidence rate was

- 49.4 for Native Americans
- 22.7 for Asian/Pacific Islanders
- 19.4 for African Americans
- 17 for Hispanics
- 5.6 for non-Hispanic whites

- **Type 2 Diabetes**
  - 0.5% of adolescents have diabetes
  - 71% type 1 and 29% type 2
    - Determined by insulin use vs no insulin use
  - 39,005 US teens with T2D

- **Impaired Fasting Glucose**
  - 11% had IFG
  - 2,769,736 teens with IFG

Duncan, Arch Pediatr Adolesc Med 2006;160:523
Prevalence of Type 2 Diabetes Mellitus among Kuwaiti Children and Adolescents

Table 1. Age- and sex-specific prevalence rates (per 100,000) of type 2 diabetes in Kuwaiti children and adolescents aged 6–18 years

<table>
<thead>
<tr>
<th>Age group, years</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>prevalence rate</td>
<td>n</td>
</tr>
<tr>
<td>6–9 (primary)</td>
<td>2</td>
<td>17.3 (0–41.4)</td>
<td>3</td>
</tr>
<tr>
<td>10–13 (intermediate)</td>
<td>9</td>
<td>45.3 (15.7–74.8)</td>
<td>5</td>
</tr>
<tr>
<td>14–18 (secondary)</td>
<td>14</td>
<td>65.2 (31.0–99.3)</td>
<td>12</td>
</tr>
<tr>
<td>6–18 (all)</td>
<td>25</td>
<td>47.3 (28.7–65.8)</td>
<td>20</td>
</tr>
</tbody>
</table>

n = Identified number of children with type 2 diabetes. Figures in parentheses indicate 95% CIs.
## Presenting Symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>% Type 1 (n=48)</th>
<th>% Type 2 (n=40)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Pain</td>
<td>46</td>
<td>33</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Dizziness</td>
<td>15</td>
<td>33</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Headache</td>
<td>33</td>
<td>43</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Nocturia</td>
<td>71</td>
<td>65</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Polydipsia</td>
<td>96</td>
<td>85</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Polyphagia</td>
<td>69</td>
<td>60</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Polyuria</td>
<td>94</td>
<td>88</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Visual Problem</td>
<td>17</td>
<td>20</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>Weight loss</td>
<td>71</td>
<td>40</td>
<td>.005</td>
</tr>
</tbody>
</table>
## Type 1 Versus type 2 Diabetes in youth?

<table>
<thead>
<tr>
<th></th>
<th>T1DM</th>
<th>T2DM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>20% may be overweight / obese</td>
<td>Virtually all BMI &gt; 85th percentile</td>
</tr>
<tr>
<td><strong>Course</strong></td>
<td>Rapid</td>
<td>Indolent</td>
</tr>
<tr>
<td></td>
<td>From DPT-1 can be indolent</td>
<td>Virtually none found on screening</td>
</tr>
<tr>
<td><strong>DKA</strong></td>
<td>35%-40%</td>
<td>Ketonuria (33%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mild DKA (5%-25%)</td>
</tr>
<tr>
<td><strong>Relative with DM</strong></td>
<td>5% with T1DM</td>
<td>74%-100% - 1st –2nd degree with T2DM</td>
</tr>
<tr>
<td></td>
<td>Up to 30% may have with T2DM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FH of T2 2-3Xs in person with T1</td>
<td></td>
</tr>
<tr>
<td><strong>Comorbid</strong></td>
<td>Thyroid, adrenal, vitiligo, celiac</td>
<td>Increase in polycystic ovary syndrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acanthosis nigricans</td>
</tr>
<tr>
<td><strong>C-peptide</strong></td>
<td>C-peptide can be preserved at DX</td>
<td>Normal or increased</td>
</tr>
<tr>
<td><strong>Antibody</strong></td>
<td>85%</td>
<td>15% (reported as high as 30%)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>Whites predominate</td>
<td>NA, AA, HA, Asian, Pacific Islander</td>
</tr>
</tbody>
</table>

*Kaufman, Endocrinol Meta Clinics N Am, 34;659-676: 2005*
Differentiation Between Type 1 and 2

- 48 with type 2 vs 39 with type 1
- Type 2
  - Ethnicity, 1st degree relative, BMI>24, +C-peptide, acanthosis

<table>
<thead>
<tr>
<th></th>
<th>Type 2</th>
<th>Type 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKA</td>
<td>33%</td>
<td>53%</td>
</tr>
<tr>
<td>C-peptide</td>
<td>2.2±2.2 ug/l</td>
<td>1.8±3.5 ug/l</td>
</tr>
<tr>
<td>Abs</td>
<td>8.1% ICA</td>
<td>85% have islet autoimmunity</td>
</tr>
<tr>
<td></td>
<td>30% GAD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35% IAA</td>
<td></td>
</tr>
</tbody>
</table>
Diagnosis

