

**Joslin Diabetes Center and Beth Israel Deaconess Medical Center**

**Guideline for Management of  
UNCONTROLLED GLUCOSE IN THE HOSPITALIZED ADULT  
05/20/2013**

The Beth Israel Deaconess Medical Center/Joslin Diabetes Center Guideline for *Management of Uncontrolled Glucose in the Hospitalized Adult* is designed to assist primary care and emergency department providers to individualize the care of adult patients who present with hyperglycemia, diabetic ketoacidosis, hyperosmolar hyperglycemic state, or hypoglycemia. This guideline should not be applied to the care of pediatric population. For more information on diabetes and pregnancy see Joslin's Guideline for *Detection and Management of Diabetes in Pregnancy*. This Guideline is not intended to replace sound medical judgment or clinical decision-making. Clinical judgment must determine the need for adaptation in all patient care situations; more or less stringent interventions may be necessary. This Guideline was developed and approved through the Joslin Clinical Oversight Committee that reports to the Joslin Clinic Medical Director of Joslin Diabetes Center, and was established after careful review of current evidence, literature and clinical practice. This guideline will be reviewed periodically and modified as clinical practice and medical evidence suggests.

<b>Initial Evaluation</b>	
<b>History &amp; Physical Examination</b>	<p><b>Assess:</b></p> <ul style="list-style-type: none"> <li>• Hemodynamic status: volume status/degree of volume depletion/perfusion</li> <li>• Vomiting and/or inability to consume oral nutrition.</li> <li>• Diabetes history, medications and symptoms</li> <li>• Diabetes classification (type 1, type 2 or other); newly diagnosed or established</li> <li>• Diabetes-related complications</li> <li>• Adherence to treatment plan</li> <li>• Social and medical history (e.g., smoking, alcohol and drug abuse, eating disorders)</li> <li>• Precipitating events leading to high plasma glucose and potential acidosis: e.g. omission of insulin, infection (e.g. pneumonia, UTI, cellulitis, prostatitis, skin infection), CVA, MI, pancreatitis, drug induced (e.g. glucocorticoids, higher dose thiazide diuretic, theophylline, second generation antipsychotic agents), toxicologic (e.g. ethylene glycol)</li> <li>• Mechanical failure of insulin pump</li> <li>• Rule-out pregnancy if clinically relevant</li> </ul>
<b>Lab &amp; Other Diagnostic Testing</b>	<ul style="list-style-type: none"> <li>• Immediate finger-stick glucose</li> <li>• If available, consider immediate finger-stick beta-hydroxybutyrate (β-OHB) if ketoacidosis is suspected</li> <li>• Glucose (lab), CBC, Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, BUN, creatinine levels, Mg<sup>++</sup>, Ca<sup>+</sup>, PO<sub>4</sub><sup>-</sup>, A1C (if recent result within 60 days is unavailable), serum lipase and amylase</li> <li>• If considering osmotically active substance other than glucose, measure osmolar gap; consider toxicology screen</li> <li>• Urinalysis, urine ketones; if positive or if unable to void, check serum ketones or blood β-OHB</li> <li>• ABGs or VBGs if chemistries suggest metabolic or respiratory acidosis</li> <li>• Calculated or measured serum osmolality and anion gap (see Table 1)</li> <li>• Sputum, blood and/or urine cultures, when indicated</li> <li>• Chest x-ray, when indicated (e.g. shortness of breath, cough, fever)</li> <li>• Review medications used by patient, such as metformin, before contrast studies, if any, are done</li> <li>• EKG if diabetes &gt; 10 years duration or type 2 with cardiovascular risk factors</li> <li>• Pregnancy test, if clinically relevant</li> </ul>
<b>Diagnosis (based on clinical findings &amp; lab results)</b>	<ul style="list-style-type: none"> <li>• Determination of diagnosis:               <ul style="list-style-type: none"> <li>- Hyperglycemia (blood glucose &gt; 250 mg/dl)</li> <li>- Hyperglycemia with hyperosmolarity</li> <li>- Ketosis without acidosis</li> <li>- Diabetic ketoacidosis</li> <li>- Other acid-base disturbance (e.g., lactic acidosis, alcoholic acidosis)</li> </ul> </li> </ul>

<b>Table 1</b>		<b>CALCULATIONS</b>	
<i>Calculation of effective serum osmolality</i>	$2[\text{Na}^+ + \text{K}^+] + \frac{(\text{glucose in mg/dl})}{1.8} + \frac{\text{BUN}}{2.8}$		
<i>Correction of serum sodium</i>	$[\text{Na}^+] + 1.6 \times \frac{([\text{glucose in mg/dl}] - 100)}{100}$		
<i>Calculation of the anion gap</i>	$[\text{Na}^+] - [\text{Cl}^- + \text{HCO}_3^-]$		

<b>Table 2</b>		<b>OVERVIEW OF HYPERGLYCEMIA TREATMENT</b>	
		(for diabetic ketoacidosis see table 3)	
		(for hyperosmolar hyperglycemic state see Table 4)	
		(for discharge planning guide and checklist, see appendix)	

