PENNSYLVANIA HOSPITAL ENGAGEMENT NETWORK: ORGANIZATION ASSESSMENT OF SAFE ANTICOAGULANT PRACTICES

As a high-alert medication class, anticoagulants bear a heightened risk of causing significant patient harm when used in error.[1]

Proactively assessing safety practices, especially those involving anticoagulant use, can provide hospitals with valuable information about the weaknesses that exist within their medication-use system. As the harm from errors involving anticoagulants can be potentially devastating, identifying the risks associated with anticoagulant use should be considered a priority by healthcare organizations.

This tool will help you assess the safety of anticoagulant practices in your facility and identify opportunities for improvement. The aggregate findings also may be used to develop an action plan for implementing recommended error reduction strategies in order to assist your hospital in enhancing anticoagulant safety.

Instructions for Completing the Assessment

Please note:
It is important for each hospital in a multihospital system to complete the assessment *individually*.

1. **Establish an interdisciplinary team** consisting of the following (or similar) roles:
   - Chief medical officer
   - Nurse executive
   - Director of pharmacy
   - Clinical information technology specialist
   - Medication safety officer/manager
   - Risk management and quality improvement professionals
   - At least two staff nurses from different specialty areas
   - At least two staff pharmacists (one clinical and one distribution)
   - At least one active staff physician who regularly orders anticoagulants

   Your team should be provided with sufficient time to complete the assessment and be charged with the responsibility to evaluate, accurately and honestly, the current status of anticoagulant practices in your facility. Because medication use is a complex, interdisciplinary process, *the value and accuracy of the assessment is significantly reduced if it is completed by a single discipline involved in medication use*.

2. **Read and review the assessment in its entirety (including the instructions) *before* beginning the assessment process.** Each team member should be provided with either a hard copy or electronic version of the assessment and the definitions for review before the first team meeting.

3. **Verify your demographic information.** *Before* the first team meeting, the team leader should complete this section and, if necessary, verify any responses with hospital administration. All demographic questions must be answered.

4. **Convene the team.** During the evaluation process, ensure that each team member can view the assessment during the meeting by providing each member with a printed hard copy of the assessment and definitions.

[1] Institute for Safe Medication Practices. ISMP's list of high-alert medications [online]. 2012 [cited 2014 May 16]. http://www.ismp.org/Tools/highAlertMedications.asp

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Instructions for Completing the Assessment (continued)

5. **Discuss each assessment item.** As necessary, investigate and verify the level of implementation with other healthcare practitioners outside your team. When a consensus on the level of implementation for each assessment item has been reached, select the appropriate choice. For the majority of the assessment items, your hospital will have the following options: Not implemented, Partially implemented, and Fully implemented.

   Key: Please use the following key and guidelines to select the most appropriate response:

   - Not implemented: This item has *not* been implemented within the hospital.
   - Partially implemented: This item has been *partially implemented in some or all areas* of the hospital, or this item has been *fully implemented in some areas* of the hospital.
   - Fully implemented: This item is *fully implemented throughout the hospital*.

   Hospitals may want to consider assigning an individual to record any discussion generated around each assessment item and the rationale behind the selected choice.

   Definitions: Within the assessment, defined terms are highlighted throughout the text in bold letters. Definitions are provided on the last page of this tool.

   For all assessment items: Unless otherwise stated, assessment items refer to anticoagulants prescribed, dispensed, and administered to all inpatients and outpatients typically seen in most hospitals, including patients admitted to the emergency department and ambulatory surgery/procedure units.

   - **For assessment items with multiple components:** The choice of "Fully implemented" should only be selected if *all components* are present in *all areas* of the hospital. If only one or some of the components have been partially or fully implemented in some or all areas of the hospital, a choice of "Partially implemented" should be selected.
   - **For assessment items with an option of "Not applicable":** Select "Not applicable" *only* if your hospital meets the statement that follows. For example, for assessment item #13, only select "Not applicable" if your organization does not have a computerized prescriber order entry system.

6. **Repeat the process outlined in step 5 for all assessment items.** All assessment items must be answered. *Save the paper copy* of your hospital's assessment.

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DEMOGRAPHIC QUESTIONS

1. Please select the *one category* that best describes the number of inpatient beds currently staffed for use in your hospital.

   ○ Fewer than 100 beds ○ 100 to 299 beds ○ 300 to 499 beds ○ 500 beds and over

2. Please select the *one category* that best describes the type of service that your hospital provides to the majority of its admissions.

