

Insulin: A high-alert medication

“The patient noticed his insulin box was different than [what] he had before.

He should have received Novolin® ge NPH and had been given Novolin® ge 30/70 in error.”

By Carolyn Kasprzak and Certina Ho

Insulin is one of the most well-known medications available on the market as diabetes is an increasingly prevalent disease in Canada. Whether in the hospital or community setting, insulin use is widespread. In hospital, insulin is routinely the treatment of choice for admitted patients with diabetes and in the community, patients with type 1 diabetes and many patients with type 2 diabetes self-administer insulin at home.

Insulin is consistently recognized as a high-alert medication, meaning that it has the potential to cause detrimental patient harm when used in error. If given as an excessive dose, insulin may cause life-threatening seizures and coma due to hypoglycemia, while an under-dose of insulin may lead to life-threatening ketoacidosis or hyperosmolality related to hyperglycemia.

Insulin has been consistently identified as one of the top medications associated with medication incident-related harm to patients

To examine medication incidents involving insulin occurring in the community, ISMP Canada evaluated 81 insulin-related medication incidents voluntarily reported to the Community Pharmacy Incident Reporting (CPhIR) program (<http://www.cphir.ca>). The incidents were categorized into four main themes and further subthemes based on common characteristics (Table 1). Potential contributing factors (Table 2) were then identified, from which system-based recommendations were developed to enable health care providers to prevent these insulin-related medication incidents from recurring.

Product selection (related to unique insulin properties)

Insulin may be administered by a syringe, a pen, or a pump. There are various insulin preparations available, such

as, rapid-acting, short-acting, long-acting, and pre-mixed. In addition, patients often use multiple insulin products. This may lead to insulin product mix-up at various stages of the medication-use process, particularly, prescribing, order entry and dispensing. Significant patient harm may occur if the wrong insulin product is selected and administered.

In order to prevent insulin product mix-up, prescribers should consider using standardized pre-printed orders. Pharmacy order entry and dispensing software should include both generic and brand names for insulin with warning flags to alert for potential product mix-up. Independent double checks are recommended throughout the pharmacy workflow and medication-use process, including an overview and confirmation of the insulin product(s) that the patient uses at prescription drop-off and pick-up. Lastly, insulin products should be stored and segregated in the fridge according to the onset of action (e.g., rapid-acting, short-acting, long-acting, and pre-mixed) instead of by the alphabetical order of the product name.

Therapeutic regimen change

Due to the progressive nature of diabetes and the multiple factors affecting blood glucose, patients often require or experience frequent insulin regimen changes, such as, a change in dose, change in insulin product, or an addition of another insulin product. Often insulin-related medication incidents occur after a patient's therapeutic regimen has changed. Therefore, health care practitioners should have adequate communication with the patient with regards to any regimen changes. A comprehensive diabetes-focused medication review is recommended whenever a patient has a significant change in insulin usage to ensure the safe use of insulin by the patient.

Dosage calculations

Insulin dispensing typically involves the calculation or conversion of insulin units to milliliters, and then to the total quantity that needs to be dispensed for a duration of supply to the patient. Additionally, insulin syringes are available in different sizes, holding different amounts of units. Medication incidents may occur if the wrong dose is calculated, an incorrect amount of medication is drawn up in

the syringe, or if the patient receives the wrong number of days of supply of insulin. Policies should be developed for independent double checks among pharmacy staff members when preparing or dispensing insulin prescriptions to patients, for instance, by documenting handwritten calculations for insulin quantity during order entry followed by an independent calculation and verification by a different team member during the dispensing process.

Storage requirements

Insulin requires adequate refrigeration to preserve drug stability until administration. Medication incidents occur when insulin is accidentally left outside of the fridge. Therefore, policies and procedures with regards to dispensing refrigerated products should be developed and reinforced. For example, refrigerated medications should always be returned to the fridge immediately after filling for proper storage until patient is ready to pick up the prescription.

Overall, while insulin is a vital medication for many patients with diabetes, it must be used with vigilance to prevent unnecessary patient harm. Table 2 provides a summary of possible contributing factors to insulin medication incidents that have been identified from this multi-incident analysis. ISMP Canada recommends using system-based solutions to prevent insulin medication incidents in all practice settings. ■

Carolyn Kasprzak is a Pharmacist at Quinte Health Care and a consultant at the Institute for Safe Medication Practices Canada (ISMP Canada); Certina Ho is a Project Lead at ISMP Canada.

Table 2: Possible Contributing Factors to Insulin Medication Incidents

- Variety of dosage forms are available for insulin products (e.g., rapid-acting, short-acting, long-acting, premixed, vials, cartridges, preloaded pens)
- Multiple formulations are available for the same insulin type
- Look-alike, sound-alike (LASA) drug names and LASA packaging of insulin products
- Proximity of storage of LASA insulin products in the fridge
- Patients may use multiple insulin products for their disease management concurrently
- Frequent insulin regimen changes and adjustments may be required for medication therapy management of patients with diabetes
- Unique dosage calculations are required during the dispensing of insulin products (e.g., conversion from units to mL and the number of days' supply)
- Variety of insulin syringe sizes are available
- Unique storage requirements (i.e. refrigeration) for insulin products

Table 1: Main Themes from a Multi-Incident Analysis of Insulin Medication Incidents

Main Themes	Subthemes
Product Selection (related to unique insulin properties)	Prescribing Order Entry Dispensing
Therapeutic Regimen Change	
Dosage Calculations	
Storage Requirements	