Thus far in the guide, you have learned:

Part 1
The Model for Improvement, which can be applied to any area you want to improve.

Part 2
A step-by-step guide to using that model to work on reducing adverse drug events, with each of the basic steps—setting aims, forming the team, establishing measures, and developing and testing changes—illustrated with examples.

Part 3
A group of change concepts that can be applied in different ways throughout the medication system to reduce adverse drug events.

Part 4
Achieving Breakthrough Improvement in Reducing Adverse Drug Events

This section provides a comprehensive guide to reducing adverse drug events by showing how organizations in the Collaborative applied the change concepts introduced in Part 3, to different parts of the medication system. Part 4 contains the following sections:

THE BASICS

THE MEDICATION SYSTEM (FLOWCHART)
Changes to Improve the Ordering Process
Changes to Improve the Dispensing Process
Changes to Improve the Administration Process
In the long run, effective error prevention for most hospitals will require substantial redesign of their medication systems. However, in the short run, organizations can achieve substantial gains in patient safety by implementing widely accepted processes and procedures that have already been demonstrated to be effective. Most of these can be implemented promptly without prior data collection or analysis of errors, and provide a sure way to prevent or greatly reduce certain errors.

The Basics  The first steps for error

Enforce standardized prescribing

Many errors result from sloppy or hurried prescribing practices—abbreviating, using code symbols, or leaving out elements of the order. Well-publicized and firmly enforced prescribing rules will reduce errors.

Basic rules for standardized prescribing:

- Use the word “unit,” not “u” or “U”.
- Do not use the letter “Q” or “q” (QD, QID, etc.). Use “Every.”
- Use leading zero (0.1 mg, not .1 mg) but not trailing zero (2 mg, not 2.0 mg).
- Include all elements of the order—dose, strength, units (metric), route, frequency, and rate.
- Use full names (preferably generic).
- Use only authorized abbreviations.
- Use metric system only.
Simplify
Complexity is a cause of error. The more steps, handoffs, and communication required in a process, the greater the likelihood of error. Eliminating any of the steps in a process reduces the chances of error. Streamlining even a part of the medication system will almost always reduce errors.

Changes to simplify the process:
- Eliminate the transcription process by computerization or automatic copying of orders.
- Limit the number of possible concentrations for a drug, particularly high-hazard drugs like morphine, heparin, etc.
- Limit the types of infusion pumps to one or two.

Standardize multiple processes
Widely used in other industries, standardization is the simplest, most broadly applicable and effective method for reducing errors. Standardization is a form of simplification. If all personnel know and follow a single procedure or practice, they are less likely to make errors and more likely to discover errors made by others.

Candidates for standardization include:
- Doses
- Times of administration (for example, antibiotics)
- Packaging and labeling
- Storage (for example, placing medications in the same place in each unit)
- Dosing scales (for example, insulin, potassium)
- Protocols for the use and storage of potentially lethal drugs: potassium injection, insulin, lidocaine, sodium chloride injection, calcium injection, magnesium injection, chemotherapeutic agents, heparin, dextrose injection, narcotics, adrenergic agonists, theophylline
Use unit dosing

Unit dosing, introduced 20 or more years ago, is perhaps the most powerful change ever implemented in the medication system. It substitutes routine and repetitive pharmacist calculation and dispensing for the nonroutine process of the nurse preparing each individual medication, which is a different calculation and task each time. While somewhat more expensive than bulk dispensing and on-site preparation, unit dosing costs less overall by virtue of preventing errors in drug administration that could have far more costly results.

Use pharmacy-based admixture of IV medications

The error-preventive effect of pharmacy IV admixture is analogous to that of unit dosing. Both are examples of the improved efficiency and accuracy that result from specialization. IV calculations and mixing are ad hoc, on-the-spot events when performed on the nursing unit, fraught with error because they are performed occasionally and with a multitude of drugs. In a pharmacy admixture program, standardization and repetition make errors much less likely.

Eliminate too-long or double shifts

Fatigue degrades performance; tired workers make more errors. Health care is unique among the hazardous industries (such as aviation or nuclear power) in that this well-known fact is often ignored.

Use computerized drug profiling in the pharmacy

Every pharmacy should have a complete drug database for each patient against which staff can check each new prescription prior to dispensing the medication. This check system should identify therapeutic duplication, contradictory orders, and potentially harmful drug-drug interactions.
6  Use error-preventive packaging

The Food and Drug Administration (FDA) and drug manufacturers have not done all they could to ensure that pharmacists and nurses can easily tell drugs apart. “Look-alike” packages and ambiguous or unclear labels lead to errors. Pharmacies can repackage look-alikes and provide distinctive packages and labels for lethal drugs. They also can ensure that the labels on all drugs have clear, dark, large, and easy-to-read type.