**TREATMENT IN EMERGENCY DEPARTMENT**

<b>Type 1 DM</b> • New • Stable	<b>Type 1 DM</b> • Established • Stable	<b>Type 1 or 2 DM</b> • New or Established • Unstable/DKA	<b>Type 2 DM</b> • New • Stable	<b>Type 2 DM</b> • New or Established • Unstable
<ul style="list-style-type: none"> <li>Administer rapid-acting subcutaneous insulin STAT e.g., (blood glucose - 100)/CF (CF: Correction Factor = 3000/Body Weight in Kg)</li> <li>Consider IV fluids*</li> <li>Re-assess clinical condition in 2-4 hours</li> <li>Consider admission for:               <ul style="list-style-type: none"> <li>Observation and continuation of IV fluids and subcutaneous insulin</li> <li>Complicating psychosocial or medical problems</li> <li>If timely follow up outpatient treatment cannot be arranged</li> </ul> </li> <li>Obtain consultation from diabetologist/endocrinologist</li> <li>Arrange for discharge once diabetes management plan is confirmed</li> <li>Provide written instructions</li> </ul>	<ul style="list-style-type: none"> <li>Consider rapid-acting subcutaneous insulin STAT e.g., (blood glucose - 100)/CF (CF: Correction Factor = 3000/Body Weight in Kg or 1700/Total Daily Dose)</li> <li>Consider IV fluids*</li> <li>Re-assess clinical condition in 2-4 hours</li> <li>Contact PCP or primary endocrinologist</li> <li>Arrange for discharge once diabetes management plan is confirmed</li> <li>Provide written instructions</li> </ul>	<ul style="list-style-type: none"> <li>Refer to DKA guideline (Table 3) and admit</li> </ul>	<ul style="list-style-type: none"> <li>Consider rapid-acting subcutaneous insulin STAT e.g., (Blood glucose - 100)/CF (CF: Correction Factor = 3000/Body Weight in Kg)</li> <li>Consider IV fluids*</li> <li>Re-assess clinical condition in 2-4 hours</li> <li>Contact PCP re: discharge plans</li> <li>Provide written instructions</li> </ul>	<ul style="list-style-type: none"> <li>Refer to HHS guideline (Table 4)</li> <li>Administer rapid-acting subcutaneous insulin STAT e.g., (Blood glucose - 100)/CF (CF: Correction Factor = 3000/Body Weight in Kg or 1700/Total Daily Dose)</li> <li>Start IV fluids*</li> <li>Re-assess clinical condition in 2-4 hours</li> <li>Consider admission for continuation of IV fluids and insulin; measure intake and output</li> <li>Consider that, in the hyperosmolar state, the patient may need more fluid and less insulin than indicated in the DKA guideline (Table 3)</li> </ul>

**\*SUGGESTIONS for IV FLUID MANAGEMENT**

Infuse normal saline as indicated to maintain euolemia. If the patient is normotensive, hypotonic saline (1/2 NS) may also be necessary if the patient has a high normal serum sodium and will be required if hypernatremic initially. Assessment of initial and follow-up volume status is an important parameter in deciding rates of fluid administration. One may need to adjust type and rate of fluid administration (e.g., use 1/2 NS) in the elderly and in patients with CHF or renal failure.

**ADMISSION CRITERIA FOR HYPERGLYCEMIA**

**Consider admission if:**

- |  |  |   |
|--|--|---|
| <ul style="list-style-type: none"> <li>Hemodynamically unstable</li> <li>Anuric</li> <li>Altered mental status</li> <li>MI</li> <li>Infection, sepsis</li> </ul> | <ul style="list-style-type: none"> <li>Very low pH, low HCO<sub>3</sub></li> <li>Blood glucose ≥ 400 mg/dl</li> <li>Unable to maintain oral intake</li> <li>Newly diagnosed with type 1 DM with special circumstances such as psychosocial issues, travel distance from healthcare facility</li> </ul> | <ul style="list-style-type: none"> <li>Pregnant</li> <li>Other apparent medical/surgical reasons</li> <li>Unable and/or unlikely to initiate/attain self-management skills within 24 hours</li> </ul> |
|--|--|---|

**SUBSEQUENT INSULIN MANAGEMENT FOR STABLE TYPE 1 & INSULIN-REQUIRING TYPE 2 PATIENTS**

<b>For Patients Taking P.O.</b>	<b>If Patient N.P.O</b>
<ul style="list-style-type: none"> <li>Return to prior insulin regimen or re-evaluate dose if prior regimen inadequate (for patients previously receiving insulin)</li> <li>If patient becomes hypoglycemic (blood glucose &lt; 70 mg/dl), administer 15 grams of carbohydrate (4 glucose tablets, or 4 oz. juice, or 1 tube glucose gel) and repeat blood glucose 15 min. later</li> </ul>	<ul style="list-style-type: none"> <li>Give 1/2 usual dose intermediate (NPH) or full dose long-acting (glargine or detemir) insulin; no rapid or short-acting insulin; no change in basal rate for insulin pump patients</li> <li>Pre-mixed insulin: the optimal regimen is to give 1/2 of the NPH component of the usual dose of premixed insulin and no rapid or short-acting insulin.</li> <li>If patient becomes hypoglycemic (blood glucose &lt; 70 mg/dl), correct with IV glucose if the patient has an IV line. Use subcutaneous glucagon injection if there is no IV access.</li> </ul>