   ○ General medical and surgical
   ○ Long-term acute care
   ○ Specialty: cardiology
   ○ Specialty: oncology
   ○ Specialty: orthopedic
   ○ Specialty: pediatric
   ○ Specialty: psychiatric
   ○ Specialty: rehabilitation
   ○ Specialty: women and children
   ○ Other:

3. Does your hospital also provide any of the services listed below?

   ○ No
   ○ Yes

   Please select all that apply.

   Oncology services (select even if chemotherapy is administered infrequently)

   Pediatric services (select even if pediatric care is provided only in the emergency department and/or outpatient surgery)

   Neonatal intensive care unit (select for any level of service)

   Trauma services (select for any level of service)

   Transplant services

4. Is your hospital accredited?

   ○ No
   ○ Yes

   Who accredits your hospital?

   The Joint Commission

   Healthcare Facilities Accreditation Program (HFAP)

   Det Norske Veritas (DNV)

   Other:

CONTINUED...

5. Is a pharmacist available in the hospital 24 hours a day, seven days per week to review orders and dispense medications?

- ○ Yes
- ○ No

Please specify how many hours a day a pharmacist is available.

Monday through Friday: hours

Saturday and Sunday: hours

6. Please select the *one category* that best describes the type of medication administration records (MARs) used at your hospital?

- ○ Handwritten MARs
- ○ Paper MARs printed from the pharmacy information system
- ○ Electronic MARs

7. Does your hospital use **bar-coding technology**?

- ○ No, we do not have bar-coding technology in our organization.
- ○ Yes

Please select the *one category* that best describes your hospital's use of bar-coding technology.

Bar-coding technology is *only* used in the pharmacy for drug selection.

Bar-coding technology is *only* used at the patient bedside for medication administration.

Bar-coding technology is used *both* in the pharmacy and at the patient bedside.

8. Does your hospital use **smart infusion pumps** with computer software that is capable of alerting the user to unsafe doses for continuous anticoagulant infusions?

- ○ No, we do not have smart infusion pumps in our organization.
- ○ Yes

9. Does your hospital use a **computerized prescriber order entry (CPOE)** system?

- ○ No, we do not have CPOE in our organization.
- ○ Yes

a. Please select the *one choice* that best describes the area(s) where CPOE is used.

All inpatient areas

Emergency department only

CPOE is used in both the inpatient areas and the emergency department.

Other:

b. What types of clinical decision support are available in the CPOE system and are used by prescribers when processing orders for anticoagulants? (Select all that apply.)

Alert prescribers to duplicate class orders for anticoagulants (for two or more drugs within the same class)

Alert prescribers to drug interactions that can affect the dose of anticoagulant therapy

Provide an alert and an electronic abstract or reference when drug-herbal interactions with prescribed anticoagulant therapy are detected

Alert prescribers if aspirin or nonsteroidal anti-inflammatory agents are prescribed for "as needed" (PRN) use in patients who are receiving anticoagulant therapy

Perform dose range checks and warn prescribers about anticoagulant overdoses and underdoses

Hard stops (catastrophic stops) for doses known to cause serious harm

10. Please select *all* areas where anticoagulants are stored in automated dispensing cabinets (ADCs) (e.g., Pyxis, Omnicell).

- ☐ Catheterization lab
- ☐ Dialysis
- ☐ Emergency department
- ☐ Endoscopy
- ☐ Intensive care units
- ☐ Labor and delivery units
- ☐ Medical-surgical units
- ☐ Neonatal intensive care units
- ☐ Newborn nursery
- ☐ Oncology units
- ☐ Operating room
- ☐ Outpatient ambulatory care clinics
- ☐ Pediatric units
- ☐ Postanesthesia care unit (PACU)
- ☐ Radiology
- ☐ Same-day surgery/pre-op
- ☐ Other:

11. Please select *all* areas that have active "profiling" functionality available and turned on (i.e., anticoagulants cannot be accessed from the ADC without an order review by a pharmacist, with the exception of a limited supply of drugs needed for emergent situations).

