Hypoglycemia
Outline

- Top causes of inpatient hypoglycemia
- Strategies preventing hypoglycemia
- RN driven hypoglycemia protocols
- Systems for tracking hypoglycemic events
Iatrogenic Hypoglycemia
A Top Source of Inpatient Adverse Drug
Events (ADEs)

- ADEs are most common cause of inpatient complications
  - affecting 1.9 million stays annually
  - costing $4.2 billion / year
  - responsible for 1/3 of hospital acquired conditions (HACs).
- 50-60% of ADEs are preventable
- 57% of ADEs are from hypoglycemic agents
- > 10% of those on a hypoglycemic agent suffer at least one hypoglycemic ADE

What level of BG constitutes Hypoglycemia?

A. 80 mg/dL
B. 70 mg/dL
C. 60 mg/dL
D. 40 mg/dL
What level of BG constitutes Hypoglycemia?

A. 80 mg/dL
B. 70 mg/dL  physiologic response occurs
C. 60 mg/dL
D. 40 mg/dL  (severe hypoglycemia)
Hypoglycemia Risk Factors - Different Flavors

Inherent
- Low BMI / cachexia / Advanced Malignancy / Age
- Liver / Kidney disease / CHF

Iatrogenic
- Insulin / oral agents
- Some risk with appropriate use.
- Risk magnified with inappropriate use or failure to react / anticipate preventable problems.
- Overly aggressive targets, inappropriate prescribing
- Hypoglycemic (< 70 mg/dL) events - 50% preventable
- Severe Hypoglycemic events (< 40 mg/dL) - 50-80% preventable

Improved Glycemic Control AND Reduced Hypoglycemia is possible.
The most powerful predictor for an inpatient to experience an iatrogenic hypoglycemic ADE?

A. Liver Disease
B. Advanced Age
C. A prior hypoglycemic event during same stay
D. Cancer
Which of the following is NOT a top source of inpatient iatrogenic hypoglycemia?

A. Nutritional Insulin mismatch
B. Decreasing steroid doses
C. Failure to manage a prior hypoglycemic event during same hospitalization appropriately
D. Inappropriate prescribing of insulin
# Iatrogenic Hypoglycemia

<table>
<thead>
<tr>
<th>Etiologic factor</th>
<th>% of hypo cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in enteral intake</td>
<td>40</td>
</tr>
<tr>
<td>Insulin adjustment</td>
<td>6.1</td>
</tr>
<tr>
<td>Steroid withdrawal</td>
<td>0.4</td>
</tr>
<tr>
<td>Unclear</td>
<td>43</td>
</tr>
<tr>
<td>“Diverse causes”</td>
<td>10.4</td>
</tr>
<tr>
<td>Medication error</td>
<td>none</td>
</tr>
</tbody>
</table>

- Poor hypoglycemia management and follow up was the rule
  - < 50% with documented euglycemia within 2 hours of hypo event
  - Average time to documented resolution was 4 hrs, 3mins
  - (median 2 hrs, 25mins)

Iatrogenic Hypoglycemia – Risk Factors, Treatment, and Prevention

- 130 ward inpatients monitored for glucose
- 65 consecutive cases with iatrogenic hypoglycemic day
- Matched 1:1 with controls (monitored, similar hospital day, not hypoglycemic)
- Examine risk factors for hypoglycemia
- Study hypoglycemia treatment and adjustments made to prevent recurrence

Table 2. Final Multivariate Logistic Analysis Pseudo $R^2 = 66\%, P < 0.0001$

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio</th>
<th>P value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.01</td>
<td>0.881</td>
<td>0.94–1.07</td>
</tr>
<tr>
<td>Sex</td>
<td>0.34</td>
<td>0.222</td>
<td>0.06–1.91</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>6.35</td>
<td>0.111</td>
<td>0.65–61.47</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>5.16</td>
<td>0.131</td>
<td>0.61–43.30</td>
</tr>
<tr>
<td>Nutritional interruption/discordance</td>
<td>12.09</td>
<td>0.032</td>
<td>1.23–118.05</td>
</tr>
<tr>
<td>Prior hypoglycemic day</td>
<td>31.18</td>
<td>0.004</td>
<td>2.91–333.67</td>
</tr>
<tr>
<td>Insulin as outpatient</td>
<td>15.57</td>
<td>0.026</td>
<td>1.39–174.80</td>
</tr>
</tbody>
</table>