• The challenge is to distinguish type 1 from type 2 diabetes.
• A thin adolescent in diabetic ketoacidosis is easily recognized as having type 1 diabetes.
• However, since obesity does not negate the presence of type 1 diabetes, it is appropriate to measure:
  • diabetes-related antibody
  • C-peptide
  • insulin levels in individuals who are thought to have type 2 diabetes to ensure that they do not have type 1 or a mixed type of diabetes.
Epidemiology of T1DM

- Type 1 diabetes (T1D) is the second most common chronic illness in adolescents, trailing only asthma

- 78,000 children (<15 years) develop Type 1 DM annually worldwide

- The incidence is increasing worldwide by approximately 3% per year
The Diabetes Mondiale Study
Diamond

Europe and Diabetes Study EUROMOBS

SEARCH for Diabetes in Youth (USA)

## Incidence of Type 1 Diabetes In Arab Countries As Per Diamond Study Classification

<table>
<thead>
<tr>
<th>Incidence*</th>
<th>Arab Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low (&lt;1)</td>
<td>---------------</td>
</tr>
<tr>
<td>Low (1-4.99)</td>
<td><strong>Oman</strong>, <strong>Jordan</strong>, <strong>Palestine</strong></td>
</tr>
<tr>
<td>Intermediate (5-9.99)</td>
<td><strong>Egypt</strong>, <strong>Libya</strong>, <strong>Tunisia</strong>, <strong>Morocco</strong>, <strong>Algeria</strong>, <strong>Bahrain</strong>, <strong>Lebanon</strong>, <strong>Syria</strong></td>
</tr>
<tr>
<td>High (10-19.99)</td>
<td><strong>Saudi Arabia</strong> and <strong>Sudan</strong></td>
</tr>
<tr>
<td>Very High (20- )</td>
<td><strong>Kuwait</strong> and <strong>Qatar</strong></td>
</tr>
</tbody>
</table>
Management
The goals of treatment

• The Diabetes Control and Complications Trial demonstrated that improved glycemic control decreased the risk of long-term diabetic complications.

• for all adolescents with type 1 diabetes.

• To reach these goals, home glucose monitoring is critical.

• Patients need to know how to adjust insulin to maintain glucose levels in the range of 70–120 mg/dL (3.9–6.7 mmol/L) before meals.

• Insulin regimens need to be individually tailored to meet each patient’s needs.
American Diabetes Association- BG and HbA1c goals for T1DM by age group

<table>
<thead>
<tr>
<th>Age</th>
<th>Before Meals</th>
<th>Bedtime/Overnight</th>
<th>HbA1c</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 years</td>
<td>100-180</td>
<td>110-200</td>
<td>7.5-8.5%</td>
</tr>
<tr>
<td>6-12 years</td>
<td>90-180</td>
<td>100-180</td>
<td>&lt;8%</td>
</tr>
<tr>
<td>13-19 years</td>
<td>90-130</td>
<td>90-150</td>
<td>&lt;7.5%</td>
</tr>
</tbody>
</table>

Diabetes Care, 2010
Successful management of children with diabetes includes the following:

• **Balancing** the goal of strict glycemic control, which reduces the risk of long-term sequelae of chronic hyperglycemia, **against** the goal of avoiding severe hypoglycemia, which is more likely with stricter control

• Targeted glycemic goals define what is thought to be the best **balance** between these **long-** and **short-term** complications
Successful management of children with diabetes includes the following:

• Setting realistic goals for each child and family
• The patient's age and developmental status, and the level of family involvement are important factors in establishing a practical management plan that can be implemented by the patient and family.
Successful management of children with diabetes includes the following:

- **Training** the patient and family to provide appropriate daily diabetes care in order to attain glucose control within the range of predetermined goals, and to recognize and treat hypoglycemia.
Successful management of children with diabetes includes the following:

- **Maintaining** normal growth, development, and emotional maturation, with increasing independence and self-care of diabetes as the child grows older.
Diabetes education

• Initial diabetes education and self-care training provided by a multidisciplinary team effectively permits the patient and family to acquire the knowledge and skills needed for care

• Team members should include
  • an endocrinologist
  • nurse educator
  • dietitian
  • a mental health professional, who can provide pediatric-specific education and care.

