Standards of Medical Care in Diabetes – Adult/Pediatric – Inpatient/Ambulatory Clinical Practice Guideline

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ACKNOWLEDGEMENT
This guideline was produced as a collaborative effort between clinicians and quality improvement staff of Unity Health Insurance, Physicians Plus Insurance Corporation, University of Wisconsin Medical Foundation, the Department of Family Medicine, and Group Health Cooperative. The guidelines are reviewed, revised and approved on an annual basis.

CPG Contact for Content:
Name: Vanessa Rein, MD - Medicine- Endocrinology
Phone Number: (608) 263-5010
Email Address: vr2@medicine.wisc.edu

CPG Contact for Changes:
Name: Lindsey Spencer, MS - Center for Clinical Knowledge Management (CCKM)
Phone Number: (608) 890-6403
Email Address: lspencer2@uwhealth.org

Guideline Author: The American Diabetes Association (ADA) (2016)
Coordinating Team Members:
Mary T. Bekx, MD - Pediatrics- Endocrinology
Allison Pollock, MD – Pediatrics
Peter Gill, MD - Hospitalists
Kara Hoppe, MD – OB/GYN- Perinatal
Brian Arndt, MD – Family Medicine
Nicole Weathers, MD – Family Medicine
Matt Anderson, MD – Internal Medicine
Megan Barry, PA – Medicine- Endocrinology
Gwen Klinkner, CNS – Nursing- Practice Innovation
Lisa Bennett, CNS – Clinics- Pediatric Specialties-AFCH
Sara Smith-Shull, PharmD – Pharmacy Drug Policy Program
Brenda Burke, MS, RD, CDE, BC-ADM - Clinical Nutrition
Cassie Vanderwall, MS, RDN, CDE – Clinical Nutrition
Cheryl Franz, RN, BSN, CDE – Clinical Support- Staff Education
Jill Lindwall, MSN, RN – RN Care Coordination Program Manager
Amber Buckingham, RN- Family Medicine- General
Lynnette Alvarado, RN- Family Medicine- General
Christina McOwen, RN- Family Medicine- General
Amanda Grob, RN- Family Medicine- General
Gina Lanz, RN- Family Medicine- General
Katelyn Gibson, RN – Family Medicine- General
Tricia Murtha, RN- Family Medicine- General
Meg Chin- Population Health
Linda Dries, APRN- SwedishAmerican
Sravanthi Nagavalli, MD- Swedish American Endocrinology
Heidi Wolf- Unity Health Insurance
Elaine Rosenblatt – Unity Health Insurance
Donna Twining, CNS, APNP, BC-ADM- Group Health Cooperative
Heidi Vierstra- Meriter-Unity Point Health
Kenneth Ligaray, MD – Endocrinology (Meriter-Unity Point Health)
Jennifer Grice, PharmD- Center for Clinical Knowledge Management (CCKM)

Individual Reviewers:
Amy Peterson, MD- Medicine- Cardiology
Jim Stein, MD- Medicine- Cardiology
Patrick McBride, MD- Medicine- Cardiology

Committee Approvals/Dates:
UWHC Inpatient Diabetes Quality Committee (02/11/2016)
Clinical Knowledge Management (CKM) Council (Last Periodic Review: 03/24/2016)
Interim revisions: Pharmacy and Therapeutics Committee (04/21/2016)- DKA Algorithm

Release Date: June 2016 | Next Review Date: January 2017
Executive Summary
Guideline Overview
UW Health has agreed to endorse the 2016 American Diabetes Association (ADA) Standards of Medical Care in Diabetes. The recommendations include screening, diagnostic criteria, and therapeutic actions which are known or believed to favorably affect health outcomes of patients with diabetes.

Companion/Collateral Documents

AMBULATORY
- 2016 Diabetes Guideline: Key Practice Recommendations
- Management of Hyperglycemia in Type 2 Diabetes
- Preoperative Instructions for Ambulatory Procedures

(Pediatric only):
- Outpatient Management of Type 2 Diabetes Mellitus in Children

INPATIENT/EMERGENCY DEPARTMENT
- 2016 Diabetes Guideline: Key Practice Recommendations
- Management of Hyperglycemia in Type 2 Diabetes
- Glycemic Goals for Hospitalized Patients
- Cautions Regarding Oral Agents for Diabetes in the Hospital Setting
- Medication Adjustment for Hospitalized Patients who are NPO
- Steps for Coordinating Glucose Monitoring, Meals, and Medications
- Continuous Glucose Monitoring (CGM): Information for Clinicians

(Adult only):
- Adult Hypoglycemia Algorithm
- Adult Diabetic Ketoacidosis (DKA) Management Algorithm
- Adult Inpatient Insulin to Carbohydrate Ratios (ICRs)
- Transition from Intravenous (IV) to Subcutaneous (SC) Insulin Administration Algorithm
- Initiation of Insulin in Non-Critically Ill Insulin-Naïve Hyperglycemic Adult Patients Algorithm

(Pediatric only):
- Pediatric Hypoglycemia Algorithm
- Pediatric ED Diabetic Ketoacidosis (DKA) Management Algorithm

Related UW Health Clinical Practice Guidelines and External Resources
1. UW Health Preventive Health Care – Pediatric/Adult – Ambulatory Guideline
2. UW Health Hypertension – Adult – Inpatient/Ambulatory Guideline
3. UW Health Tobacco Cessation – Pediatric/Adult – Inpatient/Ambulatory Guideline
4. UW Health Depression – Pediatric/Adult – Ambulatory Guideline
5. Insulin Pump Use – Pediatric/Adult – Inpatient Nursing Practice Guideline

External Resources:
Scope
Disease/Condition(s): Diabetes mellitus

Clinical Specialty:
Endocrinology, Internal Medicine, Pediatrics, Obstetrics and Gynecology, Family Practice, Surgery, Ophthalmology, Pathology & Laboratory Medicine

Intended Users:
Endocrinologists, Surgeons, Primary Care Physicians, Physician Assistants, Hospitalists, Nurse Practitioners, Advanced Practice Nurses, Registered Nurses, Medical Assistants, Pharmacists

CPG objective(s): To provide standardized, evidence-based guidelines for diabetes care throughout a patient's lifetime.

Target Population: Pediatric and adult patients with a prediabetes or diabetes diagnosis. Screening recommendations apply to asymptomatic patients.

Methodology
Methods Used to Collect/Select the Evidence:
Electronic database searches (e.g., PUBMED) were conducted by the guideline author(s) and workgroup members to collect evidence for review. Expert opinion and clinical experience were also considered during discussions of the evidence.

Methods Used to Formulate the Recommendations:
The workgroup members agreed to adopt recommendations developed by external organizations and/or arrived at a consensus through discussion of the literature and expert experience. All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees (as appropriate).

Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:
Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health. Identification and selection of the evidence was completed by the American Diabetes Association (ADA). Evidence was weighed according to the rating scheme (see below). Recommendations were assigned ratings of A, B, or C, depending on the quality of evidence. Expert opinion E is a separate category for recommendations in which there is as yet no evidence from clinical trials, in which clinical trials may be impractical, or in which there is conflicting evidence.

Recommendations with an A rating are based on large well-designed clinical trials or well-done meta-analyses. Generally, these recommendations have the best chance of improving outcomes when applied to the population to which they are appropriate. Recommendations with lower levels of evidence may be equally important but are not as well supported.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see Figure 1 below).
Rating Scheme for the Strength of the Evidence/Recommendations:
A grading system developed by ADA in 2002, and modeled after existing methods, was used to clarify and codify the evidence that forms the basis for the recommendations (see Table 1 below).¹

Table 1. ADA Grading Scheme

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Description</th>
</tr>
</thead>
</table>
| A                 | Clear evidence from well-conducted, generalizable RCTs that are adequately powered, including:  
|                   |  • Evidence from a well-conducted multicenter trial  
|                   |  • Evidence from a meta-analysis that incorporated quality ratings in the analysis  
|                   | Compelling nonexperimental evidence, i.e., “all or none” rule developed by the Center for Evidence-Based Medicine at the University of Oxford  
|                   | Supportive evidence from well-conducted RCTs that are adequately powered, including:  
|                   |  • Evidence from a well-conducted trial at one or more institutions  
|                   |  • Evidence from a meta-analysis that incorporated quality ratings in the analysis  |
| B                 | Supportive evidence from well-conducted cohort studies  
|                   |  • Evidence from a well-conducted prospective cohort study or registry  
|                   |  • Evidence from a well-conducted meta-analysis of cohort studies  
|                   | Supportive evidence from a well-conducted case-control study  |
| C                 | Supportive evidence from poorly controlled or uncontrolled studies  
|                   |  • Evidence from randomized clinical trials with one or more major of three or more minor methodological flaws that could invalidate the results  
|                   |  • Evidence from observational studies with high potential for bias (such as case series with comparison with historical controls)  
|                   |  • Evidence from case series or case reports  
|                   | Conflicting evidence with the weight of evidence supporting the recommendation  |
| E                 | Expert consensus or clinical experience  |

Figure 1. GRADE Methodology adapted by UW Health
GRADE Ranking of Evidence

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>We are confident that the effect in the study reflects the actual effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.</td>
</tr>
<tr>
<td>Low</td>
<td>The true effect may differ significantly from the estimate.</td>
</tr>
<tr>
<td>Very Low</td>
<td>The true effect is likely to be substantially different from the estimated effect.</td>
</tr>
</tbody>
</table>

GRADE Ratings for Recommendations For or Against Practice

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.</td>
</tr>
<tr>
<td>Weak/conditional</td>
<td>Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.</td>
</tr>
</tbody>
</table>

Introduction

Diabetes mellitus is a complex, chronic illness requiring continuous medical care with multifactorial risk reduction strategies beyond glycemic control. The American Diabetes Association (ADA)’s Standards of Care are intended to provide clinicians, patients, researchers, payers, and other interested individuals with the components of diabetes care, general treatment goals, and tools to evaluate the quality of care.