Unexpected interruption of Nutrition and Prior Hypoglycemic Day – Top Predictors
Basal – Bolus errors: Creeping basal dose violating 50:50 rule

Management:
We did not follow our own protocol.
Poor or absent documentation, prolonged time to resolution.
Frequent failure to prevent recurrent hypoglycemia.
Iatrogenic Hypoglycemia from Insulin

Most Common Failures

1. Inappropriate prescribing

2. Failure to respond to unexpected nutritional interruption

3. Poor coordination of nutrition delivery, monitoring, and insulin delivery

4. Failure to respond to a prior hypoglycemic event

Other Failures

• Monitoring and measurement deficiencies
  – Only 41% of hospitals utilize their glucose data to track glycemic control and hypoglycemia rates
  – Concurrent monitoring to manage outliers and those at risk for glycemic excursions often lacking

• Storing and Dispensing
  – Too many insulin concentrations leads to error

• Administering
  – Insulin pen errors
  – IV bolus and insulin infusions prepared outside of pharmacy prone to error

Cobaugh DJ et al. *Am J Health Syst Pharm*;70(16):1404-13
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D. Inappropriate prescribing of insulin
**IMPACT OF A HYPOGLYCEMIA REDUCTION BUNDLE AND A SYSTEMS APPROACH TO INPATIENT GLYCEMIC MANAGEMENT**

Greg Maynard MD, MS, SFHM\(^1\)\(^2\); Kristen Kulasa, MD\(^3\); Pedro Ramos, MD\(^1\); Diana Childers, MD\(^1\); Brian Clay, MD\(^1\); Meghan Sebasky, MD\(^1\); Ed Fink MHSM\(^2\); Aaron Field\(^2\); Marian Renvall, MS\(^2\); Patricia S. Juang, MD\(^3\); Charles Choe, MD\(^3\); Diane Pearson, RN, BSN, MPH, PHN, CDE\(^3\); Brittany Serences, MSN, RN, FNP-BC, BC-ADM\(^4\); Suzanne Lohnes, MA, BSN, RN, CDE\(^4\)

**RR 2013 vs 2009-10 baseline**

<table>
<thead>
<tr>
<th>Measure</th>
<th>RR</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>Hypoglycemic stay</td>
<td>0.71</td>
<td>(0.65, 0.79)</td>
</tr>
<tr>
<td>Severe hypoglycemic stay</td>
<td>0.44</td>
<td>(0.34, 0.58)</td>
</tr>
<tr>
<td>Recurrent hypoglycemia</td>
<td>0.78</td>
<td>(0.64, 0.94)</td>
</tr>
<tr>
<td>Hypoglycemic day</td>
<td>0.73</td>
<td>(0.66, 0.79)</td>
</tr>
<tr>
<td>Severe hypoglycemic day</td>
<td>0.48</td>
<td>(0.37, 0.62)</td>
</tr>
<tr>
<td>Days with BG &gt; 299 mg/dL</td>
<td>0.76</td>
<td>(0.73, 0.80)</td>
</tr>
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Enhancing insulin-use safety in hospitals: Practical recommendations from an ASHP Foundation Expert Consensus Panel


### Table 1.
**Expert Panel-Identified High-Priority Insulin Errors, by Phase of Medication-Use Process**

<table>
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<th>Error</th>
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<td>Monitoring</td>
<td>Relationship of insulin administration to nutrition</td>
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<tr>
<td></td>
<td>Failure to appropriately monitor for insulin effects and adjust dose accordingly</td>
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</table>
Prescribing: **Recommendations 1 - 3**

**Recommendation 1**
Develop protocol-driven and evidence-based order sets for specific uses of insulin:
- IV to Subcutaneous insulin transitions, DKA, etc
- Include decision-support to guide insulin use based on patient’s nutritional status and for appropriate monitoring

**Recommendation 2**
Eliminate the routine administration of correction / sliding scale insulin doses as the primary strategy to treat hyperglycemia

**Recommendation 3**
Eliminate the use of “free text” insulin orders in electronic and paper records.
Replace them with protocol-driven and evidence-based order sets that allow for the prescribing of complex insulin regimens.

