Dr. Meisel’s health system uses the U-500 insulin pen, but the technology enhancements that Fairview Health Services made are applicable, with minor text adjustments, for all hospitals using U-500 insulin. Following is a detailed description of the safeguards Fairview built into their prescriber order-entry system, pharmacy order-verification system, nursing medication-administration record (MAR), and patient discharge instructions to support safety when prescribing, dispensing, and administering U-500 insulin.

1. Selecting the Order Panel

Prescribers ordering Humulin R U-500 must first select it from a pick list, which includes the notation that the drug is a “very high concentration.” When the drug is selected, an order panel appears on the screen that must be used to prescribe the drug. The three components of the panel are preselected for implementation by default. Although prescribers can deactivate these preselected orders, such occurrences are said to be rare, to date. The three preselected orders that accompany the medication include:

**Glucose monitoring by nursing at point-of-care.** This includes routine testing four times daily before meals and at bedtime, along with details regarding the testing schedule for the initial 24 hours (e.g., when to start testing and additional testing at 2 a.m. and 5 a.m. during the initial 24 hours).

**Pharmacy inpatient consult.** This is an order for a one-time consult with a pharmacist who, after consulting with the patient, must add an admission medication-history note in the electronic health record (EHR) using an “RxInsulinConc” phrase (to promote searching for the pharmacy consultation note). The pharmacist should determine whether the order for U-500 insulin is a continuation of home therapy, and whether the patient has been using a pen or a vial at home. If the patient is using a vial, the pharmacist should interview the patient to determine exactly how he or she is measuring and preparing the dose, and cross-check that assessment with the patient’s ordered dose.

**Endocrinology inpatient consult to follow patient during hospitalization.** This is a required consultation to endocrinology for glycemic management recommendations and to follow the patient during hospitalization. Directions for contacting the on-call endocrinologist are provided in the order panel. For hospitals in the system without an endocrinologist on staff, separate instructions to consult a clinical nurse specialist for diabetes are also provided.

2. Issuing a Best-Practice Advisory

Once the prescriber has selected the U-500 insulin, an urgent patient-care advisory is always presented on the screen as follows:

You are placing an order for insulin U-500 (high concentration). The dose should be ordered as actual insulin units (not markings on the syringe). Please check the patient’s dose and consider switching any patients using U-500 insulin in a vial to the pen at discharge.

The prescriber can either accept the advisory or cancel it to continue the prescribing process.

3. Prescribing the Dose

Prior to entering the dose, the prescriber is reminded via prepopulated order instructions that a very high concentration of insulin (500 units/mL) has been ordered and that the dose must be prescribed as actual units of insulin, not syringe markings. There is also a reminder that the dose must be ordered in 5-unit increments, as the organization only dispenses pens. The order-entry system automatically rounds the dose to the nearest 5 units if the prescriber has not done so.

4. Prescribing the Route

The route field is prepopulated with
the subcutaneous route, which is the only choice available, as U-500 insulin should not be administered intramuscularly or intravenously.

5. Prescribing the Frequency
   The order-entry system limits the possible frequencies for administering U-500 insulin to those that are appropriate. The most common frequencies are provided as quick-select buttons, and a menu can be accessed to select other appropriate frequencies. This prevents the prescriber from ordering U-500 insulin too frequently. A selection for “user specified” directions is available, but this has rarely been used, to date.

6. Issuing Alternative Alerts
   The prescriber will receive the following alternative alert if he or she attempts to reorder U-500 insulin via a vial from a previous admission or from a “prior to admission” list of medications:
   Please select the alternative order below (HumulinR U-500 KwikPen 500 Units/mL subcutaneous solution).
   Note: The alternative order takes the prescriber to the U-500 insulin order panel, as this is the only way to order U-500 insulin for a hospital patient.
   The prescriber also receives an alternative alert when entering an ambulatory or discharge order for U-500 insulin via a vial, although the prescriber can proceed with prescribing a vial if desired:
   Consider switching to the U-500 insulin pen (HumulinR U-500 KwikPen 500 units/mL subcutaneous solution). There is a patient safety advantage to using the pen, as dosing is in actual insulin units and no dose conversion is needed.

7. Issuing an Alert During Order Verification
   After the pharmacist verifies the prescriber’s orders, a best-practice alert will appear on the screen if the pharmacist’s consulting note hasn’t been entered using the “RxInsulinConc” phrase. This alert reminds the pharmacist to add an admission medication-history note using “RxInsulinConc” to determine whether this is a continuation of home therapy and if the patient has been using a pen or a vial. If the patient uses a vial at home, the pharmacist is instructed to interview the patient to determine exactly how the dose is being measured and prepared, and to cross-check that assessment with the patient’s order(s).

8. Pharmacy Consulting and Documentation
   After the consultation with the patient, the pharmacist is offered three standard choices from which to choose when documenting the patient’s dose at home:
   - The insulin was supplied in a U-500 pen. There is no dose conversion with the pen.
   - The insulin was supplied in a vial, and measured with an insulin syringe. The patient’s actual dose of insulin is [insert appropriate text] units, which the patient measured by drawing the insulin to the [insert appropriate text] unit marking with a U-100 insulin syringe.
   - The insulin was supplied in a vial, and measured with a tuberculin syringe. The patient’s actual dose of insulin is [insert appropriate text] units, which the patient measured by drawing up [insert appropriate text] mL with a tuberculin syringe.

9. Issuing a MAR Alert
   If a nurse selects U-500 insulin for administration within six hours of the prior dose, a critical patient-care advisory appears on the screen stating:
   A U-500 insulin dose was administered in the last 6 hours. U-500 insulin doses should be separated by at least 6 hours in most cases. Please contact the pharmacist for guidance on when this dose should be administered.
   The nurse can either accept the advisory or cancel it to continue the administration process.

10. Educating the Patient at Discharge
    If the pharmacist has documented that the patient was using a vial of U-500 insulin at home, but the prescriber has ordered a pen at discharge, the patient will receive a discharge summary (after-visit summary) that includes these instructions, which reinforces the verbal education the patient receives:
    U-500 Insulin Pen: Our records indicate that you have been using U-500 insulin supplied in a vial in the past. Your doctor has now prescribed a U-500 insulin pen.

When using the pen, the dose is measured in actual insulin units, which is different from the markings on the syringe you may have been using previously. Before leaving the hospital, make sure you know your insulin dose and understand how to use the pen.

We thank Dr. Meisel for sharing these electronic safeguards and messages associated with certain aspects of using U-500 insulin. The details demonstrate how the various safeguards and alerts will likely improve safety when using U-500 insulin. It is hoped that other hospitals using or planning to use U-500 insulin will follow suit and work with their IT staff and system vendors to make similar adjustments to their medication-use systems to help support safety with this concentrated insulin.

ADDITIONAL NOTES
As with any insulin pen, steps should be taken to ensure that the U-500 insulin pen remains “patient-specific” and is never shared with or used by another patient, even if the needle has been changed. Any insulin pen in use should also be labeled with a distinct patient-specific and drug-specific barcode that is scanned before dispensing and administration to verify the correct insulin type and correct patient. U-500 insulin pens should be dispensed from the pharmacy when prescribed, and neither vials nor pens should be stored in automated dispensing cabinets. For inpatients, dispensing individualized, patient-specific U-500 insulin doses in syringes from the pharmacy may be a safe alternative to the U-500 insulin pen in many hospitals.