Recommendations


*Although the 2016 ADA standards recommend testing for diabetes and prediabetes in all asymptomatic adults beginning at age 45 years, direct evidence to support age as the only risk factor is lacking. The 2015 U.S. Preventive Services Task Force supports alternative recommendations which define screening based on age and other risk factors (e.g., obesity, cardiovascular disease, smoking, etc.).[2]
UW Health Implementation

Pertinent UW Health Policies & Procedures

AMBULATORY
1. UWMF Policy - Hypoglycemia Management Delegation Protocol
2. UWMF Policy – MF Infection Prevention During the Use of Point of Care Devices
3. UWMF Policy – MF Subcutaneous Injection, Administering
4. UWMF Policy – MF Sharps Disposal for Patients

INPATIENT
1. UWHC Departmental Policy 13.24 – Hypoglycemia, Care of the Hospitalize Patient
2. UWHC Departmental Policy 10.25AP – Use of a Subcutaneous Insulin Pump (Patient’s Own) in the Hospitalized Setting (Adult & Pediatric)
3. UWHC Departmental Policy 11.26 – Nova Stat Strip Blood Glucose Meter
4. Pharmacy Operating Procedure, U-500 Insulin Regular 500 units/1 mL: Storage, Order Entry, Preparation, and Dispensing

Patient Resources
1. Health Facts For You (Category: Diabetes, Endocrine)
2. Healthwise® Patient Instructions (Category: Diabetes and Endocrinology)
3. UW Health Pediatric Diabetes Apps

Additional Nutrition Resources:
1. 5210 Habits Nutrition Resource
2. Go, Slow, Whoa Nutrition Resource
3. Choose My Plate Nutrition Resource

Guideline Metrics

ACO
1. Hemoglobin A1C Poor Control 2. Eye Exam

WCHQ
2. A1C Blood Sugar Control 7. Most Recent Tobacco Status is Tobacco-Free
3. Use of Statin 8. All or None Process Measure: Optimal Testing
4. Kidney Function Monitored
5. Blood Pressure Control

Inpatient TJC Certification
2. Diabetes Patient Education Documentation 5. Follow-up Appointment Documentation at Discharge
3. Hypoglycemia Monitoring

Inpatient Quality Committee
1. Patient satisfaction during hospitalization 3. Hypoglycemia Cause Documentation
2. 30-Day All-Cause Readmission Rates for Diabetes Patients 4. Manifestations of Poor Glycemic Control

CPG Workgroup-Derived
1. Efficacy of inpatient carb-counting orders (glycemic control)
2. Patient education/nutrition counseling for patients with prediabetes
3. Rate or timing of follow-up appointments/care for patients with prediabetes
4. % of pediatric patients with PHQ-2 screening completed
5. A1C control in pediatric patients

**Implementation Plan/Clinical Tools**
1. Guideline will be posted on uConnect in a dedicated location for Clinical Practice Guidelines.
2. Release of the guideline will be advertised in the Physician/APP Briefing newsletter.
3. Content and hyperlinks within clinical tools, documents, or Health Link related to the guideline recommendations (such as the following) will be reviewed for consistency and modified as appropriate.

**Best Practice Alerts (BPA)**
- Hypoglycemia Documentation (Inpatient)

**Practice Protocols**
- Wisconsin Insulin Infusion Standard Dose – Adult – Practice Protocol
- Wisconsin Insulin Infusion HIGH Dose – Adult – Practice Protocol (ICU Only)

**Delegation Protocols**
- Adjusting Insulin for Pediatric Patients Protocol – Ambulatory [65]
- Blood Glucose Testing and Insulin Delivery Supplies Ordering – Adult/Pediatric – Outpatient [110]
- Diabetes Lab Ordering – Adult – Outpatient [21]
- Diabetes Mellitus Medication Titration – Adult – Outpatient – Endocrine Diabetes Clinic/UWMF Health and Education Department [88]
- Diabetes Mellitus Medication Titration – Adult – Primary Care [87]
- Intravenous (IV) to Subcutaneous (SQ) Insulin Transition Delegation Protocol – Adult – Inpatient [97]
- OB/GYN and Women’s Health Gestational Diabetes Screening and Treatment Protocol [22]
- Referral to Diabetes Education - Ambulatory [58]

**E-Consults**
- UWOP EConsult to Endocrinology- Diabetes Mellitus [5027]

**Flowsheets**
- Insulin Infusion Flow Sheet
- Point of Care Glucose Flow Sheet

**Order Sets & Smart Sets**
- Diabetes [101]
- Diabetes Education UWHC [3430]
- Diabetes F/U ACHC [155]
- Chronic Disease- Care Team [3672]
- Diabetes Mellitus Type 1 [3185]
- Ped Diabetes Mellitus [2599]
- Ped Endodiet – Office Visit [2595]
- IP – Anesthesiology – Diabetes Management with Pump – Adult – Supplemental [5341]
- IP – Anesthesiology – Diabetes Management with Pump – Pediatric – Supplemental [5084]
• ED – Diabetic Ketoacidosis – Pediatric [3464]
• IP - Diabetic Ketoacidosis - Adult - Admission [1335]
• IP - Diabetic Ketoacidosis – Pediatric - Intensive Care – Admission [1196]
• IP - Diabetes - Newly-diagnosed - Pediatric - Admission [1235]
• IP - Diabetes Management With Pump - Adult - Supplemental [3139]
• IP - Diabetes Management With Pump - Pediatric - Supplemental [2187]
• IP - Diabetes Management Without Pump - Adult - Supplemental [3140]
• IP - Diabetes Management Without Pump - Pediatric - Supplemental [2183]
• IP - Diabetic Discharge Supplies - Adult - Supplemental [4797]
• IP - Diabetic Discharge Supplies - Pediatric - Supplemental [4555]
• IP - Insulin Infusion - Adult - Supplemental [1345]
• IP - Diabetes - Insulin Transition - IV to Subcutaneous – Adult - Supplemental [5254]
• IP - Cardiac Surgery - Adult - Postoperative [2821]*

Order Panels
Insulin Infusion- Pediatric [191555]
Hypoglycemia Management (Adult) [191576]

Reporting Workbench Reports
• Diabetes – possible patients (general printing letter size)
• Diabetes and Hypertension Patients
• Diabetes patients (general printing letter size)
• Diabetes patients (huddle printing legal size)
• Diabetes patients, A1c>= 7 & not on metformin (general printing letter size)
• Diabetes Patients (using Diabetes Concept Grouper)- All IP Units

Disclaimer
Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician’s judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

References


* Contains Diabetes Management Order Panel.
**2016 Diabetes Guideline: Key Practice Recommendations**

*(New recommendations/changes in purple)*

### When to Screen - Adults

<table>
<thead>
<tr>
<th>Asymptomatic Adults</th>
<th>At 45 years (ADA Grade B)</th>
<th>If results are normal, repeat testing at a minimum every 3 yrs. (ADA Grade C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients of any age with BMI ≥ 25 kg/m² (or ≥ 23 kg/m² in Asian Americans) AND one or more additional risk factors. (ADA Grade B)</td>
<td>Direct evidence to support age as the only risk factor is lacking. The 2015 U.S. Preventive Services Task Force supports alternative recommendations which define screening based on age and other risk factors (e.g., obesity, CVD, smoking, etc.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pregnant Women</th>
<th>Test for GDM at 24-28 wks. using OGTT. (ADA Grade E)</th>
<th>Screen women with GDM for persistent diabetes at 6-12 wks. postpartum using the OGTT. (ADA Grade E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In pregnant women with risk factors, test for undiagnosed type 2 diabetes at first prenatal visit. (ADA Grade B)</td>
<td>Women with a history of GDM should have lifelong screening at least every 3 yrs. (ADA Grade B)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adult Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical inactivity</td>
</tr>
<tr>
<td>• First-degree relative with diabetes</td>
</tr>
<tr>
<td>• High risk race/ethnicity (African American, Latino, Native American, Asian American, Pacific Islander)</td>
</tr>
<tr>
<td>• Women who have delivered a baby &gt; 9lbs. or were diagnosed with GDM</td>
</tr>
<tr>
<td>• HTN (&gt; 140/90 mmHg or on therapy)</td>
</tr>
<tr>
<td>• HDL &lt; 35 mg/dL and/or triglyceride level &gt; 250 mg/dL</td>
</tr>
<tr>
<td>• Women with polycystic ovarian syndrome</td>
</tr>
<tr>
<td>• A1C &gt; 5.7%, impaired glucose tolerance (IGT), or impaired fasting glucose (IFG) on previous tests (i.e., prediabetes)</td>
</tr>
<tr>
<td>• Other clinical conditions associated with insulin resistance (i.e., severe obesity, acanthosis nigricans)</td>
</tr>
<tr>
<td>• History of CVD</td>
</tr>
</tbody>
</table>

### When to Screen- Pediatrics

<table>
<thead>
<tr>
<th>Asymptomatic Children</th>
<th>If results normal, repeat testing every 3 years. (ADA Grade C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients ≥ 10 yrs. (or at onset of puberty if earlier) with BMI ≥ 85th percentile for age and sex, weight for height &gt; 85th percentile, or weight &gt; 120% of ideal for height AND two or more additional risk factors. (ADA Grade E)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Children with Cystic Fibrosis</th>
<th>A1C is not a recommended test. (ADA Grade B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annually screen for cystic-fibrosis related diabetes (CFRD) with OGTT by age 10 yrs. (ADA Grade B)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pediatric Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• First or second-degree relative with type 2 diabetes</td>
</tr>
<tr>
<td>• High risk race/ethnicity (African American, Latino, Native American, Asian American, Pacific Islander)</td>
</tr>
<tr>
<td>• Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, HTN, dyslipidemia, polycystic ovarian syndrome, or small-for-gestational-age birth weight)</td>
</tr>
<tr>
<td>• Maternal history of diabetes or GDM during pregnancy</td>
</tr>
</tbody>
</table>

### Testing Options/Results (ADA Grade B) *(Test should be repeated if abnormal result)*

<table>
<thead>
<tr>
<th>A1C</th>
<th>Fasting Plasma Glucose</th>
<th>2-h PG on 75-g OGTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.7-6.4% Prediabetes</td>
<td>100-125 mg/dL Prediabetes</td>
<td>140-199 mg/dL Prediabetes</td>
</tr>
<tr>
<td>&gt; 6.5% Diagnosis</td>
<td>&gt; 126 mg/dL Diagnosis</td>
<td>≥ 200 mg/dL Diagnosis</td>
</tr>
</tbody>
</table>

*Blood glucose rather than A1C should be used to diagnose acute onset of type 1 if symptoms of hyperglycemia present. (ADA Grade E)*