- ☐ No areas have active "profiling" functionality available and turned on.
- ☐ Catheterization lab
- ☐ Dialysis
- ☐ Emergency department
- ☐ Endoscopy
- ☐ Intensive care units
- ☐ Labor and delivery units
- ☐ Medical-surgical units
- ☐ Neonatal intensive care units
- ☐ Newborn nursery
- ☐ Oncology units
- ☐ Operating room
- ☐ Outpatient ambulatory care clinics
- ☐ Pediatric units
- ☐ Postanesthesia care unit
- ☐ Radiology
- ☐ Same-day surgery/pre-op
- ☐ Other:

12. What types of clinical decision support are available in the pharmacy information system and are used by pharmacists when processing orders for anticoagulants? (Select all that apply.)

- ☐ Alert pharmacists to duplicate class orders for anticoagulants (for two or more drugs within the same class)
- ☐ Alert pharmacists to drug interactions that can affect the dose of anticoagulant therapy
- ☐ Provide an alert and an electronic abstract or reference when drug-herbal interactions with prescribed anticoagulant therapy are detected
- ☐ Alert pharmacists if aspirin or nonsteroidal anti-inflammatory agents are prescribed for PRN use in patients who are receiving anticoagulant therapy
- ☐ Perform dose range checks and warn pharmacists about anticoagulant overdoses and underdoses
- ☐ Hard stops (catastrophic stops) for doses known to cause serious harm

13. Does your hospital have an interdisciplinary anticoagulant/antithrombotic management team?

- ○ No
- ○ Yes

Which disciplines are represented on this team? (Select all that apply.)

Physician	Social worker
Nurse	Other:
Pharmacist	

ASSESSMENT ITEMS

Organizational Structure

1. Disease-specific protocols (e.g., atrial fibrillation, deep-vein thrombosis, pulmonary embolism) are readily available and used to guide appropriate and safe warfarin therapy, and the different protocols are clearly labeled to ensure proper identification and use.

○ Not implemented ○ Partially implemented ○ Fully implemented

2. Disease-specific protocols (e.g., stroke, cardiac disease, deep-vein thrombosis) are readily available and used to guide appropriate and safe use of heparin and thrombolytics, and the different protocols are clearly labeled to ensure proper identification and use.

○ Not implemented ○ Partially implemented ○ Fully implemented

3. A protocol or guideline exists in the organization for the following. (Select all that apply.)

- ☐ Safely managing the care and removal of epidural catheters placed during regional anesthesia when low-molecular-weight (LMW) heparin has been administered for surgical prophylaxis
- ☐ Monitoring and/or discontinuing anticoagulant therapy prior to invasive procedures
- ☐ Permitting and guiding the rounding of doses for certain anticoagulant agents (e.g., enoxaparin 73 mg could be rounded to 70 mg, a weight-based heparin bolus dose of 2,485 units could be rounded to 2,500 units)
- ☐ Guiding the reversal of supratherapeutic international normalized ratio (INR) values while taking into consideration the INR value, the absence or presence of clinically significant bleeding, and other factors that gauge necessity and urgency of reversal
- ☐ Directing prescribers to order oral phytonadione (vitamin K1), unless rapid reduction of a supratherapeutic INR is required

4. All protocols, pathways, guidelines, nomograms, order sets, flow sheets, and/or checklists for anticoagulant therapy are reviewed at least annually and revised when significant, new information becomes available.

   ○ Not implemented ○ Partially implemented ○ Fully implemented

5. All weight-based guidelines or protocols identify whether the patient's ideal body weight, actual weight, or a medical staff–approved dosing-corrected weight is to be used in the calculations.

   ○ Not implemented ○ Partially implemented ○ Fully implemented

6. Warnings appear on protocols, pathways, order sets, pharmacy order entry screens, and ADC monitors to review all medications the patient has received in the past 24 hours (including in the emergency department) to ensure that adequate time has elapsed between doses of the same or different anticoagulant (e.g., LMW heparin given in the emergency department and heparin or fondaparinux prescribed upon admission to the hospital).

   ○ Not implemented ○ Partially implemented ○ Fully implemented

7. The organization performs ongoing review of compliance with established anticoagulant protocols, and a convened interdisciplinary team recommends and facilitates action to reduce noncompliance.

   ○ Not implemented ○ Partially implemented ○ Fully implemented

8. Warfarin (and other selected oral agents [e.g., dabigatran, rivaroxaban]) and parenteral anticoagulants are included in the organization's defined list of **high-alert medications**, which has been communicated to all healthcare **practitioners**.