### CALCULATION OF BASAL-BOLUS INSULIN FOR HOSPITALIZED PATIENTS

#### Long Acting Insulin (NPH, glargine, detemir)

- Starting dose = ideal body weight (kg) x 0.2 (A multiplier of 0.2 to 0.5 may be considered based on the home insulin regimen and the degree of insulin resistance)
  - Glargine insulin: One dose at bed time for type 1 or type 2 DM
  - Detemir insulin : One dose at bed time for those with type 2 DM or split to 2 equal doses, AM and HS for those with type 1 DM
  - NPH insulin: 2/3 of dose in AM and 1/3 of dose in the evening

#### Rapid Acting Insulin (regular, lispro, aspart, glulisine)

- Starting dose = body weight (kg) x 0.2 (a multiplier of 0.2 to 0.5 may be considered based on the home insulin regimen and the degree of insulin resistance) divided equally for the 3 meals (for a blood glucose >80 mg and eating a meal)
- Calculation of Correction factor (CF) and building a scale for pre-meal insulin
  - For previously known total, CF = 1700/ total daily dose (TDD)
  - For unknown total daily dose, CF = 3000/Body weight (Kg)
  - Build the scale by increasing insulin dose by 1-2 units for every correction factor starting from blood glucose of 80 mg/dl

### DIABETES SELF-MANAGEMENT EDUCATION

#### Educational Assessment

- If admitted, refer for inpatient diabetes education as early as possible
- Assess short-term learning needs/skills re: diabetes self-management
- Refer for outpatient ongoing diabetes self-management education:
  - within 1 week for newly diagnosed patients
  - within 2-3 weeks for established patients

#### Skills/Knowledge Needed

- Self-monitoring blood glucose (SMBG): frequency of monitoring should be individualized, but recommend minimum of 2-4x/day
- Insulin administration if indicated
- Basic meal planning skills
- Sick day guidelines and hypoglycemia treatment strategies
- Emergency indicators and reasons to call healthcare team

**Table 3 TREATMENT OF DIABETIC KETOACIDOSIS (DKA)****DEFINITION:**

**Blood glucose >200 mg/dl with metabolic acidosis (arterial pH <7.3) and an elevated anion gap (>12) with positive ketones\*\***  
**\*\*Ketoacidosis with blood glucose <200 mg/dl may occur, but consider other causes of metabolic acidosis.**

**SPECIMENS/TESTS: Acute Inpatient Management**

- Fingerstick glucose every hour
- Electrolytes every 2 hours until sustained improvement x 4 hours
- Follow anion gap
- Recommend checking phosphate every 4 hrs; calcium and magnesium level at initiation
- Check urine ketones; DO NOT REPEAT if anion gap and bicarb are returning to normal
- Check EKG if  $K^+ > 6.0$  mEq/l

**TREATMENT**

- If diagnosis confirmed as DKA and insulin drip required, consider admission.
  - If mild DKA and patient able to tolerate po intake, consider correction of metabolic state and then discharge from hospital
- Contact PCP re: plan
- Obtain consultation from diabetologist/endocrinologist; refer to diabetes consult team if available
- Initiate patient education

**SUGGESTED FLUID AMOUNTS**

May need to adjust type & rate of fluid administration in the elderly, in patients with CHF or renal failure, or in patients with HHS (See Table 4). KCL should be added to IV fluids once urination is established. If patient is severely hypovolemic or in shock, initiate fluid resuscitation before commencing insulin.

- Administer NS as indicated to maintain volume status, then follow general guidelines:
  - Administer NS for first 4 hours
  - Then consider  $\frac{1}{2}$  NS x 4 hours
  - When plasma glucose <250 mg/dl, switch from  $\frac{1}{2}$  NS to D5  $\frac{1}{2}$  NS

Hour	Volume
1 <sup>st</sup> $\frac{1}{2}$ -1	1 Liter
2 <sup>nd</sup>	1 Liter
3 <sup>rd</sup>	500 ml-1 Liter
4 <sup>th</sup>	500 ml-1 Liter
5 <sup>th</sup>	500 ml-1 Liter
Total 1 <sup>st</sup> 5 Hours	3.5-5 Liters
6-12 <sup>th</sup> hours	250-500 ml/hr

**INSULIN MANAGEMENT**

- Aim for target plasma glucose between 140-180 mg/dl
- Stop or remove insulin pump if used
- Administer Regular insulin 10 units IV STAT (may not apply in pregnancy)
- Prepare IV insulin infusion by adding 250 units of regular insulin into 250 cc NS (1 unit/ml)
- Starting Rate: Units / hour = (Current BG – 60) x 0.02 (0.02 is the multiplier)
  - Adjust multiplier hourly to keep in desired glucose target range (140 to 180 mg/dl)
    - If BG 140 - 180 mg/dl, no change in multiplier
    - If BG > 180 mg/dl, increase by 0.01 (if the drop in blood glucose is >50 mg in any hour, don't increase the multiplier)
    - If BG < 140 mg/dl, decrease by 0.01
  - When BG drops to < 250mg/dl, add D10W to IVF and continue insulin infusion
  - If BG drops to < 100, stop insulin infusion. Give a bolus of D50. To calculate the volume in cc: (100 – BG) x 0.4. Continue IV infusion of D10W. Check plasma glucose every 30 minutes. After reaching the target blood (140-180 mg/dl) resume insulin infusion at 1/2 previous rate
- Assess possible causes for lack of adequate decrease in plasma glucose (e.g., sepsis, glucocorticoids, severe insulin resistance, IV access problems)
- Once patient can eat and anion gap is resolving, consider change to subcutaneous insulin (continue IV insulin infusion for 1 hour **after** starting rapid acting subcutaneous insulin or 2 hour after starting long-acting subcutaneous insulin)
  - For patients previously managed on insulin: re-evaluate insulin regimen before returning to prior dose
  - For patients new to insulin: consider a regimen including a mixture of rapid- and long-acting insulin