### Post-Diagnosis Testing for Prediabetes or Diabetes

<table>
<thead>
<tr>
<th>A1C</th>
<th>Fasting Plasma Glucose</th>
<th>2-h PG on 75-g OGTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform A1C at least twice a year if meeting treatment goals (i.e., stable glycemic control). (ADA Grade E)</td>
<td>Perform A1C quarterly if therapy changes or when not meeting glycemic goals. (ADA Grade E)</td>
<td>Consider obtaining A1C in patients admitted to the hospital if result not available in the previous 3 months. (ADA Grade E)</td>
</tr>
<tr>
<td>Prediabetes should be tested at least annually. (ADA Grade E)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Last reviewed: 03/2016 | For revisions, please contact the Center for Clinical Knowledge Management (CCKM)

# 2016 Diabetes Guideline: Key Practice Recommendations

(New recommendations/changes in **purple**)

## Glycemic Targets *(should be individualized)*

<table>
<thead>
<tr>
<th>Adults</th>
<th></th>
<th>Pediatrics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>A1C</strong></td>
<td>&lt; 7.0% <em>(ADA Grade B)</em></td>
<td><strong>A1C</strong></td>
<td>&lt; 7.5% <em>(ADA Grade E)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Preprandial glucose</strong></td>
<td>80-130 mg/dL</td>
<td><strong>Before meals</strong></td>
<td>90-130 mg/dL</td>
<td><strong>Bedtime/overnight</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Post-prandial glucose</strong></td>
<td>&lt; 180 mg/dL</td>
<td><strong>Post-prandial glucose</strong></td>
<td>&lt; 180 mg/dL</td>
<td><strong>Postprandial glucose</strong></td>
</tr>
</tbody>
</table>

- Goals should be individualized based on duration of diabetes, age/life expectancy, comorbid conditions, known CVD or advanced microvascular complications, hypoglycemia unawareness, and individual patient considerations.
- Postprandial values may be targeted if A1C goals not met despite reaching premeal glucose targets. Postprandial measurements should be made 1-2 hours after beginning the meal.

### Pregnant Women

<table>
<thead>
<tr>
<th><strong>Gestational Diabetes (GDM)</strong></th>
<th><strong>Preexisting type 1 or type 2</strong></th>
<th><strong>ACOG</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1C</strong></td>
<td>&lt; 6-6.5% <em>(ADA Grade B)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Preprandial glucose</strong></td>
<td>&lt; 95 mg/dL</td>
<td>60-99 mg/dL</td>
</tr>
<tr>
<td><strong>Post-prandial glucose</strong></td>
<td>&lt; 140 mg/dL (1-hr.)</td>
<td>100-129 mg/dL (Peak)</td>
</tr>
<tr>
<td><strong>&lt; 120 mg/dL (2-hr.)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fasting glucose</strong></td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

*ADA recommends alternative targets if ACOG ranges cannot be achieved without significant hypoglycemia:
- Postprandial glucose < 155 mg/dL (1-hr.), < 130 mg/dL (2-hr.) or fasting glucose < 105 mg/dL.

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### Individualization of Goals

![Approach to the management of hyperglycemia](image)

*Figure 6.1—Depicted are patient and disease factors used to determine optimal A1C targets. Characteristics and predicaments toward the left justify more stringent efforts to lower A1C; those toward the right suggest less stringent efforts. Adapted with permission from Inzucchi et al. (45).*

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Last reviewed: 03/2016 | For revisions, please contact the Center for Clinical Knowledge Management (CCKM)
## 2016 Diabetes Guideline: Key Practice Recommendations

*(New recommendations/changes in purple)*

### Adults

- **Physical Activity & Medical Nutrition Therapy**
  - Adults with diabetes should be advised to perform at least 150 min. per week of moderate-intensity aerobic activity, spread over at least 3 days/week with no more than 2 consecutive days without exercise. *(ADA Grade A)*
  - Adults with type 2 should be encouraged to perform resistance training at least twice per week. *(ADA Grade A)*

- **Nutrition therapy** is recommended for all patients with type 1 or 2 diabetes. *(ADA Grade A)*
  - Consider annual visit to dietitian.
  - All patients should be encouraged to reduce sedentary time, particularly by breaking up extended amounts of time (>90 min) spent sitting. *(ADA Grade B)*
  - Patients with impaired glucose tolerance (IGT) *(ADA Grade A)*, impaired fasting glucose (IGF) *(ADA Grade E)*, or A1C 5.7-6.4% *(ADA Grade E)* should be referred to a dietitian for intensive nutrition and physical activity counseling, targeting loss of 7% of body weight and increasing physical activity.

- **Self-Management & Education**
  - All should participate in diabetes self-management education (DSME) to facilitate knowledge, skills, and ability necessary for diabetes self-care and in diabetes self-management and support (DSMS) to assist with implementing and sustaining skills and behaviors needed for ongoing self-management, both at diagnosis and as needed thereafter. *(ADA Grade B)*

- **Psychosocial Issues**
  - Routinely screen for psychosocial problems such as depression, diabetes-related distress, anxiety, eating disorders, and cognitive impairment. *(ADA Grade B)*
  - Older adults (age ≥ 65 yrs.) with diabetes should be considered for evaluation of cognitive function and depression screening and treatment. *(ADA Grade B)*
  - Patients with comorbid diabetes and depression should receive a stepwise collaborative care approach for depression management. *(ADA Grade A)*

### Pregnant Women

- **Eye Exam**
  - Women with pre-existing diabetes should have eye exam in 1st trimester, with follow-up 1 yr. postpartum. *(ADA Grade B)*
  - Dilated eye exam at puberty once diagnosed for 3-5 yrs. *(ADA Grade B)*
  - Repeat annually or per eye care professional. *(ADA Grade E)*

- **Foot Exam**
  - Consider annual foot exam puberty or age 10 yrs. once diagnosed with type 1 for 5 yrs. *(ADA Grade E)*
  - Perform an annual foot exam. *(ADA Grade B)*
  - Patients with insensate feet, deformities, and ulcers should have an exam at every visit. *(ADA Grade E)*

### Pediatrics

- **Physical Activity & Medical Nutrition Therapy**
  - Children with diabetes or prediabetes should be encouraged to engage in at least 60 min. of daily physical activity. *(ADA Grade B)*

- **Tobacco Use**
  - All patients should be advised not to smoke/use tobacco (including use of e-cigarettes). *(ADA Grade A)*

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Last reviewed: 03/2016 | For revisions, please contact the Center for Clinical Knowledge Management (CCKM)
# 2016 Diabetes Guideline: Key Practice Recommendations

*(New recommendations/changes in purple)*

**Last reviewed: 03/2016 | For revisions, please contact the Center for Clinical Knowledge Management (CCKM)**


## Blood Pressure Goals

<table>
<thead>
<tr>
<th>Adults</th>
<th>Pregnant Women</th>
<th>Pediatrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target &lt; 140/90 mmHg <em>(ADA Grade A)</em>&lt;br&gt;Targets of &lt;130 mmHg systolic <em>(ADA Grade C)</em> and &lt; 80 mmHg diastolic <em>(ADA Grade B)</em> may be appropriate for younger patients.&lt;br&gt;&lt;br&gt;<em>In older adults, pharmacological therapy to achieve target &lt;130/70 mmHg is not recommended.</em> <em>(ADA Grade C)</em></td>
<td>110-129/65-79 mmHg <em>(ADA Grade E)</em></td>
<td>&lt; 90&lt;sup&gt;th&lt;/sup&gt; percentile for age, sex and height <em>(ADA Grade E)</em></td>
</tr>
</tbody>
</table>

## Lipids

**Screen at first diagnosis, initial medical evaluation, and/or at age 40 yrs. and periodically (every 1-2 yrs.) *(ADA Grade E)*

Intensify lifestyle therapy and optimize glycemia control if triglyceride levels > 150 mg/dL and/or low HDL < 40 mg/dL (men), < 50 mg/dL (women). *(ADA Grade C)*

**Ezetimibe in addition to moderate-intensity statin may be considered in patients > 40 yrs. with recent a recent acute coronary syndrome and LDL > 50 mg/dL or in those who cannot tolerate high-intensity statins. *(ADA Grade A)***

<table>
<thead>
<tr>
<th>Age</th>
<th>Risk</th>
<th>Statin Dose**</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40 yrs.</td>
<td>At Risk*</td>
<td>Moderate or High <em>(ADA Grade C)</em></td>
</tr>
<tr>
<td></td>
<td>ASCVD</td>
<td>High <em>(ADA Grade A)</em></td>
</tr>
<tr>
<td>40-75 yrs.</td>
<td>None</td>
<td>Moderate <em>(ADA Grade A)</em></td>
</tr>
<tr>
<td></td>
<td>At Risk*</td>
<td>High <em>(ADA Grade B)</em></td>
</tr>
<tr>
<td></td>
<td>ASCVD</td>
<td>High <em>(ADA Grade A)</em></td>
</tr>
<tr>
<td>&gt; 75 yrs.</td>
<td>None</td>
<td>Moderate <em>(ADA Grade B)</em></td>
</tr>
<tr>
<td></td>
<td>At Risk*</td>
<td>Moderate or High <em>(ADA Grade B)</em></td>
</tr>
<tr>
<td></td>
<td>ASCVD</td>
<td>High <em>(ADA Grade A)</em></td>
</tr>
</tbody>
</table>

*ASCVD Risk Factors: LDL ≥ 100 mg/dL, high BP, smoking, overweight/obesity, family history of premature ASCVD.