   ○ Not implemented ○ Partially implemented ○ Fully implemented

9. A convened interdisciplinary team in the organization routinely does the following. (Select all that apply.)

   ☐ Analyzes and uses internal error experiences to target improvements in the use of anticoagulant agents

   ☐ Analyzes and uses external published error experiences from other organizations to proactively target improvements in the use of anticoagulant agents

   ☐ Evaluates the literature for new evidence-based practices and technologies that have been proven to be effective in reducing anticoagulant errors and improving patient outcomes to determine if any of these can improve the organization's own anticoagulant therapy

   ☐ Retrospectively reviews cases in which an activated partial thromboplastin time (aPTT) or INR falls outside of predetermined values and makes organization-wide process recommendations aimed at reducing the variation in achieving and maintaining therapeutic drug levels

Prescribing

10. The indication and therapeutic goal for anticoagulant therapy is documented in the patient's medical record and communicated to pharmacy for monitoring and managing patient therapy.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

11. Patients who are being discharged on warfarin therapy and have a subtherapeutic INR are consistently evaluated regarding the need for LMW heparin until a therapeutic INR is reached; and, when appropriate, patients are maintained or "bridged" with LMW heparin until therapeutic INR levels are reached.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

12. If surgery is significantly delayed or postponed, a reliable process is in place to consistently remind the prescriber to evaluate the need to resume anticoagulant therapy for all patients who had previously been receiving such therapy.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

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13. The **computerized prescriber order entry (CPOE)** used for medication order entry is directly **interfaced** with the laboratory system to automatically alert prescribers to abnormal values, indicating a potential need to modify anticoagulant therapy. Score "Not applicable" if your organization does not have CPOE.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

    ○ Not applicable

Order Review, Compounding, and Product Storage

14. The pharmacy order entry computer system used for medication order entry is directly **interfaced** with the laboratory system to automatically alert *pharmacists* to abnormal values, indicating a potential need to modify anticoagulant therapy.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

15. Anticoagulant orders cannot be entered into the pharmacy computer system until the patient's weight (preferably in kilograms) and height have been entered (i.e., weight and height are required fields.)

    ○ Not implemented ○ Partially implemented ○ Fully implemented

16. Pharmacists can automatically modify anticoagulant therapy doses when laboratory values are below or above the target range, as specified by medical staff–approved protocols.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

17. If intravenous vitamin K1 is required (e.g., life-threatening warfarin overdose, rapid reduction of a supratherapeutic INR accompanied by life-threatening bleeding), admixture procedures require diluting the medication in at least 50 mL of appropriate solution and administering the medication over 30 to 60 minutes.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

18. Upon inpatient admission, all medications (including one-time doses) administered in the emergency department or other outpatient settings (e.g., cardiac catheterization lab, radiology) are immediately communicated to the pharmacy and entered (or readily available) in the pharmacy computer system in a manner that facilitates an automated alert for duplicate therapy, contraindications, and drug interactions when anticoagulants prescribed upon admission are profiled.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

19. Standard concentrations are used throughout the facility for IV (intravenous) anticoagulant infusions.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

20. Only commercially prepared, premixed IV solutions of heparin are used in the facility.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

21. The formulary limits the variety of heparin concentrations and vial sizes.

    ○ Not implemented ○ Partially implemented ○ Fully implemented

22. Prefilled syringes of heparin flushes are provided to all patient care units where heparin flushes are used. (Score "Not applicable" if heparin flushes are not used anywhere in the facility.)

    ○ Not implemented ○ Partially implemented ○ Fully implemented

    ○ Not applicable

23. Thrombolytic bolus doses (e.g., tissue plasminogen activator [tPA]) are prepared by the following: (Select one response.)

    ○ Only trained practitioners prepare thrombolytic bolus doses, using a disease-specific kit (e.g., stroke, acute myocardial infarction) containing the protocol, drug, supplies needed for preparation, and preparation instructions.

    ○ Pharmacists prepare all thrombolytic bolus doses.

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Administration

24. Warfarin administration is scheduled for the same time each day, after INR results are available (e.g., afternoon, early evening).

○ Not implemented ○ Partially implemented ○ Fully implemented

25. An **independent double check** is performed with each new infusion bag, bottle, or bolus dose and/or change in the rate of infusion of parenteral anticoagulants (i.e., one practitioner readies the solution for administration and a second practitioner independently verifies all of the following before starting the infusion).

☐ We do not perform an independent double check for parenteral anticoagulants with each new infusion bag, bottle, or bolus dose and/or change in the rate of infusion.

☐ We perform an independent double check with each *new infusion bag, bottle, or bolus dose,* which includes checking the following components against the MAR/medication order as appropriate. (Select all that apply.)