7  Make allergy information available

Too often, hospitalized patients receive drugs to which they have a known allergy. Hospitals with programs that ensure that all parties—doctors, pharmacists, and nurses—have allergy information available when they need it and for each patient have substantially reduced this risk. This information should be prominently displayed on the order sheets, in the pharmacy, and on the medication administration record (MAR).

10 Institute 24-hour pharmacy service

Only pharmacists should dispense medications. Permitting nonpharmacy personnel (such as the nursing supervisor) to access the pharmacy during off hours is unwise. If there is doubt that this is a problem, ask: Would anyone sanction the reverse—a pharmacist substituting for the nurse or physician during off hours?

11 Have an effective system to monitor and report adverse drug events

Few hospitals are aware of the extent of adverse drug events because staff, fearing punishment or because the reporting system is too complex, do not report errors. When hospitals create a nonpunitive environment and encourage and reward reporting, they will begin to understand the nature and extent of their ADEs, which is the first step toward redesigning systems to reduce errors.
The Medication System

Every organization needs to implement “the basics” as the first step in reducing adverse drug events. But for most hospitals, effective error prevention will require redesign of their medication systems. The medication system in a typical hospital consists of a number of sequential actions carried out by doctors, clerks, pharmacists, technicians, and nurses. At each stage multiple factors determine whether the task will be performed without error. An error-free end result depends on error-free performance at each stage.

Unfortunately, those participating in this system tend to focus on their own part of the process and overlook the extent to which parts of the process are interrelated and the extent to which errors early in the process may cause later errors.

The flowchart is an example of a typical medication system, from ordering through dispensing and administration. Each step is annotated with some of the factors that affect the accuracy and efficiency with which the step is completed.

Most of the steps are critical control points, that is, steps where preventing errors is crucial because unchecked errors can lead to multiple errors later on. Actually, almost every stage in the medication system is a critical control point—but some are more critical than others. While no two hospitals have precisely the same system, all share some essential elements and their accompanying hazards.
Ordering

Prescriber conceives order

The key factor at this step is information: For the prescriber to make a sound decision, the system must provide the right information, when it is needed, and where it is needed, in an easy-to-use format.

Prescriber writes order

Having decided on a drug, does the prescriber write the order correctly? Too often, the answer is no. Errors at this point in the process have a cascade effect and, if not picked up early, can cause a chain of errors—by pharmacy and nursing—that can result in harm to the patient.

Here the issue is communication. Prescribers often write orders that are hard to read, nonstandard in form, and use unauthorized abbreviations. The goal is to ensure unambiguous, error-free communication.

Order legible?

How does the system deal with illegible orders? Do nurses or pharmacists inform prescribers that orders are illegible and clarify questions, or do they resolve the issue informally by guessing (and increase the potential for misinterpretation)?
Ordering (continued)

Order transcribed to MAR
This is often a clerical function with many opportunities for error. The clerk, who may not be very familiar with medications, writes in the medication administration record (MAR) what the prescriber has ordered. Both the legibility of the order and the accuracy of entering the information determine whether this handoff happens without error.

Nurse reviews order
The nurse must make sure that the order is correct: proper in form, unambiguous, and appropriate for the patient. The key to this step is the availability of information. To begin with, the nurse needs to be informed that a new order has been written. What is the system for making sure the nurse is aware of a new order? How does the system ensure that the MAR and the appropriate drug and patient information are available?

Order OK?
If there is a problem with the order, the nurse must consult with the prescriber to clarify the order.
Order transmitted to pharmacy

How is the order transmitted? Whether by fax, pneumatic tube, computer, hand carried, or telephone, each method carries its own unique potential for error.

Pharmacist reviews order

Again, the key is the availability of information. The pharmacist must have the information he or she needs, including:

- Drug information, with dose, form, and compatibility
- Patient information, including age, height, and weight
- Clinical judgment: Is this an appropriate drug for this patient?
- Therapeutic duplication: Is the patient receiving another medication with similar effect?

Order OK?

If the order is unclear, the pharmacist must intervene and consult with the prescriber to clarify the order. Pharmacists frequently intercept prescribing errors, but the goal is to have a system that works so well that such interception becomes virtually unnecessary.
Drug prepared and dispensed

Before an order arrives, two issues must be resolved:
- Drug purchasing: Are drugs provided in appropriate forms and packages and with labeling that minimizes errors?
- Drug storage: Are “look-alike” or “sound-alike” drugs stored separately so that they cannot easily be confused?

The following factors relate specifically to the dispensing function. Here, careful reading, accuracy, and vigilance are important.

To ensure accuracy, the system must address the following:
- Is it the right drug (no mistakes due to look-alikes or sound-alikes)?
- Is the drug appropriate for the patient?
- Did the pharmacist screen for drug-drug interaction, therapeutic duplication, appropriate dosing (age and weight check or body surface area), route, and frequency?
- Are the dose and amount calculated correctly?
- Is the dose prepared correctly?
- Is the packaging unique and not easily confused with another drug?
- Is the labeling clear, including drug identity, dose, and patient identity?

