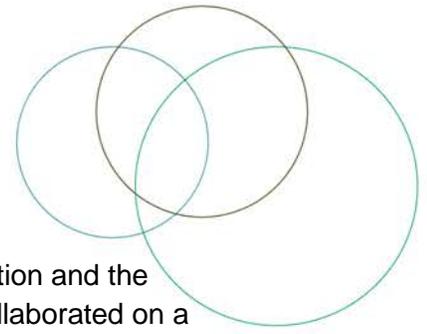


HOSPITAL HARM IMPROVEMENT RESOURCE

# Hypoglycemia



## ACKNOWLEDGEMENTS



The Canadian Institute for Health Information and the Canadian Patient Safety Institute have collaborated on a body of work to address gaps in measuring harm and to support patient safety improvement efforts in Canadian hospitals.

The Hospital Harm Improvement Resource was developed by the Canadian Patient Safety Institute to complement the Hospital Harm measure developed by the Canadian Institute for Health Information. It links measurement and improvement by providing resources that will support patient safety improvement efforts.



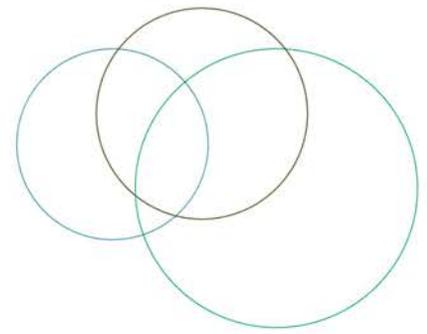


## DISCHARGE ABSTRACT DATABASE (DAD) CODES INCLUDED IN THIS CLINICAL CATEGORY:

### A07: Hypoglycemia

<b>Concept</b>	Hypoglycemia in diabetic and non-diabetic patients identified during a hospital stay.
<b>Selection Criteria</b>	
E10.63 E11.63 E13.63 E14.63 E15	Identified as diagnosis type (2)
E16.0	Identified as diagnosis type (2) <b>AND Y40–Y59 in the same diagnosis cluster</b>
<b>Codes</b>	<b>Code descriptions</b>
E10.63	Type 1 diabetes mellitus with hypoglycemia
E11.63	Type 2 diabetes mellitus with hypoglycemia
E13.63	Other specified diabetes mellitus with hypoglycemia
E14.63	Unspecified diabetes mellitus with hypoglycemia
E15	Nondiabetic hypoglycemic coma
E16.0	Drug-induced hypoglycemia without coma
<b>Additional Codes</b>	<b>Inclusions</b>
Y40-Y59	Drugs, medicaments and biological substances causing adverse effects in therapeutic use (refer to Appendix A of the <a href="#">Hospital Harm Indicator General Methodology Notes</a> )





## OVERVIEW AND IMPLICATIONS

### Altered blood glucose: Introduction

#### Hypoglycemia

Hypoglycemia is defined as any blood glucose less than 4.0 mmol/L. When blood glucose decreases to 2.8 mmol/L, cognitive impairment ensues (Canadian Diabetes Association (CDA), Clayton, Woo, Yale 2013). Hypoglycemia is a widely recognized cause of acute, potentially fatal events.

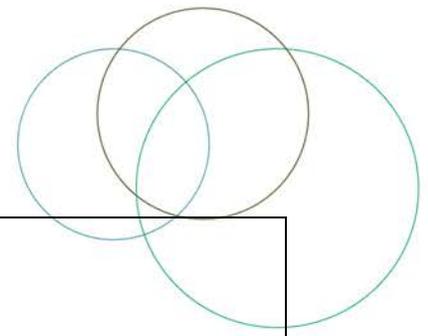
Patients with or without diabetes may experience hypoglycemia in the hospital due to co-morbidities such as heart failure, renal or liver disease, malignancy, infection or sepsis or in association with an altered nutritional state. Additional triggering events include sudden reduction of corticosteroid dose, altered ability of the patient to report symptoms, reduced oral intake, emesis, new “nothing by mouth” (NPO) status, inappropriate timing of short- or rapid-acting insulin in relation to meals, and unexpected interruption of enteral feedings or parenteral nutrition (American Diabetes Association (ADA) 2015; CDA, Houlden, Capes, Clement, Miller 2013; Rubin & Golden 2013).

Patients with diabetes are at a higher risk of hypoglycemia than other patients due to the added risk of medication errors involving insulin (Rubin & Golden 2013). Hypoglycemia is associated with increased length of stay and inpatient mortality (Nirantharakumar et al. 2012). In patients with type 2 diabetes and established cardiovascular disease (or very high risk for cardiovascular disease), symptomatic hypoglycemia (<2.8 mmol/L) is associated with increased mortality (CDA, Clayton, Woo, Yale 2013).

Symptoms of hypoglycemia are sweating, shakiness, tachycardia, anxiety, hunger, weakness, fatigue, dizziness, difficulty concentrating, confusion and blurred vision. In extreme cases, hypoglycemia may lead to coma and death (Desimone & Weinstock 2016). The Canadian Diabetes Association (CDA, Clayton, Woo, Yale 2013) lists the symptoms of hypoglycemia according to neurogenic (autonomic) and neuroglycopenic symptoms (see Table 1 below).