- Patient (using two unique identifiers)
- Drug and base solution on pharmacy label
- Drug concentration on pharmacy label
- Rate of infusion on pharmacy label
- Channel selection (for multiple-channel pumps)
- Pump settings (e.g., drug, concentration, rate)
- Line attachment

☐ We perform an independent double check with each *change in the rate of infusion*, which includes checking the following components against the MAR/medication order as appropriate. (Select all that apply.)

- Patient (using two unique identifiers)
- Drug and base solution on pharmacy label
- Drug concentration on pharmacy label
- Rate of infusion on pharmacy label
- Channel selection (for multiple-channel pumps)
- Pump settings (e.g., drug, concentration, rate)
- Line attachment

26. Protamine and/or vitamin K and accompanying guidelines for the reversal of heparin and/or warfarin toxicity are readily available wherever anticoagulants are administered.

○ Not implemented ○ Partially implemented ○ Fully implemented

Monitoring

27. A baseline hemoglobin, hematocrit, serum creatinine, and platelet count are obtained prior to initiating anticoagulant therapy (inpatient or outpatient) with unfractionated heparin or LMW heparin.

○ Not implemented ○ Partially implemented ○ Fully implemented

28. When heparin is prescribed for therapeutic anticoagulation, nurses, pharmacists, *and* prescribers monitor all aPTT laboratory values to ensure that the range is maintained within the range specified by the organization or as dictated by a correlation between the aPTT and heparin levels measured by anti-factor Xa assay or protamine titration method.

○ Not implemented ○ Partially implemented ○ Fully implemented

29. A baseline INR is obtained for all patients starting on warfarin therapy.

○ Not implemented ○ Partially implemented ○ Fully implemented

30. Blood specimens for INRs are drawn at the same time each morning so the results are available to prescribers before warfarin doses are prescribed.

○ Not implemented ○ Partially implemented ○ Fully implemented

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31. When warfarin is prescribed, nurses, pharmacists, *and* prescribers monitor all INR values to ensure that the INR is maintained or at a level consistent with recommendations or protocols for the specific disease or condition for which warfarin therapy is prescribed.

○ Not implemented ○ Partially implemented ○ Fully implemented

32. The hospital provides stat laboratory test results 24 hours a day, seven days per week to ensure safe and timely monitoring of anticoagulant therapy.

○ Not implemented ○ Partially implemented ○ Fully implemented

33. The organization has defined the acceptable length of time between the ordering of critical hematological tests (e.g., INR, aPTT) and reporting of the test results, as well as between the availability of the results and receipt by a responsible licensed healthcare provider.

○ Not implemented ○ Partially implemented ○ Fully implemented

34. All hematological lab values defined as critical by the laboratory are reported directly to a responsible licensed healthcare provider within the time frame established by the organization.

○ Not implemented ○ Partially implemented ○ Fully implemented

35. The following are used to monitor adverse drug events with anticoagulants. (Select all that apply.)

☐ Medication event reports

☐ Adverse drug reaction reports

☐ Pharmacy interventions

☐ Administration of reversal agents such as vitamin K1 and protamine

☐ Selected laboratory tests (e.g., aPTT outside the therapeutic range, INR greater than "x" as defined by facility, platelet count less than 100,000/mm^3)

Patient Education

36. Inpatients and outpatients on warfarin therapy, and/or their **caregivers**, receive verbal and up-to-date written information (eighth-grade reading level or lower) about the following. (Select all that apply.)

☐ The purpose, action, and side effects of the therapy and information about the specific drugs being used, including the generic and brand (if applicable) names, strength/dose, and frequency/duration of use

☐ How their anticoagulant therapy is monitored and the need for close medical supervision and adherence to prescribed treatment

☐ The signs and symptoms of bleeding or thromboembolic complications

☐ Proper dietary measures and their effect on overall therapy goals

☐ Drug and herbal interactions, including a list of over-the-counter drugs, nutritional supplements, and herbal products to avoid

☐ That their dose may change during the course of treatment based on their laboratory results

☐ How to manage dose changes safely once at home when their existing tablet strength differs from a newly prescribed dose

37. For inpatients, education about antithrombotics begins when therapy is initiated, and most of the information about their antithrombotic therapy after discharge is presented at least 24 hours prior to discharge.

○ Not implemented ○ Partially implemented ○ Fully implemented

CONTINUED...