**\*\* \* POTASSIUM (use KCL)**

Do not administer  $K^+$  if  $K^+ > 5.5$  or if patient is **anuric**. Once patient voids, add  $K^+$  to each liter of IV fluids and administer as above.

Serum $K^+$ (mEq/l)	Additional $K^+$ required (at infusion rates listed above)
<3.5	40 mEq/L (hold insulin until $K^+$ is back >3.5)
3.5-4.4	20 mEq/L
4.5-5.5	10 mEq/L
>5.5	DON'T give $K^+$ and recheck in 1-2 hrs

**\*\*\* If there is persistent acidosis due to hyperchloremia, consider using  $K^+$  phosphate or  $K^+$  acetate instead of KCL as replacement. Can consider oral  $K^+$  replacement, as needed, once able to tolerate oral intake**

**BICARBONATE**

- If arterial pH < 7.0, consider giving 50 mEq  $NaHCO_3$  over 45 minutes
- Check acid-base 30 min. later & repeat if pH <7.0
- Bicarbonate should not be administered if  $K^+$  is  $\leq 3.5$  mEq

### PHOSPHATE

Consider K<sup>+</sup>phosphate if patient is hypophosphatemic. Oral replacement is preferred.

### GENERAL MEASURES

- Consider Foley catheter
- Adequate IV access recommended for appropriate hydration/insulin administration. Rec. #18 catheter or larger.
- Consider nasogastric tube (NGT) for gastric atony
- Consider anti-emetics if no concerns about mental status

### **Table 4 TREATMENT OF HYPEROSMOLAR HYPERGLYCEMIC STATE (HHS)**

#### **DEFINITION: Blood glucose >600mg/dl and osmolarity >320 mOsm/kg**

The treatment of HHS requires management similar to that of DKA with the following exceptions:

- Acidosis, if present, may be due to other causes. Consider checking lactic acid, toxicology screen, etc.
- More fluids, as noted in **Table 3**, may be required to treat HHS as patients may be more dehydrated
- Lower doses of insulin may be required as patients may be sensitive to insulin.
- Monitoring of the cardiovascular status in elderly is required especially if at risk for CHF and fluid overload

### **Table 5 TREATMENT OF HYPERGLYCEMIA for PATIENTS RECEIVING NUTRITION SUPPORT**

#### **1. Total Parenteral Nutrition (TPN Nutrition)**

- For patients requiring TPN support, it is important to avoid hyperglycemia.
- Target blood glucose:
  - ICU: 140-180 mg/dl
  - Non-critical: 100-180 mg/dl
- Check blood glucose every 4-6 hours (based on the type of insulin used for correction)
- Start regular insulin at a dose of 0.1 unit/gram of carbohydrates in TPN (added to TPN)
  - Use a correction dose of regular insulin every 6 hours or rapid acting analog insulin every 4 hours (divide the excess glucose above the target glucose by the correction factor)
  - Calculation of Correction factor:
    - For previously known total daily dose (TDD): 1700/TDD
    - For unknown total daily dose: 3000/body weight (kg)
- Insulin dose in TPN can be adjusted daily by adding 80% of the previous day's correctional insulin to the previously used TDD
- If blood glucose is severely elevated, use IV insulin/per protocol
  - Once IV insulin dose is stable, add 75% of the insulin dose to the TPN
- Alternative method for patients with pre-existing diabetes: 40% of known TDD as subcutaneous basal insulin and 60% as regular insulin added to TPN
- To transition to oral feeding, divide the previous TDD in ½ so that 50% will be the basal dose and the other 50% will be the prandial boluses, divided equally before meals.

#### **2. Enteral Nutrition**

- Target blood glucose
  - ICU: 140-180 mg/dl
  - Non-critical: pre-meal 100-140 mg/dl, random 100 – 180 mg/dl
- Check blood glucose every 4-6 hours (based on the type of insulin used for correction)

#### **Continuous Tube Feeding**

- TDD = 0.3-0.6 unit/kg body weight as basal insulin (1 dose of glargine, 2 doses of detemir or 2-3 doses of NPH)
- Use a correction dose of regular insulin every 6 hours or rapid acting analog insulin every 4 hours (divide the excess glucose above the target glucose by the correction factor)
  - Calculation of correction factor:
    - For previously known total daily dose (TDD): 1700/TDD
    - For unknown total daily dose: 3000/body weight (kg)
- Basal insulin is adjusted by adding 80% of the previous day's correctional insulin

#### **Cyclic Overnight Tube Feeding**

- TDD = 0.3-0.6 unit/kg body weight as NPH insulin given 3-4 hours before the start of the feeding
- If on nocturnal tube feedings and the patient is eating meals, mealtime bolus insulin may be required

#### **Bolus Tube Feedings**

- Bolus tube feedings are covered the same way as an ingested meal. Use basal insulin and a dose of rapid-acting analog insulin for each bolus feeding (Refer to calculating basal and bolus insulin).

