



Complexity of Insulin Therapy

A 1998 Institute for Safe Medication Practices (ISMP) study found that 11% of serious medication errors involve insulin misadministration.¹ With the rising prevalence of diabetes in recent years has come a corresponding increase in the use of insulin. Though it is often the most effective treatment for this chronic disease, data derived from scientific research and adverse event reporting systems such as PA-PSRS show that errors related to insulin are frequent and often cause significant patient harm. In fact, nearly 16% of all medication errors classified as Serious Events in PA-PSRS involved the use of insulin.

Insulin therapy has always required thoughtful management; however, over the last decade, the release of new insulin formulations, insulin delivery devices, and blood glucose monitors has made this process increasingly complex.² There are now close to a dozen different types of insulins manufactured by several companies, many with names or packages that look or sound alike.³

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It should not be surprising that 12.8% of the medication error reports involving insulin have been classified as “wrong drug” errors. For instance, organizations have reported errors related to confusion between **LENTE** (insulin zinc suspension) and **LANTUS** (insulin, glargine) and **HUMULIN** (insulin, human) and **HUMALOG**. Figure 1 lists insulin product names that Pennsylvania facilities have reported as being confused with one another.

Other examples of insulin-related medication error reports submitted to PA-PSRS include:

The physician ordered Humalog 72 units sq every A.M. and 48 units sq every P.M. After giving the A.M. dose, the nurse realized the type of insulin ordered was not the same as the patient’s home insulin type of Humulin 70/30. The physician was contacted, an IV of D5W was started, and accuchecks were monitored. The patient did not require any further treatment.

Patient ordered Novolog 70/30 insulin. Nurse pulled Novolin 70/30 instead. No Novolog was available in floor stock.

Insulin mix-ups also occur among premixed products containing both rapid and intermediate acting insulin. These “mix” products are available in varying combination strengths (e.g., **HUMULIN 50/50** or **70/30**, **HUMALOG MIX 75/25**, **NOVOLOG MIX 70/30**, **NOVOLIN 70/30**). As a result, several errors have been reported in which clinicians forgot to include the strength or transcribed the order incorrectly.

Another cause of many insulin-related errors is the use of error-prone abbreviations when communicating prescription information. As mentioned in a previous *Advisory*, the abbreviation “U” to indicate “units” contributes to many errors when it is misread as a zero (0) or the number four (4).⁴ Examples of medication error reports submitted to PA-PSRS in which the use of “U” for unit, many of which contributed to a 10-fold or greater overdose, include:

The pharmacist misread the order and added 80 units of regular insulin in the TPN [total parenteral nutrition] solution when the order was for 8 units of regular insulin.

Order for Humulin R insulin 70 units twice daily. Patient stated that this was more than she usually took at home. Order was clarified with physician to be 7 units.

100 units of regular insulin were given IM [intramuscular injection]. MD ordered 10 units of regular insulin.

Patient received 44 units of insulin instead of 4 units of insulin. The MAR [medication administration record] was misread by the nurse administering the medication.

Physician wrote an order for insulin 5 units. The handwriting could be interpreted as 54 units. The nurse caught and corrected the error prior to administration.

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Complexity of Insulin Therapy (Continued)

It is not uncommon for patients to receive widely varying insulin doses or to receive more than one type of insulin concurrently. Confusion among several different insulin products and failure to discontinue previous insulin when switching to a new product may go unnoticed until patient harm occurs. ISMP has received several reports through the USP/ISMP Medication Error Reporting Program (MERP) where patients were hospitalized after taking both Humalog and regular insulin, or Lantus along with twice daily NPH insulin.²

Figure 1. Examples of Insulin Products Reported to PA-PSRS as “Wrong Drug” Errors.

