

Professional
Practice
Recommendations
for

Safe Use of Insulin in Hospitals



Section of
**INPATIENT
CARE PRACTITIONERSSM**



American Society of Health-System Pharmacists

Recommendations for Safe Use of Insulin in Hospitals

**A Joint Project of the American Society of Health-System Pharmacists
and the Hospital and Health-System Association of Pennsylvania**

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TABLE OF CONTENTS

Background	4
Expert Panel	5
Acknowledgments	6
Recommendations for Leaders	7
Recommendations for Frontline Staff	8
1. Purpose, background, and use	9
2. General recommendations for the health care organization	12
3. Recommendations for caregiver competency	17
4. Recommendations for patient information: collection, documentation, and availability	19
5. Recommendations for prescribing practices	21
6. Recommendations for order transcription	25
7. Recommendations for order review, distribution, preparation, and dispensing	26
8. Recommendations for administration	30
9. Recommendations for monitoring and documenting	33
10. Recommendations for nutrition	36
11. Recommendations for patient and family involvement and education	37
12. References and resources	39

BACKGROUND

The American Society of Health-System Pharmacists and the Hospital and Health-System Association of Pennsylvania convened a panel of experts from medicine, pharmacy, and nursing in October 2004 to discuss best practices for improving the safety of insulin use in hospitals. The expert panel met over a two-day period, evaluating current literature and recommendations to determine why insulin use in

hospitals has not achieved a high level of safety, and how the medication-use system could be redesigned to prevent patient harm associated with poorly designed insulin-use processes. The recommendations developed from this meeting served as the guiding principles for the *Recommendations for Safe Use of Insulin in Hospitals*.

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RECOMMENDATIONS FOR LEADERS

The recommendations in this document are sufficiently comprehensive and supported by evidence to ensure that an empowered team of health care professionals, charged with implementing the recommendations, has a strong basis for making necessary changes to improve the insulin-use process. Leaders must recognize, however, that a commitment by top-management *must* exist to ensure that the interdisciplinary team charged with implementation has the necessary resources, authority, and organizational support to make what might be significant changes in the interest of preventing patient harm associated with insulin use.

Leaders should consider the following:

- Provide this document to the interdisciplinary team that is responsible for leading safety and quality improvement efforts in their organizations. At a minimum, the team should be comprised of physicians, nurses, and pharmacists. The team should have a means to report on their efforts directly to top executives in the organization.
- Strive to link improving insulin-use safety to broader efforts associated with encouraging and implementing a culture of safety and making your hospital among the safest in the country.
- Remember that, year-after-year, insulin is consistently implicated in causing the most preventable patient harm in hospitals through reporting systems maintained by the U.S. Pharmacopeia and Institute for Safe Medication Practices.
- Recognize that there are no quick-fixes to making insulin use safer in your organization. The comprehensive nature of this document reflects the complexities of the process in which insulin is used. As a starting point, use this document as a means to determine where safety gaps exist, and devise a plan with a reasonable time frame to make the necessary changes, factoring in culture and resources.
- Make improving insulin-use safety a priority for your board of regents and use this document as a maker of ongoing progress toward designing a system that provides the maximum number of safeguards for patients.

RECOMMENDATIONS FOR FRONTLINE STAFF

This document contains a series of well-referenced recommendations that, if implemented, will augment other efforts by your organization to protect patients from preventable harm associated with insulin and other medications. The breadth of the recommendations reflects the inherent complexity of the medication-use process in general and, specifically, the high-risk nature of insulin.

In addition to insulin, many of these recommendations could apply to other high-risk medications. Utilize this document first as a self-assessment tool to determine where safety gaps might exist. Prioritize your findings based on the relative impact of a failure in the system based on the likelihood of patient harm. Be reasonable in setting improvement goals making sure your recommendations and approaches have sufficient buy-in by leaders and frontline staff. Organizational culture and the subcul-

tures of various health care professions are major determinants in the success of any improvement efforts. Each recommendation is supported by a crosswalk to relevant literature. Use that alignment with the evidence to justify making the necessary changes in how insulin is handled in your organization.

Strive to document the successes of your efforts to improve insulin-use safety by encouraging staff and others to share their individual and collective experiences with the implemented improvements in the process. Use those experiences to make changes and adaptations that fit the unique needs of your organization. And, as always, demonstrate your commitment to a culture of safety by ensuring that your experiences are shared with others through national reporting systems such as those maintained by USP, ISMP, and FDA MedWatch.

INTRODUCTION

Statement of Purpose

Insulin is widely considered to be one of the most important and beneficial drug discoveries of the 20th century. Its therapeutic benefits are undeniable when health care processes are designed with appropriate safeguards. However, preventable patient harm associated with errors involving insulin use continues to be a problem in many hospitals. Despite the substantial attention to medication safety in general, and insulin safety specifically, evidence over the past 10 years suggests that patient injuries are still occurring. Insulin consistently appears as a top offender, leading to the most harmful and severe adverse events on the list of high-alert drugs published by the United States Pharmacopeia (USP) and the Institute for Safe Medication Practices (ISMP).

The purpose of this report is to assist health care organizations and practitioners in improving the safety and effectiveness of insulin use in hospitalized patients. This report strives to provide a comprehensive set of recommendations and, therefore, incorporate and cite numerous and diverse resources. The recommended safer insulin therapy practices guidelines are intended to meet *and exceed* current regulatory and accreditation (JCAHO) standards and recommendations of professional bodies [American Association of Clinical Endocrinologists (AACE), American Diabetes Association (ADA), American Society of Health-System Pharmacists (ASHP), ISMP, and USP] as well as to drive improvements in the standards of care.

The format of this report as a list of best practices characteristics was adapted from the ISMP, which has successfully assisted organizations in medication-safety assessments and guided improvements. Each of the recommendations includes its own set of references. The referenced resources should be used to provide additional information and specific details that will be necessary for effective implementation of safer insulin practices within health care organizations.

Background and Statement

Twelve percent of patients discharged from hospitals carry the diagnosis of diabetes, and up to twenty-five percent of all hospitalized patients meet the criteria for the diagnosis of diabetes (Clements, ADA 2005a). Factors such as medications and stress cause many non-diabetic patients to develop hyperglycemia while hospitalized. Insulin is used in both of these populations to manage hyperglycemia. With such frequent use of insulin comes the risk of error and subsequent patient harm.

Types of insulin-use errors include

- administration of a wrong dose,
- administration to the wrong patient,
- use of the wrong insulin type,
- administration via the wrong route,
- wrong timing of doses,
- omission of doses,
- failure to properly adjust insulin therapy, and
- improper monitoring, timing, and assessment of blood glucose (BG) results.

Factors contributing to insulin-use errors are numerous: the use of abbreviations, failure to follow the “leading zero always/no trailing zero” rules, legibility problems, calculation errors, measurement errors, mis-timing of doses, sound-alike/look-alike errors, decimal point errors, pump-setting errors, drug therapy knowledge deficit, inadequate access to and interpretation of accurate patient information, and miscommunication (ISMP, USP). Implementation of recommended general medication-safety practices (ASHP, ISMP) will reduce the risk to patients from insulin-use errors. Practices that have been suggested include pre-printed orders, standardized insulin order sets, elimination of insulin sliding dosage scales, elimination of commonly used dangerous abbreviations, implementation of independent second-person verifications, and others (ISMP, Kowiatek, Santell, Smetzer, USP 2005). However, large gaps still exist in the implementation of these practices, and even greater gaps exist in the evidence documenting improvement in safety and patient outcomes.

Prevention of hypoglycemia from unintentional insulin-use errors is only one aspect of safe and effective insulin use. Data suggest that the most common causes of both hypoglycemia and hyperglycemia are deficiencies in the use and monitoring of insulin therapy (Smith, Winterstein). Additionally, emerging data on the benefits of improved glycemic control for hospitalized patients make the achievement of safe BG targets an important patient safety goal. Failure to appropriately manage hospitalized patients’ hyperglycemia to achieve “tight control” is now viewed by many experts (Clements, AACE 2003, ADA 2005a) as a type of medication error because therapy is not managed effectively enough to reduce the risk of adverse outcomes. Of course, the greatest risk of efforts to achieve tighter BG control is hypoglycemia (Rubin, Saleh). Thus, the *safe* and *effective* use of insulin in hospitalized patients should be viewed as interdependent processes.

Ensuring the safety of insulin therapy is a prerequisite to successful implementation of practices

to achieve the BG targets for hospitalized patients currently being recommended (Clement, Cryer 2002b, Rubin, Saleh, Thompson). Given the need for multiple system changes to optimize insulin therapy, many recommendations provided in this report are overarching medication-safety principles integrated with recommendations for specifically improving management of insulin therapy. Taken together with other medication-safety recommendations (ISMP, ASHP), these practices are likely to improve the safety of insulin use in hospitals. This report strongly encourages the use of overall safe-medication practices within the context of an organization-wide comprehensive diabetes and hyperglycemia management system.

These guidelines provide practice recommendations, references, and tools to help hospitals assess current practices and identify high-impact approaches to improving the insulin-use process, emphasizing a detailed description of the characteristics of a safe inpatient insulin-use system. Recommended potential best practices for safe and effective insulin use in hospitals were identified through a wide variety of resources, including a comprehensive review of the medical literature, web-based searches, recommendations of professional organizations, review of relevant regulatory requirements and accreditation standards, discussions with medication-safety and diabetes care experts, and peer-to-peer communications. Many recommendations for insulin use in hospitals are based on the comprehensive technical review by Clement et. al. (Clement), which is a reliable resource for improving the use of insulin in hospitalized patients. The medication-use policies, guidelines, recommendations, and statements of ASHP, ISMP, and the Institute for Health care Improvement (IHI) (available at www.ih.org) are suggested resources for many best practices recommendations for safe insulin use and medication-use systems in general.

Most recommendations for improving insulin safety are based on experience and engineering models of process improvement. Some have been evaluated using controlled trials; however, applicability will vary based on individual care environment characteristics. Whenever implementing recommended safety practices, organizations must carefully assess the potential for risks associated with changes and monitor for unintended consequences. These recommendations will likely require modification as changes in technology, drug therapy, nutrition, and glucose monitoring occur and as further evidence and experience related to improving insulin-use safety become available. Such changes will require an organized, sustained, and committed effort to be successfully implemented.

RECOMMENDATIONS FOR MAKING HIGH-IMPACT CHANGE

Considering the complexity of improving insulin therapy safety in hospitals and lessons learned in previous efforts, organizations should approach insulin safety in a comprehensive and coordinated manner. The impact of comprehensive medication-safety practices is substantially greater than the sum of its components. Recommended individual insulin-safety practices will, if implemented, marginally improve safety, while implementation of comprehensive and coordinated improvements are likely to have a major impact on patient outcomes. The following are high-level recommendations necessary for organizations to make significant change in the safety and efficacy of insulin therapy:

1. The organization should designate a high-level project leader/sponsor with overall responsibility for program success (IHI).
2. The insulin therapy multidisciplinary group should coordinate and lead development of institutional policies and procedures for insulin practices (IHI, ISMP).
3. Institutional policies should incorporate safe medication practices in general, as well as practices specific to insulin (ASHP, IHI, ISMP).
4. Institutional policies should establish evidence-based target standards for glycemic control for patients in the hospital (ADA 2005, Clement).
5. Policies should require the ordering of all components of insulin therapy in a defined format, preferably using mandatory pre-printed, guideline-based order sets [or formatted computerized prescriber order entry (CPOE) orders] for most patients prescribed insulin. Order process design should incorporate medication-safety principles and evidence-based BG control standards (Clement, Rubin).
6. Insulin orders should prompt and facilitate order transcription, pharmacist and nurse order review, pharmacy computer order entry, and nursing workflow.
7. Insulin orders should include (or refer to) defined standards for laboratory and clinical insulin therapy monitoring practices (Clement).
8. Insulin administration record, glucose monitoring results, and carbohydrate intake should be effectively displayed to allow caregivers to accurately and efficiently assess data.
9. Institutional policies should promote and provide for the ongoing involvement of patients and families in care processes.