Drug delivered to unit

This handoff has a high potential for error. To ensure accuracy, the system must address the following:
- Is the drug delivered to the right unit, to the right patient, at the right time?
- Are “look-alike” drugs stored separately in the unit?
- If drugs are delivered to a dispensing machine, what procedures are in place to prevent errors?
- If drugs are delivered in unit dose carts, what ensures that the cart-filling process was correct?
RN matches drug to MAR
Verification by the nurse is vital for the system to ensure the drug dose is given as prescribed and as recorded in the medication administration record. And conversely, the nurse must check that the MAR is accurate and up to date regarding drugs given, times, and other details.

RN prepares to administer dose
The goal of this step is to achieve the “Five Rights”: the right drug gets to the right patient in the right dose at the right time by the right route.

To ensure accuracy, the system must answer the following:
• Are monitoring data available when and where needed?
• Are there protocols that apply? Does the dose fit?
• Is the dispensing machine used properly? Does it increase or decrease errors?
• Is unit dosing used?
• If unit dosing is not used, then how are calculation, counting, and measuring accuracy ensured?

RN takes drug to patient
This process may not be as straightforward as it seems:
• Are medications prepared a long distance away?
• Will there be distractions along the way?
• If the patient is not in the room, when can the dose be given?
Correct patient?
Is there a fool-proof system for ensuring that the medication is given to the correct patient?

Drug administered
Each route has its own risks. Parenteral use, in particular, can result in many errors. A host of technical factors can combine to cause errors, including IV equipment malfunction or pump failures. Self-administration has some advantages, but may pose additional problems.

Medications charted
Are all medications charted in one place so that anyone—doctors, pharmacists, nurses—can easily find out whether a patient has received a dose, or are there multiple records that potentially lead to errors and confusion? Are medications charted correctly?
Patient response monitored

Is the necessary information about a patient's response to medication available on a chart when needed? Are procedures in place to initiate a change if the response is not as expected?

IMPROVING THE MEDICATION SYSTEM

Each major process in the medication system—ordering, dispensing, and administration—has its own unique opportunities for error. However, a few key change concepts have been found to be particularly useful in redesigning all three processes to improve patient safety.

For each major process in the medication system, the charts on pages 92–118 indicate the following:

- **Change concepts that are useful in redesigning the process**
- **Problems in applying each change concept**
- **Useful process changes**
- **Examples of process changes tested by organizations either before or during the Collaborative**
- **Resources**

This symbol indicates that a resource developed by an organization in the Collaborative is included at the end of Part 4.
## Changes to Improve the Ordering Process

### Reduce Reliance on Memory

**Ordering Problems**
- There are too many drugs and too many facts to be remembered.
- When prescribers rely on memory, they forget important details about drugs or patients.

**Useful Process Changes**
- Use computerized prescriber order entry.
- Use preprinted orders.
- Use guided dose algorithms.
- Check dose ranges.
- Use protocols for hazardous drugs (chemotherapy, insulin, anticoagulants, etc.).
- Make accurate allergy information available to the physician, the pharmacist, and the nurse.
- Use an automatic dose reduction plan.

### Use preprinted orders.

Using dosing algorithms reduces the need to rely on memory. Dosing algorithms have been used successfully in the administration of antibiotics, chemotherapeutics, heparin, and parenteral nutrition. Many algorithms can be printed on order sheets so that a physician writing an order can insert patient information into the formula that is already printed and calculate the dose. Eliminating the need to remember multiple formulas makes dosing far more reliable.

### Use an automatic dose reduction plan.

Elderly patients and patients with renal failure need to receive substantially lower doses of many medications than those generally prescribed for adults. Physicians frequently forget to prescribe lower doses for these patients. One hospital instituted a program in which the pharmacist automatically reduces doses as needed for elderly patients and those with renal failure, thus virtually eliminating overdosing in these patients.

### Examples of Process Changes Tested

- Allegheny General Hospital
- Bay Medical Center
- The Cambridge Hospital
- Cedars-Sinai Medical Center
- Children's Hospital, Boston
- Dartmouth-Hitchcock Medical Center
- Deaconess-Nashoba Hospital
- Fairview Health System
- Garden City Hospital
- Kaiser Foundation Health Plan, Inc.
- Kaweah Delta Health Care District
- Lee Memorial Hospital
- Lucile Salter Packard Children's Hospital at Stanford
- Northwest Covenant Medical Center
- Paoli Memorial Hospital
- Pontiac Osteopathic Hospital Medical Center
- Promina Gwinnett Health System
- The Valley Hospital
Change Concept

Simplify

Ordering Problems

• The large number of drugs increases the likelihood of error.
• The need for transcribing orders introduces an additional opportunity for error.