38. All patient/**caregiver** education for antithrombotic therapy is documented on a multidisciplinary patient education record or other appropriate record, which is kept at the bedside or in the patient's medical record for reference.

○ Not implemented ○ Partially implemented ○ Fully implemented

39. To avoid the potential for duplicate therapy if warfarin is prescribed using both brand and generic names, inpatients and outpatients on warfarin are informed that Coumadin®, Jantoven®, and warfarin contain the same ingredients.

○ Not implemented ○ Partially implemented ○ Fully implemented

40. Inpatients and outpatients (or their **caregivers**) who will be administering heparin products via the subcutaneous route at home demonstrate proficiency with the techniques and methods of drug administration prior to discharge or leaving the facility.

○ Not implemented ○ Partially implemented ○ Fully implemented

41. Prior to discharge, inpatients on warfarin therapy have a confirmed appointment scheduled with the laboratory and physician or antithrombotic clinic, and the importance of keeping follow-up appointments is stressed.

○ Not implemented ○ Partially implemented ○ Fully implemented

Heparin-Induced Thrombocytopenia (HIT)

42. Medical staff–approved protocols exist to treat patients with known or suspected HIT with direct thrombin inhibitors (e.g., argatroban, lepirudin, bivalirudin) if antithrombotic therapy is required.

○ Not implemented ○ Partially implemented ○ Fully implemented

43. Prior to ordering any heparin product (including LMW heparin), prescribers specifically ask patients if they have a known history of HIT and/or an allergy to heparin, and positive responses are documented on the medical record and clearly visible to healthcare practitioners who prescribe, dispense, or administer heparin.

○ Not implemented ○ Partially implemented ○ Fully implemented

44. If a patient's platelet count decreases to less than 100,000/mm3 or less than 50% of the baseline, there is a mechanism in place to ensure that the patient is evaluated for HIT and that all sources of heparin (including LMW heparin, heparin used for arterial line infusions or catheter flushes, and heparin-coated catheters or instruments) are discontinued.

○ Not implemented ○ Partially implemented ○ Fully implemented

45. If HIT is suspected or diagnosed, there is a mechanism in place to ensure that a prominent notation is placed on the patient's medical record, pharmacy patient profile, and medication administration record to alert staff to avoid the administration of, or exposure to, heparin in any form (including LMW heparin, heparin used for arterial line infusions or catheter flushes, and heparin-coated catheters or instruments).

○ Not implemented ○ Partially implemented ○ Fully implemented

46. Patients diagnosed with HIT are instructed to communicate this information to all physicians and other healthcare providers.

○ Not implemented ○ Partially implemented ○ Fully implemented

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Bar-coding technology	Technology that reads bar codes with a computerized reading device, such as a scanner or imager.
Caregiver	Family member, friend, or other person assisting or monitoring the patient's adherence to instructions in the outpatient setting.
Computerized prescriber order entry (CPOE)	A computer system into which prescribers enter medical orders, including orders for medications.
Hard stop (catastrophic stop)	Clinical alert in electronic systems (e.g., infusion pumps, order entry systems) that notifies the user that something is out of range or incorrect and prevents them from continuing. The alert cannot be overridden and the user must start the process over from the beginning.
High-alert medications (or drugs)	Medications that have a high risk of causing serious injury or death to a patient if they are misused. Errors with these products are *not* necessarily more common, but their results can be more devastating. Examples of high-alert medications are warfarin and other anticoagulants, insulin, chemotherapy, opioids, and neuromuscular blocking agents. A complete list can be found at http://www.ismp.org.
Independent double check	A procedure in which two individuals, preferably two licensed practitioners, separately check each component of the work process. An example would be one person calculating a medication dose for a specific patient and a second individual independently performing the same calculation (not just verifying the calculation) and matching results.
Interfaced	A direct link between two information systems such that the information from one system is immediately available to the user of the second system and integrated into the system in a way that supports clinical decision making (e.g., interfacing the laboratory and pharmacy computer systems would immediately provide corresponding laboratory data to the pharmacist while he or she is entering or reviewing a specific medication order). This may or may not include a bidirectional interface of two systems to allow communication in both directions.
Practitioner	A licensed healthcare professional such as a physician, physician assistant, nurse anesthetist, nurse practitioner, nurse, or pharmacist.
Smart infusion pump	An infusion pump with computer software that is, at a minimum, capable of alerting the user to unsafe dose limits and programming errors if standard concentrations and dose limits have been programmed into the pump's library.

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