**In addition to lifestyle therapy.

## Aspirin

Consider aspirin therapy (75-162 mg/day) for primary prevention in those with type 1 or type 2 diabetes at increased cardiovascular risk (10-year risk > 10%). *(ADA Grade C)*

Aspirin therapy is recommended for secondary prevention in patients with diabetes and a history of ASCVD. *(ADA Grade A)*
Management of Hyperglycemia in Type 2 Diabetes: A Patient-Centered Approach

Healthy eating, weight control, increased physical activity, and diabetes education

Mono-therapy
- Efficacy
- Hypo risk
- Weight
- Side effects
- Costs

Dual therapy
- Efficacy
- Hypo risk
- Weight
- Side effects
- Costs

Triple therapy

Combination injectable therapy

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Thiazolidinedione</th>
<th>DPP-4 inhibitor</th>
<th>SGLT2 inhibitor</th>
<th>GLP-1 receptor agonist</th>
<th>Insulin (basal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>high</td>
<td>intermediate</td>
<td>intermediate</td>
<td>high</td>
<td>highest</td>
</tr>
<tr>
<td>low risk</td>
<td>low risk</td>
<td>low risk</td>
<td>low risk</td>
<td>high risk</td>
<td>high</td>
</tr>
<tr>
<td>neutral / loss</td>
<td>neutral</td>
<td>neutral</td>
<td>neutral</td>
<td>high risk</td>
<td>high</td>
</tr>
<tr>
<td>lactic acidosis</td>
<td>edema, HF, edema</td>
<td>edema, HF, edema</td>
<td>edema, HF, edema</td>
<td>GI, dehydration</td>
<td>variable</td>
</tr>
<tr>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
</tr>
</tbody>
</table>

If A1C target not achieved after 3 months of monotherapy, proceed to 2-drug combination (order not meant to denote any specific preference—choice dependent on a variety of patient- and disease-specific factors):

If A1C target not achieved after 3 months of dual therapy, proceed to 3-drug combination (order not meant to denote any specific preference—choice dependent on a variety of patient- and disease-specific factors):

If A1C target not achieved after 3 months of triple therapy and patient (1) on oral combination, move to injectables; (2) on GLP-1 RA, add basal insulin; or (3) on optimally treated basal insulin, add GLP-1 RA or mealtime insulin. In refractory patients consider adding TZD or SGLT2.

Figure 2—Antihyperglycemic therapy in type 2 diabetes: general recommendations. Potential sequences of antihyperglycemic therapy for patients with type 2 diabetes are displayed. The usual transition being vertical, from top to bottom (although horizontal movement within therapy stages is also possible, depending on the circumstances). In most patients, begin with lifestyle changes; metformin monotherapy is added as, or soon after, diagnosis, unless there are contraindications. If the HbA1c target is not achieved after 3 months, consider one of the six treatment options combined with metformin: a sulfonylurea, TZD, DPP-4 inhibitor, SGLT2 inhibitor, GLP-1 receptor agonist, or basal insulin. (The order in the chart, not meant to denote any specific preference, was determined by the historical availability of the class and route of administration, with injectables to the right and insulin to the far right.) Drug choice is based on patient preferences as well as various patient, disease, and drug characteristics, with the goal being to reduce glucose concentrations while minimizing side effects, especially hypoglycemia. The figure emphasizes drugs in common use in the U.S. and/or Europe. Rapid-acting secretagogues (meiglinacils) may be used in place of sulfonylureas in patients with irregular meal schedules or who develop late postprandial hyperglycemia on a sulfonylurea. Other drugs not shown (e.g., glucosidase inhibitors, aseleolem, bromocriptine, praliminid itself) may be tried in specific situations (where available), but are generally not favored because of their modest efficacy, the frequency of administration, and/or limiting side effects. In patients intolerant of, or with contraindications for, metformin, consider initial drug from other classes depicted under "Dual therapy" and proceed accordingly. In this circumstance, while published trials are generally lacking, it is reasonable to consider three drug combinations that do not include metformin. Consider initiating therapy with a dual combination when HbA1c is >9% (≥75 mmol/mol) or to more expediously achieve target. Insulin has the advantage of being effective where other agents may not be and should be considered a part of any combination regimen when hyperglycemia is severe, especially if the patient is symptomatic or if any catastrophic features (weight loss, any ketones) are evident. Consider initiating combination injectable therapy with insulin when blood glucose is ≥300–350 mg/dl (≥16.7–19.4 mmol/l) and/or HbA1c ≥10–12% (≥86–108 mmol/mol). Potentially, as the patient’s glucose toxicity resolves, the regimen can be subsequently simplified. DPP-4 I, DPP-4 inhibitor; fxs, fractures; GI, gastrointestinal; GLP-1 RA, GLP-1 receptor agonist; GU, genitalia; HF, heart failure; hypo, hypoglycemia; SGLT2-I, SGLT2 inhibitor; SU, sulfonylurea. *See Supplementary Data for description of efficacy categorization.


References:
**Diabetes Medication Adjustment: Ambulatory Procedures**

*This reference is meant to reflect best practice. Provider orders (or delegated authority) are required to enact.*

**All Patients**
- If possible, schedule test early in the day.
- Monitor blood glucose frequently (before and after procedure). If procedure is longer than 1 hour, monitor blood glucose during the procedure (optimally, every hour).
- Hypoglycemia: Glucose tablets can be used by the patient at any time before or after the procedure if safe to swallow. Use IV dextrose during the procedure if the patient is sedated.
- Questions related to medication adjustment before/after contrast should be resolved by referring to UW Health Guideline: Contrast-Induced Nephropathy – Adult – Inpatient/Ambulatory.

**Type 1 Diabetes**
- Be sure there is always basal insulin prescribed (injects, pump, or insulin drip); ketoacidosis (“DKA”) can occur if insulin levels are not maintained.
- Correction insulin (sliding scales) should never be used as the sole insulin but instead used only as a supplement to the patient’s basal insulin regimen (glargine, NPH, or detemir).

**Type 2 Diabetes**
- Patients treated by diet alone should have blood glucose monitoring at minimum to recognize hyperglycemia and then treat as indicated.
- In general, oral hypoglycemic agents are omitted on the day of the procedure. Some oral medications need to be adjusted or omitted the day before the procedure if the diet will change, i.e. clear liquids.
- Patients using insulin will require insulin pre-procedure as noted below. Insulin should not be stopped. Ketoacidosis can occur even though the patient has type 2 diabetes.

**ORAL AGENTS AND NON-INSULIN INJECTABLES**

<table>
<thead>
<tr>
<th>Secretagogues: Sulfonylurea (glipizide, glyburide, glimepiride); non-sulfa drugs (repaglinide, nateglinide)</th>
<th>Hold if on clear liquids, NPO, or bowel prep needed</th>
<th>Hold</th>
<th>After procedure when eating usual meals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-glucoosidase: Acarbose (Precose®), Miglitol (Glyset®)</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
<tr>
<td>Amylin Analog: Pramlintide (Symlin®)</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
<tr>
<td>GLP-1 agonists: i.e., exenatide (Byetta®), Bydureon®, liraglutide (Victoza®), dulaglutide (Trulicity®), albiglutide</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
<tr>
<td>DPP-4 Inhibitors: “gliptins” – i.e. sitagliptin (Januvia®), saxagliptin (Onglyza®), linagliptin (Tradjenta®), alogliptin (Nesina®)</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
<tr>
<td>TZDs: pioglitazone (Actos®), rosiglitazone (Avandia®)</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
<tr>
<td>SGLT-2 Inhibitors “flozins” – i.e., canagliflozin (Invokana®), dapagliflozin (Farxiga®), empagliflozin (Jardiance®)</td>
<td>Hold if on clear liquids, NPO, or bowel prep needed</td>
<td>Hold</td>
<td>After procedure when eating usual meals</td>
</tr>
</tbody>
</table>

**Regular Insulin**
- Hold if on clear liquids, NPO, or bowel prep needed. (may use to correct hyperglycemia if patient uses correction scale at home) | Hold | After procedure when eating usual meals |
- Hold if on clear liquids, NPO, or bowel prep needed. (may use to correct hyperglycemia if patient uses correction scale at home) | Hold | After procedure when eating usual meals |

**Regular U-500 insulin /Other Concentrated Insulins**
- Contact the prescriber before procedure. (U-500 insulin is 5 times the concentration of U-100 insulin) | CONTACT THE PRESCRIBER BEFORE PROCEDURE (U-500 insulin is 5 times the concentration of U-100 insulin) |

**INSULIN**

**Intermediate-acting insulin**
- Ifosfane (NPH)
- Prep day: if on clear liquids, NPO, or bowel prep needed, ½ dose in the morning (if taking) and ⅓ of usual evening dose.
- ½ dose in the morning | After procedure when eating usual meals |

**Long-acting**
- Glargine (Lantus®)
- Detemir (Levemir®)

**Pre-mixed/combination insulins (e.g., 70/30)**
- Prep day: if on clear liquids, NPO, or bowel prep needed, ½ to ⅓ dose in morning and evening | ⅓ dose in the morning | After procedure when eating usual meals |

**INSULIN PUMP**
- Fast-acting insulin analogs (lispro, aspart, glulisine) are used in insulin pumps. On occasion, Regular insulin is used. If REGULAR U-500 is used, contact patient’s Endocrinologist.
- No change in basal insulin or patient can use a temporary basal decrease to maintain target BG. Bolus insulin is not given unless for hyperglycemia. REMOVE PUMP before certain procedures (i.e., MRI, CT), procedure/surgery longer than 2 hours, and/or other contraindications. (See Policy 10.25)
- SQ or IV insulin infusion MUST be given before the pump is removed. | Resume usual programming when eating (pt should correct for hyperglycemia as long as patient can independently manage pump. |
# Key Recommendations for Outpatient Management of Type 2 Diabetes Mellitus in Children

## Screening in Children (10-18 years)

<table>
<thead>
<tr>
<th>When to Test</th>
<th>Screening Tests</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen patients &gt; 10 yrs. (or at onset of puberty if earlier) with BMI &gt; 85th percentile for age and sex, weight for height &gt; 85th percentile, or weight &gt; 120% of ideal for height AND two or more additional risk factors. <em>(ADA Grade E)</em></td>
<td>A1C, fasting plasma glucose with insulin level, or oral glucose tolerance test (preferred with fasting and 2-hour insulin levels) <em>(ADA Grade B)</em></td>
<td>If results normal, repeat testing every 3 years. <em>(ADA Grade C)</em>&lt;br&gt;If results abnormal (prediabetes), repeat testing annually. <em>(ADA Grade E)</em></td>
</tr>
</tbody>
</table>

### Risk Factors:
- First or second-degree relative with type 2 diabetes
- High risk race/ethnicity (African American, Latino, Native American, Asian American, Pacific Islander)
- Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, HTN, dyslipidemia, polycystic ovarian syndrome, or small-for-gestational-age birth weight)
- Maternal history of diabetes or GDM during pregnancy

### Diagnosis *(ADA Grade B)*

A diagnosis should be given when a positive test result is exhibited on more than one occasion.