Integrate Best Practice into Protocols, Order Sets, Documentation

- Actionable glycemic target
- Consistent carbohydrate / dietary / consult
- A1c
- Patient education plan
- Hypoglycemia protocol
- Guidance for transitions (linked protocols)
- Coordinated monitoring / nutrition / insulin
- DC oral agents, insulin preferred
- Insulin regimens for different conditions
- Dosing guidance
A Series of Linked Protocols:
Reinforce protocols by multiple methods, hardwire whenever possible

<table>
<thead>
<tr>
<th>Basic Protocols</th>
<th>Always More to Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQ insulin</td>
<td>SQ Insulin Pumps</td>
</tr>
<tr>
<td>IV infusion insulin</td>
<td>Monitoring</td>
</tr>
<tr>
<td>Periop management</td>
<td>Coordination: CHO / BG test / insulin</td>
</tr>
<tr>
<td>Hypoglycemia Management</td>
<td>Transitions</td>
</tr>
<tr>
<td>Patient Education</td>
<td>Provider Education / competency</td>
</tr>
</tbody>
</table>
### Glycemic Control Review - Data Collection Tool

<table>
<thead>
<tr>
<th>Field</th>
<th>Options</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Name (Last, First)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt/Encounter ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date/Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>W Surgery</td>
<td></td>
</tr>
<tr>
<td>Blood Glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for referral:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of regimen? (check all that apply)</td>
<td>Infusion, Oral meds, Other (describe below)</td>
<td></td>
</tr>
<tr>
<td>Etiology (check all that apply)</td>
<td>Prescribing - Incorrect Dose, Prescribing - Failure to adjust dose, Other (describe below)</td>
<td></td>
</tr>
<tr>
<td>Nutrition on hold protocol followed? (check all that apply)</td>
<td>Yes, No, N/A</td>
<td></td>
</tr>
<tr>
<td>Hypoglycemia protocol followed? (check all that apply)</td>
<td>Yes, No, N/A</td>
<td></td>
</tr>
<tr>
<td>Computer protocol recommendations followed in previous 12 hours?</td>
<td>Yes, No, N/A</td>
<td></td>
</tr>
<tr>
<td>Other Comments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Proposed CDS Display for hypoglycemia evaluation – Federal Interagency Workgroup to prevent ADE**

**Report etiology of hypoglycemic event after event resolution**

<table>
<thead>
<tr>
<th>Etiology of hypoglycemic event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional interruption without reducing insulin or adding carbohydrate</td>
</tr>
<tr>
<td>Prior hypoglycemic event without medication or carbohydrate adjustment</td>
</tr>
<tr>
<td>Excessive basal insulin dosing that inappropriately covered nutritional needs, as well as basal needs</td>
</tr>
<tr>
<td>Glycemic target that is too stringent for patient condition/co-morbidities</td>
</tr>
<tr>
<td>Failure to discontinue oral hypoglycemic agents in the inpatient setting</td>
</tr>
<tr>
<td>Time interval between testing was too long</td>
</tr>
<tr>
<td>Other failure mode: ______________________________________________________</td>
</tr>
<tr>
<td>No preventable factors detected.</td>
</tr>
</tbody>
</table>

**Report ACTION taken to MITIGATE hypoglycemia**

<table>
<thead>
<tr>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call to reduce hypoglycemic agent</td>
</tr>
<tr>
<td>Call to increase CHO</td>
</tr>
<tr>
<td>Education/reinforcement of policy/protocols</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>
Contributing Factors for Hypoglycemic Events (n = 139)

- Nutrition Discordance: 22.3%
- Medication Related: 30.9%
- NPO: 26.6%
- Tube feeds held: 6.5%
- Other: 13.7%

Total: 42%
Guidance for Scheduled Temporary NPO
Example UC San Diego

• Basal / Nutritional / Correction insulin terms reinforced across orders, MAR, documentation venues
• New orders not required for temporary NPO

Basal Insulin: “basal insulin should still be administered even if the patient is temporarily NPO for a procedure, or has temporary interruption of nutrition”

Nutritional RAA-I guidance for eating patients: “Give with first bite of food (or up to 30 minutes after first bite of food if patient is nauseated or has poor appetite). Give 0% if patient ate less than 50%, half if patient eats 50%, and full dose if they eat all / almost all (>50%) of meal.”
**Nutrition on Hold Unexpectedly Guideline**

This algorithm is a guideline. Contact physician for orders.