#### **Interruption of Tube Feedings**

1. Insulin should be adjusted appropriately if there is a planned withholding of feedings.
2. If the enteral feeding is unexpectedly interrupted for more than 2 hours, stop all insulin and give DW10% IV at the same rate as that of the enteral feedings to prevent hypoglycemia.
3. Monitor electrolytes and provide adequate free water to prevent dehydration.

**Table 6****TREATMENT OF HYPOGLYCEMIA (BG < 70mg/dl)**

Treatment of hypoglycemia is influenced by the in-hospital diabetes management (insulin infusion, subcutaneous insulin, or insulin secretagogue)

- Target Blood Glucose After Correction
  - ICU: 140 – 180mg/dl
  - Non-critical: 100 – 180 mg/dl
- Check blood glucose every 15-30 min
- Correct hypoglycemia with oral glucose if the patient is conscious and on oral feedings by giving 15-20 grams of carbohydrates (Example: 4 glucose tablets, or 1 tube glucose gel, or 4 oz (1/2 cup) of juice or regular soda, or 4 teaspoons of sugar)
- Correct hypoglycemia with IV glucose if the patient has an IV line and is unconscious or conscious but not able to take anything by mouth
  - ICU patients on insulin infusion: Stop insulin infusion and give a bolus of D50. Volume of bolus D50 is calculated by:  $(100 - BG) \times 0.4$  ml followed by IV infusion of D10W. After reaching the target blood glucose, resume insulin infusion at 1/2 previous rate
  - Patients on subcutaneous insulin and NPO: Give a bolus of D50. Volume of bolus is calculated:  $(100 - BG) \times 0.4$  ml followed by IV infusion of D10W. After reaching the target blood glucose, resume insulin regimen after appropriate insulin adjustment if needed
- Correct hypoglycemia with subcutaneous glucagon injection if the patient has no IV access and is unconscious or unable to take anything by mouth

**MANAGEMENT OF PATIENTS WITH A SELF-ADMINISTERING INSULIN PUMP**

To insure patient safety, patients using a self-administering insulin pump require guidelines around assessment, ordering, monitoring and the need for consultation. Please see the appendix for the details of an approved policy.

- To allow a given patient to continue using an insulin pump, a medication order for insulin must be provided by a healthcare provider with prescriptive privileges
- A medication order to allow a patient to continue using an insulin pump should also include acknowledgement that the patient has been assessed to be competent in the operation of the pump, and that no exclusion criteria apply.
- The provider's orders for the self-administering insulin pump should include:
  - Type of insulin
  - Basal Rate: A continuous delivery of insulin via a self-administering insulin pump.
  - Bolus Doses: A dose of insulin infused by the patient via a self-administering pump for meal glucose coverage or hyperglycemia correction.
  - Frequency of blood glucose monitoring
  - Prompts to obtain endocrine and nutrition consultation for admitted patients or patients with an extended stay in the emergency unit

**Contraindications for Self-Administered Insulin Pump Therapy Include:**

- Acute change in conscious state/mental status as assessed by hospital staff or patient's family.
- Some procedures involving anesthesia that alter the patient's capability to manage the pump.
- Some diagnostic procedures such as MRI
- Inability to demonstrate competence with pump management
- Risk of suicide
- Recurrent or persistent episodes of hypoglycemia or hyperglycemia
- Patient refusal or inability to participate in pump management
- Inability of the patient to procure their own pump supplies
- Unresolved pump failure
- Unexplained hyperglycemia

**Alternative Insulin Management Plan When Pump is Contraindicated or Suspended**

- When use of a self-administering insulin pump is contraindicated or must be stopped, the patient will require either subcutaneous insulin or an insulin drip. Any alternative subcutaneous insulin regimen must include basal insulin

**Table 7****TRANSITION TO OUTPATIENT**

To help insure patient safety once discharged, all patients, while still in the hospital, need assessment of their diabetes knowledge.

- Education of the patient should begin as soon as the patient is able to assimilate educational information.
- Information should be focused on filling gaps in diabetes education and self-management
- When appropriate, family members should be included in the educational process and development of the post-hospital care plan.
- A plan needs to be in place prior to discharge that will facilitate ongoing diabetes education, safe use of medications and follow up with members of the healthcare team in an appropriate time frame.
- A detailed list of topics to be covered prior to discharge for those with type 1 or type 2 diabetes, newly diagnosed or with an established diagnosis, is included in the appendix. These topics include:
  - Skills assessment
  - Communication to other healthcare providers involved in the patient's care
- Scheduling follow up appointments with healthcare team members.
  - High risk patients include patients new to insulin, newly diagnosed, those admitted with DKA, severe hypoglycemia or other diabetes-related emergencies. These patients should be seen within 4 days by their PCPs or by endocrinologists.
  - Non high risk patients, should be seen within 1-2 weeks of discharge
- Written instructions should include information on glucose monitoring, meal planning, activity level, medication (including name of medication, action of medication, dose and when to take), treatment for potential hypoglycemia (if applicable), list of follow-up appointments and name of diabetes contact person(s).

**SEE APPENDIX for DISCHARGE PLANNING**  
**SEE APPENDIX for EXAMPLE OF PUMP POLICY**

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**Approved by the Joslin Clinical Oversight Committee 11/2012**

Glossary	
<b>ABGs:</b> arterial blood gasses	<b>K<sup>+</sup>:</b> potassium
<b>BG:</b> blood glucose	<b>Mg<sup>++</sup>:</b> magnesium
<b>BUN:</b> blood urea nitrogen	<b>mEq/l:</b> milli-equivalent per liter
<b>Ca<sup>+</sup>:</b> calcium	<b>mg/dl:</b> milligram per deciliter
<b>CBC:</b> complete blood count	<b>MI:</b> myocardial infarction
<b>cc:</b> cubic centimeter	<b>Na<sup>+</sup>:</b> sodium
<b>CHF:</b> congestive heart failure	<b>NGT:</b> nasogastric tube
<b>CF:</b> correction factor	<b>PCP:</b> primary care provider
<b>Cl:</b> chloride	<b>P.O.:</b> orally
<b>CNS:</b> central nervous system	<b>PO<sub>4</sub><sup>-</sup>:</b> phosphate
<b>CVA:</b> cerebral vascular accident	<b>NS:</b> normal saline
<b>β-OHB:</b> beta-hydroxybutyrate	<b>REE:</b> resting energy expenditure
<b>DKA:</b> diabetic ketoacidosis	<b>SMBG:</b> self-monitoring of blood glucose
<b>Dry weight:</b> body weight when total body water makes the normal contribution to body weight.	<b>Subcut:</b> subcutaneously
<b>HCO<sub>3</sub><sup>-</sup>:</b> bicarbonate	<b>TDD:</b> total daily dose
<b>HHS:</b> hyperosmolar hyperglycemic state	<b>TPN:</b> total parenteral nutrition
<b>ICU:</b> intensive care unit	<b>UTI:</b> urinary tract infection
	<b>VBGs:</b> venous blood gasses

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## Discharge Planning Guide for Inpatient Providers

Topic	Type 1 Newly Diagnosed	Type 1 Existing	Type 1 with DKA	Type 2 Newly Diagnosed	Type 2 Existing	All Patients new to insulin
Skills Assessment	Instruct in Survival Skills: <ul style="list-style-type: none"> <li>• Safe insulin administration</li> <li>• Self- monitoring blood glucose</li> <li>• Hypoglycemia</li> <li>• Blood glucose targets and parameters for when and whom to contact</li> </ul>	Assess diabetes self-management skills	Review factors leading to DKA. <ul style="list-style-type: none"> <li>• Confirm understanding of use of Ketostix and or ketone meter.</li> <li>• Assess patient's troubleshooting ability</li> </ul>	Medications: oral agents or insulin <ul style="list-style-type: none"> <li>• Provide written instructions</li> </ul>	Review diabetes self-management skills <ul style="list-style-type: none"> <li>• Use of blood glucose meter, strips and lancets</li> <li>• Confirm dose (new dosage or dose used prior to admission)</li> </ul>	Survival Skills: <ul style="list-style-type: none"> <li>• Safe insulin administration</li> <li>• Self- monitoring blood glucose</li> <li>• Hypoglycemia</li> <li>• Blood glucose targets and parameters for when and whom to contact</li> </ul>
Communication to Providers	Contact PCP or primary endocrinologist re: medical discharge plans and plan for post-discharge education	Same	Same	Same	Same	Same
Schedule follow up visits to specialists: <ul style="list-style-type: none"> <li>• VNA</li> <li>• Physical Therapy</li> <li>• Behavioral Health</li> </ul>	<ul style="list-style-type: none"> <li>• 2-3 days post discharge, follow up with phone call</li> <li>• 2 days -7 days post discharge follow up with provider and educator in office</li> </ul>	<ul style="list-style-type: none"> <li>• 2-3 days post discharge, follow up with phone call</li> <li>• Review dosing changes</li> <li>• Appointment for education on advanced care topic (CHO, MIC, CGM, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Outpatient education visit 1-2 weeks for review of ketone checking,</li> <li>• Sick Day Plan (foods and fluids)</li> </ul>	<ul style="list-style-type: none"> <li>• Diabetes education</li> <li>• Appointment with provider 1-2 weeks</li> </ul>	<ul style="list-style-type: none"> <li>• Diabetes education</li> <li>• Appointment with provider 1-2 weeks</li> </ul>	<ul style="list-style-type: none"> <li>• 2-3 days, phone call</li> <li>• 1-2 weeks provider/ educator visit</li> <li>• Educator visit: to assess for further education needs.</li> <li>• Consider follow up with RN-RD-EP</li> </ul>
Prescriptions	Necessary equipment and prescriptions: Specific meter, strips, lancets. Specific brand of insulin vial and syringes or disposable insulin pen, pen needles.					
Written Instructions	Patient Handouts Discharge Instructions	Same	Same	Same	Same	Same
Meal planning	<ul style="list-style-type: none"> <li>• RD visit- 1-2 weeks tailoring to lifestyle</li> <li>• 3 month follow-up</li> </ul>	<ul style="list-style-type: none"> <li>• Resume meal plan.</li> <li>• RD needed if weight altered</li> </ul>	Resume meal plan/ Fluids	RD visit- 1-2 weeks	Resume or confirm new meal plan	
Blood Glucose Contact Parameters	If blood glucose <80mg/dl >300mg/dl x 2 in 24 hours	Same	Same	Same	Same	Same
Case Management Consult <ul style="list-style-type: none"> <li>• Financial concerns</li> <li>• Coverage for supplies and medications</li> </ul>						

### Definitions:

**Diabetes Self-Care Behaviors** as defined by American Association of Diabetes Educators (AADE): healthy eating, being active, monitoring, taking medication, problem solving, healthy coping, reducing risks

**Survival Skills:** meal planning, safe medication administration, blood glucose monitoring and hypoglycemia treatment. \* Focused Training Specific to the Event Resulting in the Admission

**Sick Days:** the person with diabetes has an infection, surgery, trauma, an invasive procedure or a major life stress.

**MIC: matching insulin to carbohydrates**

**CGM: continuous glucose monitoring**



## Diabetes Discharge Checklist

<b>Patient Name:</b>		<b>Medical Record No.</b>	
<b>Glucose Monitoring</b>			
Blood Glucose Meter Name			
Prescription for:                      Strips <input type="checkbox"/> Lancets <input type="checkbox"/>			
Blood Glucose Checking Times:			
Patient Blood Glucose Targets:			
<ul style="list-style-type: none"> <li>• Call your healthcare provider if:               <ul style="list-style-type: none"> <li>▪ you have more than 2 low blood glucoses (less than 70mg/dl) in one week or</li> <li>▪ if your blood glucose is above 300mg/dl for 2 days in a row.</li> </ul> </li> </ul>			
<b>Meal Plan</b>			
Consistent Carbohydrate Counting: # of servings per meal			
Breakfast:	Lunch:	Dinner:	Snacks:
Blood Glucose Checking Times:			
Patient Blood Glucose Targets:			
<ul style="list-style-type: none"> <li>• Follow your plan as recommended by your healthcare provider. If you do not have a meal plan, or need more nutrition education, make an appointment to see an outpatient dietician.</li> <li>• Eat three meals a day. Try to eat fresh fruits, vegetables and whole grains.</li> </ul>			
<b>Activity</b>			
• Get out and be active: Check with your healthcare provider first and ask if there are any activity restrictions.			
<b>Oral Diabetes Medications</b>			
<b>Name of Medication</b>	<b>Works on what part of the body</b>	<b>Dose</b>	<b>When to take</b>
Prescriptions for Oral Diabetes Medications <input type="checkbox"/>			
<b>Insulin</b>			
<b>Name of Insulin</b>	<b>When to take</b>	<b>Dose</b>	
Prescriptions for Insulin: vial and syringe or insulin pen and pen needles <input type="checkbox"/>			
<b>Treatment of Hypoglycemia</b>			
Follow the 15-15 Rule for treatment of low blood glucose (a glucose less than _____)			
<input type="checkbox"/> Have 15 grams of quick-acting sugar. Use one of the following: <ul style="list-style-type: none"> <li>4oz of apple or orange juice</li> <li>6 oz regular soda</li> <li>4 glucose tablets</li> </ul>			
<input type="checkbox"/> Recheck blood glucose in 10-15 minutes and repeat treatment if blood glucose <70mg/dl.			
<b>Follow-up Appointments for Diabetes Management</b>			
<b>Healthcare provider</b>			
Name:		Date:	
<b>Educator</b>			
Name:		Date:	

**Title: Management of Patients with a Self-Administering Insulin Pump**

**Policy #: CP-49**

**Policy Statement/Purpose:** To provide guidelines for appropriate management of patients with a self-administering insulin pump. These guidelines specify assessment, ordering, monitoring, and consultation practices necessary for safe utilization of insulin pumps in the hospital setting, and include opportunity for patients to manage their own insulin pumps when appropriate. These guidelines apply for all patients at BIDMC regardless of location (inpatient units, intensive care units, emergency unit and procedural units).

**Medical Orders:**

1. In order to allow a given patient to continue using an insulin pump while at BIDMC a medication order for insulin must be provided by a licensed independent practitioner (LIP).
2. A medication order to allow a patient to continue using an insulin pump includes acknowledgement that the patient has been assessed to be competent in the operation of the pump, and that no exclusion criteria apply, as described in this policy.
3. The provider's orders for the self-administering insulin pump shall include:
  - Type of Insulin
  - Basal Rate: A continuous delivery of insulin via a self-administering insulin pump.
  - Bolus Doses: A dose of insulin infused by the patient via a self-administering pump for meals or hyperglycemia correction.
  - Frequency of Blood Glucose Monitoring
  - Prompts to obtain Endocrinology and Nutrition consultation for admitted patients or patients with an extended stay in the emergency unit

**Consultation Services:**

1. A Joslin Endocrinology consult should be obtained upon admission for any patient with an insulin pump.
2. A Nutrition consult should be obtained for all patients admitted with an insulin pump.
3. Pharmacy should be consulted to assess and confirm/verify insulin concentration in the pump and will be available to assist clinicians in managing this "patient own med" policy (refer to pharmacy policy Patient's Own Med" Policy)

**Supplies:**

Reservoirs and infusion sets should be changed at least every 72 hours. These supplies are not stocked at Beth Israel Deaconess Medical Center. Patients must bring these supplies from home.

**Pump Management:**

If a medication order for insulin pump self-administration has been activated, the patient will be considered responsible for programming of his/her insulin pump and for changing the infusion set as per his/her own regimen.

**Contraindications for Self-Administered Insulin Pump Therapy:**

- Acute change in conscious state/mental status as assessed by nurse or LIP
- Some Procedures involving anesthesia that alter the patient's capability to manage the pump. (See "Patients Going to MRI, an Invasive Procedure or Surgery" below)

- Inability to demonstrate competence with pump management.
- Risk of suicide.
- Recurrent or persistent episodes of hypoglycemia or hyperglycemia.
- Patient refusal or inability to participate in pump management.
- Inability to procure their own supplies.
- Unresolved pump failure.
- Unexplained hyperglycemia

#### **Alternative Insulin Management Plan**

When use of a self-administering insulin pump is contraindicated or must be stopped, the patient will require either subcutaneous insulin or an Insulin drip. Any alternative subcutaneous insulin regimen must include basal insulin

#### **Patient Assessment and Management:**

- Patients and family shall be educated about the policy for continuing/discontinuing use of the self-administered insulin pump therapy upon admission.
- The patient will demonstrate the proper use of their self-administering insulin pump.
- The patient must be able to describe their pump function, basal rates and bolus doses, frequency of blood glucose monitoring, and the ability to procure and change reservoir and infusion set.
- Patients who are unable to accurately describe the above should have their pump discontinued and be started on alternative insulin management.
- The insertion site and infusion set securement shall be assessed once a shift and with any blood glucose greater than 250.
- Patients and family shall be educated about informing the RN immediately if the insertion site becomes red, swollen or warm to the touch.
- The nurse or LIP will remove the self-administering insulin pump in the event the patient becomes unable to manage the pump independently.

#### **Indications to Change the Infusion Set:**

- All infusion sets shall be changed by the patient at least every 72 hours.
- Indications to change infusion sets more frequently may include but are not limited to:
  - The site is red, swollen, or warm to the touch.
  - Bleeding noted at insertion site.
  - Discomfort noted at insertion site.
  - Unresolved delivery alarm alerts.
  - The patient has two consecutive blood glucose readings greater than 250 which are refractory to bolus correction dosing.

#### **Monitoring and Documentation:**

All patients on self-administering insulin pumps will be monitored as follows:

- Finger stick blood glucose monitoring as per patient's own protocol, minimum of QACHS( with each meal and at bedtime)
  - All finger stick blood glucose measurements will be reported to the patient's nurse and recorded in the Insulin Pump Documentation Flow sheet, which shall include the following elements:
    - Blood glucose values

- Basal rate of insulin via pump
- Bolus doses of insulin administered for mealtime/correction
- Mealtime carbohydrate intake (as reported by patient)
- Routine assessment of insertion site and infusion set

**Patients Going to MRI, an Invasive Procedure or Surgery:**

- Prior to MRI, insulin pumps need to be disconnected from the patient because of incompatibility with the MRI scanning environment. In such cases, providers will order insulin to be administered via an alternative dosing route as needed to maintain glycemic control for the duration of time that the pump is disconnected. Alternative means of insulin delivery (IV insulin or subcutaneous injection) should be initiated immediately upon discontinuation of insulin delivery by pump.
- In all procedures/surgeries requiring moderate sedation or anesthesia, the patient will have limited or no ability to operate the pump independently throughout the peri-operative period. In many such cases, it will be appropriate to discontinue the insulin pump and provide insulin therapy via alternate route; however, in some cases continuation of the insulin pump for basal rate administration of insulin may be appropriate. Any such cases in which an insulin pump is to be continued during the perioperative period for basal insulin administration should be reviewed and endorsed by the Joslin/Endocrinology consultant prior to implementation.

**Hand-off Communication during patient Intrafacility Transfer:**

- **In the event of a change in level of care (i.e. Med – Surg Unit to ICU, EU to Med –Surg Unit) the hand-off communication should include information related to the presence of an insulin pump, including current dosage, trended information related to blood sugar monitoring and a reassessment of patients ability to manage the pump independently in the new level of care.**

**Exceptions/Special Circumstances:**

- Exceptions to the any of the above contraindications or peri-procedure guidelines may be appropriate in certain special circumstances; all exceptions should be reviewed and endorsed by the Joslin/Endocrinology consultant prior to implementation

**Discharge Planning:**

- Prior to discharge to a rehab or skilled nursing facility, Case Management will determine the competence of the facility to manage an insulin pump.
- Prior to patient transfer, the facility will be required to provide their protocol for managing patients on insulin pumps.
- The Page 1 will include the insulin pump treatment plan and a contingency plan for insulin management should the patient not be able to continue insulin pump therapy.