- A1C: ≥ 6.5%
- Fasting plasma glucose*: ≥ 126 mg/dL
- 2-hr plasma glucose on 75-g oral glucose tolerance test (OGTT): ≥ 200 mg/dL
- Random plasma glucose: ≥ 200 mg/dL

*Fasting is defined as no caloric intake for ≥ 8 hrs.

## First Line Therapy

### Lifestyle Interventions

- All patients with type 2 diabetes need to be evaluated by a registered dietitian at every visit with expertise in addressing the nutritional needs of children with Type 2 diabetes and obesity. *(ADA Grade A)*

Healthy eating is encouraged with 3 meals and planned snacks, reducing portion size *(ADA Grade C)*, encouraging water consumption of water, reducing juice intake, increasing consumption of fruits and vegetables. *(ADA Grade B)*

### Pharmacologic Interventions

- Metformin *(ADA Grade A)*
- Insulin *(ADA Grade E)*

### References:

Last reviewed and revised: 03/2016 | Contact Pediatric Endocrinology with questions.
<table>
<thead>
<tr>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test</strong></td>
</tr>
<tr>
<td><strong>Tobacco Use</strong></td>
</tr>
</tbody>
</table>
| **Blood Glucose Control** | Check blood glucose levels fasting, pre-meal and at bedtime until at target level | At diagnosis | Once at target level:  
 Patients on metformin only: To be determined by individual provider  
 Patients on basal insulin: Daily fasting blood sugars and 2-hour postprandial  
 Patients on basal/bolus insulin therapy: Pre-meals and at bedtime. |
|  | A1C | Review self-monitored blood glucose (SMBG) at each visit  
 Repeat A1C every 3 months |
| **Hypertension** | Blood pressure | Every visit (ADA Grade B) | Goal: < 90th percentile for age, sex and height (ADA Grade E)  
 If elevated, first line therapy is diet and exercise (ADA Grade E)  
 If still elevated after 3-6 months, recommend further evaluation with laboratory evaluation of sodium, potassium, chloride, bicarbonate, BUN, creatinine, urinalysis without microscopy renal ultrasound and referral to Hypertension Clinic. Consider ACE Inhibitor following appropriate reproductive counseling. (ADA Grade E) |
| **Retinopathy** | Dilated eye exam | At diagnosis  
 Annually thereafter (ADA Grade E) | Less frequent examinations (i.e., every 2 years) may be acceptable on the advice of an eye care professional. (ADA Grade E) |
| **Nephropathy** | Random urine sample for microalbumin/creatinine ratio (UACR)  
 Creatinine clearance/estimated glomerular filtration rate | At diagnosis  
 Consider annual urine screen (UACR) once patient has diabetes for 5 yrs. (ADA Grade B)  
 Measure creatinine clearance at diagnosis, then based on age, diabetes duration and treatment thereafter (ADA Grade E) | If initial positive screen, repeat on separate occasion  
 If repeat screen is positive, recommend a 24 hour urine study for protein and creatinine  
 If elevated (UACR > 30 mg/g) on 2/3 urine samples, consider renal consult and initiation of an ACE inhibitor. (ADA Grade B) |
| **Dyslipidemia** | Fasting lipid profile (ADA Grade E) | At diagnosis (ADA Grade E)  
 If abnormal, repeat annually (ADA Grade E)  
 If normal, repeat every 5 years (ADA Grade E) | Initial therapy diet and exercise with counseling with a registered dietician (ADA Grade B)  
 If patient 10 years old and LDL > 160 mg/dL after 6 months or LDL > 130 mg/dL and one or more CVD risk factors, consider statins with goal of LDL < 100 mg/dL (ADA Grade E)  
 If triglycerides > 150 mg/dL and < 600 mg/dL, decrease simple carbohydrates, fat, and increase exercise. If > 700 mg/dL, consider niacin therapy to prevent pancreatitis.  
 Consider referral to Pediatric Preventive Cardiology Clinic  
 Consider Omega 3 fatty acids. |
| **Nonalcoholic Fatty Liver Disease** | Liver Enzymes (AST, ALT) | At diagnosis  
 Annually thereafter |
| **Obstructive Sleep Apnea** | Interview patient/parent | Every visit |
| **Depression** | Interview patient/parent  
 PHQ-2, with follow-up for children > 12 yrs. | At diagnosis (ADA Grade E)  
 Every visit (ADA Grade E) | Positive screen on PHQ-2 (≥ 3 points)  
 May further assessment using PHQ-A or PHQ-9 (≥ 10 points) |
## Glycemic Goals

### Adult Patients

**Non-ICU:**
- Pre-meal glucose: less than 140 mg/dL
- Random glucose: less than 180 mg/dL

**ICU Patients:**
- 140-180 mg/dL

### Insulin Infusion Target:
- 110 – 150 mg/dL

### Pediatric Patients

**Patients with history of diabetes:**
- Ages 0-12: 100-180 mg/dL
- Ages 12-19: 90-130 mg/dL

**Newly diagnosed:**
- 100-180 mg/dL

### Other Important Glycemic Values

#### Hypoglycemia
- Glucose <70 mg/dL
- Refer to orders, [adult/pediatric hypoglycemia treatment algorithms](#), and [Patient Care Policy 13.24: Hypoglycemia, Care of the Hospitalized Patient](#)

#### Critical Values
- Critical Low: <40 mg/dL
- Critical High: >400 mg/dL
- See related policies: 11.26 Nova Stat Strip Blood Glucose Meter and 8.07 Communication of Critical Results and Critical Tests/Procedures
Cautions Regarding Oral Agents for Diabetes in the Hospital Setting/Inpatient Diabetes Management

**Oral Agents and Non-Insulin Injectables**

★ Hold all oral agents and non-insulin injectables★

*(Orders are required)*

<table>
<thead>
<tr>
<th>Medication Class/ Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biguanides</strong> (metformin): consider re-checking SCr post-procedure if patient has received contrast AND has history of renal disease.</td>
</tr>
<tr>
<td><strong>Sulfonylureas</strong> (glipizide, glyburide, glimepiride)</td>
</tr>
<tr>
<td><strong>Meglitinides</strong> (repaglinide, nateglinide)</td>
</tr>
<tr>
<td><strong>Thiazolidinediones</strong> (“TZDs” – i.e., pioglitazone, rosiglitazone)</td>
</tr>
<tr>
<td><strong>DPP-4 inhibitors</strong> (“gliptins” – i.e., sitagliptin, saxagliptin, linagliptin, alogliptin)</td>
</tr>
<tr>
<td><strong>GLP-1 agonists</strong> (exenatide, liraglutide, albiglutide, dulaglutide)</td>
</tr>
<tr>
<td><strong>SGLT-2 Inhibitors</strong> (“flozins” – i.e., canagliflozin, dapagliflozin, empagliflozin)</td>
</tr>
</tbody>
</table>

**Key Points about Oral Agents in Hospital Settings:**

- Oral medications are generally not recommended in hospitalized patients due to multiple factors.
- Stop metformin for following conditions: renal insufficiency, acidosis, decompensated heart failure, or received contrast dye.
- Stop thiazolidinediones (TZD) for following conditions: fluid overloaded, congestive heart failure, or liver dysfunction.
- Sulfonylureas should never be used in a patient who is NPO/not eating consistently.

**Key Points about Initiating Insulin:**

- UW Health Formulary options include glargine for basal insulin and lispro for nutritional and correction insulin.
- Regular and NPH insulin are also available but used less frequently.
- Combination insulins are not recommended during inpatient hospital stays due to inconsistent PO intake and increased risk of hypoglycemia.
- Patients with type 1 DM and insulin-requiring type 2 DM must have some basal (long-acting) insulin even when NPO.
- Refer to *Initiation of Insulin in Non-Critically Ill Insulin-Naive Hyperglycemic Patients – Adult – Inpatient Algorithm* for guidance about starting insulin.

**American Diabetes Association Guidelines**¹:

- The sole use of sliding scale insulin in the hospital settings is strongly discouraged.
- Glucose monitoring should be obtained every 4 to 6 hours according to nutrition or more frequently when IV insulin is used.
- Hypoglycemia protocols should be available whenever POC glucose monitoring is ordered.
- The majority of critically ill patients should be treated with IV insulin if BG>180 mg/dL. Non-critically ill patients have glucose goals of <140mg/dL prior to meals and random glucose <180mg/dL.
- An insulin regimen with basal insulin, nutritional (if patients are receiving nutrition), and correction components is the preferred approach for non-critically ill patients.

Patients with type 1 DM & insulin-requiring type 2 DM **must have some basal (long-acting) insulin** even when NPO.

### Adjustment When NPO

★ A written/verbal order is needed to adjust insulin.

<table>
<thead>
<tr>
<th>Type of Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus Insulin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humalog® (lispro)</td>
<td>5-15&quot;</td>
<td>1-2 hours</td>
<td>4-6 hours</td>
</tr>
<tr>
<td>Novolog® (aspart)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apidra® (glulisine)</td>
<td>30-60&quot;</td>
<td>2-4 hours</td>
<td>6-10 hours</td>
</tr>
<tr>
<td><strong>Regular</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Basal Insulin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH</td>
<td>1-2 hours</td>
<td>4-8 hours</td>
<td>10-20 hours</td>
</tr>
<tr>
<td>Detemir (Levemir®)</td>
<td>1-2 hours</td>
<td>8-12 hours</td>
<td>12-24 hours</td>
</tr>
<tr>
<td>Glargine (Lantus®)</td>
<td>1-2 hours</td>
<td>Flat</td>
<td>~24 hours</td>
</tr>
<tr>
<td><strong>Combinations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin combinations containing mixtures of intermediate-acting and short-acting or rapid-acting insulins will have onset, peak and duration of action similar to the individual components.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-500 or Other Concentrated Insulin types</td>
<td>Variable</td>
<td></td>
<td></td>
</tr>
</tbody>
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<td></td>
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</table>

**Hypoglycemia:** Follow hypoglycemia treatment orders. To maintain glucose control after hypoglycemia intervention, DO NOT hold scheduled insulin; once the glucose is > 70 mg/dL, insulin should be given as ordered. If the patient has had repeated hypoglycemic episodes, contact the ordering provider to discuss adjustment of insulin doses. Nurses should chart the CAUSE of hypoglycemia in Doc Flowsheets.