- **Patient on insulin drip**
  - Consider starting D10 at tube feed/TPN infusion rate* (caution patients with cerebral edema or hyponatremia)
  - Resume q 1 hour glucose monitoring until glucose in range for 3 consecutive readings, per protocol
  - If BG<70 mg/dL or 70-79 mg/dL and symptomatic, follow hospital hypoglycemia protocol. **Recheck BG within 15-30 minutes per protocol**
  - If >2 consecutive BG<80 mg/dL, notify MD. Pharmacy may be contacted for further consultation
  - Continue q 1-2 hour glucose monitoring per protocol.

- **Patient on subcutaneous insulin**
  - For patient with glargine insulin order:
    - Continue glargine insulin. Consider reducing the dose by 20% if tight control or high risk of hypoglycemia
  - For patient with routine scheduled nutritional insulin (regular or lispro):
    - If dose of scheduled nutritional insulin given in past 1-6 hours, increase frequency of glucose monitoring q 1-2 hours until insulin action complete
  - Hold future nutritional insulin until nutrition resumes but continue correction insulin.
  - If BG<70 mg/dL or 70-79 mg/dL and symptomatic, follow hospital hypoglycemia protocol. **Recheck BG within 15-30 minutes per protocol**
  - Notify MD. Consider starting D10 at tube feed/TPN infusion rate. Pharmacy may be contacted for further consultation
  - Resume q 4-6 hour and qm glucose monitoring.

*Alternatives:
1. Decrease Rate of Insulin Drip - Contact pharmacy to decrease insulin drip. Insulin Sensitivity Coefficient (ISC):
   - If drip > 6 units/hr → decrease ISC by 50% and adjust per insulin protocol
   - If drip < 6 units/hr → decrease ISC to 0.01 and adjust per insulin protocol
2. Stop insulin drip and start subcutaneous insulin correction scale insulin with q2-4h monitoring. Suggest administering lispro q4h or regular insulin q6h. (Patients with Type 1DM need basal insulin at all times, do not use correction scale only for Type 1DM.)
3. Call Pharmacy for assistance

Nutrition on Hold Unexpectedly (5-26-14)
BPA for Tube Feedings on hold + Insulin

- Appears for pt’s w/ “0” charted for TF rate + “on insulin”
- Wording is as follows:

- Potential Problems
  - RNs don’t consistently chart TF interruptions in I/O
  - Charting, if done, not always timely
On Insulin

If tube feed or TPN is stopped and patient is on insulin, patient could be at risk of hypoglycemia.

*Please refer to guidelines shown on the back of this sign.*
Which of the following is FALSE?

A. Insulin induced hypoglycemia is a top source of inpatient ADEs
B. Hypoglycemia management is an important endeavor, thus nurses should call physicians for direction before initiating hypoglycemia treatment
C. For a hyperglycemic diabetes patient eating full meals, a 50:50 ratio of basal / rapid acting insulin in divided doses is appropriate
D. Hypoglycemia symptoms may include confusion, diaphoresis, tremulousness, seizures, and even death.
Which of the following is FALSE?

A. Insulin induced hypoglycemia is a top source of inpatient ADEs
B. Hypoglycemia management is an important endeavor, thus nurses should call physicians for direction before initiating hypoglycemia treatment
C. For a hyperglycemic diabetes patient eating full meals, a 50:50 ratio of basal / rapid acting insulin in divided doses is appropriate
D. Hypoglycemia symptoms may include confusion, diaphoresis, tremulousness, seizures, and even death.
Nurse Driven Hypoglycemia Protocol

Hypoglycemia Protocol for diabetic patients or patients receiving insulin

If BG < or = 70mg/dL, treat as follows:

If patient is ABLE to drink,
- Give 6-8 oz. of clear (not pulpy) juice example: apple juice, then call MD
- Recheck BG in 30 minutes
- Continue rechecking until BG is >70mg/dL

If patient is UNABLE to drink
- Give 12.5 g (½ amp) of D50% IV then call MD
- Recheck BG in 30 minutes.
- If BG is < or = 70mg/dL, give another 12.5g (½ amp) of D50% IV.
- Recheck BG in 30 minutes
- Continue rechecking until BG >70mg/dL
ADULT HYPOGLYCEMIA PROTOCOL

Definition: Blood Glucose (BG) < 70 mg/dl with OR without symptoms
OR Glucose 70-99 mg/dl with symptoms (e.g., shakiness, diaphoresis, confusion, irritability)

1. TREATMENT: NOTE: If an IV insulin infusion, stop infusion, recheck blood glucose q15min until BG ≥ 80 mg/dL 2 times in a row, then resume insulin infusion per computer protocol.

CONSCIOUS, ABLE TO SWALLOW, ABLE TO TAKE PO:

Give fast-acting carbohydrate.
Choose ONE of the following:
- 1 tube Glucose Gel OR
- 4 Glucose tablets (16 grams) OR
- 4 oz juice OR
- 8 oz skim milk

*If patient is not responding to po treatment, consider using IV/IM options

UNCONSCIOUS, UNABLE TO SWALLOW, UNABLE TO TAKE PO:

With IV:
- Give 25 ml (12.5 grams) of D50 IV over 5 minutes
No IV access:
- Give 1 mg Glucagon IM (turn pt on side, may induce emesis) – Do not repeat Glucagon.
- OR, Start IV stat and give 25 ml (12.5 grams) D50 over 5 minutes

2. RETEST:

- Retest blood glucose 15-30 minutes from initial glucose test.
- If repeat BG is < 80, repeat treatment and check BG again in 15-30 minutes.
- Continue to check BG q15-30min until BG ≥ 80 mg/dL, 2 times in a row.

3. ASSESS possible cause of hypoglycemia to avoid recurrence. Common causes of hypoglycemia are poor po intake when nutritional insulin is administered, emesis, interruption of tube feedings, TPN or IV dextrose, prolonged NPO, decreased steroids, increased activity or disease process. Does patient need Medicine or Endocrine consult for recurring hypoglycemia? Does patient need to stop oral agent or reduce insulin?

4. NOTIFY PROVIDER of hypoglycemic event, include symptoms, time of last nutritional intake, time/dose of last insulin, glucose trend and RN assessment as above.

5. DOCUMENT event in EPIC Flowsheet – Glycemic Control POCT, Example:

<table>
<thead>
<tr>
<th>Blood Sugar (mg/dL)</th>
<th>Yes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC Glucose (mg/dL)</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypoglycemia protocol
Is the patient experiencing symptoms of hypoglycemia? Yes
Is the order a requested emergency blood sugar? No
Hypoglycemia treatment administered per BG protocol: 1 tube g
Identify possible contributing factors to hypoglycemia: Poor P2
Hypoglycemia Event: Blood Sugar Rechecks
15 to 30 minute Blood Sugar Recheck (initial): Completed
15 to 30 minute Blood Sugar Recheck (second): Completed
Provider Identification
Provider: Medical
Provider: Nurse
Method of Communication: Test Page
Reason for Communication: Call
Provider Response: Called

And Why?
Documentation to Support Critical Thinking to Prevent Next Episode!
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Evaluating: Recommendation 9

Every hospital should prospectively monitor/measure:

- rates of hypoglycemia and hyperglycemia
- Insulin use patterns
- Coordination of insulin administration, glucose testing, and nutrition delivery

Real-time, institution-wide glucose reports should be provided to health care team members to ensure appropriate surveillance and management of patients with unexpected hypoglycemia and hyperglycemia

Glycemic Control Data- Why measure?

- Assess local baseline
- Assure the team and medical staff protocols are safe and effective
- Track progress over time
- Compare like units to each other
- Prioritize efforts
- Benchmark – compare performance to others
- Assess trade-offs between glycemic control and hypoglycemia
“Glucometrics” – Unit of measure Operational definitions

• Unit of analysis –
  – the individual reading (not recommended)
  – the patient-day
  – the patient-stay
• No consensus on best methods yet, but SHM offers a variety of measures
• Hypoglycemia: < 70 mg/dL
• Severe hypoglycemia: < 40 mg/dL
• DWM ≥ 180 mg/dl
• Percent patient-days with BG > 299 mg/dL
• Recurrent hypoglycemia: > 1 hypoglycemic day
# NYSPFP ADE Metrics

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>Measure Description</th>
<th>Numerator Definition</th>
<th>Denominator Definition</th>
<th>Data Submission Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Rate of ADEs for high alert drugs per 1,000 patient days</td>
<td>Number of total ADEs for anti-coagulants, insulin, and opioids</td>
<td>Number of total patient days</td>
<td>Monthly</td>
</tr>
<tr>
<td>Proxy Outcome</td>
<td>Percentage of patients with a blood glucose level outside of normal range (high)</td>
<td>Unique inpatients with one or more blood glucose ≥ 200 mg/dL</td>
<td>Number of (unique) inpatients who are prescribed insulin</td>
<td>Monthly</td>
</tr>
<tr>
<td>Proxy Outcome</td>
<td>Percentage of patients with a blood glucose level outside of normal range (low)</td>
<td>Unique inpatients with one or more blood glucose ≤ 50 mg/dL</td>
<td>Number of (unique) inpatients who are prescribed insulin</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
Society of Hospital Medicine: https://www.studydata.net/qgen/LoginSecure.php
Data / Reporting for Glucometrics, Community, and More

Society of Hospital Medicine

Main Menu
- Hospital Master
- BOOST
- GCMI
- VTE
- MARQUIS
- Milestone Edits
- BOOST Mentor Library
- Unit Care Type Fixer

Community
- BOOST
- VTE
- GCMI
- HP3

Applications
- BOOST Applications
- GCMI Applications
- VTE Applications

Extracts
- Extract
- Results Report
- MarquisErrors

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  Terms of Use
  HIPAA Guidelines
- McAfee SECURE
  TESTED DAILY 23-AUG

Hospital Name | Hospital Type | City | State | Bedsize | Cohort | Mentor
---|---|---|---|---|---|---
Baystate Medical Center | Academic Medical Center | Springfield | MA | 660 | 10/10 | Jeff Schnipper

Start Month: (choose)
End Month: (choose)

Care Type:
- Critical Care Inpatient
- Non-Critical Care Inpatient (Includes Telemetry)
- Other Care Type (ED / PACU / Holding Units / Endoscopy Areas, Outpatient Surgery, Dialysis, Rehab, SNF, etc.)

Unit Type:
- Mixed Medical / Surgical (Includes Transplant)
- Medical (Includes Oncology and BMT Units)
- Surgical
- Psychiatry or Behavioral
- OB/GYN
- Orthopedics
- Pediatrics / Adolescent
- Other
3. Patient Days Glucometrics

**Patient-Days Glucometrics**

**Site:** University of California San Diego Medical Center

**Care Type:** Critical Care Inpatient

**Units:** All

**Unit Type:** All

**Time Period:** 2012/02 to 2012/07

<table>
<thead>
<tr>
<th>Period</th>
<th>Days with Results &gt; 299</th>
<th>Days with Results &gt; 40 Mean Blood Glucose for the Population (mg/dL)</th>
<th>Days with Results &lt; 40</th>
<th>Days with Results &lt; 70</th>
<th>Days with Results &gt; 299</th>
<th>Days with Results &gt; 180</th>
<th>Days with Weighted Mean ≥ 180</th>
<th>Days with Weighted Mean ≥ 180</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/02</td>
<td>1439</td>
<td>151.6</td>
<td>4</td>
<td>0.3%</td>
<td>67</td>
<td>4.2%</td>
<td>86</td>
<td>6.0%</td>
</tr>
<tr>
<td>2012/03</td>
<td>1544</td>
<td>150.4</td>
<td>11</td>
<td>0.7%</td>
<td>65</td>
<td>4.2%</td>
<td>82</td>
<td>5.3%</td>
</tr>
<tr>
<td>2012/04</td>
<td>1312</td>
<td>145.9</td>
<td>7</td>
<td>0.5%</td>
<td>64</td>
<td>4.0%</td>
<td>73</td>
<td>5.6%</td>
</tr>
<tr>
<td>2012/05</td>
<td>1354</td>
<td>153.1</td>
<td>7</td>
<td>0.7%</td>
<td>59</td>
<td>4.4%</td>
<td>99</td>
<td>6.6%</td>
</tr>
<tr>
<td>2012/06</td>
<td>1354</td>
<td>147.2</td>
<td>4</td>
<td>0.3%</td>
<td>41</td>
<td>3.0%</td>
<td>87</td>
<td>6.4%</td>
</tr>
<tr>
<td>2012/07</td>
<td>1211</td>
<td>147.4</td>
<td>12</td>
<td>1.0%</td>
<td>37</td>
<td>3.1%</td>
<td>53</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

| Report Population | 9214                   | 150.0                                                           | 47                   | 0.6%                 | 333                    | 4.1%                   | 470                         | 5.7%                        | 1494                         | 17.8%                      |
### Non-ICU “Core” Unit Benchmarking