Comprehensive management by a pediatric diabetes team reduces the number of hospitalizations and emergency room visits, and is cost-effective
Adolescents

• Glycemic control in adolescents with type 1 diabetes mellitus can be
  • challenging
  • complex
  • influenced by many factors
<table>
<thead>
<tr>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>357</td>
<td>414</td>
<td>468</td>
<td>747</td>
<td>887</td>
<td>991</td>
<td>1072</td>
<td>1285</td>
<td>1375</td>
<td>1664</td>
<td>1635</td>
</tr>
<tr>
<td>Mean A1c</td>
<td>8.4</td>
<td>8.6</td>
<td>8.5</td>
<td>8.2</td>
<td>8.3</td>
<td>8.5</td>
<td>8.5</td>
<td>8.2</td>
<td>8.3</td>
<td>8.2</td>
<td>8.07</td>
</tr>
<tr>
<td>% &lt;7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>% 7-7.99</td>
<td>46</td>
<td>37</td>
<td>44</td>
<td>51</td>
<td>47</td>
<td>42</td>
<td>42</td>
<td>50</td>
<td>48</td>
<td>29</td>
<td>34</td>
</tr>
<tr>
<td>% 8-10</td>
<td>37</td>
<td>45</td>
<td>42</td>
<td>38</td>
<td>40</td>
<td>44</td>
<td>44</td>
<td>39</td>
<td>40</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>% &gt;10</td>
<td>17</td>
<td>18</td>
<td>14</td>
<td>11</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>11</td>
<td>12</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>
• Despite the availability of effective therapies, adolescents with type 1 diabetes demonstrate poorer adherence to treatment regimens compared with other pediatric age groups

• Resulting in more than 70%, whom do not have optimal control of their disease

### HbA1c Statistics for CHLA 2003 Type 1:

Diabetes > 1 year, followed > 1 year
Enrolled in Long-term study – total n 1375

<table>
<thead>
<tr>
<th>Age Group</th>
<th>n</th>
<th>Average ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>1375</td>
<td>8.2 ± 1.6</td>
</tr>
<tr>
<td>Males</td>
<td>673</td>
<td>8.2 ± 1.6</td>
</tr>
<tr>
<td>Females</td>
<td>702</td>
<td>8.2 ± 1.6</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>61</td>
<td>7.8 ± 1.3</td>
</tr>
<tr>
<td>5-10</td>
<td>450</td>
<td>7.9 ± 1.3</td>
</tr>
<tr>
<td>11-16</td>
<td>579</td>
<td>8.4 ± 1.8</td>
</tr>
<tr>
<td>17-19</td>
<td>157</td>
<td>8.3 ± 1.5</td>
</tr>
<tr>
<td>&gt;20</td>
<td>127</td>
<td>7.4 ± 1.3</td>
</tr>
</tbody>
</table>
Findings from the Hvidøre Study Group on Childhood Diabetes: metabolic control and quality of life.

Mortensen HB1; Hvidøre Study Group on Childhood Diabetes.

- The study involved 2,101 adolescents, aged 10-18 years, from 21 centres in 17 countries in Europe, Japan and North America. Adolescent quality of life (QOL) was assessed by a previously developed Diabetes Quality of Life Questionnaire for adolescents (DQOL), measuring impact of diabetes, worries about diabetes, satisfaction with life and health perception. Parents and health professionals assessed 'family burden' using newly constructed questionnaires. Mean HbA1c was 8.7% (range 4.8-17.4%). Lower HbA1c was associated with lower impact (p < 0.0001), fewer worries (p < 0.05), greater satisfaction (p < 0.0001) and better health perception (p < 0.0001) for adolescents. Girls showed increased worries (p < 0.01), less satisfaction and poorer health perception (p < 0.01) earlier than boys. Parent and health professional perceptions of burden decreased with age of adolescent (p < 0.0001). Lower HbA1c was significantly associated with better adolescent-rated QOL on all four subscales and with lower perceived family burden as assessed by parents and health professionals.
• **Adherence obstacles** include
  • developmental behaviors
  • flux in family dynamics
  • perceived social pressures
  • which compound the *relative insulin resistance* brought on by pubertal physiology.

ADOLESCENT DEVELOPMENT

• Social/Behavioral Development
  • 25% of teens surveyed falsify BG results so as not to be judged
  • 25% of teens surveyed miss injections due to forgetting
While diabetic adolescents are concerned about control of their blood glucose, there are **many other outcomes that matter to them**. Health care providers and diabetes educators should consider **identifying the adherence obstacles** and apply effective interventions to solve them.

Adolescence naturally is a time of:
- increasing independence
- self-assertiveness
- risk-taking.