**Hypoglycemia Prevention:** If insulin has been given and patient is suddenly NPO (or TF/TNA interrupted), notify team/DMS (if involved). Orders may be needed for IVF with dextrose.

**Tube Feedings:** USE CAUTION! Patients will likely need some basal (long-acting) insulin even if feeding is interrupted. Patients receiving tube feedings should not be considered NPO. **If tube feeding is interrupted, consider risk for hypoglycemia, monitor appropriately, and notify team/DMS (if involved).**

**Other Resources:** U-Connect Inpatient Diabetes Management page; Gwen Klinkner, Diabetes CNS, Pager #3302; Diabetes Management Service, pager #0218

Steps for Coordinating Glucose Monitoring, Meals, and Medications for Inpatient Diabetes Care

**Monitoring**
Check Blood Glucose

- Check glucose no more than 30 minutes before insulin administration

**Meals**
- Ask patient to notify you when ordering food or when tray arrives
- Check glucose before patient eats
- Document % meal eaten and/or carb grams eaten

**Medications**
Insulin

- Lispro: Give within 0-15 minutes of meal (after meal if carb counting or adjusting dose for intake)
- Regular: Give 25-35 minutes before meal

**Give PRN correction insulin with meal dose if possible to limit the number of injections**

Questions? Contact Inpatient Diabetes Quality Committee
Continuous Glucose Monitoring (CGM):
Information for Clinicians

Continuous Glucose Monitoring Systems (CGM) are devices that continuously monitor and record interstitial fluid glucose levels. Patients and families may refer to this as “sensor therapy.”

How does a CGM (sensor) work?

CGM systems use a tiny sensor inserted under the skin to check glucose levels in the interstitial space. The sensor stays in place for several days to a week and then must be replaced. A transmitter is connected to the sensor and sends information about glucose levels via radio waves from the sensor to a pager-like wireless monitor. The user must (calibrate) check blood sample with a glucose meter to program the device 2-3 times per day.

What does a CGM look like?

Can I use sensor glucose readings for treatment?

- Glucose readings obtained from the CGM are used to monitor patterns and trends. They are not intended to replace standard blood glucose monitoring.
- Any diabetes intervention (meal/snack insulin, correction insulin, or hypoglycemia treatment) must be preceded by POC blood glucose check.

Can anything alter sensor glucose values?

- **Lag time:** Sensor glucose values are typically 10-15 minutes behind blood glucose values.
- **Compression:** If the sensor is compressed due to positioning, the sensor glucose value can be dramatically lower than the blood glucose value.
- **Acetaminophen:** Any medication with acetaminophen will falsely elevate sensor data for as much as 8 hours.

How do I keep it safe if it needs to be removed?

- **CGM transmitters are very expensive and not disposable.** If you need to remove the device, carefully lift the tape and pull the sensor out. Place sensor/transmitter (dressing and all) in a patient belonging container (order from CS) with a patient label on it for the family to take home.
Adult Hypoglycemia Treatment Algorithm

Patients with G-tubes

If Blood Glucose is between 40 and 69 mg/dL

- Is patient able to eat/swallow safely?
  - Yes: Give 15 grams of carbohydrate
  - No: Does patient have intravenous access?
    - Yes: Administer 12.5 grams (25 mL) dextrose 50% slowly by intravenous push
    - No: Administer 1 mg Glucagon subcutaneously or intramuscularly

Recheck glucose in 15 minutes

If Blood Glucose is less than 40 mg/dL

- Is patient able to eat/swallow safely?
  - Yes: Give 30 grams of carbohydrate
  - No: Does patient have intravenous access?
    - Yes: Administer 25 grams (50 mL) dextrose 50% slowly by intravenous push
    - No: Administer 1 mg Glucagon subcutaneously or intramuscularly

Recheck glucose in 15 minutes

15 grams of carbohydrate = 3 to 4 oz. of juice or 4 glucose tablets

30 grams of carbohydrate = 6 to 8 oz. of juice or 8 glucose tablets

Consider rechecking glucose after 1 hour to ensure glucose remains greater than or equal to 70 mg/dL

Recheck glucose after 1 hour to ensure glucose remains greater than or equal to 70 mg/dL

Last updated: 12/10/2012 | Last reviewed: 02/2016
Questions? Contact Diabetes Quality Committee
For revisions, contact Center for Clinical Knowledge Management (CCKM)
Reference: UW Health Standards of Diabetes Care - Adult/Pediatric - Inpatient/Ambulatory Guideline
Check blood gases, serum glucose, sodium, potassium, bicarb, chloride, anion gap, CBC, SCr, beta-hydroxybutyrate, and a UA. Order a HbA1C, if not done in last 60 days. Start IV fluids: 1 L NS over 1 hour.

---

**IV Fluids**

- Evaluate hydration status
- Severe hypovolemia
  - Give 0.9% NaCl at rate of 1 L/hr
- Mild dehydration
  - Hemodynamic monitoring/pressors
- Cardiogenic shock
  - Give 0.9% NaCl at rate of 250-500 mL/hr

**Insulin**

- Ensure adequate potassium level before starting insulin therapy
  - Use Standard Dose Insulin Infusion – Adult – Practice Protocol
  - Use an IV solution containing 5% dextrose when blood glucose declines to 200 mg/dL or lower

**Potassium**

- Establish adequate urine output of ≥50 ml/hr, then replete, if necessary
  - K+ < 3.3 mEq/L
  - Before starting insulin therapy, give 10-20 mEq K+ per hour in IV fluids until K+ > 3.3 mEq/L
  - K+ > 5.2 mEq/L
  - Do not supplement K+ but check K+ level every 2 hours
  - K+ 3.3 to 5.2 mEq/L
    - Give 10-20 mEq/L of K+ in IV fluids to maintain K+ level between 4 and 5 mEq/L.

---

‡ K+ Infusion rates ≥20 mEq/hr require a cardiac monitor. Maximum recommended rate for peripheral K+ administration is no greater than 10 mEq/hr. Sliding Scale potassium only allowed on B4/3, B4/5, B6N3, B6S3, D4/5, D6/5 IMC, F4/5, F4M5, F8/4

---

For a patient in HHS, use an IV solution containing 5% dextrose when blood glucose declines to 300 mg/dL or lower.

Hourly glucose monitoring required every hour until glucose within target range of 110-150 mg/dL for 3 hours, then check every 2 hours. Resume hourly monitoring if blood glucose deviates from the target range. Check electrolytes and phosphate level every 2 hours times two, then every 4 hours. Check a beta-hydroxybutyrate level every 8 hours. Identify and treat the cause of the DKA precipitation.

Once the patient is able to eat and the DKA episode is resolved (as demonstrated by pH > 7.3, bicarbonate > 18 mmol/L, and blood glucose < 200 mg/dL), transition the patient to subcutaneous (SQ) insulin. Overlap the insulin drip with the SQ insulin by 2 or more hours. For an insulin-naïve patient, calculate the daily insulin dose received via insulin infusion in the last 24 hours, decrease by 20%, and split the remainder up as ½ basal insulin and ½ mealtime insulin (mealtime dose to be divided between all meals).

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Questions? Contact Inpatient Diabetes Quality Committee

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Last updated: 2/18/2016
## Insulin to Carbohydrate Ratios (ICRs)
### for Adult Inpatients

#### 1:4
- **Insulin to Carb Ratio (ICR)**: (1 unit of insulin covers 4 grams of carbohydrate)
- **Nutritional Dose**

<table>
<thead>
<tr>
<th>Grams of Carbs Eaten</th>
<th>Units of Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
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<td>94-97</td>
<td>24</td>
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<tr>
<td>98-101</td>
<td>25</td>
</tr>
</tbody>
</table>

**Example:**
- If ICR is 1:3 and patient ate 30 grams of carbohydrate, you would administer 10 units of insulin (30 ÷ 3 = 10)

#### 1:5
- **Insulin to Carb Ratio (ICR)**: (1 unit of insulin covers 5 grams of carbohydrate)
- **Nutritional Dose**

<table>
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<th>Units of Insulin</th>
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<tbody>
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<td>93-97</td>
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<td>98-102</td>
<td>20</td>
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</tbody>
</table>

**Example:** If ICR is 1:25 and patient ate 30 grams of carbohydrate, you would administer 1 unit of insulin (30 ÷ 25 = 1.2 or 1 unit)

### Custom Ratios
If provider orders a ratio that is not 1:4, 1:5, 1:8, 1:10, 1:12, 1:15, or 1:20, you will need to calculate the appropriate insulin dose as follows:

**Formula:**

\[
\text{Total Grams of Carbohydrates} \div \text{# grams per unit of insulin (1:x)} = \# \text{ units of insulin}
\]

**Example:**
- If ICR is 1:3 and patient ate 30 grams of carbohydrate, you would administer 10 units of insulin (30 ÷ 3 = 10)

If dose needs to be rounded, do so as follows:
- \(< .\overline{5}\), round down
  - **Example:** If ICR is 1:25 and patient ate 30 grams of carbohydrate, you would administer 1 unit of insulin (30 ÷ 25 = 1.2 or 1 unit)
- \(\geq .\overline{5}\), round up
  - **Example:** If ICR is 1:8 and patient ate 30 grams of carbohydrate, you would administer 4 units of insulin (30 ÷ 8 = 3.75 or 4 units)

### 1:8
- **Insulin to Carb Ratio (ICR)**: (1 unit of insulin covers 8 grams of carbohydrate)
- **Nutritional Dose**

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<th>Units of Insulin</th>
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<tr>
<td>92-99</td>
<td>12</td>
</tr>
</tbody>
</table>

**Example:**
- Patient who eats 35 grams of carbs would receive 7 units of insulin to cover nutritional needs (plus more if correction insulin ordered for pre-meal hyperglycemia)

---

### Insulin to Carbohydrate Ratios (ICRs) (for Adult Inpatients)

Last Updated: 2/12/2016

**Questions? Contact Inpatient Diabetes Quality Committee**

**Step 1:** Select ICR that corresponds with provider orders.

**Step 2:** Determine nutritional dose of insulin based on number of carbohydrates patient ate.

**Step 3:** Determine if correction insulin is ordered/needed for pre-meal hyperglycemia.

**Step 4:** Document carb grams eaten and insulin given.

### 1:10

**Insulin to Carb Ratio (ICR)**
(1 unit of insulin covers 10 grams of carbohydrate)

<table>
<thead>
<tr>
<th>Nutritional Dose</th>
<th>Grams of Carbs Eaten</th>
<th>Units of Insulin</th>
</tr>
</thead>
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<td>95-104</td>
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</tbody>
</table>

