

March 2022 ~ Resource #380308

Tips to Improve Insulin Safety

The checklist below provides strategies and resources to help prevent insulin errors.

| Goal | Suggested Approach |
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| Safely prescribe/order insulin | <ul style="list-style-type: none"> <input type="checkbox"/> Avoid writing orders with trailing zeros.¹³ <ul style="list-style-type: none"> ○ correct: 10 units of regular insulin ○ incorrect: 10.0 units of regular insulin <input type="checkbox"/> Spell out the word “units” instead of abbreviating with “U” or “u.”¹³ <input type="checkbox"/> Use TALLman lettering with look-alike drug names, such as HumuLIN and HumaLOG and NovoLIN and NovoLOG.⁶ <input type="checkbox"/> Avoid writing “use as directed.” <input type="checkbox"/> Specify pens or vials on prescriptions to avoid confusion.¹⁶ For example, write the full name of the product to avoid confusion with pens, vials, or cartridges (e.g., <i>Levemir FlexTouch</i>). <input type="checkbox"/> Consider standardized ordering to reduce mistakes and avoid transcription errors.⁵ <input type="checkbox"/> Use protocol-driven order sets that incorporate blood glucose monitoring and decision support for inpatients.^{1,7} <ul style="list-style-type: none"> ○ Examples can be found at ISMP Canada (http://www.ismp-canada.org/insulin/#1=tab3). <input type="checkbox"/> Use our chart, <i>How to Switch Insulin Products</i>, (US subscribers; Canadian subscribers) for insulin conversion tips. |
| Prevent product mix-ups | <ul style="list-style-type: none"> <input type="checkbox"/> Be aware of potential look-alike, sound-alike mix-ups, (e.g., lispro and <i>Lantus</i>), when ordering and dispensing insulin. <input type="checkbox"/> Put safeguards in place such as storing products in separate locations or using shelf tags to avoid mix-ups when dispensing similar looking pens or vials, or for different strengths of insulin (e.g., U-100, U-200, U-300, U-500). <input type="checkbox"/> Educate patients and prescribers about the differences between the different products as related to onset, duration of action, and intended use. See our charts, <i>Comparison of Insulins</i>, (US subscribers; Canadian subscribers) for specifics. <input type="checkbox"/> Avoid attaching labels to the cap of a pen. If caps are interchangeable between pens, this could lead to mix-ups. <input type="checkbox"/> Encourage patients who use multiple types of insulin to double-check that they are using the right pen or vial prior to administration of every dose. <input type="checkbox"/> For inpatients, use standard concentrations of insulin infusions prepared in the pharmacy.¹ <input type="checkbox"/> Ensure that pharmacy technicians are knowledgeable about insulin and potential for serious consequences with errors with our technician tutorials: <ul style="list-style-type: none"> ○ <i>Dispensing Insulin and Other Injectable Diabetes Meds</i> ○ <i>Diabetes 101</i> ○ <i>Preventing Med Errors</i> |