Humalog – Humulin R
Humulin N – Humulin R
Humulin R – Humulin 70/30
Humulin 70/30 – Humalog 75/25
Humalog 75/25 – Humalog
Lente Insulin – Lantus
Novolog – Novolog Mix 70/30
Novolog Mix 70/30 – Humulin 70/30
Novolin 70/30 – Novolog Mix 70/30

Potential Solutions

The examples above, and many others that have been reported to PA-PSRS, leave no doubt that insulin is a “high alert” drug that is prescribed, dispensed, and administered via error-prone processes and to patients who often are at risk for an adverse outcome if an error occurs. With such complexity, it is not surprising that errors with insulin are frequent and characteristically harmful to patients. As such, this high alert medication warrants special handling.

The following strategies may help to reduce the incidence of insulin-related errors:

- **Obtaining an accurate history** of insulin therapy from patients upon admission and following up with questions to detect possible confusion between the many look- and sound-alike insulin products. Whenever possible, encourage patients or families to bring in the insulin for validation.
- **Communicating prescriptions clearly** using the entire product name and writing out the word “units.” (Overdoses have occurred when the abbreviation “U” has been misinterpreted as a “0” [zero] or a “4.”)
- **Discouraging the use of verbal orders.** If they are used, reading back the spelling of the product name to avoid confusion with sound-alike insulin products. Considering the patient’s usual times for meals and specifying a clear relationship between insulin administration and the meals.

- **Storing insulin safely.** In the refrigerator, segregating vials (e.g., with storage bins) that may have look-alike names or packaging, or using other means (e.g., stickers, labels, enhancement with pen or marker) to call attention to important information that could be missed.
- **Building alerts into pharmacy and prescriber order entry systems to warn about the potential for error.** For example, using bold print or upper case lettering in order entry screens to clearly differentiate drug names that are similar and dangerous if confused (e.g., HumALOG vs. HumULIN, NovoLOG vs NovoLIN). In addition, emphasizing the word “Mix” along with the name of the insulin product mixture (e.g., Novolog ****Mix**** 70/30).
- **Performing an independent double check** of all doses before dispensing and administering insulin. Building the double check into daily work processes so it can be accomplished without disruption. In pharmacies, the original order could be compared with both the product to be dispensed and the computer-generated label before reaching the patient.
- **Providing staff with ongoing education** about insulin products, delivery devices, and monitoring devices. Consider providing staff with a chart that lists all insulin products used in your organization. Include: generic and brand names; onset, peak, and duration of action; time of administration in relationship to meals; and special precautions (e.g., measuring the proper dose, mixing instructions, more frequent patient glucose monitoring). Posting the charts in areas where insulin is prescribed, stored, and administered.

Don’t assume that there are no problems with insulin therapy in your organization. Periodic auditing of orders for episodes of misuse of the abbreviation “u” in prescriptions, the frequency of verbal insulin orders, and other poor prescribing habits, could help identify errors “waiting to happen.” Even if these problems are not obvious in your facility today, every facility can proactively anticipate and address problems with insulin use by discussing insulin errors that have happened in other facilities and incorporating the risk reduction strategies presented above.

Notes

1. Cohen MR, et al. Survey of hospital systems and common serious medication errors. *J Healthc Risk Manag.* 1998;18(1):16-27.
2. ISMP. Medication Safety Alert! Acute Care Edition. 17 Apr 2002; (7)8.
3. ISMP. Medication Safety Alert! Community/Ambulatory Care Edition. Jan 2004;(3)1.
4. Pennsylvania Patient Safety Reporting System. Abbreviations: A shortcut to medication errors. *PA-PSRS Patient Safety Advisory.* Mar 2005;2(1):19-20.



An Independent Agency of the Commonwealth of Pennsylvania

The Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error (“Mcare”) Act. Consistent with Act 13, ECRI, as contractor for the PA-PSRS program, is issuing this newsletter to advise medical facilities of immediate changes that can be instituted to reduce serious events and incidents. For more information about the PA-PSRS program or the Patient Safety Authority, see the Authority’s website at www.psa.state.pa.us.



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The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP’s efforts are built on a non-punitive approach and systems-based solutions.