Patient who eats 35 grams of carbs would receive 4 units of insulin to cover nutritional needs (plus more if correction insulin ordered for pre-meal hyperglycemia)

### 1:12

**Insulin to Carb Ratio (ICR)**
(1 unit of insulin covers 12 grams of carbohydrate)

<table>
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<tr>
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<th>Grams of Carbs Eaten</th>
<th>Units of Insulin</th>
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<tr>
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</tbody>
</table>

Patient who eats 35 grams of carbs would receive 3 units of insulin to cover nutritional needs (plus more if correction insulin ordered for pre-meal hyperglycemia)

### 1:15

**Insulin to Carb Ratio (ICR)**
(1 unit of insulin covers 15 grams of carbohydrate)

<table>
<thead>
<tr>
<th>Nutritional Dose</th>
<th>Grams of Carbs Eaten</th>
<th>Units of Insulin</th>
</tr>
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</tbody>
</table>

Patient who eats 35 grams of carbs would receive 2 units of insulin to cover nutritional needs (plus more if correction insulin ordered for pre-meal hyperglycemia)

### 1:20

**Insulin to Carb Ratio (ICR)**
(1 unit of insulin covers 20 grams of carbohydrate)

<table>
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<tr>
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<th>Grams of Carbs Eaten</th>
<th>Units of Insulin</th>
</tr>
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<td></td>
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</tbody>
</table>

Patient who eats 35 grams of carbs would receive 2 units of insulin to cover nutritional needs (plus more if correction insulin ordered for pre-meal hyperglycemia)

---

See reverse side for other ICRs
**Intravenous (IV) to Subcutaneous (SQ) Insulin Transition Algorithm - Adult - Inpatient**

**Step 1:** Does patient meet the following inclusion criteria for use of the algorithm?
- Maintained on IV insulin infusion for ≥ 24 hours; AND
- Controlled blood glucose (≤ 3 blood glucose > 180 mg/dL in the past 8 hours)

Yes (go to step 2)

**Step 2:** Does patient meet the following exclusion criteria for use of the algorithm:
- Requiring vasopressors
- Acute MI with cardiogenic shock
- Unresolved Diabetic Ketoacidosis (DKA)
- Acute changes in renal function (an increase in serum creatinine of ≥ 0.3 mg/dL in the last 48 hours)
- High dose steroid use (≥ 40 mg of prednisone or equivalent daily) or undergoing a steroid taper
- Receiving total parenteral nutrition (TPN)
- Receiving tube feeding and not at goal

No (go to step 3)

**Step 3:** Does the patient need scheduled SQ insulin?

- No
  - Patients with no history of diabetes or with diabetes managed without insulin AND with a mean infusion rate of < 1 unit/hour
  
- Yes
  
  - Order SQ correction insulin & discontinue IV insulin
  
  - Type 1 diabetes
  - Type 2 diabetes requiring insulin
  - Patients with a mean insulin infusion rate of ≥ 1 unit/hr

Yes (go to step 4)

**Step 4:** Calculate the total daily dose (TDD) of insulin

SQ transition dosing may be guided by previous home insulin dose in patients with well-controlled diabetes (A1C < 8%)

**Step 4a:** Determine the average rate (units/hour) of insulin infusion over the previous 8 hours

Multiply this average rate by 24 hours to calculate the total average daily insulin dose

**Step 4b:** Multiply daily average calculated in step 4a by 0.8 to account for a conversion safety factor

\[
TDD \text{ (units/day)} = \text{average insulin infusion rate (units/hour)} \times 24 \text{ hours} \times \text{conversion safety factor (0.8)}
\]

Do NOT exceed a TDD of 120 units/day or > 1 unit/kg/day (actual body weight) unless patient was stable on dose prior to admission. If TDD is > 120 units/day or > 1 unit/kg/day consider a Diabetes Management Service consult

**Step 5:** Evaluate the patient's current nutritional intake

**Full Nutrition**
- Patient is eating > 50% of meals or is receiving > 50% of continuous goal tube feeds

**Minimal Nutrition**
- Patient is NPO, eating ≤ 50% of meals or is on a clear liquid diet

**Step 6:** Calculate dose of SQ insulin for patients receiving full nutrition

**Patient eating Meals**
- Give 40-50% of TDD as glargine insulin 4 hours prior to discontinuation of the IV insulin infusion and give 50-60% of TDD as rapid-acting insulin in 3 divided doses with meals

**Patient on Continuous Tube Feeds (TF)**
- Give 30-40% of TDD as glargine insulin 4 hours prior to discontinuation of IV insulin and give 60-70% of TDD as regular insulin in 4 divided doses every 6 hours
- Not all patients on TF will require glargine insulin:
  - No prior history of diabetes
  - No medications or insulin for diabetes

Give these patients 100% of TDD as regular insulin in 4 divided doses every 6 hours. Give first dose 30 minutes prior to discontinuation of IV insulin

**Step 6a:** Order correction insulin for PRN hyperglycemia

**Step 6b:** Order correction insulin for PRN hyperglycemia
Example Calculations for Transition of IV to SQ Insulin

**Example Calculation: Patient eating > 50% of meals**

Patient ZZ is receiving full nutrition and has an average insulin infusion rate of 2 units/hr over the previous 8 hours.

1.) 2 units/hr X 24 hours = 48 units total average daily dose
2.) 48 units X 0.8 (safety factor) = ~38 units TDD insulin
3.) 38 X 0.5 (50%) = 19 units of glargine insulin given 4 hours prior to discontinuation of insulin infusion. 38 X 0.5 (50%) = 19 units; 19 units ÷ 3 meals = ~ 6 units of rapid-acting insulin given with each meal
4.) Order correction insulin for PRN hyperglycemia

**Example Calculation: Patient receiving > 50% of goal tube feeds**

Patient YY is receiving 30 ml/hr of tube feeds. The goal tube feed rate for YY is 45 ml/hr. The average rate of insulin infusion over the previous 8 hours was 3 units/hr. YY has a history of Type 2 diabetes requiring insulin.

1.) 3 units/hr X 24 hours = 72 units total average daily dose
2.) 72 units X 0.8 (safety factor) = ~58 units TDD insulin
3.) 58 X 0.4 (40%) = ~23 units of glargine insulin given 4 hours prior to discontinuation of insulin infusion. 58 X 0.6 (60%) = ~35 units; 35 units ÷ 4 doses = ~ 9 units of regular insulin given every 6 hours
4.) Order correction insulin for PRN hyperglycemia

* Not all patients on TF will require glargine insulin: (No prior history of diabetes, no medications or insulin for diabetes) Give these patients 100% of TDD as regular insulin in 4 divided doses every 6 hours. Give first dose 30 minutes prior to discontinuation of IV insulin

**Example Calculation: Patient is NPO (Minimal Nutrition)**

Patient XX is NPO and has an average insulin infusion rate of 1.5 units/hr over the previous 8 hours.

1.) 1.5 units/hr X 24 hours = 36 units total average daily dose
2.) 36 units X 0.8 (safety factor) = ~29 units TDD insulin
3.) 29 units x 100 % = 29 units of glargine insulin given 4 hours prior to discontinuation of insulin infusion.
4.) Order correction insulin for PRN hyperglycemia

Last revised: 02/18/2016
Last reviewed: 02/18/2016
Contact the Center for Clinical Knowledge Management or Drug Policy Program for revisions.
References:


Initiation of Insulin in Non-Critically Ill Insulin-Naive Hyperglycemic Patients – Adult – Inpatient

**Target Inpatient Blood Glucose for Non-critically Ill**

<table>
<thead>
<tr>
<th>Before meals</th>
<th>Random (non-fasting)</th>
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<tbody>
<tr>
<td>&lt;140mg/dL</td>
<td>&lt;180mg/dL</td>
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</table>

**Criteria for Algorithm use**

<table>
<thead>
<tr>
<th>Inclusion criteria:</th>
<th>Exclusion criteria:</th>
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<tbody>
<tr>
<td>Patients who have &gt;3 blood glucose (BG) readings &gt;180mg/dL in a 24 hour time period</td>
<td>Type 1 diabetes</td>
</tr>
<tr>
<td>Patients not previously on scheduled insulin or an insulin drip</td>
<td>Steroid induced hyperglycemia</td>
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<tr>
<td></td>
<td>Parenteral nutrition</td>
</tr>
<tr>
<td></td>
<td>Severe hyperglycemia (insulin drip required)</td>
</tr>
</tbody>
</table>

**Step 1:** Use the chart below to determine the patient’s initial Total Daily Dose (TDD) of insulin by taking the baseline estimate and subtracting/adding for each risk factor. *Actual body weight should be used for TDD calculation.* Stop all oral and non-insulin injectable diabetes medications if previously taking.

<table>
<thead>
<tr>
<th>Baseline TDD estimate</th>
<th>0.4 units/kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 70</td>
<td>-0.1 unit/kg/day</td>
</tr>
<tr>
<td>Renal insufficiency (CrCl&lt;60ml/min)</td>
<td>-0.1-0.2 units/kg/day</td>
</tr>
<tr>
<td>End stage liver disease</td>
<td>-0.1 unit/kg/day</td>
</tr>
<tr>
<td>Using non-insulin diabetes medication prior to admission AND all BG&gt;200mg/dL in past 24 hours</td>
<td>+0.1 unit/kg/day</td>
</tr>
<tr>
<td>Final TDD estimate</td>
<td>= ___________</td>
</tr>
</tbody>
</table>

**Step 2:** Split TDD of insulin into basal-nutritional regimen depending on diet.

<table>
<thead>
<tr>
<th>If eating meals:</th>
<th>If receiving continuous tube feeds (TF):</th>
<th>If NPO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal: glargine = TDD x 0.5 daily Nutritional: rapid-acting insulin (i.e. lispro) = TDD x 0.5 divided by 3 for 'set meal' dosing or based on insulin:carb ratio orders. Correction: rapid-acting insulin (i.e. lispro) TID prn &amp; bedtime prn</td>
<td>Not on DM meds prior to admission: Basal: none Nutritional*: regular insulin = TDD divided by 4, dosed q6hrs (hold if TF off for &gt;1 hour) Correction: regular insulin every 6hrs prn</td>
<td>Basal: glargine = TDD x 0.5 daily Nutritional: none Correction: rapid-acting insulin (i.e. lispro) every 6hrs prn</td>
</tr>
</tbody>
</table>

*On DM meds prior to admission: Basal: glargine = TDD x 0.4 daily Nutritional*: regular insulin = TDD x 0.6 divided by 4, dosed every 6hrs (hold if TF off for >1 hour) Correction: regular insulin every 6hrs prn

| Diabetes meal plan recommended | | Consider low-dose dextrose infusion (D5-1/2NS at 75ml/hr) to prevent hypoglycemia. |

*If patient is not at goal tube feed rate, consider reducing initial nutritional dose by up to 50% and titrating dose up as necessary.*

Last Updated 2/11/2016
Questions? Contact Inpatient Diabetes Quality Committee
**Step 3:** Choose correction scale insulin for blood glucose excursions TID PRN or every 6 hours prn. *May add HS scale for glucose >200mg/dl for patients eating meals.