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| Be aware of factors that can impact blood glucose. | <ul style="list-style-type: none"><input type="checkbox"/> Watch for meds that might impact blood glucose (e.g., corticosteroids, quinolones).<input type="checkbox"/> If patients are receiving multiple med drips containing dextrose, be mindful of the total dextrose content.<input type="checkbox"/> Recommend blood glucose monitoring to prevent hypoglycemia or hyperglycemia when blood glucose might be affected by meds (i.e., starts, stops, dose changes), illness, changes in nutrition, etc.⁴<input type="checkbox"/> For inpatients, use:<ul style="list-style-type: none">○ evidence-based protocols/order sets for glucose monitoring during planned and unplanned interruptions in nutrition.¹○ a “hypoglycemic team” to develop a standardized approach to preventing and detecting hypoglycemia. |
| Understand special considerations with U-500 insulin | <ul style="list-style-type: none"><input type="checkbox"/> U-500 is FIVE times as concentrated as U-100 insulins, containing 500 units/mL, instead of 100 units/mL. But it’s NOT just a more concentrated form of regular insulin. Its onset (within 30 minutes) is similar to U-100 insulin and its duration (12 to 24 hours) is similar to NPH insulin.^{14,15}<input type="checkbox"/> Recommend subcutaneous dosing only. U-500 should not be administered intravenously (IV) or intramuscularly (IM).^{14,15}<input type="checkbox"/> To prevent mix-ups, include the word “concentrated” on orders for U-500 insulin. For example, “insulin human regular (CONCENTRATED) U-500, 150 units (0.3 mL), inject subcutaneously three times daily before meals.”<input type="checkbox"/> U-500 KwikPens (U-500 <i>Humulin R KwikPen</i> [US]; <i>Entuzity KwikPen</i> [Canada]) available as 3 mL (1,500 units)/pen measure doses in ACTUAL insulin units (doses range from 5 to 300 units/injection using 5 unit increments).^{14,15}<ul style="list-style-type: none">○ Recommend using the dose window, not counting clicks, to draw up an accurate dose.^{8,14,15}<ul style="list-style-type: none"><input type="checkbox"/> The dose indicator should line up with the total dose being drawn up.<input type="checkbox"/> Even numbers are printed on the dial (e.g., 10, 20); odd numbers (e.g., 15, 25) are the line in between each number pair.○ Prime <i>U-500 KwikPens</i> with 5 units of insulin instead of the typical 2 units with other pens.^{8,15}<ul style="list-style-type: none"><input type="checkbox"/> Pens may need to be primed multiple times to remove all of the bubbles.^{8,15}<input type="checkbox"/> If insulin cannot be seen at the end of the needle after EIGHT tries, replace the needle and prime the new needle.^{8,15}○ Ensure dexterity issues aren’t a concern, especially with larger doses. The dose button extends as the dose increases.<ul style="list-style-type: none"><input type="checkbox"/> Counsel patients or caregivers to ensure understanding of dosing and administration.<input type="checkbox"/> U-500 insulin vials (20 mL [10,000 units]/vial [US only]): Ensure patients are prescribed and use U-500 insulin syringes (calibrated to U-500 insulin with 5-unit increment markings to a maximum of 250 units/syringe) to safely draw up doses.<ul style="list-style-type: none">○ Errors can occur with U-100 insulin syringes or tuberculin syringes.² If U-500 syringes are not available follow these tips to reduce the risk of confusion and error:^{17,18}<ul style="list-style-type: none"><input type="checkbox"/> When possible, give preference to tuberculin syringes over U-100 syringes and include the units AND mLs to be injected. Example sig: inject 200 units (0.4 mL) twice daily 30 minutes before breakfast and dinner.<input type="checkbox"/> If U-100 insulin syringes must be used, include the units AND the unit marking to be injected. Example sig: inject 200 units (40 unit marking) twice daily 30 minutes before breakfast and dinner.¹⁸<input type="checkbox"/> When possible, avoid switching types of syringes. If switching is necessary, consider marking the amount the patient needs to inject on the syringe.○ In the hospital, draw up U-500 doses in the pharmacy. Or, consider using one U-500 pen per patient.¹ |

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| Accurate dosing by patients | <ul style="list-style-type: none"><input type="checkbox"/> For patients with poor vision and/or dexterity, consider:<ul style="list-style-type: none">○ tools such as syringe magnifiers or a device that indicates the correct dose has been drawn up (e.g., <i>Count-a-dose</i>).○ the use of insulin pens instead of vials.<input type="checkbox"/> Improperly mixing suspensions (e.g., <i>Humulin N</i>, <i>Humalog Mix 75/25</i> [US], <i>Novolin N</i> [US], <i>Novolin ge NPH</i> [Canada]) can lead to over-dosing or under-dosing.<ul style="list-style-type: none">○ Vials: educate patients to roll (not shake) gently at least ten times before use.⁹○ Pens: educate patients to roll and tip up and down gently at least ten times each before use.<input type="checkbox"/> Note: not all types of insulin can be mixed in the same syringe. Check product labeling before mixing.<input type="checkbox"/> Advise patients to routinely:<ul style="list-style-type: none">○ check expiration dates○ visually inspect insulin to be sure it's clear (for solutions) or uniformly cloudy (for suspensions), without clumps/particles. |
| Safe use of insulin pens | <ul style="list-style-type: none"><input type="checkbox"/> Label insulin pens (not just bags) dispensed to patient-care units for individual patients.¹<input type="checkbox"/> Consider adding tamper-evident seals on pens to identify which ones have been used.<input type="checkbox"/> Use the motto, “one pen, one patient.”^{1,10} Pens should only be used for a single patient, even if the needle is changed.^{10,11}<input type="checkbox"/> Discourage “work-arounds” such as withdrawing doses for multiple patients from a single pen cartridge.<input type="checkbox"/> Advise patients who use more than one pen to double-check that they have the correct pen before administering a dose.<input type="checkbox"/> Review information such as priming and operation of the pen with patients, caregivers, etc. Include steps such as:<ul style="list-style-type: none">○ attach the needle○ prime the pen before each dose to expel air bubbles○ dial the dose○ press the button completely and leave the needle in the skin for 5 to 10 seconds to deliver the full dose○ discard the needle<input type="checkbox"/> Train patients/caregivers on proper use. If available, give printed step-by-step instructions (specific to US products):<ul style="list-style-type: none">○ <i>Humalog KwikPen</i>: https://uspl.lilly.com/humalog/humalog.html#ug1○ <i>NovoPen Echo</i>: https://www.novo-pi.com/novopenecho.pdf○ <i>Levemir FlexTouch</i>: http://www.med.umich.edu/1libr/PedEndocrine/Diabetes/LevemirFlextouch.pdf○ <i>Lantus SoloSTAR</i>: https://www.lantus.com/-/media/EMS/Conditions/Diabetes/Brands/lantus-final/PDF/lantus-quick-reference-patient-brochure.pdf<input type="checkbox"/> Educate patients not to reuse needles with their pens. Reuse can dull needles and lead to pain. Reuse can also lead to infection.<input type="checkbox"/> Discourage leaving needles on the pen due to increased risk of air bubbles, leaks, or clogging.¹²<input type="checkbox"/> Prescribe insulin quantities in multiples of mLs or units per box of pens, based on how supplied (e.g., 1500 units [15 mL] if there are three U-100 5 mL pens per box). Be sure that the quantity prescribed matches the intended days' supply.<input type="checkbox"/> Include an Rx for pen needles with prescriptions for pens. |

