Managing Inpatient Glycemic Control: Insulin Order Sets and Other Lessons Learned  
Reference Document to Workshop Slides

Background
The management of glycemic control in the inpatient setting is a common clinical situation. Some estimates suggest that up over 30% of patients in the inpatient setting have diabetes or hyperglycemia, with insulin being the preferred treatment. Hyperglycemia, with or without diabetes, has also been shown to be an independent marker of in-hospital mortality in patients. In addition, hyperglycemia has been associated with increased mortality and complications including prolonged hospital stay, recurrent ischemia, infection, disability after discharge from the hospital and delayed wound healing.

Insulin is the preferred treatment for inpatient hyperglycemia due to its flexibility in dosing, the ability to be given via multiple routes of administration, the lack of contraindications, and its ability to rapidly control hyperglycemia. Other anti-hyperglycemic agents do not have these same qualities and are more limited by contraindications. Historically, sliding scales have been used to help manage inpatient glucose levels, often with variable results. Problems encountered with sliding scales include multiple definitions of what constitutes sliding scale insulin, variable blood glucose control due to poor matching of blood glucose levels with individual blood glucose patterns for patients who are not eating, and mismatched timing of insulin administration and meal times occurring for patients who are eating meals.

Therefore, the Canadian Diabetes Association 2013 Clinical Practice Guidelines recommend that in non-critically ill inpatients utilize “a proactive approach that may include basal, prandial and correction-dose insulin, along with pattern management” over sliding scale insulin. This similar approach is echoed by other major inpatient diabetes clinical practice guidelines.

The Institute for Safe Medication Practices (ISMP) considers insulin to be a high alert medication. ISMP has suggested two strategies for improving inpatient subcutaneous insulin safety: use of institution-wide diabetes management record and the use of standard inpatient insulin order sets. Insulin order sets have been shown to improve inpatient diabetes practice and hyperglycemia. A similar approach to inpatient glycemic management has been suggested outside of Canada. However, while there are benefits to insulin order sets, writing and implementing insulin order sets can be a challenge with multiple possible problems being encountered.

Benefits to Using Insulin Order Sets
Multiple benefits of insulin order sets have been demonstrated in various studies with various designs:

- Systematic conversion from IV to subcutaneous insulin
- Decreased risk of transcription errors
- Decreased disruptive frequency of communications
- Decreased workload
- Decreased physician and RN frustration

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• Improved glycemic control
• Less use of sliding scale insulin

**Barriers to Using Insulin Order Sets**\(^ {15,16,27-33}\)
• Modest reductions in glycemic control in some studies (4-6%)
• Use of orders sets that are not patient specific
• Variable uptake of order sets (31-91%)
• Lack of knowledge re: insulin & its use
• Fear of hypoglycemia
• Severity of patient’s other disease states

**Facilitators of Insulin Order Set Update**\(^ {34,35}\)
• Programmed introduction of order sets
• Dedicated inter-professional team to support order sets
• Institutional support including pharmacy intervention/support
• Structured education programs for physicians, nursing, pharmacy

**Guideline Recommendations for Inpatient Glycemic Control**

*Comparison of Inpatient Glycemic Targets in Various Guidelines*

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*Inpatient Glycemia Management Strategies*

All three main North American guidelines suggest similar strategies for inpatient blood glucose management:

a) Canadian Diabetes Association 2013 Clinical Practice Guidelines\(^ \text{7}\)

The Canadian Diabetes Association 2013 Clinical Practice Guidelines recommend that in non-critically ill inpatients utilize “a proactive approach that may include basal, prandial and correction-dose insulin,
along with pattern management” instead for inpatient glycemia management in order to maintain glycemic levels between 5.0 and 10.0 mmol/L (5.0-8.0 preprandial mmol/L, random<10.0 mmol/L).

b) Endocrine Society
The Endocrine Society recommends “scheduled sc insulin therapy consist of basal or intermediate-acting insulin given once or twice a day in combination with rapid- or short-acting insulin administered before meals in patients who are eating … correction insulin be included as a component of a scheduled insulin regimen for treatment of BG values above the desired target.”

c) American Association of Clinical Endocrinologists/ American Diabetes Association
The American Association of Clinical Endocrinologists/ American Diabetes Association recommend “scheduled subcutaneous administration of insulin, with basal, nutritional, and correction components, is the preferred method for achieving and maintaining glucose control.” Education of hospital personnel is an essential component of this strategy as well.

Implementation Strategies

**Knowledge-to-Action Framework**

**Canadian Diabetes Association**
http://guidelines.diabetes.ca/BloodGlucoseLowering/in-hospital_mgmt

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Examples of Inpatient Diabetes Order Sets

Various groups have tried to address some of the challenges associated with insulin order set writing by providing sample inpatient insulin order sets. The order sets listed below are written in a generic fashion that need customization to the local setting.

   - provides a step by step instructions on how to write and implement insulin order sets. Sample order sets are provided for subcutaneous insulin orders, IV insulin orders and specialty situations such as diabetic ketoacidosis.

   - provides details regarding good order set writing practice and advice on writing order for subcutaneous insulin order sets only (no IV insulin use or other clinical situations)

   - Ontario-based organization that will help adapt order sets to a local institution’s needs.

   - provides a toolkit that can be used for designing a continuous quality improvement initiative around glycemia management including the use of insulin order sets

5. American Association of Clinical Endocrinologists Inpatient Glycemic Control Resource Centre - [http://resources.aace.com](http://resources.aace.com)
   - provides strategies around successful implementation of insulin related protocols and examples of various insulin order sets

   - discusses the insulin prescription and insulin titration

References


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