Therefore, determining the appropriate extent of adult involvement can be challenging.
Although adolescents can be responsible for the daily management of their diabetes

minimal or no adult supervision results in poor glycemic control

While shared management between the adolescent and parents is associated with better glycemic control

parent-child conflict over daily management leads to poor control

adolescent depression of even a mild degree can interfere with family involvement and diabetes control
Diabetes Assessment

• Family measures of functioning
  • Responsibility measures
  • Communication
The Psychology of Diabetes: Risk Factors

• Adherence is related to **family factors**
  • Perceived nagging
  • Conflict
  • Ineffective communication

• **Stress** may affect glycemic control and adherence
  • Patients in poor metabolic control have been found to exhibit maladaptive ways of coping with stress
How Psychologists Can Help: Family Factors

• Supportive (but not “nagging”) parental involvement
  • Praise, warmth, encouragement, and empathy
  • Appropriate for child’s maturity level
  • Examples
    • Gentle reminding
    • Assistance in diabetes tasks
• Balance with needs for autonomy
  • Gradual yielding of responsibility associated with increased self-confidence and personal ownership of regimen
How Psychologists Can Help: Family Factors

- Family problem solving and conflict resolution
  1. Define problem
  2. Set a goal
  3. Brainstorm ways to accomplish goal
  4. Evaluate Ideas
  5. Action plan
  6. Revise the goal
How Psychologists Can Help: Family Factors

• Communication
  • Didactic Instruction
  • Feedback
  • Modeling
  • Behavioral Rehearsal
  • Monitoring
How Psychologists Can Help: Family Factors

• Communication
  • Encourage members to talk directly to one another rather than using third parties
  • “I” statements
  • Decrease interruptions, yelling, name-calling, “mind reading”
  • Improve non-verbal communication
    • Eye contact, fidgeting, smiling
How Psychologists Can Help: Coping with Stress

• Support from health care professionals
  • Encouraging, empathetic, flexible

• Coping skills training for maladaptive coping responses
  • Social support
  • Problem solving skills
  • Cognitive restructuring
    • “It’s not fair that I have diabetes and can’t eat what I want.”

• Psychotherapy for psychiatric disorders
Family-focused teamwork

- Family-focused teamwork, which includes developing shared parent-child responsibility and strategies to avoid conflict, improves the care of the older child with diabetes.

- Family-focused care, which included establishing a responsibility-sharing plan at the end of each patient visit and active family discussion, increased family involvement, and resulted in better glycemic control.

- This approach allows the care team to develop a shared responsibility plan that is appropriate for the patient based upon his/her cognitive, physical, and psychosocial maturity.
Risky behavior

• Adolescence is also a time period that is characterized by experimentation with risky behaviors, such as alcohol and drug use.
• Alcohol intake can be associated with severe hypoglycemia.
• Adolescents should be aware of this risk, routinely assessed for alcohol use, and counseled, if appropriate.
Psychiatric issues

• Adolescent patients with diabetes have a threefold increased risk of psychiatric disorders, primarily depression and eating disorders.

• Eating disorders may take the form of intentional misuse of insulin for weight control, and symptoms of disordered eating and the possibility of intentional insulin misuse should be specifically investigated.

• Children with diabetes should be screened annually for depression, especially during adolescence.
Driving

• Adolescent drivers with diabetes should be taught to test blood glucose levels before driving.

• Data in adults demonstrate that a significant number of patients considered it safe to drive when they were hypoglycemic.

• It is essential for teenagers to understand the risks of driving while hypoglycemic and to be urged to carry carbohydrate snacks with them at all times.

• If hypoglycemic when they test their blood glucose before driving, they should take a carbohydrate snack and confirm normalization of blood glucose before driving.
goals for the management

The goals for the management of type 1 diabetes in adolescents are to:
(i) prevent diabetic ketoacidosis
(ii) prevent severe hypoglycemia
(iii) maintain normal growth and development
(iv) prevent long-term diabetic complications
• To **prevent diabetic ketoacidosis**, patients must take their insulin appropriately.

• To ensure that this happens:
  • increased parental supervision
  • psychological counseling
  • All patients must be taught to appropriately manage sick days and test their urine for ketones when hyperglycemia is present
• **Prevention of severe hypoglycemia** involves
  
  • ensuring that the patient understands the symptoms of hypoglycemia and knows to test and treat it when the signs are present.
  
  • Patients and families also need to know how to adjust insulin doses to prevent hypoglycemia and how to manage exercise appropriately.
  