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| Time insulin doses properly | <ul style="list-style-type: none"> <input type="checkbox"/> Make sure that appropriate and specific times are indicated on orders for insulin. Avoid dosing schedules such as “bid.” <ul style="list-style-type: none"> ○ See our charts, <i>Comparison of Insulins</i> (US subscribers; Canadian subscribers), for usual dosing frequencies. <input type="checkbox"/> Use our algorithms, <i>Initiation and Adjustment of Insulin Regimens for Type 2 Diabetes</i> (US subscribers; Canadian subscribers). <input type="checkbox"/> Use insulin infusion protocols in critical patients.⁴ <input type="checkbox"/> Recommend rapid-acting insulin administration with the first bite of a meal.¹ <input type="checkbox"/> Consider administering prandial insulin at the end of the meal in patients with variable food intake.¹ |
| Educate about insulin use | <ul style="list-style-type: none"> <input type="checkbox"/> Educate patients about insulin use. <ul style="list-style-type: none"> ○ Review proper injection technique (e.g., skin prep, angle of needle insertion, pinching a skinfold, site rotation).⁹ ○ Observe the patient administer a dose, with his or her own supplies, to identify errors and improve technique. <input type="checkbox"/> Consider referring patients to a diabetes education program or certified diabetes educator (CDE) including at hospital discharge.⁴ Use the following websites to find a local CDE: <ul style="list-style-type: none"> ○ US: http://www.ncbde.org/find-a-cde/ ○ Canada: https://systems.cdec.ca/findCDE <input type="checkbox"/> Educate patients about the signs and symptoms of hypoglycemia, and its management. <ul style="list-style-type: none"> ○ In the US, use CPT code 99211 to bill for insulin teaching provided by a nurse or pharmacist on a separate visit.³ <input type="checkbox"/> Participate in education and teaching of other health care professionals who are involved in the use of insulin (e.g., prescribing, compounding, dispensing, administering, monitoring).¹ |
| Store insulin properly | <ul style="list-style-type: none"> <input type="checkbox"/> Avoid storing U-500 insulin in patient care areas.¹ <input type="checkbox"/> Label insulin vials and pens with proper storage instructions, including when to refrigerate products and beyond-use dating when products are stored at room temp, if applicable. For specifics use our: <ul style="list-style-type: none"> ○ charts: <i>Comparison of Insulins</i> (US subscribers; Canadian subscribers) ○ technician tutorial: <i>Stay Cool: Storing Meds in the Fridge or Freezer</i> <input type="checkbox"/> Remind patients when devices should NOT be stored in the refrigerator, such as in-use insulin pens. <input type="checkbox"/> Store U-500 insulin and U-500 syringes separate from other insulin or syringes to avoid mixups. |

Users of this resource are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.

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