How to Use the Guidelines

Recommendations for Safe Use of Insulin in Hospitals are organized by patient care process components. Each recommendation should be reviewed and current practices compared with proposed safe practices. References for each recommendation provide additional support and information specific to the recommendation or regarding general medication-safety practices that apply to insulin use. Many of the cited references also provide resources useful as “how-to” examples in regards to the effective implementation of these practices. Those references listed in *italics* include useful tools such as tables, charts, reproductions of protocols, order sets, documentation sheets, and teaching aids.

Accessing the referenced resources will assist you in the building of a “toolkit” for improving insulin therapy processes most applicable to individual care settings. Institutions and groups using the guidelines are strongly urged to collect and share similar tools obtained from other resources or developed internally. Individual organizations will vary in current practices, available resources, technologies, need for improvement in insulin-use practices, available opportunities, and organizational priorities. The specific process improvement sequence, techniques, and methods used in implementation of potential best practice recommendations will similarly vary from organization to organization.

PATIENT CARE PROCESS

COMPONENTS

General Recommendations for the Health Care Organization

Insulin therapy involves multiple care providers and is undertaken throughout many areas of a hospital. In order to provide the safest possible use of insulin therapy, organizations must implement system-wide processes that reduce risk of error and improve the management of insulin therapy. Many recommendations for improving the safety of insulin therapy involve application of general medication-safety practices as promoted by a number of professional organizations (ASHP, ISMP, USP). Such broad changes require organizational commitment and leadership. It is worth emphasizing the need for organizations to actively promote a culture of safety and learning. The success of any effort will be greatly enhanced when such an environment is present.

Establishing Organizational Structures

Institutions should identify or establish the high-level organizational bodies and individuals in leadership positions that will be responsible for sponsoring and guiding efforts to improve insulin therapy practices. Assigning responsibility for improvement at an appropriate level in the organization assigns ownership, increases awareness, establishes priority, and allows for proper application of resources. The Pharmacy and Therapeutics (P&T)

Committee and other appropriate bodies should establish comprehensive safety-based policies and procedures for the use of insulin within the institution. It is recommended that a multidisciplinary team, including physicians (and endocrinologists specifically), nurses, pharmacists, dietitians, diabetes educators, laboratory staff, quality management staff, and others, be tasked with developing, recommending, and implementing specific process improvements related to insulin use. This team would be expected to collaborate with all other relevant components of the organization.

Establishing Evidence-Based Care Standards

Institutions should establish standards for safe insulin therapy practices and standards for glycemic control in specific populations of hospitalized patients (ADA 2005a, Clement). These standards should be evidence-based and developed by appropriate multidisciplinary care provider groups, approved by governing bodies, and disseminated, implemented, and monitored properly. Such standards should be clear, comprehensive, and detailed. A process for measurement of outcomes versus established standards should be implemented. Similarly, an active error-detection, reporting, and assessment program focused on insulin therapy should be established.

Specific guidelines and recommendations for organization-wide safe insulin therapy practices are provided in the table below. The care standards should be periodically reviewed and modified based on new evidence from the medical literature and experiences within the organization.

General Recommendations

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

<p>The organization should actively promote a culture of safety. Without such a culture, the likelihood that effective insulin-safety practices will be implemented and adhered to will be greatly reduced. Clear expectations for effective communication, coordination, and teamwork should be delineated, communicated, and promoted. A non-punitive “learning” approach to error and error reporting should be promoted.</p>	<p>AHRQ, IHI, ISMP</p>
<p>The organization should implement general medication-use system and safety recommendations as delineated by JCAHO, ASHP, ISMP, and other relevant organizations and bodies. Such practices will directly impact the safety of insulin therapy in a hospital.</p>	<p>ASHP, JCAHO, ISMP, USP</p>
<p>The organization, through appropriate bodies, should develop and implement specific system-based strategies for improving use and safety of insulin.</p>	<p>ADA 2005, Campbell, Clement, Ku, Thompson</p>
<p>The P&T Committee, or similarly responsible organization-wide committee, should determine and have oversight of the policies and procedures related to insulin use in the organization and insulin products and administration devices to be stocked and used within the organization. Safety concerns should be a significant part of the Committee’s evaluation.</p>	<p>ASHP, ISMP, JCAHO</p>
<p>Through appropriate multidisciplinary committees, the organization should establish clear, comprehensive, and coordinated policies and procedures related to insulin use. Policies should include education and competency requirements for all involved staff. Access to policies should be readily available to staff. Compliance with insulin therapy–related policies should be monitored on a routine basis.</p>	<p>ADA, ASHP, Goldberg, ISMP, JCAHO</p>
<p>The organization should establish defined responsibilities for pharmacists in the management of patients receiving insulin therapy.</p>	<p>Thompson</p>
<p>The organization should have an active ongoing process for detecting, reporting, and assessing adverse patient events related to insulin use. Organizations should monitor the use of 50% dextrose and glucagon as triggers for case review to determine if that use was associated with insulin therapy.</p>	<p>ASHP, IHI, ISMP</p>
<p>All cases of ketoacidosis or diabetic hyperglycemic hyperosmolar state occurring while patients are inpatients should automatically prompt a root cause analysis (RCA) to determine system causes or deficiencies.</p>	<p>Clement</p>
<p>Ongoing concurrent and retrospective review (such as frequency trending) of BG measurements below an established minimum critical value (i.e., hypoglycemia) and above a maximum value (i.e., hyperglycemia) should be implemented. Efficient communication links to prescribers, nurses, dietitians, and pharmacists should prompt a patient, nutrition, and drug therapy review.</p>	<p>ADA 2004, Clement, NCCLS, ISMP, Nichols, Sacks</p>
<p>The organization should have an active ongoing process for detecting, reporting, and assessing process errors and other occurrences related to insulin use. The program should include assessment of “near-miss” errors. Information should be communicated to appropriate groups and individuals within the organization.</p>	<p>Cavan, Davis, Gilman, IHI, ISMP, Manning, Quinn, Santell, Smith</p>
<p>The organization should have an ongoing process to review and monitor prescribing practices related to insulin use.</p>	<p>Baldwin, Clement, Kowiatek, Smith</p>
<p>The organization should regularly review compliance with completion of ordered BG monitoring and insulin administration.</p>	<p>ISMP, Gilman, Heatlie, Kowiatek, Manning, Smith</p>

General Recommendations	References/Resources
Insulin therapy management process improvements in organizations should be data driven. Information from active detection, practitioner review, laboratory BG critical value alerts, error reports, as well as relevant internal and external information should be used to guide insulin-use process improvements.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i> <i>IHI, ISMP, Kowatek, Manning, Smith, Trence, Winterstein</i>
System changes related to insulin should be designed and evaluated through structured methods such as failure modes and effects analysis (FMEA). All changes to insulin therapy management-related processes are monitored for success and unintended consequences.	<i>IHI, ISMP, ASHP, Smith</i>
Insulin (all forms) should be designated as a “High Alert” medication within the organization. The “High Alert” nature of insulin should be communicated to staff because the common and widespread use of insulin may result in safety net work-arounds and complacency by staff.	<i>ISMP, JCAHO</i>
Strategies to reduce errors with insulin as a “High Alert” medication should be delineated (e.g., use of independent “double checks” at critical process or error-prone steps). Defined processes to recover from (ameliorate) insulin therapy errors when they do occur should be delineated and communicated to the staff.	<i>ISMP, JCAHO</i>
Hypoglycemia “rescue” agents (dextrose and glucagon) should be readily accessible throughout the organization. A standard method for management (e.g., protocol or algorithm) of hypoglycemia should be approved, established, communicated, and readily available to caregivers.	<i>Clement, ISMP, Tomky</i>
Important patient-specific information related to insulin use should be readily available and effectively shared with all involved caregivers.	<i>Baldwin, Clement, ISMP, JCAHO, Smith, Thompson</i>
Standardized interpretation of language and terms should be in place across the organization. Examples follow.	<i>Baldwin, Clement, ISMP, JCAHO, Smith</i>
<ul style="list-style-type: none"> ● <i>Prandial insulin</i>—rapid or short-acting insulin or insulin <i>mix</i> given prior to or with meals ● <i>Basal insulin</i>—long-acting insulin given once or twice daily ● <i>Correction or supplemental insulin</i>—rapid or short-acting insulin given to reduce BG or added to prandial insulin ● <i>Finger stick</i>—bedside capillary blood glucose (CBG) monitoring ● <i>Insulin-deficient patient</i>—patient requiring ongoing insulin therapy to avoid ketoacidosis 	
Appropriate elements of the organization should be directed to establish appropriate evidence-based target BG ranges for defined patient groups associated with improved outcomes (e.g., critical care, acute MI, stroke patients).	<i>AACE, Clement, ADA 2005, Bryer-Ash, Connor, Goldberg, Finney, Van der Berghe</i>
Essential patient information should be obtained, accurately documented, and accessible to all caregivers involved. Access to information regarding reconciled inpatient medications and laboratory results is readily available to caregivers. Access to medication and laboratory results for patients in outpatient settings should be available.	<i>Baldwin, ISMP, JCAHO</i>

General Recommendations

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

The organization should establish standardized procedures for the safe use of insulin to achieve BG targets associated with improved patient outcomes. These include:

1. Protocols for continuous insulin infusions in various settings and patient populations.
2. Protocols for high-risk transitions of insulin therapy (e.g., critical care infusion to general ward).
3. Conversion from infusion to intermittent subcutaneous administration.
4. Patients not eating.
5. Patients who are eating intermittently.
6. Patients on continuous enteral nutrition.
7. Patients on intermittent enteral nutrition.
8. Patients on continuous parenteral nutrition.
9. Patients on cycled parenteral nutrition.
10. Perioperative and peri-procedural patients.
11. Pregnant and post-partum patients.
12. Hyperglycemic patients receiving high-dose glucocorticoid therapy.
13. Neonatal and pediatric patients.

Advocate Lutheran, Campbell, Clement, Dagogo-Jack, Furnary, Lewis, Luther-Midelfort, Midelfort, Markowitz, Maynard, Moghissi, O'Callaghan, Providence Health, Quevedo, Rubin, Shokough-Amri, Trence, Zimmerman

Insulin algorithms used in the organization should be designed to improve caregiver communication and coordination and assist in achieving BG targets recognizing individual variability and intra-patient variability over time.

Clement, Rubin

Protocols related to insulin use should be approved by appropriate organizational bodies. Documents are readily available to caregivers.

JCAHO, ISMP

A process for systematic review/updating and for ensuring use of only the most recent version of approved protocols should be in place.

ISMP, JCAHO

Protocols for insulin therapy should include both the generic and brand name(s) of insulin products.

ISMP

Problems and issues with use of approved protocols should be documented and forwarded to appropriate individuals or groups.

Clement, Smith

All insulin therapy protocols and order sheets should be reviewed at least annually.

JCAHO

The organization should systematically implement appropriate alerts and warnings to reduce risk of errors with insulin therapy:

JCAHO, ISMP

1. Use TALLman lettering to distinguish between look-alike/sound-alike products (e.g., NovoLOG /NovoLIN, LantUS/LenTE).
2. Emphasize the word *mix* when such products (e.g., NovoLOG **MIX** 70/30) are prescribed, dispensed, transcribed, labeled, and documented.
3. Use stickers and labels judiciously to distinguish products or call attention to important information.

Appropriate warnings should appear in information systems (e.g., pharmacy, CPOE, medication administration record) when medications that significantly alter BG levels or insulin regimen requirements are started or stopped, or the dose is increased (e.g., corticosteroids, oral hypoglycemics, quinolone antimicrobials).