Hypoglycemia



**Table 1: Symptoms of hypoglycemia**

<b>Neurogenic (autonomic)</b>	Trembling Palpitations Sweating Anxiety Hunger Nausea Tingling
<b>Neuroglycopenic</b>	Difficulty concentrating Confusion Weakness Drowsiness Vision changes Difficulty speaking Headache Dizziness

**Hypoglycemia with diabetes mellitus, type 1 or type 2**

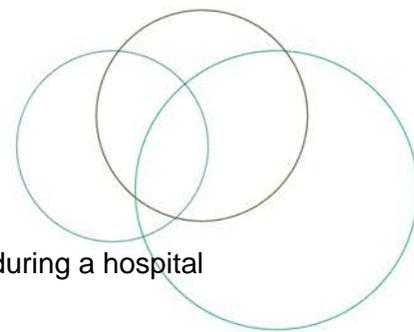
Insulin is the most appropriate agent for effectively controlling glycemia in-hospital (CDA, Houlden, Capes, Clement, Miller 2013). However, insulin causes the most harm and severe adverse events of the high alert medications (CDA, Houlden, Capes, Clement, Miller 2013; ISMP 2016). Mild hypoglycemic events are common in medical and surgical patients with type 2 diabetes who are receiving subcutaneous insulin therapy. Increasing age, impaired renal function, daily insulin dose, and insulin regimen (basal/bolus versus SSI) are important predictors of hypoglycemia in patients with type 2 diabetes mellitus who are on insulin therapy (Farrokhi et al. 2012).

**Nondiabetic hypoglycemic coma and drug-induced hypoglycemia without coma**

Hypoglycemia is uncommon in patients who do not have diabetes. Drugs are the most common cause of nondiabetic hypoglycemia. Other causes are malnutrition and alcohol use. Hypoglycemia may also follow bariatric surgery.

Drugs that may lead to hypoglycemia include: Bactrim (sulfamethoxazole and trimethoprim), beta-blockers, haloperidol, MAO (monoamine oxidase) inhibitors, pentamidine, quinidine, quinine, ACE (angiotensin-converting enzyme) inhibitors, lithium and second generation antipsychotic agents as well as medications used in the treatment of diabetes, such as insulin or oral medications used for management of type 2 diabetes (Cryer 2011; Desimone & Weinstock 2016; Murad et al., 2009; Suzuki et al. 2009). Hypoglycemia secondary to these drugs is higher in elderly patients and in patients with sepsis, and renal or hepatic disease (Murad et al. 2009).





## GOAL

Reduce the incidence of hypoglycemia in diabetic and non-diabetic patients during a hospital stay.

## IMPORTANCE FOR PATIENTS AND FAMILIES

Hypoglycemia causes tremor, anxiety, sweats and cognitive impairment. Recurrent hypoglycemia may impair the individual's ability to sense subsequent hypoglycemia (CDA, Clayton, Woo, Yale, 2013). In severe cases it may be fatal, although inpatient hypoglycemia is usually nonfatal (Rubin & Golden, 2013). Patients and families can play an important role in reducing errors and harm to the patient by understanding the medications the patient is taking, what each medication is for and when it should be taken and the dosage.

## Patient Story

We are looking for a patient story related to hypoglycemia. If you have one, please share it with the Canadian Patient Safety Institute at [info@cpsi-icsp.ca](mailto:info@cpsi-icsp.ca).

## CLINICAL AND SYSTEM REVIEWS, INCIDENT ANALYSES

Given the broad range of potential causes of Hypoglycemia, in addition to recommendations listed above, we recommend conducting clinical and system reviews to identify latent causes and determine appropriate recommendations.

Occurrences of harm are often complex with many contributing factors. Organizations need to:

1. Measure and monitor the types and frequency of these occurrences.
2. Use appropriate analytical methods to understand the contributing factors.
3. Identify and implement solutions or interventions that are designed to prevent recurrence and reduce risk of harm.
4. Have mechanisms in place to mitigate consequences of harm when it occurs.

To develop a more in-depth understanding of the care delivered to patients, chart audits, incident analyses and prospective analyses can be helpful in identifying quality improvement opportunities. Links to key resources for [conducting chart audits](#) and [analysis methods](#) are included in the [Hospital Harm Improvement Resources Introduction](#).