  • Patients with hypoglycemic unawareness need to meticulously avoid hypoglycemia.
To maintain normal growth and development, adolescents with type 1 diabetes must have the appropriate tools to effectively match their meals to their lifestyle and to avoid the increased weight gain associated with improved glycemic control without intentionally manipulating their insulin dose to lose weight.
Insulin management

• Fixed dose regimens:
  • requires scheduled meals and snacks and is not flexible enough for most young children

• Basal: bolus regimens:
  • MDI
    • useful only if child is willing to take frequent injections
  • Insulin pumps
    • child must be willing to wear the pump
Basal/Bolus Treatment Program with Rapid-acting and Long-acting Analogs

Glargine or Detemir

Plasma insulin

Breakfast
Lunch
Dinner

Aspart Lispro Glulysene
Aspart Lispro Glulysine
Aspart Lispro Glulysine

Time
4:00 8:00 12:00 16:00 20:00 24:00 4:00 8:00
Variable Basal Rate: CSII Program

![Graph showing plasma insulin levels with basal infusion and bolus injections at breakfast, lunch, and dinner times.]

- **Breakfast**
- **Lunch**
- **Dinner**

**Basal infusion**
A1c by Treatment type at CHLA:

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Injections</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.5 ± 1.5</td>
<td>8.4 ± 1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basal-Bolus</td>
<td>9.2 ± 1.7</td>
<td>8.8 ± 1.5</td>
<td>8.4 ± 1.5</td>
<td>8.4 ± 1.4</td>
<td>8.2 ± 1.4</td>
<td></td>
</tr>
<tr>
<td>CSII</td>
<td>8.1 ± 1.2</td>
<td>8.1 ± 1.2</td>
<td>7.9 ± 1.2</td>
<td>7.9 ± 1.1</td>
<td>7.8 ± 1.0</td>
<td>7.6 ± 1.2</td>
</tr>
</tbody>
</table>
Outcomes of Pump Therapy
Kaufman, et al, Diabetes Metabolism and Reviews, 2000

6 month data 130 subjects

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>POST</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HbA1c %</strong></td>
<td>8.4 ± 1.8</td>
<td>7.8 ± 1.2</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>22.8 ± 4</td>
<td>23.2 ± 5</td>
<td>NS</td>
</tr>
<tr>
<td>Hypoglycemia events/pt/y</td>
<td>0.06</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>DKA events/pt/y</td>
<td>0.15</td>
<td>0.09</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Use of CGMS to Improve Clinical Care
Telemedicine

Children with diabetes who live hours away from the Gainesville area have increased access to specialized treatment closer to home, thanks to the Telemedicine Program. The program connects health practitioners to patients through the Internet and telemedicine technology to improve care.

The Florida Department of Health's Children's Medical Services underwrites the program, allowing dozens of Volusia County children who have diabetes and other endocrine problems to be treated by UF clinicians through the Daytona Beach Children's Medical Services clinic, instead of coming all the way to Gainesville for appointments.

Every two weeks, a nurse stationed on-site assesses the patients, then presents case details to the medical team in Gainesville via a secure videoconferencing system. UF physicians personally examine patients at the Daytona Beach clinic once a year during a three-day intensive on-site visit.

The program also includes an educational Web site, open to all children who attend UF diabetes clinics, their teachers and any secondary caregivers, including prospective counselors at the Florida Diabetes Camp.
Transition into adult care

As the adolescent approaches young adulthood, there should be an orderly transition to independent self-management with support from the family and diabetes team.

Each of the following issues should be monitored during and after the transition to adult care:

- Driving, alcohol, and smoking
- Risk for eating disorders, including intentional insulin misuse
- Education about the adverse effects of alcohol on glycemic control, and of tobacco on the cardiovascular complications of diabetes
- Prevention and management of hypoglycemic episodes while driving
- Education regarding expectation of greater autonomy in the adult diabetes clinic
Young adults tend to decrease the frequency of contact with their diabetes care provider after transition to an adult program, and those with fragmented care have poorer glycemic control and a higher rate of hospitalization.

Self-care behaviors tend to deteriorate during this transitional time, and in many institutions transition practices are not optimal.

Strategies to facilitate transition to adult health care include:

- longer or more frequent initial visits
- use of a transition coordinator, or
- transition to a clinic designed for young adults
- A transition planning template should be developed to facilitate transition from pediatric to adult care; this includes a checklist for the pediatric provider, a list of key health information to be transferred, and patient information resources designed for this age group.
Conclusion

Ultimate Goals Of Diabetes Treatment

Sustained Normal Blood Glucose Control = No Long-Term Diabetes Complications

Lowest Possible Incidence of Hypoglycemia = No Acute Diabetes Complications
Thank you