ISMP, JCAHO

Organizational policy should require that insulin orders in pediatric patients be ordered in the format of "units per kilogram" with final calculated insulin dose specified in the order by the prescriber. All weight-based dose calculations should be independently re-calculated by the pharmacist and nurse.

JCAHO, ISMP

General Recommendations	References/Resources
Organizational policies should define and limit the use of insulin infusions and dilutions to predetermined standard concentrations and solutions. All such products should be prepared by the pharmacy.	JCAHO
The organization should specifically define circumstances in which insulin concentrations other than U-100 are used for intermittent subcutaneous doses (e.g., criteria for use of U-500 insulin or use of diluted insulin).	<i>ASHP, ISMP</i>
Orders for diet (or lack thereof) should be available to reviewing pharmacists and other individuals without ready access to the medical record. A system for alerting caregivers should be in place when patients receiving insulin have orders written for significant reductions in caloric intake.	<i>JCAHO, ISMP</i>
The organization should have a process to alert the pharmacy and other appropriate care providers whenever insulin-deficient patients are admitted or identified.	<i>Clement, JCAHO</i>
The institution should use a Consistent Carbohydrate Diabetes Meal-Planning System.	<i>ADA 2003, Swift</i>
The organization should have an established process for patients demonstrating hyperglycemia requiring insulin therapy during hospitalization to receive follow-up evaluation for the presence of diabetes or pre-diabetic state.	<i>Clement 2004, JCAHO</i>
The organization should have defined standards for interdisciplinary patient and family education (and documentation thereof) related to insulin therapy.	<i>ADA 2005a, ASHP, Clements, Davis, JCAHO, ISMP, Nettles</i>
The organization should have a defined standard for individualized interdisciplinary discharge planning process for patients to be discharged taking insulin.	<i>ADA 2005a, Clement, Nettles, Thompson</i>
Organization should establish criteria and appropriate safety measures for the use of insulin in treatment of severe hyperkalemia.	<i>JCAHO, ISMP</i>
Needle stick injury prevention practices should be incorporated into all relevant insulin therapy policies and procedures.	<i>ISMP, JCAHO</i>
Infection control and sharps/waste disposal are incorporated into all relevant insulin therapy policies and procedures.	<i>ISMP, JCAHO</i>

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

Caregiver Competency

Safe insulin therapy is dependent upon the competency of staff providing care. Given the high frequency and complexity of insulin use in hospitalized patients, and the inherent risks of insulin therapy, organizations should implement a systematic process to ensure the initial and ongoing competency of all staff involved in the care of patients receiving insulin therapy. Minimum expected

knowledge base and staff competencies should be defined in detail for each caregiver role, and all involved staff should be made aware of the roles and expectations of other caregivers in providing insulin therapy. Staff should be made aware of, and should adhere to, organization policies and procedures related to insulin therapy. Recommendations for general staff competency related to safer insulin practices are provided in the table below.

Caregiver Competency	References/Resources
<p>New employee training and prior experience related to use of insulin should be formally assessed, and any deficiency addressed, prior to allowing the individual to independently care for patients using insulin.</p>	<p><i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i></p> <p><i>Baldwin, Fajtova, Clement, ADA 2003, ADA 2005a, JCAHO, ISMP</i></p>
<p>All involved in the care of patients treated with insulin should be appropriately oriented to the specific organizational policies, procedures, practices, and equipment used in that care.</p>	<p><i>Baldwin, Brigham Womens, JCAHO, ISMP, Gilman, Manning, Heatlie, Nettles</i></p>
<p>Because insulin therapy is a dynamic process in hospitalized patients, it is necessary that caregivers possess the knowledge to make critical decisions. All individuals who prescribe, dispense, prepare, administer, and monitor insulin should demonstrate knowledge and have ready access to information regarding insulin therapy management, including but not limited to:</p> <ol style="list-style-type: none"> 1. Diabetes and hyperglycemia. 2. Hypoglycemia and its treatment. 3. Names (brand and generic) of available insulin products and formulations. 4. Indications for insulin. 5. Routes of insulin administration. 6. Measuring insulin doses. 7. Appropriate mixing of insulin in the same syringe. 8. Appropriate dosages. 9. Onset, peak, and duration of action of insulin types. 10. Appropriate timing of insulin administration. 11. Appropriate assessments of patient medical and medication history. 12. Appropriate clinical and laboratory monitoring procedures and assessment of results. 13. Appropriate assessment of nutritional intake. 14. Potential insulin adverse effects. 15. Cautions and warnings for insulin therapy. 16. Potential drug–drug interactions. 17. Potential for errors in providing insulin therapy. 18. Proper storage and handling of insulin products and devices. 19. Specifics regarding practices for safe insulin use within the organization. 	<p><i>ADA, Clement, Gilman, Heatlie, Hirsch 2005, Manning, Nettles, Smith, Thompson</i></p>
<p>Critical new information regarding insulin therapy and insulin products is effectively communicated to all caregivers.</p>	<p><i>Clement, ISMP</i></p>

Caregiver Competency

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

The organization should have a process for periodic competency assessment of caregivers involved in insulin therapy management.

Clement, ISMP

The organization utilizes information obtained from insulin error reporting and monitoring to improve staff education and competency processes.

Baldwin, IHI, Kowiatek, JCAHO, Smith, USP, Winterstein

Patient Information: Collection, Documentation, and Availability

Availability and use of patient information is necessary for the safe use of medications in hospitalized patients. Current standards require that important patient information is readily accessible to

caregivers (JCAHO 2005). Organizations should establish specific procedures for obtaining, documenting, and communicating information critical to the safe use of insulin therapy. Recommendations for organizations are provided below and apply to all patients with insulin orders.

Patient Information	References/Resources
Patient history of diabetes should be clearly identified in the medical record. Diagnosis of diabetes is communicated to the pharmacy and to nutrition services.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i> ADA 2005, <i>Clement</i> 2004
Patients should be assessed to determine if they are insulin deficient or non-deficient (able to produce endogenous insulin). Assessment should be documented. Patients determined to be insulin deficient must be treated with insulin at all times to avoid ketoacidosis. Insulin-deficient patients include the following (<i>Clement</i> 2004):	<i>Clement</i> 2004
<ol style="list-style-type: none"> 1. Type 1 diabetics 2. Pancreatectomy or pancreatic dysfunction 3. History of wide fluctuations in BG 4. History of diabetic ketoacidosis 5. Insulin use for 5 years or more or diabetes for more than 10 years 	
An accurate and complete medication history is obtained, reconciled, and recorded for all patients. This history includes over-the-counter products, complementary and alternative medications, and nutritional supplements. Medication history is communicated to the pharmacy.	<i>Baldwin, Fajtova, ASHP, JCAHO, ISMP</i>
Patients should be asked to bring their insulin as well as other medications to the hospital for visual validation. Medications brought to the hospital should not be left with the patient unless they are part of a self-administration program consistent with all accreditation and legal standards. Patient medications not used in the hospital should be stored appropriately or provided to family members/others to be returned to the patient's home.	<i>Clement</i>
An accurate and complete history of current insulin therapy should be obtained and recorded.	<i>Baldwin, Fajtova, Clement, JCAHO, ISMP</i>
<ol style="list-style-type: none"> 1. Type of insulin(s) (brand and formulation) 2. Storage of insulin 3. Dose(s) of insulin(s) 4. Times of dose administration for each insulin type 5. Route of administration 6. Use of other hypoglycemic agents 7. BG monitoring plan, including device used and site of blood sampling 8. Dose modifications based on dietary intake and measured BG 9. Usual dietary intake and/or meal patterns 10. Compliance with dietary plan 11. Sleep-wake patterns 12. Hypoglycemic episodes, hypoglycemic symptoms 13. Typical BG control patterns 14. Hyperglycemic episodes 	

Patient Information

References/Resources

*See list at end of document for full citations.
(Note: references printed in italics include sample order sets/protocols, etc.)*

- 15. Compliance with insulin regimen
 - 16. Compliance with BG monitoring plan
 - 17. Hemoglobin A1c levels
 - 18. Past /known effects of concurrent drug therapies, medical conditions, and nutritional intake on BG control and insulin dose regimen needs
 - 19. Assessment of patient understanding/knowledge of diabetes and treatment
-

Organizations should consider implementation of standardized forms for medication and insulin therapy documentation, which prompt collection of pertinent information.

Insulin and other medications for diabetes orders are reconciled as patients transition from one care environment to another within the organization.

IHI, JCAHO, Thompson

Insulin and other medications for diabetes prescriptions are reconciled with pre-admission use as well as changes made during hospitalization.

Prescribing Practices

Prescribers and prescribing practices play a key role in safe insulin use. Prescribers commonly initiate the cascade of care events involved in the provision of insulin therapy to patients. Organizations should develop and implement safe prescribing

practices and procedures. These procedures should be designed to appropriately direct care through clear and complete orders, and establish expectations for communication with patients and other caregivers' responsibilities. Recommendations for safe insulin prescribing practices are provided in the table below.

Prescribing Practices	References/Resources
Insulin should only be prescribed by individuals with knowledge of insulin therapy, glucose control strategies, and insulin monitoring in hospitalized patients.	<i>Baldwin, Fajtova, ISMP, JCAHO, Thompson</i>
Individuals prescribing insulin should be familiar with the patient's medical history related to insulin and other hypoglycemic agent use.	<i>ISMP, JCAHO</i>
Prescribers should actively participate in communications with the patient and family regarding insulin therapy while in the hospital and upon discharge.	<i>ISMP, JCAHO</i>
The prescriber should actively lead and coordinate insulin-related care and effectively communicate with other caregivers involved with the patient.	JCAHO
The prescriber should appropriately respond in a timely fashion to any and all patient, family, and other caregiver concerns regarding insulin therapies.	JCAHO
Insulin therapy should be ordered in a standardized format or by using pre-printed or electronic order sets that prompt appropriate guideline-directed orders.	<i>Baldwin, Campbell, Clement, Dagogo-Jack, Levetan 2002, Metchik, Moghissi, Quevedo, Thompson, Trence</i>
Orders for insulin should include:	<i>Baldwin, Fajtova, Clement, ISMP, JCAHO, Manning, Smith, Thompson</i>
<ol style="list-style-type: none"> 1. At least two patient identifiers. 2. Specific indication for use of insulin with appropriate terminology of insulin therapy defined by the organization (e.g., insulin-deficient patient, basal, prandial, supplemental, correction dose, etc.). 3. Target range of therapy in terms of control of hyperglycemia and lower limits of BG. 4. Insulin type(s)—all orders for “insulin” without qualifying type of insulin (e.g., regular, NPH, lente, aspart, glargine, lispro) must be clarified prior to administration. For greatest clarity, provide both generic and brand name of insulin product. 5. Dose(s) for each insulin type. 6. Specific time of administration (or preferably use of organization standard times), either as specific time of day (clock hour) or as time prior to or with food or meals. 7. BG monitoring regimen specified by time of day and/or as time prior to food or meals. 8. Specific insulin dose regimen adjustment based on dietary intake and/or BG results. 9. Route of administration. 10. Orders for management of hypoglycemia. 11. Description of the role of the patient in management of insulin therapy. 12. Patient-specific issues and care needs. 	

Prescribing Practices	References/Resources
Handwritten insulin therapy orders or handwritten components of pre-printed order sets should be legible. All illegible orders should be clarified in writing prior to administration.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i> <i>ISMP, JCAHO</i>
Insulin therapy orders are clearly written. Ambiguous insulin therapy orders are clarified in writing prior to administration.	<i>ISMP, JCAHO</i>
The abbreviation “u” or “U” should not be used for units. The word “units” must be written in full.	<i>ISMP, JCAHO</i>
Leading zeroes should be used before all decimal points when insulin is ordered. No “trailing” zeroes should be used following decimal points.	<i>ISMP, JCAHO</i>
No “prohibited” abbreviations as determined by the organization should be used.	<i>ISMP, JCAHO</i>
Verbal and telephone orders for insulin should be minimized and used only when necessary in urgent medical situations. In all cases, such orders should be immediately transcribed into the patient’s medical record and then read back to the prescriber for confirmation.	<i>ISMP, JCAHO</i>
All orders for standing regimens (i.e., not correction doses) of rapid or short-acting insulins (including insulin mix products) should be ordered to be given at an appropriate time prior to or with meals rather than a specific time of day or as a number of times per day # (e.g., “twice daily” or “B.I.D.” should not be used).	<i>Baldwin, Fajtova, Clement, Thompson</i>
All patients receiving insulin should have BG monitored. BG measurements should be ordered to be done at appropriate times and evaluated at least daily. Appropriate adjustments of basal and/or prandial insulin dose regimen are made.	<i>Clement, Thompson</i>
A plan for increased patient monitoring early in hospitalization should be in place for appropriate patients because hypoglycemia commonly occurs with change in caloric intake as patients are transitioned from outpatient to inpatient settings.	<i>Clement, Thompson</i>
Standardized correction, supplemental, or adjustment insulin dose orders should be established and ordered in a standard format, using CPOE, or approved pre-printed order sheets.	<i>Advocate Lutheran, Baldwin, Clement, Maynard, Metchik, Mohissi, Quevedo</i>
Only regular, aspart, or lispro insulins should be used for adjustment, supplemental, or correction doses.	<i>Clement</i>
Intermittent sliding scale insulin regimens should not be used alone to manage hyperglycemia in diabetic patients. Hyperglycemia commonly occurs when sliding scale insulin dosing is used without basal insulin therapy or continuation of oral hypoglycemics.	<i>ADA 2005, Baldwin, Clement, Thompson</i>
Type I diabetics should have orders to continue basal insulin at appropriately adjusted doses when patients are not eating (except for temporary discontinuation due to significant hypoglycemia) and receive a parenteral source of dextrose.	<i>Clement, ADA 2003</i>
Non-specific orders such as “titrate insulin drip to target BG range” should not be allowed in the organization. Instead provide specific titration parameter or refer to an established standard process.	<i>JCAHO</i>
All insulin infusions (critically ill, non-critically ill, severe hyperglycemic, DKA patients) should only be ordered using approved protocols, algorithms, or order sets.	<i>Clement, Goldberg, Ku, Luther-Midelfort, Moghissi, Quevedo, Trence, Zimmerman</i>

Prescribing Practices	References/Resources
Protocols for insulin should consider both the actual BG levels and the rate of change of BG over time.	<i>Clement, Maynard</i>
Alteration or modification of approved insulin protocols should only be allowed as approved by the organization.	<i>ISMP, JCAHO</i>
Approved insulin protocols should not require or should minimize the use of calculation.	<i>ISMP</i>
The use of insulin infusions should automatically trigger the use of frequent and defined monitoring of BG.	<i>Clement</i>
Insulin infusion solutions ordered should be standardized and limited in number. All insulin dilutions and admixtures should be prepared by the pharmacy.	<i>ISMP, JCAHO</i>
Transition from insulin infusion to subcutaneous insulin should be ordered using an approved format, CPOE, or pre-printed order sheet so as to provide clear and complete instructions. Orders for transition should include an order to administer subcutaneous insulin prior to discontinuation of the insulin infusion (short-acting insulins are administered 1 to 2 hours prior to discontinuation, while intermediate or long-acting insulins are administered 2 to 3 hours before infusion discontinuation).	<i>Clement, Maynard</i>
Orders for perioperative administration of insulin therapy should be established and written using a predetermined format or using established format, CPOE, or pre-printed order sets or protocols.	<i>Clement, Coursin, Dagogo-Jack, Levetan, Shokough-Amiri</i>
Practices for insulin use for patients receiving parenteral nutrition are established and written using a predetermined format or using established pre-printed order sets or protocols.	<i>Clement</i>
Insulin therapy for hyperglycemic patients on total parenteral nutrition (TPN) or with unstable BG or fluctuating dextrose administration should not be initially ordered to be added to TPN solutions, but rather should be administered as a separate standard insulin infusion. Insulin may subsequently be added to the TPN when the patient's TPN dextrose requirement is determined to be stable. All orders for insulin infusions with TPN should include orders for managing the insulin infusion (such as stop the insulin, reduce insulin dose, and/or monitor BG) if the TPN solution infusion is stopped or significantly reduced and prescriber contacted.	<i>Clement</i>
The prescriber should assess the need for adjustment of insulin regimens whenever changes in concurrent drug therapy occur.	<i>ADA 2005, Baldwin, Fajtova, Clement, JCAHO</i>
The prescriber should assess the need for adjustment of insulin regimens whenever changes in dietary intake or fluid therapy occur. Changes in patient caloric intake are one of the most common causes of hypoglycemia in hospitalized patients.	<i>ADA 2005, Clement, Smith</i>
The prescriber should assess the need for adjustment of insulin therapy whenever significant changes in the patient's medical condition(s) occur.	<i>Baldwin, Fajtova, Clement, Levetan, Moghissi, Smith</i>
Attempts should be made to simplify insulin regimens while achieving glycemic control goals.	<i>Clement</i>
The prescriber should appropriately respond to any and all patient, family, and other caregiver concerns regarding insulin therapies.	<i>JCAHO</i>

Prescribing Practices

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

When used, CPOE systems include appropriate alerts to reduce risk of error in insulin prescribing. CPOE systems should alert prescribers to unsafe orders, appropriateness of dose regimens, drug interactions, and dietary interactions, and should prompt use of organization-specific protocols and orders for BG monitoring. CPOE systems include proper alerts to reduce the risk of error from confusion related to various insulin products. CPOE insulin orders should be formatted in a guideline-directed manner, linking appropriate medication, diet, and monitoring orders.

ISMP, Smetzer, Thompson

Order Transcription

Order transcription is a critical step in the medication-use process as it translates prescribers orders into a document (e.g., the medication administration record or MAR), which defines how treatment will be provided. This process will vary consider-

ably from institution to institution, and often within an institution. Institutions should carefully evaluate their practices for transcribing insulin orders utilizing available information of internal error reports and performing FMEA. Ongoing monitoring of insulin transcribing practices is highly recommended.

Order Transcription	References/Resources
A defined organization-wide process for transcription of insulin therapy orders and BG monitoring orders should be delineated and implemented. The transcription process should be standardized, allowing variance between patient care units only when necessary. Staff transcribing insulin orders and BG monitoring orders should be specifically trained to transcribe insulin orders, and their competency should be assessed on a regular basis.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i> Gilman, <i>ISMP</i> , JCAHO, Manning, Smith
Orders for insulin and BG monitoring should be completely and accurately transcribed into the MAR and presented in such a way as to provide clear insulin therapy directions.	<i>ISMP</i> , JCAHO, Gilman, Manning, Smith
Pharmacy-generated MAR (paper or electronic) should be used if technology is available.	<i>ISMP</i>
Handwritten transcribed orders should be easily legible and unambiguous.	<i>ISMP</i> , JCAHO
If MAR is NOT pharmacy generated, a process should be in place to reconcile the MAR with the pharmacy medication profile prior to administration of insulin.	<i>ISMP</i> , JCAHO
The abbreviation “u” or “U” should not be used for the word “units.” The word “units” is always spelled out completely.	<i>ISMP</i> , JCAHO, Kowiatek
Leading zeroes should be used before all decimal points. No trailing zeroes should be used following decimal points.	<i>ISMP</i> , JCAHO, Kowiatek
No “prohibited” abbreviations should be used.	<i>ISMP</i> , JCAHO, Kowiatek
The organization should have a process for an independent double check of transcribed insulin orders and BG monitoring orders. The double check should be documented. No insulin should be administered until the double check has been completed and documented.	<i>ISMP</i>
All scheduled prandial doses of rapid or short-acting insulin will be transcribed to a specific time in minutes prior to meals or with meals (for rapid-acting insulins).	<i>Clement</i> , Heatlie, Gilman, Manning, Smith
Patients identified as insulin deficient and requiring regular insulin therapy should have their status clearly documented in the MAR.	<i>Clement</i>
All concerns, confusion, or uncertainties regarding insulin orders identified during transcription should be resolved with the prescriber prior to insulin administration.	<i>ISMP</i> , JCAHO
When handwritten MARs are used:	
<ol style="list-style-type: none"> 1. Minimize the number of pages used and “fragmentation” of insulin-related orders. 2. Transcribe all insulin orders together. 3. Insulins to be administered together in one syringe (e.g., mixing regular and NPH prior to administration) are always transcribed together. 	

Order Review, Distribution, Preparation, and Dispensing

Pharmacy practices related to insulin therapy play a central role in safe insulin therapy for hospitalized patients. Critical components include access controls, such as limitations on stocked items, safe storage, and restricted access to insulins and pharmacy-based insulin product preparation practices. Due to the variable nature of insulin therapy in hospitalized patients, traditional safety-based con-

trol practices (e.g., unit dosing) are not always possible, and implementation of other safety strategies is required.

Pharmacist's review of insulin orders and therapy is also often limited because of inadequate accessibility to, availability of, and/or inefficient processes to obtain patient-specific information. Improving both the access to information and provision of training in appropriate data assessment will enhance the ability of pharmacists to improve insulin safety.

Order Review, Distribution, Preparation, and Dispensing	References/Resources
The pharmacy should routinely stock only those insulin products approved by the P&T Committee or other responsible body. The organization should use single "brand" source for each insulin type. Product safety should be considered in the approval process.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i> <i>ASHP, ISMP, JCAHO</i>
Pharmacists should have the therapeutic skills and knowledge of organization-specific practices to competently review insulin therapy-related orders and to prepare and dispense insulin products.	<i>ASHP, Fajtova, ISMP, JCAHO, Kowiatek, Smith</i>
The pharmacy should establish a standard process for pharmacist review of insulin orders.	<i>ISMP, JCAHO</i>
The pharmacy computer should include appropriate alerts and decision support elements to reduce error risk.	<i>ISMP</i>
Pharmacy technicians involved in distribution and preparation of insulin products should be educated regarding the high-alert status of insulin, appropriate safety practices, and consequences of error.	<i>ISMP</i>
All orders for insulin should be reviewed by a pharmacist prior to administration except in an emergency when the drug is under the direct supervision of a licensed independent practitioner.	<i>ISMP, JCAHO</i>
Insulin order review should include: <ol style="list-style-type: none"> 1. Positive patient identification using two identifiers. 2. Completeness of order (see section on prescribing practices). 3. Appropriate regimen for specific insulin products. 4. Appropriateness of doses and dose regimens. 5. Timing of doses in relation to meals. 6. Monitoring of BG has been ordered. 7. Appropriateness of dosage adjustments. 8. Potential drug interactions. 9. Potential for error and confusion. 10. Presence of orders for treatment of hypoglycemia. 	<i>ASHP, Clement, ISMP, JCAHO, Kowiatek, Smith, USP</i>
The following information is readily available to the pharmacist reviewing insulin orders: <ol style="list-style-type: none"> 1. Indication for use of insulin. 2. Insulin-dependent status (i.e., whether patient is insulin deficient). 3. Goals of insulin therapy. 	<i>Baldwin, Fajtova, Clement, Grissinger 2003, ISMP, JCAHO</i>

Order Review, Distribution, Preparation, and Dispensing**References/Resources**

See list at end of document for full citations.
(Note: references printed in italics include sample order sets/protocols, etc.)

4. Patient co-morbidities.	
5. Concurrent medications.	
6. Prior insulin use and response.	
7. Patient age, weight, and height.	
Required actions when insulin orders are incomplete, ambiguous, or raise any concerns should be clearly defined.	<i>ISMP, JCAHO</i>
Archived information regarding patient's medication use for past hospitalizations is readily available.	<i>ISMP</i>
Pharmacists should independently check weight-based dose calculations for all insulin doses ordered for patients weighing less than 50 kilograms, or those ordered using a weight-based dose equation.	<i>ISMP, JCAHO</i>
The pharmacy computer should alert the pharmacist when orders for insulin fall outside pre-determined dose limits based on total amount of insulin or based on a unit-per-kilogram basis. A limit using unit per kilogram should be used for all patients weighing less than 50 kg.	<i>ISMP, JCAHO</i>
The pharmacy computer should be directly linked to the laboratory computer, or the reviewing pharmacist should have real-time access to the laboratory computer.	<i>ISMP, JCAHO</i>
The pharmacy should have easy access to point-of-care (bedside) BG monitoring results.	<i>JCAHO, ISMP</i>
The pharmacy should be informed when insulin-deficient patients are admitted or identified. The pharmacy should contact prescribers when insulin is not ordered or is discontinued for identified insulin-deficient patients.	<i>Clement, JCAHO</i>
Insulins should be purchased, obtained, and stored in the pharmacy in such a manner as to reduce the chance of wrong product selection:	<i>ASHP, ISMP</i>
1. Look-alike/sound-alike products should be separated within storage areas (e.g., refrigerators).	
2. Only regular insulin (lispro and aspart if subcutaneous insulin pumps are also prepared) should be stored in the parenteral products area.	
3. Appropriate labels/signs and separation should be used to differentiate insulin products and reduce risk of wrong product selection.	
4. TALLman lettering should be used in labeling of insulin storage areas	
Pharmacists should be specifically trained to enter insulin orders into the pharmacy computer system so as to produce organization-established labels, warnings, medication administration records, and patient profiles.	<i>ASHP, ISMP, JCAHO, Smith, Santell, USP</i>
The pharmacy computer should include appropriate alerts to reduce the risk of error in prescribing. Pharmacy computer systems should alert pharmacists to unsafe orders, appropriateness of dose regimens, drug-dietary interactions, prompt use of organization-specific protocols, and orders for BG monitoring. Pharmacy computer systems should include proper formatting, structure, and alerts to reduce risk of error from confusion related to various insulin products.	<i>ISMP</i>
If CPOE is available, the system should interface with the pharmacy system.	<i>ISMP</i>
An independent double check (properly documented) and/or machine-readable verification should be required whenever insulin products are dispensed from the pharmacy or placed in unit-based medication dispensing cabinets.	<i>ISMP</i>

Order Review, Distribution, Preparation, and Dispensing	References/Resources
The pharmacy should dispense individual supplies of insulin products labeled with specific patient name and second identifier (e.g., insulin products should not be shared among different patients). If doses of insulin are included on the label, they are listed as “units” or “units = ml”, but not “ml” alone.	<i>ISMP</i>
The pharmacy should prepare individual patient-scheduled doses of intermediate (NPH) or long-acting insulins (glargine, detimer) unless these products are provided as individual patient insulin devices (e.g., insulin pens) or given mixed with short-acting agents (NPH).	<i>ISMP</i>
Insulin administration devices (e.g., Innolets) should be labeled on the device itself, not the removable cover.	
The pharmacy should use appropriate auxiliary labels to alert and differentiate insulin products when appropriate.	<i>ISMP</i>
Floor stocks of insulins should be minimized or eliminated. If floor stocks of insulin are available, only regular insulin should be available as a stock item on patient care units. Access to the floor stock supply should be limited and controlled. Removal from floor stock should require an independent second check prior to administration. Specific clinical situations requiring access to floor stock insulin (e.g., severe hyperkalemia) should be defined and monitored. In such emergent situations, an independent double check by two professionals should occur.	<i>ISMP, JCAHO, Smetzer, USP</i>
Insulin should not be available to be removed from unit-based medication dispensing cabinets without review of insulin orders by a pharmacist. If override of controls is allowed (and must be defined by the organization) in emergent situations, an independent double check by two professionals should occur and an explanation for override provided. When removed, insulin products should be properly labeled with the patient’s name and second identifier, as well as expiration date.	<i>ISMP, JCAHO</i>
Insulin products should be maintained in a secure manner at all times.	<i>ISMP, JCAHO</i>
All insulin infusions and diluted insulins should be prepared in the pharmacy.	<i>ASHP, ISMP, JCAHO, USP</i>
A limited number of standard concentrations are used for insulin infusions. All insulin infusions will undergo an independent double check prior to dispensing.	<i>JCAHO, ISMP</i>
A limited number of standard insulin dilutions should be prepared using appropriate diluting solution. All insulin dilutions should undergo an independent double check prior to dispensing. Special warnings and labels should be considered for placement on the diluted insulin to alert caregivers.	<i>Clement, ISMP, JCAHO</i>
All insulins should be measured using appropriately sized insulin syringes marked in “units.” Tuberculin and other syringes should not be used unless preparing intravenous solutions requiring doses greater than 100 units.	<i>ADA 2005, Clement, ISMP</i>
All pharmacy-prepared parenteral insulin products should be prepared in compliance with USP Chapter 797 standards.	<i>USP, ASHP</i>
Institutional procedures should be established regarding potential insulin dose delivery variability due to binding to IV bags and tubing. Procedures should be established to minimize dose variability when IV tubing is changed. Considerations should include insulin concentration, infusion flow rates, clinical application, and patient characteristics.	<i>Ling, USP</i>

See list at end of document for full citations.
(Note: references printed in italics include sample order sets/protocols, etc.)

Order Review, Distribution, Preparation, and Dispensing	References/Resources
The dextrose content of intravenous drug solutions used in insulin therapy patients should be assessed and communicated to other patient caregivers.	Krajicek
Pharmacy-generated MARs should include specific administration times or time prior to meals for all standing insulin doses.	<i>Clement, ISMP, Gilman, Manning, Smith</i>
Pharmacy-generated MARs should include appropriate warnings and alerts related to insulin therapy.	<i>ISMP</i>
When a patient is prescribed more than one type of insulin, pharmacy-generated MARs should clearly discriminate between insulin types.	<i>ISMP, JCAHO, Smetzer</i>
The pharmacy should routinely inspect patient care areas for unauthorized, unlabeled, and non-secure insulin products and actively remove any unauthorized insulin products from patient care units.	<i>ASHP, ISMP, JCAHO</i>
Insulin should never be borrowed from or shared with another patient.	<i>ISMP, JCAHO</i>
Insulin should not be stored at the bedside unless secure and under control of the nurse even when patients are performing self-management. When insulin is needed, the insulin should be obtained and provided to the patient for observed administration, then returned to secure storage area.	JCAHO
Use of patient's own insulin supply is allowed only as defined by organizational policies. If patient's own insulin is allowed, independent verification of product by pharmacist, nurse, or prescriber is performed and documented.	
Non-formulary insulin products should be obtained and dispensed according to institutional policies and procedures. Prior to dispensing a non-formulary insulin product, appropriate communication, staff education, and safety measures should be implemented.	<i>ASHP, ISMP, JCAHO</i>
The pharmacy should establish a process for ongoing review of changes in insulin orders, and pharmacists should routinely review patient responses to ordered insulin therapy and make suggestions for changes when appropriate.	<i>ASHP, ISMP, JCAHO</i>
Pharmacists should communicate with prescribers, nurses, dieticians, patients, and others to coordinate insulin therapy.	<i>ASHP, ISMP, JCAHO</i>
Pharmacists with special training or knowledge/experience in the management of insulin therapy in hospitalized patients should be available for consultation.	<i>Baldwin, ISMP, Smith</i>

Administration

Safe insulin administration practices result from implementation of both safe administration procedures as well as recommended changes in all other components of the process (e.g., organizational, information, prescribing, transcribing, dispensing,

monitoring, and patient education). Changes throughout the insulin-use system support the caregiver and reduce risk for error when administering insulin. Because administration is one of the sharp points of care provision, effective safety practices at this step of the process are critical.

Administration	References/Resources
Nurses or other caregivers administering insulin should be knowledgeable about insulin products and their use, management of glycemia in complex hospitalized patients, recognition and management of hypoglycemia, and proper methods for bedside monitoring.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i>
The following information should be readily available to the nurse reviewing insulin orders and/or administering insulin:	<i>Baldwin, Brigham Womens, ISMP, JCAHO</i>
<ol style="list-style-type: none"> 1. Indication for use of insulin 2. Insulin-dependency status 3. Goals of insulin therapy 4. Patient co-morbidities 5. Concurrent medications 6. Prior insulin use and response 7. Patient age, weight, and height 8. Most recent BG measurement results 	<i>Baldwin, Brigham Womens, ISMP, JCAHO</i>
Insulin therapy orders should be reviewed for appropriateness prior to administration. All concerns should be resolved prior to insulin administration.	<i>ISMP, JCAHO</i>
Insulin should not be administered until a pharmacist has reviewed the latest insulin order(s), unless there is an emergent need and the drug is under the supervision of a licensed independent prescriber.	<i>ISMP, JCAHO</i>
Insulin orders should not be carried out until the order transcription has been verified and documented for accuracy by an independent double check.	<i>ISMP, JCAHO, USP</i>
Insulin should not be stored at the bedside unless secure and under control of the nurse even when patients are performing self-management. When insulin is needed, it should be obtained and provided to the patient for observed administration, then returned to a secure storage area.	<i>JCAHO</i>
Patient nutrition status should be considered prior to administration of all insulin doses.	<i>ADA 2005, ADA 2003, Clement</i>
All correction, supplemental, or adjustment doses of insulin should be based on bedside BG measurements taken immediately prior to insulin administration along with appropriate assessment of nutritional (carbohydrate) intake and prior insulin doses and responses to insulin.	<i>ADA 2005, Clement, Gilman, Heatlie, Manning</i>
Rapid-acting insulins (and rapid-acting insulin mix products) should be administered only when meals are being consumed or present on the unit available for the patient to start to consume within 15 minutes.	<i>Clement, Smith</i>
Only insulin syringes should be used to measure insulin doses.	<i>ADA 2005, ADA 2003, ISMP</i>

Administration

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

All measured insulin doses should be confirmed by independent checks by two individuals.

ISMP, JCAHO

Practices for mixing insulins, including which insulins can be mixed, should be defined by the organization. Individuals mixing insulins should be properly trained and demonstrate competency. Mixing of insulins should be performed using proper aseptic technique.

ADA 2003c, ADA 2005, Clement, RNAO

Insulin should be administered using appropriate safety procedures:

ADA, ADA 2003c, ADA 2005, Clement, ISMP, JCAHO, RNAO, USP

1. Proper patient identification using two identifiers (e.g., compare arm band to MAR or by bar-code identification) plus positive verbal verification by patient asking to state name and date of birth.
2. Insulin should be measured only using correct size insulin syringes or appropriate insulin delivery devices (e.g., insulin pens).
3. Insulins should be mixed only according to manufacturer’s recommendations.
4. An independent double check with another caregiver should occur prior to administration that includes ordered dose, insulin type, and measured dose.
5. Whenever appropriate, patient and/or family should provide additional double check.
6. Patient should be evaluated for signs or symptoms of hypoglycemia.
7. When insulin doses are measured in an insulin syringe, the doses should be prepared at the patient’s bedside.
8. The MAR should be brought into the patient’s room during administration, unless prohibited by policy such as infection control concerns.

Practices for proper subcutaneous injection of insulin should be defined, including choice of injection site(s), rotation of injection sites, documentation of injection site, site preparation, and injection technique.

ADA 2003c, ADA 2005, Clement, JCAHO, RNAO

All insulin infusions should be administered using an IV pump with free-flow protection. Insulin infusions should be delivered using only approved infusion devices that the nurse is familiar with and competent to use.

ISMP, JCAHO

Insulin infusions should be administered using smart pump technology with appropriately defined maximum and minimum infusion rates, alerts, and override criteria.

ISMP, JCAHO

Pre-printed guides to appropriate setting of IV pumps should be used, even when smart pump technology is available.

ISMP

An independent double check of insulin infusion product and IV pump setting should be done each time a new insulin IV infusion bag is hung.

ISMP, JCAHO

The distal ends of IV insulin lines should be clearly and boldly labeled.

ISMP

Documentation of insulin administration should occur immediately following administration while at the bedside.

JCAHO

The organization should implement bedside bar-code reconciliation processes to confirm insulin product, patient, and time of administration.

ISMP

(SENSE?) Insulin doses or dose changes in response to a BG measurement should be documented as both the time and result of the BG and the insulin dose administered.

British Columbia, IHI

The patient’s own insulin pumps are only used as defined by the organization.

Baldwin b

Administration**References/Resources**

*See list at end of document for full citations.
(Note: references printed in italics include sample order sets/protocols, etc.)*

When patient's own insulin pumps or devices are used, institution policies should specifically define safety practices and responsibilities of the patient, nurse, prescriber, pharmacy, and other appropriate departments.

JCAHO, *Baldwin b*

If the organization allows self-management using the patient's own insulin, insulin pump, or device, all institution policies for insulin should be adhered to. Insulin should not be stored at the bedside, allowing unsupervised access. Patient self-monitoring, insulin administration, and documentation is always observed by the nurse and confirmed in the medical record.

JCAHO

Monitoring and Documentation

The clinical and laboratory monitoring of patients and the response to the results of the monitoring are major determinants of safe and effective insulin use. Appropriate monitoring requires that caregivers possess both technical skills and clinical knowledge of insulin therapy. Documentation

methods and communication of insulin therapy monitoring results should be easily correlated with insulin therapy and nutritional intake (Heatlie, Gilman, Manning, Smith). Appropriate warnings, alerts, and communication processes should be in place when monitoring identifies defined critical values or clinical findings.

Monitoring and Documentation

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

Patients receiving insulin therapy should receive appropriate clinical and laboratory monitoring, including:

1. Clinical monitoring for signs or symptoms of hypoglycemia or hyperglycemia.
2. BG monitoring.

ADA 2005a, *Clement, Smith, Thompson*

The organization should adhere to the principles outlined in the ADA Position Statement on Bedside BG Monitoring in Hospitals:

1. Clear administrative responsibility should be delineated.
2. Well defined policy/procedure manual should be available.
3. Training program for individuals performing the testing should be in place.
4. Effective and comprehensive quality control procedures should be in place.
5. Regularly scheduled equipment maintenance should be performed.
6. Staff performing BG monitoring should be appropriately trained, and ongoing competency should be assessed and documented.

ADA 2004, *Clement, JCAHO, NCCLS, Vanderbilt MC*

Appropriate bedside monitoring of BG should be ordered and provided for all patients receiving insulin.

ADA 2005, *Clement, Nettles*

Standards for minimum frequency for monitoring of BG should be established by the organization. For example, minimum requirements could include:

1. Patients who are eating: pre meals and at bedtime.
2. Patients not eating: every 4–6 hours.
3. Infusions: every hour initially until stable, then every 2 hours.

ADA 2005, *Campbell, Clement, Smith, Thompson, Tomky*

Monitoring of BG by unit personnel should be under the direction and supervision of the hospital clinical laboratory services.

ADA 2004, *NCCL, JCAHO*

Accuracy and correlation of capillary and BG measurements should be closely evaluated.

ADA 2004, *Clement, NCCLS, Nichols, Sacks*

The presence of patient factors that may cause errors in bedside BG monitoring should be identified, documented, and communicated. Examples of such factors would include:

1. Low hematocrit
2. High hematocrit
3. Shock and dehydration
4. Hypoxia
5. Hyperbilirubinemia
6. Severe lipemia

ADA 2004, *Clement, NCCLS, Nichols, Sacks*

Use of alternate site capillary BG monitoring should generally not be used in hospitalized patients because such measurements fail to detect rapid changes in BG.

Clement

Monitoring and Documentation	References/Resources
Standing BG monitoring times should be defined and standardized for similar patient populations across the institution and coincide with the time meals served when appropriate.	<i>Clement, IHI</i>
Given the complexity of performing bedside glucose monitoring during insulin therapy, specific policies and procedures and useful tools to assist caregivers in this process should be developed.	<i>Heatlie, Gilman, Manning, Nettles</i>
Given the complexity of performing bedside glucose monitoring during insulin therapy, targeted staff training and monitoring of this process should be implemented.	<i>Campbel, Nettle, Thompson</i>
The organization should ensure proper blood sampling when blood is drawn through an IV site to avoid false-positives due to sampling through lines containing dextrose solutions.	<i>Clement</i>
The organization should define time limits for insulin administration prompted by a BG measurement (e.g., if insulin is not administered within a given time frame, the measurement must be repeated).	<i>Clement, Manning, Smith</i>
Results of all BG monitoring should be clearly documented in the medical record and be easily correlated with insulin doses, concurrent oral hypoglycemic(s) administration, and caloric/meal intake.	<i>Barglowski, British Columbia, Medtronics</i>
Graphical or flow sheet documentation of BG measurements' timing and amount of insulin(s) administration as well as timing and amount of caloric intake (oral, per tube, intravenous) should be used.	<i>Barglowski, British Columbia, Medtronics</i>
The organization should have an effective process for communication of BG measurements outside of set limits (low and high critical levels) to appropriate caregivers. Actions to be taken by the caregiver in response to critical level alerts should be defined and standardized.	<i>ADA 2004, ISMP, JCAHO, NCCLS</i>
Insulin use should trigger alerts to appropriate caregivers when factors associated with hypoglycemia are present:	<i>Allen, Bates, Clement, Cryer 2002a, Cryer 2002b, Smith, Tomky</i>
<ol style="list-style-type: none"> 1. Sudden reduction in oral intake or NPO status. 2. Discontinuation of enteral feeding. 3. Discontinuation of parenteral nutrition. 4. Reduction or discontinuation of dextrose-containing intravenous solutions. 5. Failure of patient to eat after prandial insulin dose has been administered. 6. Unexpected transport from unit after rapid or short-acting insulin has been given (i.e., risk of no food to be given). 7. Reduction in glucocorticoid dose. 8. Addition of new antihyperglycemic therapy. 	
Hypoglycemia should always be considered when a patient receiving insulin has altered level of consciousness for no apparent reason.	<i>ADA 5005c, Allen, Bates, Ben Ami, Clement, Cryer 2002a, Cryer 2002b, Jones</i>
Hypoglycemia should not be ruled out as a cause of confusion or altered behavior based on a capillary (finger stick) BG result; a laboratory measured venous BG level should also be obtained.	<i>Clement, Cryer 2002a, Cryer 2002b</i>

Monitoring and Documentation

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

As part of the monitoring procedures, policy allows nurses to administer hypoglycemia rescue agents (dextrose or glucagon) per established standard order sets or protocol with minimal physician oversight (but with appropriate prescriber notification of events).

Clement

Nurses and other appropriate caregivers expected to urgently treat hypoglycemia should be properly trained, and their ongoing competency should be assessed.

Clement, Cryer 2002a

When patients practice self-monitoring of BG, the accuracy of the patient's technique should be determined (including use of patient's own device if allowed by policy).

ADA 2004, Clement

Patients should be directly observed when performing diabetes self management and documentation. The self-management documentation should be verified by the nurse in writing.

JCAHO

Nutrition

Insulin therapy should be linked with the nutritional therapy of hospitalized patients. Organizations should utilize a Consistent Carbohydrate Diabetes Meal-Planning System for all patients receiving insulin therapy. Organizations should

establish a standard set of terms for nutrition therapy just as they should for insulin ordering and BG monitoring. Nutritional intake should be documented so it may be easily correlated with insulin doses and BG measurements. Clinical nutrition services must play an active role in coordinating care of patients receiving insulin.

Nutrition	References/Resources
Nutrition of hospitalized patients receiving insulin should be appropriately individualized.	<i>See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)</i>
Registered dietitians should participate in the care of hospitalized patients receiving insulin.	ADA 2003b, JCAHO, <i>Swift</i>
The institution should utilize a Consistent Carbohydrate Diabetes Meal-Planning System. Staff caring for diabetic patients should be educated regarding this system.	ADA 2005a, <i>Clement</i> , JCAHO, <i>Nettles</i>
Standardized language for describing and ordering nutrition based on the Consistent Carbohydrate Diabetes Meal-Planning System for patients on insulin should be defined and communicated to staff. All orders for nutrition for patients on insulin should use organization-defined terminology.	<i>Clement</i> , ADA 2003b, <i>Swift</i>
Orders for diets such as no concentrated sweets, “no sugar added,” “low sugar,” etc. should not be allowed.	ADA 2003b, <i>ISMP</i> , JCAHO
The carbohydrate intake of patients on insulin therapy should be monitored and documented. Documentation of carbohydrate intake should be displayed with insulin doses and BG monitoring results.	ADA 2003b, <i>Clement</i>
The dextrose content of intravenous drug solutions used in insulin-therapy patients should be assessed and communicated to other patient caregivers.	<i>Clement</i> , <i>Swift</i>
A system should exist for identifying patients who require nutritional assessment and notifying the dietitian.	<i>Krajicek</i> , <i>Thompson</i>
	<i>Clement</i> , JCAHO, <i>Nettles</i> , <i>Swift</i>

Patient and Family Involvement and Education

Patient participation in care is a critical safety net for insulin therapy. Effective involvement and education of patients and families require a planned

and coordinated multidisciplinary process. Caregivers should be specifically trained to provide patient and family education and assess patient knowledge and skills. Patient education should include discussion of potential for errors and methods of reducing risk.

Patient and Family Involvement and Education

References/Resources

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

Patients (and/or families of patients) receiving insulin should be properly educated and engaged in their care.

ADA 2005b, Davis, ISMP, JCAHO, Nettles

Hospitals should promote use of diabetes self-management for inpatients, while ensuring patient safety and compliance with all applicable standards of care.

AZHHA, Campbell, Nettles

Hospital policies should clearly define the criteria for selection of patients to perform self-management of diabetes while in the hospital and the specific practices required for safe and effective patient care.

ADA 2005 b, Clement, Davis, JCAHO , Nettles

1. Physicians and nurses caring for a patient should agree that self-management is appropriate.
2. Patients should be competent to provide self-management (including administration, monitoring, and assessment).
3. Patients should have an expected stable level of consciousness.
4. Patients should have fairly stable known insulin needs.
5. Patients should successfully perform diabetes self-management at home.
6. Patients should have demonstrated the physical skills/ability to perform self-management tasks.
7. Patients should have documented adequate oral intake.
8. Patients should demonstrate proficiency at calorie counting.
9. Patients should be proficient at using multiple daily injection regimens.
10. Patients should be proficient at self-monitoring of BG.
11. Correlation of patient-determined CBG and laboratory BG should be performed and documented.
12. Patients should be proficient at sick-day management of insulin therapy.

Patients playing an active role in insulin therapy should be determined to be competent. Verification of competency should be documented. Competency should be assessed at regular intervals as determined by the individual situation.

Clement, Nettles

The role of the patient and/or family in the management of insulin therapy while in the hospital should be jointly agreed upon and documented in the medical record. All policies and procedures should be adhered to when self-management is allowed.

Clement, JCAHO, Nettles

Newly diagnosed diabetics started on insulin should be educated sufficiently (provided with “diabetes survival skills”) to safely go home, with proper arrangements made for follow-up education and training. More in-depth patient education should be provided when appropriate. Requirements for patient discharge should be delineated. Recommendations follow:

ADA 2005b, Clement, Davis, Nettles

1. Patients should demonstrate ability to select and measure insulin products accurately.
2. Patients should demonstrate ability to accurately perform CBG monitoring, assess results, and determine appropriate action. The patient should be provided with appropriate organization-approved written videos or computer-

Patient and Family Involvement and Education**References/Resources**

See list at end of document for full citations. (Note: references printed in italics include sample order sets/protocols, etc.)

based instruction at an appropriate reading level in a language the patient is fluent in. Patient understanding should be documented.

Cultural and literacy factors should be considered in the education of the patient and decisions regarding insulin management.

ADA 2005b, JCAHO, *Nettles*

Discharge planning should include appropriate communication and coordination among the patient and family, physicians, nurses, pharmacists, diabetes educators, and other involved caregivers. Discharge plans should be individualized and agreed upon by all individuals involved.

ADA 2005b, *Clement, Davis, JCAHO, Nettles, Campbell*

Discharge planning should include appropriate assessment and follow-up for insulin use post-hospitalization.

ADA 2005b, *Clement, Davis, JCAHO, Nettles, Thompson*

The patient should be provided with appropriate written documents to safely and effectively facilitate change in care environments and communicate with care providers.

ADA 2005b, JCAHO, *Campbell, Davis, Nettles, Thompson*

Appropriate information regarding the patient's insulin therapy should be communicated to providers caring for the patient following hospital discharge, including the patient's pharmacy. A standardized communication form regarding diabetes care for the patient should be used.

JCAHO, *Campbell, Nettles, Thompson*

REFERENCES AND RESOURCES

Links

- Agency for Health Care Research and Quality (AHRQ) <http://www.psnet.ahrq.gov/>
- American Diabetes Association (ADA) <http://www.diabetes.org/home.jsp>
- American Society of Health-System Pharmacists (ASHP) www.ashp.org
- Diabetes Roundtable: <http://www.diabetesroundtable.com/egroundrounds/round2/page6.asp>
- Diabetes Self Management <http://www.diabetesselfmanagement.com/resources.cfm?sk=5WZ6>
- Institute for Healthcare Improvement (IHI) www.ihp.org
- Institute for Safe Medication Practices (ISMP) www.ismp.org
- Joint Commission on Accreditation of Healthcare Organizations (JCAHO) www.jcaho.org
- National Diabetic Education Program <http://www.ndep.nih.gov/index.htm>
- NovoNordisk CE: <http://www.ceciv.com/novo/portal.htm>
- United States Pharmacopeia (USP) www.usp.org

Advocate Lutheran General Hospital Diabetes Adult Medical Patient Protocol. Available at the Society of Hospital Medicine website: http://www.hospitalmedicine.org/AM/Template.cfm?Section=Search_Advanced_Search§ion=Clinical_Toolbox&template=/CM/ContentDisplay.cfm&ContentFileID=252

Ahman AJ. Inpatient management of hospitalized patients with type 2 diabetes. *Curr Diab Rep* 2004; 4:346–351.

Aldersberg MA, Fernando S, Spollett GR, et al. Gargine and lispro. *Diabetes Care* 2002; 25:404–405.

Allen K. Nocturnal hypoglycemia: clinical manifestations and therapeutic strategies toward prevention. *Endocrinol Pract* 2003; 9:530–543.

American Diabetes Association (ADA 2001). Consensus statement: postprandial BG. *Diabetes Spectrum* 2001; 14:71–74.

American Diabetes Association (ADA 2003a). Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care* 2003; 26:S51–61.

American Diabetes Association (ADA 2003c). Insulin administration. *Diabetes Care* 2003; 26:S121–S124 Supplement 1.

American Diabetes Association (ADA 2004). Bed-side BG monitoring in hospitals. *Diabetes Care* 2004; 27 Supplement 1:S104.

American Diabetes Association (ADA 2005a). Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 2005; 26 Supplement 1:S4–S36.

American Diabetes Association (ADA 2005b). National standards for diabetes self-management education. *Diabetes Care* 2005; 28 Supplement 1:S72–S79.

American Diabetes Association (ADA 2005c). Workgroup on hypoglycemia. Defining and reporting hypoglycemia in diabetes. *Diabetes Care* 2005; 28:1245–1249.

American Diabetes Association (ADA2003b). Translation of the diabetes nutrition recommendations for health care institutions. *Diabetes Care* 2003; 26:S70–72.

Arizona Hospital and Healthcare Association Patient safety Taskforce (AZHHA). The administration of insulin in hospitals and healthcare settings. Available at: http://www.azhha.org/public/uploads/InsulinAdministration_07-2002.pdf

Baldwin D, Villanueva G, McNutt R, et al. Eliminating inpatient sliding-scale insulin. A reeducation project with medical housestaff. *Diabetes Care* 2005; 28:1008–1011.

Baldwin D, Harms D (Baldwin b). The clinical challenge of in-hospital diabetes and glycemic management. Available at: <http://cardio.cme-today.com/cmetoday/cardio/V2I1/AB0410.htm>

ISMP-Canada. Insulin Errors. ISMP Canada Safety Bulletin. Available at: <http://www.ismp-canada.org/download/ISMPCSB2003-04Insulin.pdf>

Barglowski KE. Clinical application of point-of-care testing informatics. AACC 54th Annual Meeting and Clinical Lab Exposition, July 28–Aug 1, 2002, Orlando, Fla.

Bates DW. Unexpected hypoglycemia in a critically ill patient. *Ann Intern Med* 2002; 137:110–116.

Ben-Ami H. Drug-induced hypoglycemic coma in 102 diabetic patients. *Arch Intern Med* 1999; 159:281–284.

Bhattacharyya A, Chrisstodoulides C, Kaushal K, et al. In-patient management of diabetes mellitus and patient satisfaction. *Diabetes Med* 2002; 19:412–416.

Bloomgarten ZT. Treatment issues in type I diabetes. *Diabetes Care* 2002; 25:230–236.

British Columbia Children's Hospital. BG and insulin record. Available at: <http://www.cw.bc.ca/endodiab/pdf/gluinsflow.pdf> (accessed June 2005).

- Browning LA, Dumo P. Sliding-scale insulin: an antiquated approach to glycemic control in hospitalized patients. *Am J Health-Syst Pharm* 2004; 61:1611–1614.
- Bryer-Ash M, Garber AJ. Point: inpatient glucose management: the emperor finally has clothes. *Diabetes Care* 2005; 28:973–975.
- Campbell KB, Braithwaite SS. Hospital management of hyperglycemia. *Clinical Diabetes* 22:81–88. **(MISSING YEAR)**
- Canadian Diabetes Association. 2003 Clinical Practice Guidelines for the prevention and management of diabetes in Canada. Available at: <http://www.diabetes.ca/cpg2003/downloads/cpgcomplete.pdf> (accessed May 2005).
- Capes SE. Stress hyperglycemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. *Lancet* 2000; 355:773–778.
- Cavan DA. Reducing hospital inpatient length of stay for patients with diabetes. *Diabet Med* 2001; 8:162–164.
- Clement S, Braithwaite SS, Magee MF, et al. Management of diabetes and hyperglycemia in hospitals. *Diabetes Care* 2004; 27:553–591. Appendices available at: <http://care.diabetesjournals.org/cgi/content/full/27/2/553/DC2>
- Clinical and Laboratory Standards Institute. Point of care BG testing in acute and chronic care facilities: Approved Guidelines—Second Edition. August 2002. nt C30-A2. NCCLS, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania.
- CME-Today for Cardiology. Sample pre-admission treatment plan for persons with diabetes and American Diabetes Association Patient BG Log. Available at: http://cardio.cme-today.com/cme-today/cardio/V2I1/pdf/CD0088_CutOut.pdf
- Cochran E, Musso C, Gorden P. The use of U-500 inpatients with extreme insulin resistance. *Diabetes Care* 2005; 28:1240–1244.
- Connor TM, Flesner-Gurley, Barner JC. Hyperglycemia in the hospital setting: the case for improved control among non-diabetics. *Ann Pharmacother* 2005; 39:492–501.
- Coursin DB. Perioperative diabetic and hyperglycemic management issues. *Crit Care Med* 2004; 32:[Suppl]:S116–S125.
- Cryer PE (2002a). Negotiating the barrier of hypoglycemia in diabetes. *Diabetes Spectrum* 2002; 15:20–27.
- Cryer PE (2002b). Hypoglycemia: the limiting factor in the glycemic management of type I and type II diabetes. *Diabetologia* 2002; 45:937–948.
- Cryer PE. Hypoglycemia in diabetes. *Diabetes Care* 2003; 26:1902–1912.
- Dagogo-Jack S. Management of diabetes mellitus in surgical patients. *Diabetes Spectrum* 2002; 15:44–48.
- Davis ED. A quality improvement project in diabetes patient education during hospitalization. *Diabetes Spectrum* 2000; 13:234.
- Deepak PJ. Inpatient management of diabetes: survey in a tertiary care centre. *Postgrad Med J* 2003; 79:585–587.
- Dickerson LM. Glycemic control in medical inpatients with type 2 diabetes mellitus receiving sliding scale insulin regimens versus routine diabetes medications: a multicenter randomized controlled trial. *Ann Fam Med* 2003; 1:29–35.
- Fajtova V. Brigham and Women's hospital medication education program. Managing diabetes in hospitalized patients. Medication Education Program; 2003.
- Finney SJ. Glucose control and mortality in critically ill patients. *JAMA* 2003; 290:2041–2047.
- Furnary AP. Continuous intravenous insulin infusion reduces the incidence of deep sternal wound infection in diabetic patients after cardiac surgical procedures. *Ann Thorac Surg* 1999; 67:352–362.
- Garber AJ, Moghissi ES, Bransome ED, et al. American College of Endocrinology Task Force on Inpatient Diabetes Metabolic Control: American College of Endocrinology position Statement on Inpatient Diabetes and Metabolic Control. December 2004. *Endocr Practice* 2004; 10:4–9. Available at: <http://www.aace.com/pub/icc/ACEPosiStat.pdf>
- Gilman JA. A quality improvement project for better glycemic control in hospitalized patients with diabetes. *Diabetes Educ* 2001; 27:541–546.
- Goldberg PA, Inzucchi SE. Selling root canals: lessons learned from implementing a hospital insulin infusion protocol. *Diabetes Spectrum*. Wntr 2005 v18 i1 p28(6).
- Goldberg HI. Evidence-based management: using serial firm trials to improve diabetes care quality. *Jt Comm J Qual Improv* 2002; 28:155–166.
- Grissinger M (2003a). Proper treatment means avoiding insulin related medication errors. *Drug Topics Diabetes Suppl* Oct 2003:17s. **(YEAR?)**
- Grissinger M (2003b). Reducing medication errors associated with intravenous insulin infusions. *P&T* 2003; 28:628.
- Grissinger M, Altzman J. Strategies for preventing medication misadventures: impact on insulin safety; 2004. Available at: <http://www.cecacity.com/novo/portal.htm> (accessed May 2005).
- Heatlie JM. Reducing insulin medication errors: evaluation of a quality improvement initiative. *J Nurs Staff Dev* 2003; 19:92–98.
- Hellman R. Improving patient safety in diabetes care: the importance of reducing medical errors. *Clinical Diabetes* 2001; 19:190–192.
- Herbst KL. Insulin strategies for primary care providers. *Clin Diabetes* 2002; 20:11–17.

- Hirsch I. In-patient hyperglycemia—are we ready to treat yet? *J Clin Endocrin Metab* 2002; 87:975–977.
- Hirsch I. Insulin analogues. *NEJM* 2005; 352:174–183.
- Hirsch I. The burden of diabetes (care). *Diabetes Care* 2003; 26:1613–1614.
- Hirsch IB. Sliding scale or sliding scare: it's all sliding nonsense. *Diabetes Spectrum* 2001; 14:79.
- Institute for Safe Medication Practices. ISMP Medication Safety Self Assessment for Hospitals; 2004. Available at: www.ismp.org (accessed May 2005).
- Institute for Safe Medication Practices—Canada. Insulin Errors. ISMP Canada Safety Bulletin. Available at: <http://www.ismp-canada.org/download/ISMPCSB2003-04Insulin.pdf>
- Inzucchi SE, Rosenstock J. Counterpoint: inpatient glucose management: a premature call to arms? *Diabetes Care* 2005; 28:976–979.
- Jones TW. Hypoglycemia in children with type 1 diabetes: current issues and controversies. *Pediatr Diabetes* 2003; 4:143–150.
- Kaushal K. A protocol for improved glycaemic control following corticosteroid therapy in diabetic pregnancies. *Diabetic Med* 2003; 20:73–75.
- Kowiatek J, Skledar S, Potoski B. Insulin medication error reduction: a quality improvement initiative. *Hosp Pharm* 2001; 36:639–644.
- Krajcicek B, Kudva, Hurley H. Potentially important contribution of dextrose used as diluent to hyperglycemia in hospitalized patients. *Diabetes Care* 2005; 28:981–982.
- Ku SY, Sayre CA, Hirsch IB, et al. New insulin infusion protocol improves BG control in hospitalized patients without increasing hypoglycemia. *Joint Commission Journal on Quality and Patient Safety* 2005; 31:141–147.
- Leese GP. Frequency of severe hypoglycemia requiring emergency treatment in type 1 and type 2 diabetes. *Diabetes Care* 2003; 26:1176–1180.
- Levetan CS. Case study: The recipe for diabetes success in the hospital. *Diabetes Spectrum* 2002; 5:40–43.
- Levetan CS. Impact of endocrine and diabetes team consultation on hospital length of stay for patients with diabetes. *Am J Med* 1995; 99:22–28.
- Lewis KS, Kane-Gill SL, Bobek MB, et al. Intensive insulin therapy for critically ill patients. *Ann Pharmacother* 2004; 38:1243–1251.
- Ling J, Hi M, Hagerup T, et al. Lispro insulin: absorption and stability in selected intravenous devices. *Diabetes Care* 1999; 25:237–245.
- Luther-Midelfort- Mayo Health System. Insulin Protocol for adult surgical heart patients. Available online at www.IHI.org (accessed May 2005).
- Malmberg K (DIGAMI). Prospective randomized study of intensive insulin treatment on long term survival after acute myocardial infarction in patients with diabetes mellitus. *BMJ* 1997; 314:1512–1515.
- Manning EH, Jackson L. An evaluation of the timing between key insulin administration-related processes: the reasons why these processes happen when they do, and how to improve their timing. *Aust Health Rev* 2005; 29:61–67.
- Markowitz LJ. Description and evaluation of a glycemic management protocol in patients with diabetes undergoing heart surgery. *Endocr Pract* 2002; 8:10–18.
- Maynard G. Subcutaneous Insulin Order Set Guidelines for Insulin Use and Care of the Hospitalized Patient with Hyperglycemia. Available at Society for Hospital Medicine website: http://www.hospitalmedicine.org/AM/Template.cfm?Section=Quality_Improvement_Tools&Template=/CM/HTMLDisplay.cfm&ContentID=4239
- Maynard G. Critical Care Unit Insulin Infusion Orders, Critical Care Physician's Orders Pilot VIII. Available at Society for Hospital Medicine website:http://www.hospitalmedicine.org/AM/Template.cfm?Section=Quality_Improvement_Tools&Template=/CM/HTMLDisplay.cfm&ContentID=4243
- McDonough KA. Inpatient management of diabetes. *Prim Care Office Pract* 2003; 30:557–567.
- McMullin J. Glycemic control in the ICU: a multicenter survey. *Intens Care Med* 2004; 30:798–803.
- Medtronic Minimed. Daily Journal. Available at: http://www.minimed.com/patientfam/pdf/log_book_9196327.pdf
- Meguru S, Funae S, Hosokawa K, et al. Hypoglycemia detection rates differs among BG monitoring sites. *Diabetes Care* 2005; 28:708–709.
- Mensing C, Boucher J, Cypress M, et al. National standards for diabetes self-management education. *Diabetes Care* 2005; 28(supplement 1):S72–S79.
- Metchick LN. Inpatient management of diabetes mellitus. *Am J Med* 2002; 113:317–323.
- Moghissi ES, Hirsch IB. Hospital management of diabetes. *Endocrin Metabol Clin N Am* 2005; 34:99–116.
- Najarian J, Swavely D, Wilson E, et al. Improving outcomes for diabetic patients undergoing vascular surgery. *Diabetes Spectrum* Wntr 2005 v18 i1 p53(8).
- Nettles AT. Patient education in the hospital. *Diabetes Spectrum* Wntr 2005 v18 i1 p44(5).
- Nichols JH. A critical review of BG testing. *Point of Care* 2002; 2:49–61.

- O'Callaghan, RJ Beale. Impact of a standard insulin sliding scale on the efficacy of controlling BG levels in the critically ill. *Br J Anaesthesia* 2000; 84:687.
- O'Connor PJ. Electronic medical records and diabetes care improvement. Are we waiting for Godot? *Diabetes Care* 2003; 26:942-943.
- Orford N, Stow P, Green D, et al. Safety and feasibility of an insulin adjustment protocol to maintain BG concentrations within a narrow range in critically ill patients in an Australian level III adult intensive care unit. *Crit Care Resusc* 2004; 6:92-98.
- Pearson J. Pattern management: an essential component of effective insulin management *Diabetes Spectrum* 2001; 14:75-78.
- Pittas AG, Siegel RD, Lau J. Insulin therapy for critically ill hospitalized patients. A meta-analysis of randomized controlled trials. *Arch Intern Med* 2004; 164:2005-2011.
- Providence Health System. Portland Protocol. Available at: http://www.providence.org/Oregon/Health_Resource_Centers/Heart_Disease_Center/FAQs_PortlandProtocol.htm#Transitioning (accessed May 2005).
- Queale WS. Glycemic control and sliding scale insulin use in medical inpatients with diabetes mellitus. *Arch Intern Med* 1997; 157:545-552.
- Quevedo SF. Improving diabetes care in the hospital using guideline-directed orders. *Diabetes Spectrum* 2001; 14:226-233.
- Quinn DC. Overcoming turf battles: develop a clinical process improvement model a pragmatic, collaborative to improve glycemic control in patients with diabetes. *Jt Comm J Qual Improv* 2001; 27:255-264.
- Rafoth RJ. Standardizing sliding scale insulin orders. *Am J Med Qual* 2002; 17:175-178.
- Ragone M. Errors of commission? (practical pointers). *Clin Diabetes* 2002; Fall:20-21.
- Rao N. Prevention of postoperative mediastinitis a clinical process improvement model. *J Health-care Qual* 2004; 26:22-27.
- Ratner RE. Less hypoglycemia with insulin glargine in intensive insulin therapy for type 1 diabetes. *Diabetes Care* 2000; 23:638-643.
- Registered Nurse Association of Ontario (RNAO). Best Practices Guidelines for Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes. Available at: www.RNAO.org/bestpractices (accessed May 2005).
- Roman SH, Chassin MR. Windows of opportunity to improve diabetes care when patients with diabetes are hospitalized for other conditions. *Diabetes Care* 2001; 24:1371-1376.
- Rosenstock J. Basal insulin supplementation in type 2 diabetes: refining the tactics. *Am J Med* 2004; 116(3A):10S-16S.
- Rozich JD, Howard RJ, Justeson JM, et al. Standardization as a mechanism to improve safety in health care. *Jt Comm J Qual Saf* 2004 Jan 30(1):5-14.
- Rubin H, Fajtova V. Too tight control: Intensive insulin. *AHRQ WebM&M* May 2004. Available at: www.webmm.ahrq.gov (accessed May 2005).
- Sacks DB, Bruns DE, Goldstein DE, et al. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. *Clin Chem* 2002; 436-472.
- Saleh M, Grunberger G. Hypoglycemia: An excuse for poor glycemic control? *Clin Diabet* 2001; 19:161-167.
- Santell JP, Cousins D. Insulin errors. A common problem. *US Pharmacist* 2003; 28:November.
- Sawin CT. Action without benefit. The sliding scale of insulin use. *Arch Intern Med* 1997; 157:489.
- Schmidt SO. Evaluation of a quality improvement intervention for diabetes management. *J Health-care Qual* 2003; 25:26-32.
- Shokough-Amiri MH, Stratta, Latif KA, et al. Glucose control during and after pancreatic transplant. *Diabetes Spectrum* 2002; 15:49-53.
- Smetzer J, Cohen M. Complexity of insulin therapy has risen sharply in the past decade. *ISMP Medication Safety Alert!* 2004; 3:1-5.
- Smith WD, Winterstein AG, Johns T, et al. Causes of hyperglycemia and hypoglycemia in adult inpatients. *Am J Health-Syst Pharm* 2005; 62:714-719.
- Spollett GR. Moving toward excellence in the care of hospitalized patients with diabetes. *Diabetes Spectrum* Wntr 2005 v18 i1 p18(2).
- Stoller WA. Individualizing insulin management. Three practical cases, rules for regimen adjustment. 2002:111. Available at: http://www.postgradmed.com/issues/2002/05_02/stoller2.htm
- Suwatee P. Quality of care for diabetic patients in a large urban public hospital. *Diabetes Care* 2003; 26:563-568.
- Swift CS, Boucher JL. Nutrition care for hospitalized individuals with diabetes. *Diabetes Spectrum* Wntr 2005 v18 i1 p34(5).
- Thompson, Cara L, Dunn, et al. Hyperglycemia in the hospital. Braithwaite, Susan S. *Diabetes Spectrum* Wntr 2005 v18 i1 p20(8).
- Tomky D. Detection, prevention, and treatment of hypoglycemia in the hospital. *Diabetes Spectrum* 2005; 18:39-45. Also available at: <http://spectrum.diabetesjournals.org/cgi/content/abstract/18/1/39>
- Trence DL. The rationale and management of hyperglycemia for inpatients with cardiovascular disease: time for change. *J Clin Endocrinol Metab* 2003; 88:2430-2437.

- Umpierrez GE (2002a). Diabetic ketoacidosis and hyperglycemic hyperosmolar syndrome. *Diabetes Spectrum* 2002; 15:28–36.
- Umpierrez GE (2002b). Hyperglycemia: an independent marker of inpatient mortality in patients with undiagnosed diabetes. *J Clin Endocrinol Metab* 2002; 87:978–982.
- United States Pharmacopeia. Insulin Errors: A Common Problem. USP Patient Safety CAPSLINK. July 3003. Available at: www.usp.org (accessed May 2005).
- Van den Berghe G. Intensive insulin therapy in critically ill patients. *NEJM* 2001; 345:1359–1367.
- Vanderbilt University Medical Center. Point of Care Testing (POCT) BG Monitoring - One Touch Basic, CL 30-08.01 <http://vumcpolicies.mc.vanderbilt.edu/E-Manual/Hpolicy.nsf/AllDocs/4BC66B8650A017C4862569260060DEA8>
- White JR. How can pharmacists help avoid medication errors in the use of insulin glargine (Lantus) *US Pharmacist* 2003; 28:5.
- Winterstein AG, Hatton RC, Gonzalez-Rothi R, et al. Identifying clinically significant preventable adverse drug events through a hospital's database of adverse drug reaction reports. *Am J Health Syst Pharm* Sep 2002; 59:1742–1749.
- Zimmerman C, Mlynarek ME, Jordan JA, et al. An insulin infusion protocol in critically ill cardiothoracic surgery patients. *Ann Pharmacother* 2004; 38:1123–1129.