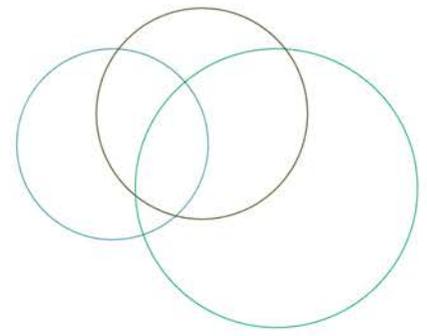
If your review reveals that your cases of hypoglycemia in diabetic and non-diabetic patients identified during a hospital stay are linked to specific practice or process issues, you may find these resources helpful:

- American Diabetes Association [www.diabetes.org](http://www.diabetes.org)
- Canadian Diabetes Association [www.diabetes.ca](http://www.diabetes.ca)



## Hypoglycemia

- Institute for Safe Medication Practices [www.ismp.org](http://www.ismp.org)
- Institute for Healthcare Improvement (IHI) [www.ihl.org](http://www.ihl.org)
- Public Health Agency of Canada: [Your Guide to Diabetes](#)



## MEASURES

Vital to quality improvement is measurement, and this applies specifically to implementation of interventions. The chosen measures will help to determine whether an impact is being made (primary outcome), whether the intervention is actually being carried out (process measures), and whether any unintended consequences ensue (balancing measures). In selecting your measures, consider the following:

- Whenever possible, use measures you are already collecting for other programs.
- Evaluate your choice of measures in terms of the usefulness of the final results and the resources required to obtain them; try to maximize the former while minimizing the latter.
- Try to include both process and outcome measures in your measurement scheme.
- You may use different measures or modify the measures described below to make them more appropriate and/or useful to your particular setting. However, be aware that modifying measures may limit the comparability of your results to others.

Posting your measure results within your hospital is a great way to keep your teams motivated and aware of progress. Try to include measures that your team will find meaningful and exciting (IHI, 2012).

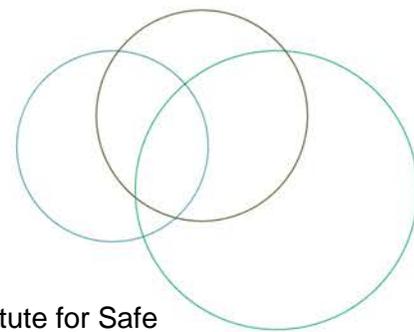
## GLOBAL PATIENT SAFETY ALERTS

[Global Patient Safety Alerts](#) provides access and the opportunity to learn from other organizations about specific patient safety incidents including alerts, advisories, recommendations and solutions for improving care and preventing incidents. Learning from the experience of other organizations can accelerate improvement.

### Recommended search terms:

- Insulin
- Diabetes
- Hypoglycemia
- Insulin sensitivity
- Low blood sugar





## SUCCESS STORIES

### Toolkit for Safe Implementation of Insulin Pens

Insulin safety is a key priority nationally for healthcare organizations, the Institute for Safe Medication Practice (ISMP) Canada and provincial governments. There is a growing interest in the adoption of insulin pens in the hospital setting as a means to improve insulin administration safety and ensure continuity of insulin product use by the patient from the community to the hospital setting and at discharge.

The Pharmacy leaders at the University Health Network (UHN) and Hamilton Health Sciences (HHS) agreed to collaborate for insulin pen implementation in 2013, as both organizations were undertaking conversion to insulin pens at one or more of their sites. The knowledge gained from this project led to the development of a toolkit to provide guidance and stewardship to other healthcare organizations in the safe implementation of insulin pen use in a variety of adult patient care settings.

The collaboration examined the following:

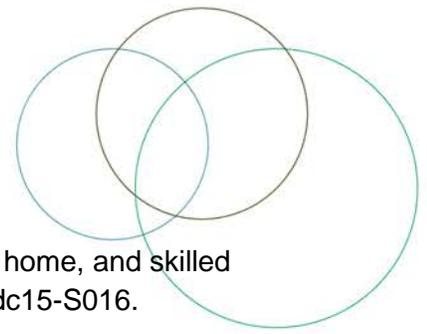
- To evaluate the effectiveness of the toolkit tools in the safe conversion to insulin pens on selected patient care areas at HHS and UHN.
- To evaluate outcome measures related to insulin administration to further inform healthcare organizations.
- To evaluate the work flow and workload changes related to conversion from insulin vials and syringes.
- To facilitate knowledge translation principles of synthesis, dissemination, exchange and application of knowledge to improve health services.
- To evaluate outcome measures related to insulin administration.
- To capture lessons learned for the benefit of other healthcare organizations.
- To develop a best practice education and implementation plan for replication by other healthcare organizations across the country.

In order to help other organizations embark on the shift in clinical practice to use of insulin pens, UHN and HHS have developed a toolkit within the framework of five guiding dimensions of what is required to successfully achieve such a practice change. This framework is supplemented, in a series of appended documents, with checklists designed as considerations for healthcare organizations to take into account as they contemplate this clinical practice change.

The framework offered in the toolkit captures the essence of the UHN and HHS experience and is offered from an evidence based perspective as an essential component for successful adoption of clinical practice changes related to insulin administration.

(Health Standards Organization, 2015)



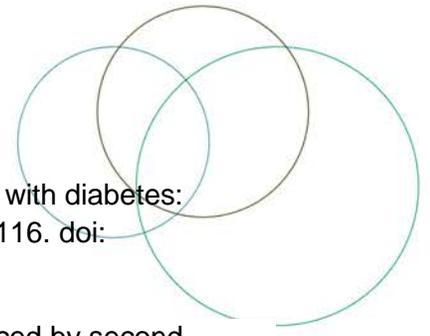


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