476 non-ICU units in 76 hospitals

<table>
<thead>
<tr>
<th>Metric</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
<th>Top 25th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient day-weighted mean BG</td>
<td>162</td>
<td>164.4</td>
<td>128.4 – 187.5</td>
<td>≤ 157.0</td>
</tr>
<tr>
<td>% patient-day BG means ≥ 180 mg/dL</td>
<td>29.5%</td>
<td>30.5%</td>
<td>12.0 - 45.8%</td>
<td>≤ 21%</td>
</tr>
<tr>
<td>% stays with BG mean (day-weighted) ≥ 180 mg/dL</td>
<td>27.5%</td>
<td>28.4%</td>
<td>6.8 – 43.3%</td>
<td>≤ 24%</td>
</tr>
<tr>
<td>% patient-days with any BG &gt; 299 mg/dL</td>
<td>10.5%</td>
<td>10.9%</td>
<td>2.7 - 21.5%</td>
<td>≤ 6.9%</td>
</tr>
<tr>
<td>% patient-days with any BG &lt; 70 mg/dL</td>
<td>5.0%</td>
<td>4.9%</td>
<td>1.7 - 13.1%</td>
<td>≤ 3.3%</td>
</tr>
<tr>
<td>% patient-days with any BG &lt; 40 mg/dL</td>
<td>0.6%</td>
<td>0.5%</td>
<td>0.1 - 1.6%</td>
<td>≤ 0.3%</td>
</tr>
<tr>
<td>% hypoglycemic patients with recurrence</td>
<td>32.4%</td>
<td>33.2%</td>
<td>7.0 - 52.7%</td>
<td>≤ 27.3%</td>
</tr>
<tr>
<td>Mean time- resolution of hypoglycemia (minutes)</td>
<td>127</td>
<td>120</td>
<td>39 - 245</td>
<td>≤ 78</td>
</tr>
</tbody>
</table>

Benchmarking: Ranking Bar Chart
Hypoglycemia Rates

Non-Critical Care - Hospital Rank by Percent Days with Results < 70

Hospital Number

Median

% Days

0.0% 2.0% 4.0% 6.0% 8.0% 10.0% 12.0% 14.0%

Hospital

3 2 4 1 3 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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Glycemic control – y axis: Hypoglycemia – x axis: Note extreme variability

Non-Critical Care

Outlier hospitals with a result greater than 10% for ‘Percent Days with Results <70’ are excluded from the scatter plot.

Hospital(s): 28, 37
Hypoglycemia Reduction with Simultaneous Improvement in Glycemic Control
Secondary prevention of Hypoglycemia
Iatrogenic Hypoglycemia from Insulin
Most common failures and strategies to address them

- Inappropriate prescribing
  - Standardized orders with embedded CDS – mandatory use
  - Ongoing monitoring for inappropriate prescribing, just in time intervention
- Failure to respond to unexpected nutritional interruption
  - Protocols and Education
  - Methods to reduce interruptions in tube feeding
- Poor coordination of nutrition delivery, monitoring, and insulin delivery
  - Clear directions in protocols and order sets
  - Regular education / competency training
  - Redesign process
- Failure to respond to a prior hypoglycemic day
  - Make sure ASSESSMENT is part of hypoglycemia protocol
  - Competency and case based-training
  - Monitor recurrent hypoglycemia rates
Hypoglycemia: Take Home Points

• Opportunities for prevention often missed
• Assess need for change after hypoglycemic event
• Existence of a hypoglycemia protocol does not guarantee good management
• Protocol for unexpected interruption of nutrition
• Carbohydrate intake / insulin rate should be tethered and accounted for
• Flow sheets can help pull together required data and make trends more apparent
• You can’t improve what you don’t measure
Thank you