<table>
<thead>
<tr>
<th>Lower intensity</th>
<th>Higher intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blood Glucose (mg/dL)</strong></td>
<td><strong>Insulin (units)</strong></td>
</tr>
<tr>
<td>151-200</td>
<td>1</td>
</tr>
<tr>
<td>201-250</td>
<td>2</td>
</tr>
<tr>
<td>251-300</td>
<td>3</td>
</tr>
<tr>
<td>301-350</td>
<td>4</td>
</tr>
<tr>
<td>&gt;350</td>
<td>5</td>
</tr>
</tbody>
</table>

Generally used for:
- Insulin sensitive (TDD<40units)
- Renal failure

Generally used for:
- Insulin resistant (TDD≥40units)
- Obese patients

### Day after initiating insulin

**How to adjust insulin regimen when eating meals:**

<table>
<thead>
<tr>
<th>Pre-breakfast</th>
<th>Pre-lunch</th>
<th>Pre-supper</th>
<th>Bedtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG &lt;100</td>
<td>BG &gt;140</td>
<td>BG &lt;100</td>
<td>BG &gt;140</td>
</tr>
<tr>
<td>Decrease glargine</td>
<td>See below** for type of insulin to adjust</td>
<td>Decrease breakfast dose</td>
<td>Increase breakfast dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decrease lunch dose</td>
</tr>
<tr>
<td>Decrease</td>
<td>Increase</td>
<td>Decrease</td>
<td>Increase</td>
</tr>
<tr>
<td>breakfast dose</td>
<td>glargine</td>
<td>supper dose</td>
<td>supper dose</td>
</tr>
</tbody>
</table>

**Dose adjustments:**

1. For BG 140-200mg/dL, increase dose by 10%.
2. For BG >200mg/dL, increase dose by 20%.
3. For BG 70-100mg/dL, consider dose reduction of 10-20%.
4. For BG <70 (i.e. hypoglycemia), review for cause of hypoglycemia and reduce “at fault” insulin by 20-30%.
   - If episode is clearly explained (i.e. patient decided to eat only half of meal but full dose of insulin given), insulin reduction may not be necessary.

** If pre-breakfast blood glucose is >140mg/dL, compare to bedtime glucose:
- If the AM blood glucose ≤ bedtime blood glucose, increase the supper dose and DO NOT adjust the glargine dose.
- If the AM glucose is < bedtime glucose by 50mg/dL or more, decrease glargine by 10-20% (except if the patient received a bedtime correction insulin dose).
- If the AM blood glucose > bedtime blood glucose, increase the glargine dose by 10-20%.

**How to adjust insulin regimen when NPO or receiving tube feeds:**

1. For BG 140-200mg/dL and no risk of hypoglycemia, increase TDD by 10%.
2. For BG >200mg/dL, increase TDD by 20%.
3. For BG 70-100mg/dL, decrease TDD by 10-20%.
4. For BG <70mg/dL (i.e. hypoglycemia), decrease TDD by 20-30%. May consider starting D5-1/2NS at 75ml/hr if needed. If hypoglycemia episode is clearly explained (i.e. tube feeds were shut off but dose of regular insulin still given), insulin reduction may not be necessary.
References

Pediatric Hypoglycemia Treatment Algorithm

Glycemic Values: Pediatrics

<table>
<thead>
<tr>
<th>Age</th>
<th>Lab Reference Range (mg/dL)</th>
<th>Hypoglycemia (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days to 23 hours</td>
<td>40–60</td>
<td>&lt;40</td>
</tr>
<tr>
<td>24 hours to 30 days</td>
<td>50–80</td>
<td>&lt;50</td>
</tr>
<tr>
<td>31 days to 5 years</td>
<td>60–99</td>
<td>&lt;60</td>
</tr>
<tr>
<td>6 years and older</td>
<td>70–99</td>
<td>&lt;70</td>
</tr>
</tbody>
</table>

Regardless of age, if patient has diabetes, provide hypoglycemia treatment when blood glucose is less than 70 mg/dL.

Follow individualized orders (when given) to accommodate special needs or populations (i.e., neonates, ketogenic therapy, metabolic conditions).

Is patient able to eat/swallow safely?

Yes

Give 15-30 grams carbohydrates

No

Does patient have intravenous access?

Yes

Administer IV dextrose over 2-3 min

0.25-1 g/kg

(See orders: appropriate dextrose concentration is based on patient age and clinical scenario)

Establish IV access

Recheck glucose within 15 minutes

Reasons for delayed recheck (>15 min) and/or ongoing efforts to correct hypoglycemia must be documented (i.e., initiating antiemetic treatment to promote PO intake, breast feeding, obtaining IV access, dextrose infusing)

Administer glucagon SQ or IM (see orders for weight-based dose)

0.03 mg/kg, max dose 1 mg

Oral carbohydrate Choices:

15 grams of carbohydrate = 3 to 4 oz. of juice or 4 glucose tablets
30 grams of carbohydrate = 6 to 8 oz. of juice or 8 glucose tablets

For less than 1 year of age, breast milk or formula

Consider rechecking glucose after 1 hour to ensure glucose remains in normal range.

For critical lows (<40 mg/dL), recheck glucose 1 hour after glucose normalizes to ensure glucose remains in normal range.

No

Administer glucagon SQ or IM (see orders for weight-based dose)

0.03 mg/kg, max dose 1 mg

Continue to follow Hypoglycemia Treatment Algorithm until no longer hypoglycemic

If meal or snack is not planned within 1 hour, consider giving a snack with protein for those with diabetes

If patient has a NG/G-tube being used for enteral nutrition and patient is conscious, juice may be used for initial treatment. If still hypoglycemic after initial treatment, IV dextrose or glucagon should be used as indicated above. Other types of tubes (i.e., Dobhoff, J-tubes) should not be used for hypoglycemia treatment.

Pediatric Emergency Dept. Diabetic Ketoacidosis (DKA) Algorithm

Initial Lab Tests and Evaluation

**Severity of Dehydration**
- **Mild**
  - Normal saline maintenance
- **Moderate**
  - Normal saline 10 mL/kg
- **Severe**
  - Normal saline 20 mL/kg

**Initial Labs:** Glucose, POC; Potassium, whole blood; Sodium, whole blood; BMP (sodium, potassium, chloride, total carbon dioxide, anion gap, glucose, BUN, creatinine, calcium); pH; Magnesium; Phosphate; Urinalysis; Consider Hgb A1C if not completed in the last 90 days

**Evaluation:**
- Perform hourly neurological exams and vital signs
- Evaluate hydration status
- Perform continuous electrocardiogram monitoring to assess for hyper- or hypokalemia and arrhythmias
- Stop patient’s insulin pump (if applicable)

**IV Fluids (1st Hour)**
- Normal saline 10 mL/kg
- Normal saline 20 mL/kg

**DKA Not Diagnosed**
- **pH > 7.25 and/or CO2 > 15**
  1. Consult Pediatric Endocrinology to discuss:
     - Last insulin dose (long-acting and short-acting)
     - Current lab values
     - Correction factor and patient sick day plans (see last clinic visit note)
  2. Administer subcutaneous insulin lispro (once) based on discussion with Pediatric Endocrinology. Consider insulin glargine if patient reports missed dose of long-acting insulin. Check blood sugar every 2-3 hours and give correction insulin every 2-3 hours.
  3. Administer further 0.9% NS boluses as needed depending on degree of dehydration. If unable to take orally, consider starting 0.9% NS with 5% dextrose at maintenance rate with close attention to glycemic control.
  4. Evaluate disposition. Instruct patient and family to check blood sugar every 2-3 hours and give correction insulin every 2-3 hours. Consider providing contact information for diabetes resources (608-263-6420 or www.uwhealthkids.org/type1diabetes)

**DKA Diagnosed**
- **pH < 7.25 and/or CO2 < 15**
  1. Consult PICU
  2. Administer IV insulin regular (0.1 units/kg/hr). Hold if K < 3 mmol/L.
  3. Administer 2nd Hour IV fluids at 1.5 x maintenance IV fluid rate according to 2-bag system:
     - If K > 5.5 mmol/L, 0.9% NS (Bag A) and 0.9% NS with 10% dextrose (Bag B) given in ratio dependent upon blood glucose (see table below)
     - If K ≤ 5.5 mmol/L, 0.9% NS with 20 mEq/L KCl (Bag A) and 0.9% NS with 10% dextrose and 20 mEq/L KCl (Bag B) given in ratio dependent upon blood glucose (see table below)
  4. Consider 2nd IV for hourly lab draws:
     - Glucose, POC; pH; Electrolytes, whole blood (sodium, potassium, chloride, total carbon dioxide, anion gap)

**Blood Glucose (mg/dL)**

<table>
<thead>
<tr>
<th>Blood Glucose (mg/dL)</th>
<th>Rate of Bag A (Saline)</th>
<th>Rate of Bag B (Dextrose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 350</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>301-350</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>251-300</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>201-250</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>101-200</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>&lt; 100</td>
<td>0%</td>
<td>125%*</td>
</tr>
</tbody>
</table>

*Note: Call physician if blood glucose falling more than 100 mg/dL per hour or if blood glucose less than 100 mg/dL

**Discharge**

**Admit to General Care**

**Admit to PICU ASAP**

References: