Multidisciplinary Approach to Managing Inpatient Hyperglycemia Across Patient Transitions

Learning Objectives

• Identify roles of key stakeholders for development and implementation of insulin protocols
• Compare and contrast the unique roles in the multidisciplinary care team to support the safe and effective use of insulin
• List best practices for transitions of care to avoid hyperglycemia and hypoglycemia
• Develop discharge plans to ensure appropriate outpatient follow-up of patients with diabetes and/or inpatient hyperglycemia
Epidemiology of Diabetes in the Hospital

From 1988 to 2009, the number of hospital discharges with diabetes as any-listed diagnosis increased from 2.8 million to nearly 5.5 million.

U.S. Hospitals Beginning to Implement Insulin Protocols for Different Inpatient Settings

2008 Inpatient Insulin Protocol Implementation by Patient Type in US Hospitals (N = 269)

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Full</th>
<th>Partial</th>
<th>Planned</th>
<th>No Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critically III</td>
<td>39</td>
<td>13</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Noncritically III</td>
<td>21</td>
<td>38</td>
<td>28</td>
<td>13</td>
</tr>
<tr>
<td>Perioperative</td>
<td>15</td>
<td>29</td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>

However, Poor Glycemic Control in Hospitals in the United States Persists

![Graph showing glycemic control in ICU vs. Non-ICU.]

49,191,313 POC-BG measurements (12,176,299 ICU and 37,015,014 non-ICU values) were obtained from 3,484,795 inpatients (653,359 in the ICU and 2,831,436 in non-ICU areas).


Correlates of Inpatient Hyperglycemia and Poor Outcomes: A Few Examples

<table>
<thead>
<tr>
<th>Ref</th>
<th>Patient Population</th>
<th>Significant Hyperglycemia-Related Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total parenteral nutrition</td>
<td>↑ Mortality risk, pneumonia risk, acute renal failure</td>
</tr>
<tr>
<td>2</td>
<td>Noncardiac surgery</td>
<td>↑ Mortality risk, surgery-specific risk</td>
</tr>
<tr>
<td>3</td>
<td>Aneurysmal subarachnoid hemorrhage</td>
<td>↑ Mortality risk, impaired prognosis</td>
</tr>
<tr>
<td>4</td>
<td>Critically injured trauma patients</td>
<td>↑ LOS, mortality risk, ventilator time, infection</td>
</tr>
<tr>
<td>5</td>
<td>Chronic obstructive pulmonary disease</td>
<td>↑ LOS, mortality risk, adverse outcomes</td>
</tr>
<tr>
<td>6</td>
<td>Community acquired pneumonia</td>
<td>↑ LOS, mortality risk, complications</td>
</tr>
</tbody>
</table>

Clinical Inertia of Discharge Planning Among Patients with Poorly Controlled Diabetes

Percentage of Veterans Affairs patient admissions with uncontrolled diabetes per calendar year discharged with no change in diabetes medications, no follow-up appointment within 30 day, and no follow-up A1C within 60 day by year of study.


Gaps in US Hospital Discharge Planning and Transitional Care

Base: Adults with any chronic condition who were hospitalized in past 2 years

Percent that did NOT:

- Know who to contact for questions about condition or treatment: 8%
- Receive written plan for care after discharge: 9%
- Receive instructions about symptoms and when to seek further care: 12%
- Have arrangements made for follow-up visits with any doctor: 28%
- Any discharge gaps: 38%

2008 Commonwealth Fund International Health Policy Survey of Sicker Adults (data collection: Harris Interactive, Inc.).
## Guidelines from Professional Organizations on the Management of Glucose Levels in the ICU

<table>
<thead>
<tr>
<th>Year</th>
<th>Organization</th>
<th>Patient Population</th>
<th>Treatment Threshold (mg/dl)</th>
<th>BG Target (mg/dl)</th>
<th>Hypo Definition (mg/dl)</th>
<th>Updated since NICE-SUGAR, 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>American Association of Clinical Endocrinologists and American Diabetes Association</td>
<td>ICU patients</td>
<td>180</td>
<td>140 – 180</td>
<td>&lt;70</td>
<td>Yes</td>
</tr>
<tr>
<td>2009</td>
<td>Surviving Sepsis Campaign</td>
<td>ICU patients</td>
<td>180</td>
<td>150</td>
<td>Not stated</td>
<td>Yes</td>
</tr>
<tr>
<td>2009</td>
<td>Institute for Healthcare Improvement</td>
<td>ICU patients</td>
<td>180</td>
<td>&lt;180</td>
<td>&lt;40</td>
<td>Yes</td>
</tr>
<tr>
<td>2008</td>
<td>American Heart Association</td>
<td>ICU patients with acute coronary syndromes</td>
<td>180</td>
<td>90 – 140</td>
<td>Not stated</td>
<td>No</td>
</tr>
</tbody>
</table>

Guidelines from Professional Organizations on Glycemic Management in Non-Critically Ill Patients

<table>
<thead>
<tr>
<th>Year</th>
<th>Organization</th>
<th>Patient Population</th>
<th>Treatment Threshold (mg/dl)</th>
<th>Time of Measurement</th>
<th>Definition of Hypoglycemia</th>
<th>Updated since NICE-Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>AACE and ADA Consensus Statement</td>
<td>Non-critically ill patients</td>
<td>180 mg/dL</td>
<td>Premeal</td>
<td>&lt;70 mg/dL (reassess treatment if &lt;100 mg/dL)</td>
<td>Yes</td>
</tr>
<tr>
<td>2012</td>
<td>Endocrine Society Clinical Practice Guideline</td>
<td>Non-critically ill patients</td>
<td>180 mg/dL</td>
<td>Premeal</td>
<td>&lt;140 mg/dL (reassess treatment if &lt;100 mg/dL)</td>
<td>Yes</td>
</tr>
</tbody>
</table>


Case Study: Hyperglycemia on Admission

- DS is 63-year old African-American male admitted to surgical unit through the Emergency Department with abdominal pain
- CT scan with contrast revealed gallbladder wall thickening with pericholecystic thickening
- WBC ~19K, amylase = 220, lipase = 350, glucose = 280 mg/dL
- Patient was admitted and IV antibiotics were started
- ERCP was performed and some gallbladder sludge was removed
- Decision was made to pursue outpatient laparoscopic cholecystectomy

Case Study: Hyperglycemia on Admission

- Blood glucose levels were 180-250 mg/dL; A1C was 8.2%
- Chart review:
  - Sliding-scale insulin coverage but no routine basal or bolus doses
  - He was discharged home to return for outpatient cholecystectomy
Case Study: Hyperglycemia on Admission

- DS returned 10 days later for outpatient cholecystectomy
- Blood glucose levels
  - Preoperatively 195 mg/dL
  - Postoperatively 250 mg/dL
  - Procedure went well, he was told to see his primary care for evaluation of his “high sugars”
  - He returned to the Emergency Department 6 days later with fever and pain at the surgical site
  - His blood glucose was >400 mg/dL
  - He was admitted to ICU and started on IV insulin

Case Study: Hyperglycemia on Admission

- He was transitioned to basal bolus insulin
  - Achieved blood glucose levels
    - 100-118 mg/dL fasting and 140-160 mg/dL before meals
- 1,800-calorie diet
  - His family brought in food from home so that he would “get well sooner,” which was not detected by the nursing staff
- His discharge dose for insulin was based on inpatient needs
  - Sent home on a regimen of premixed insulin twice a day (0.2 u/kg/day)
Case Study: Hyperglycemia on Admission

- Feeling better, DS resumed normal activity and began following the suggested meal plan
  - As a result, he experienced early morning hypoglycemia at least twice a week (62 mg/dL, 55 mg/dL, 70 mg/dL) and reported it to his primary care physician
  - PCP discontinued DS’ insulin completely and prescribed metformin XR, 500 mg twice daily

Multidisciplinary Approach to Managing Inpatient Hyperglycemia Across Patient Transitions

Hospitalist
Nurse
Patient
Pharmacist
Care Coordinator
Diabetes Educator

Primary Care Physician
Care Coordination Beginning at Admission

✔ Fully assess patients
  – Learn about
    • Patients lifestyle
    • Access to health care services
    • Available support
    • Culture
    • Health literacy
    • Knowledge of diabetes and treatment recommendations
    • Financial stability (including ability to pay for SMBG supplies, medications, and healthful foods)


Care Coordination Beginning at Admission

✔ Create a collaborative team
  – Physicians, nurses, diabetes educators, dietitians, case/care managers, pharmacists, and discharge planners

✔ Develop an individualized plan
  – Include family members
  – Adopt a patient-centered approach

Diagnosis & Recognition of Hyperglycemia and Diabetes in the Hospital setting

Admission
Assess all patients for a history of diabetes
Obtain laboratory BG testing on admission

- No history of diabetes
  - BG < 140 mg/dL
    - Initiate POC BG monitoring according to clinical status

- No history of diabetes
  - BG > 140 mg/dL
    - Start POC BG monitoring x 24-48h
    - Check A1C
    - A1C ≥ 6.5%
    - BG monitoring

- Confirmed diabetes
  - BG monitoring
  - If BGs > 140 persist

POC BG = Point of care blood glucose testing


Treatment Considerations for Management of Inpatient Hyperglycemia

- Hospitalized patients with hyperglycemia (BG > 180 mg/dL)
  - Critically ill patients
    - IV insulin infusion adjusted to maintain BG 140-180 mg/dL
  - Noncritically ill patients
    - Scheduled subcutaneous insulin injections (basal, prandial, correction) adjusted to maintain premeal BG < 140 mg/dL and random BG < 180 mg/dL

- Non-insulin antihyperglycemic agents have a limited role in acute care settings and practitioners should consider discontinuing them in favor of insulin during acute illness.

Successful IV Insulin Protocol

- **Reaches and maintains** BG successfully within a pre-specified target range.
- Includes a **clear algorithm** for making temporary corrective changes in IV insulin rate, as patient requirements change.
- Incorporates the ‘**rate of change**’ in BG, not just the absolute values.
- Incorporates the current **IV insulin rate**.
- Minimizes **hypoglycemia**; provides specific directions for its treatment when it occurs.
- Provides specific guidelines for timing and selection of doses for the **transition to SQ insulin**.

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Safe Use of IV Insulin Therapy

- Insulin infusion concentrations and protocols should be standardized within a hospital.
- All prescribers/RNs should be trained with competence and assessed regularly.
- Accurate bedside blood glucose monitoring done hourly (and if stable, every 2 hours).
- Potassium should be monitored and given if necessary.

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Transition From IV Insulin to SC Insulin

- IV insulin should be transitioned to SC basal bolus insulin therapy
  - Two hours before patient begins to eat and BG levels are stable
- Because of short half life of IV insulin, SC basal insulin should be administered at least 2-3 hours prior to discontinuing the drip
  - if short-acting insulin also administered, IV insulin may be able to be stopped sooner, e.g., after 1 hour


Converting from IV to Subcutaneous Insulin

- Endocrine Society Guidelines conservatively recommend the following:
  - Establishing the 24-hour insulin requirement by averaging the IV insulin dose required over the previous 6 to 8 hour
  - Using a fraction of that (i.e., 75-80%) as the Total Daily Dose (TDD) of subcutaneous insulin
    - Giving half of that as basal and dividing the other half among short- or rapid-acting insulin before meals
  - Clinical trial support using 80% of the TDD to achieve 80-140 mg/dL

Subcutaneous Insulin Administration

Basal + Meal* + Correction = Total daily insulin needs

* Sometimes referred to as ‘nutritional’ insulin or ‘bolus’ insulin


Subcutaneous Correction Insulin Algorithms

- Does NOT replace scheduled insulin
  - Rather it corrects for changing needs
- Based on the insulin sensitivity of the patient
  - Inferred from total daily insulin requirement
  - Inferred from weight/BMI
- Utilize same rapid-acting analog as nutritional insulin
  - Need rapid onset and short duration of action

### Example of Correction Insulin Scale

<table>
<thead>
<tr>
<th>BG (mg/dl)</th>
<th>Insulin-sensitive</th>
<th>Usual</th>
<th>Insulin-resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 141–180</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>181–220</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>221–260</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>261–300</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>301–350</td>
<td>10</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>351–400</td>
<td>12</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>&gt; 400</td>
<td>14</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

The numbers in each column indicate the number of units of regular or rapid-acting insulin analogs per dose. “Supplemental” dose is to be added to the scheduled insulin dose. Give half of supplemental insulin dose at bedtime.

If a patient is able and expected to eat all or most of his/her meals, supplemental insulin will be administered before each meal following the “usual” column dose.

Start at insulin-sensitive column in patients who are not eating, elderly patients, and those with impaired renal function.

Start at insulin-resistant column in patients receiving corticosteroids and those treated with more than 80 U/d before admission.


### Differences Between Correction and Sliding Scale Insulin

1. Correction insulin therapy uses rapid-acting insulin analogues not regular insulin
   - Rapid onset is needed to correct the hyperglycemia, and the short duration helps minimize the risk of delayed hypoglycemia.

2. Correction insulin is given in addition to scheduled basal and prandial insulin, not instead of scheduled insulin

3. Dose of correction insulin is determined by individual insulin sensitivity, not on the basis of a one-dose-fits-all assumption

Pitfalls of Sliding-Scale Insulin

- Is reactive, rather than proactive
- Does not establish an accurate insulin dose requirement
- May result in wide glycemic fluctuations
- Often mismatched with changes in patients insulin sensitivity
- Does not meet physiologic needs
- Can lead to ‘insulin stacking’
  - When several boluses are given in a short period of time, insulin action overlaps which may cause hypoglycemia

Basal-Bolus Superior to Sliding Scale Insulin Treatment for Inpatient Hyperglycemia

*P < .01; †P < .05. Error bars denote standard deviation.
Insulin glargine + glulisine: 0.4 units/kg for BG 140-200 mg/dL; 0.5 units/kg for BG 201-400 mg/dL (1/2 daily dose given as basal insulin).
SSI = regular insulin 4 times daily for BG > 140 mg/dL.
## Basal Bolus vs Sliding Scale in the RABBIT 2 Surgery Study

### Achievement of Glucose Goals

<table>
<thead>
<tr>
<th></th>
<th>Basal Bolus</th>
<th>Sliding Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled Basal Bolus</td>
<td>55%</td>
<td>31%</td>
</tr>
<tr>
<td>Sliding Scale</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percent of Patients with BG <140 mg/dL

P < 0.001

### Outcomes and Hypoglycemia

<table>
<thead>
<tr>
<th></th>
<th>Hospital Complications*</th>
<th>BG &lt;70 mg/dL</th>
<th>BG &lt;40 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Bolus</td>
<td>8.6%</td>
<td>23.1%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Sliding Scale</td>
<td>24.3%</td>
<td>4.7%</td>
<td>0%</td>
</tr>
</tbody>
</table>

P value 0.003 < 0.001 0.057

* Composite of postoperative complications including wound infection, pneumonia, bacteremia, and respiratory and acute renal failure.


## Striking the Right Balance

- Hyperglycemia
- Hypoglycemia
Case control study; Severe hypoglycemia (<40 mg/dL) is associated with an increased risk of mortality (OR, 2.28; 95% CI, 1.41-3.70; \( P = .0008 \))

Hypoglycemia was a predictor of higher mortality in patients not treated with insulin, but not in patients treated with insulin.
Hypoglycemia and Risk of Death in Critically Ill Patients

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Deaths</th>
<th>Population</th>
<th>Median Time from Randomization to Hypoglycemia (IQR)</th>
<th>Median Time from Hypoglycemia to Death (IQR)</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe hypoglycemia</td>
<td>79</td>
<td>223</td>
<td>4 (2–9)</td>
<td>8 (3–15)</td>
<td>3.21 (2.49–4.15)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stratified by treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.64 (2.01–3.47)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>and adjusted for baseline characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.10 (1.59–2.77)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>


Essential Part of Any Insulin Use: A Hypoglycemia Protocol

- Clear Definition of Hypoglycemia
  - Glucose level (ADA) <70 mg/dL
- Nursing Order to Treat Without Delay
  - Stop insulin infusion (if patient is on one)
  - Oral glucose (15-20 gm)
  - IV dextrose or glucagon (if patient is unable to take oral)
  - Repeat blood glucose monitoring 15 min after treatment for hypoglycemia and repeat treatment if BG not up to target
  - Directions for when and how to restart insulin
- Documentation!
- Look for the cause of hypoglycemia and determine if other treatment changes are needed

Recognition and Management of Hypoglycemia in the Hospital Setting

- Standardized, hospital-wide, nurse-initiated hypoglycemia treatment protocol with specific directions for hypoglycemia avoidance and management

- Implement a system to track frequency of hypoglycemia events with root cause analysis of events associated with potential for patient harm

Example Hypoglycemia Protocol

If patient CAN safely swallow without aspirating

- If BG 50-69 mg/dL: Give 4 oz. juice or regular soda
- If BG ≤49 mg/dL: Give 8 oz. juice or regular soda

If patient CANNOT safely swallow or patient has NPO status

- IV access: Give 1 dose D50W IV push
- If no IV access: Give 1 dose glucagon IM

Recheck BG in 15-20 min. If BG <70 mg/dL, then continuously repeat above until BG ≥70 mg/dL and notify provider.

Once BG >70 mg/dL, repeat BG monitoring in 1 hour and check again in 2 hours. Notify provider of insulin adjustments and changes in BG monitoring. If BG level has not remained ≥70 mg/dL for both BG checks, notify provider for further insulin adjustments and changes in BG level monitoring.

Pharmacists and Formularies

Pharmacokinetics of Insulin Preparations

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Onset</th>
<th>Time to Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspart</td>
<td>5–15 min</td>
<td>30–90 min</td>
<td>4–6 hr</td>
</tr>
<tr>
<td>Glulisine</td>
<td>20 min</td>
<td>100 min</td>
<td>5 hr</td>
</tr>
<tr>
<td>Lispro</td>
<td>5–15 min</td>
<td>30–90 min</td>
<td>4–6 hr</td>
</tr>
<tr>
<td>Short-acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>30–60 min</td>
<td>2–3 hr</td>
<td>8–10 hr</td>
</tr>
<tr>
<td>Intermediate-acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH</td>
<td>2–4 hr</td>
<td>4–10 hr</td>
<td>12–18 hr</td>
</tr>
<tr>
<td>Long-acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detemir</td>
<td>2–4 hr</td>
<td>Relatively flat</td>
<td>Up to 24 hr</td>
</tr>
<tr>
<td>Glargine</td>
<td>2–4 hr</td>
<td>No pronounced peak</td>
<td>Up to 24 hr</td>
</tr>
</tbody>
</table>

Pharmacists Can Contribute to the Safe Use of Insulin in the Inpatient Setting

- Remove unusual concentrations (e.g., Humulin® R U-500) from patient care areas (dispense only from inpatient pharmacy)
- Remove intermediate- and long-acting insulin from nursing stock
- Store insulin and heparin separately on nursing units and in the pharmacy
- Store insulin syringes apart from tuberculin syringes and remove tuberculin syringes from nursing units, if possible

Pharmacists Can Contribute to the Safe Use of Insulin in the Inpatient Setting

- Label insulin vial (pen) with patient's name and vial expiration per institutional guidelines
- Conduct unit inspections to ensure proper labeling and disposal per institutional guidelines
- Provide ongoing education and oversight to assure insulin pens are not shared between patients and that cartridges are not used to prepare insulin doses with a conventional insulin syringe


Nursing

- Assessment of Patient Diabetes Knowledge on Admission
- Awareness of Blood Glucose Checks
- Alerting Physician of Trends in Blood Glucose Levels
- Insulin Dosing and Administration
Medical Nutrition Therapy

- MNT should be a component of the glycemic management program for all hospitalized patients DM and hyperglycemia
- Consistent amount of carbohydrates at each meal can be useful in coordinating doses of rapid-acting insulin to carbohydrate ingestion
- Providing fixed carbohydrate amounts to meet mealtime insulin dose
  - BG values <70 mg/dL were less frequent in patients receiving the consistent carbohydrate diet


Nursing + Pharmacy + Care Coordination
“Survival Skills” to Be Taught Before Discharge

- How and when to take medication/insulin
  - What to expect from the medication
- How/when to test BG (SMBG)
  - What are target glucose levels
- Basics on meal planning
- How to treat hypoglycemia
- Sick-day management plan
- Date/time of follow-up visits
  - Including diabetes education
- When and who to call on the healthcare team
  - What community resources are available

Our Case Study Revisited: Better Care Coordination

• DS is 63-year old African-American male admitted to surgical unit through the Emergency Department with abdominal pain
• CT scan with contrast revealed gallbladder wall thickening with pericholescystic thickening
• WBC ~19K, amylase = 220, lipase = 350, glucose = 280 mg/dL
• IV antibiotics were started
• Point of care glucose testing was started and he remained hyperglycemic
• An admission A1C of 8.2% confirmed a diagnosis of diabetes

Our Case Study Revisited: Better Care Coordination

• An admission A1C of 8.2% confirmed a diagnosis of diabetes
• He was started scheduled insulin therapy (basal/bolus and correction dose) glucose were maintained in 110-160 range
• His insulin dose was calculated based on his weight (100 kg) 0.4 units/kg
  – 20 units long acting basal and 7 units of rapid acting insulin before each meal
• The diabetes education team was consulted immediately and DS was taught blood glucose monitoring and normal levels, the basic survival skills for diabetes
Our Case Study Revisited: Better Care Coordination

- ERCP was performed and some gallbladder sludge was removed
- Decision was made to pursue outpatient laparoscopic cholecystectomy
- He was discharged home on 70/30 15 units twice/day insulin calculated based on 80% of his total dose during hospitalization (the last two days of hospitalizations he was on Long acting insulin)

Hyperglycemia on Admission: Better Care Coordination

Discharge Services Performed

- A follow up appointment was scheduled with his primary care physician and a diabetes educator
- Medication reconciliation was performed by the pharmacist upon discharge
- Nursing performed insulin administration training
- Nutritional services provided information on dietary modifications
Multidisciplinary Approach to Managing Inpatient Hyperglycemia Across Patient Transitions

Resources

- American Association of Clinical Endocrinologists Inpatient Glycemic Resource Center
- Institute for Safe Medication Practices
  - [http://www.ismp.org/default.asp](http://www.ismp.org/default.asp)
- American Society of Health-System Pharmacists: Safe Use of Insulin in Hospitals
- Society for Hospital Medicine Resource Center
- American Association of Diabetes Educators
  - [http://www.diabeteseducator.org](http://www.diabeteseducator.org)