Useful Process Changes

• Limit the number of drugs in the formulary.
• Limit the number of dose options.
• Use protocols for hazardous drugs.
• Eliminate transcription.

Examples of Process Changes Tested

Limit the number of drugs in the formulary.

Many highly toxic drugs or drugs likely to be used incorrectly have little therapeutic advantage over other less hazardous drugs designed to treat the same disorders. One hospital removed these hazardous drugs from the formulary, thus eliminating hundreds of potential adverse drug events per year.

Tested and implemented by:
Dartmouth-Hitchcock Medical Center
Deaconess-Nashoba Hospital
Fairview Health System
Kaweah Delta Health Care District
Morton Plant Mease Health Care
Northwest Covenant Medical Center
Promina Gwinnett Health System
### Change Concept

#### Standardize

<table>
<thead>
<tr>
<th>Ordering Problems</th>
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</thead>
<tbody>
<tr>
<td>• Stylistic practices, such as individual differences in the use of terminology, use of improper abbreviations, and failure to follow rules continue to be tolerated.</td>
</tr>
<tr>
<td>• Physicians use multiple “sliding scales” for insulin.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Useful Process Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use standard usage rules (for example, “unit” not “u”; leading not trailing zeroes).</td>
</tr>
<tr>
<td>• Use abbreviations sparingly; use standard abbreviations only.</td>
</tr>
<tr>
<td>• Use standard measures (metric).</td>
</tr>
<tr>
<td>• Use preprinted orders.</td>
</tr>
<tr>
<td>• Reject illegible orders.</td>
</tr>
</tbody>
</table>

### Examples of Process Changes Tested

#### Reject nonstandard orders.

Many organizations set standards for prescribing practices, including rules for appropriate abbreviations and notations. They notified medical staff in staff meetings, sent letters to all, put the information in newsletters, and placed a laminated copy of the standards on all charts. All orders were clarified and filled promptly, but after three weeks, physicians still using nonstandard notation received in the mail their nonstandard orders accompanied by a “pink slip.” This process proved very effective, and the percentage of nonstandard or illegible orders received in the pharmacy dropped by 60%.

#### Tested and implemented by:

<table>
<thead>
<tr>
<th>Morton Plant Mease Health Care</th>
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<td>Munson Medical Center</td>
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<td>Paoli Memorial Hospital</td>
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<td>Pontiac Osteopathic Hospital Medical Center</td>
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<tr>
<td>Promina Gwinnett Health System</td>
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<tr>
<td>The Valley Hospital</td>
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</tbody>
</table>

Adult Medication Order Guidelines (pp. 122–123)

Dartmouth-Hitchcock Medical Center
<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Use Constraints and Forcing Functions</th>
</tr>
</thead>
</table>
| **Ordering Problems** | • Excessively hazardous drugs are ordered when safer substitutes are available.  
• Many ordering processes permit ordering of toxic or lethal doses. |
| **Useful Process Changes** | • Use computerized order entry.  
• Make high-hazard drugs and doses unavailable for use.  
• Allow certain drugs to be used only by protocol. |
| **Examples of Process Changes Tested** | **Use computerized order entry.**  
Most computerized order entry systems are programmed so that medications have dose range checks based on the age, height, and weight of patients, as well as screens for allergies. The prescriber cannot specify a dose that is improper for the patient. A more sophisticated system can calculate dosages for the prescriber, given the medication, its indication, and the height, weight, and age of the patient. Of course, most of these systems allow the user to override the computer, but to do so requires some effort—which often allows the prescriber time to reflect on the correct dose. |

**Tested and implemented by:**  
Bay Medical Center  
Children's Hospital of Philadelphia  
Dana-Farber Cancer Institute  
Maine Medical Center
## Change Concept

### Use Protocols and Checklists Wisely

#### Ordering Problems
- Complicated medication routines, such as those used for anticoagulation and for chemotherapy, frequently lead to errors.

#### Useful Process Changes
- Use protocols for hazardous drugs.
- Use preprinted orders.

## Examples of Process Changes Tested

### Orders for Chemotherapy
(pp. 124–125)
Fairview Health System

<table>
<thead>
<tr>
<th>Tested and implemented by:</th>
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<tbody>
<tr>
<td>Allegheny General Hospital</td>
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<td>Bay Medical Center</td>
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<tr>
<td>The Cambridge Hospital</td>
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<tr>
<td>Children's Hospital of Philadelptha</td>
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<tr>
<td>Dana-Farber Cancer Institute</td>
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<tr>
<td>Deaconess-Nashoba Hospital</td>
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<td>Deaconess-Waltham Hospital</td>
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<td>Fairview Health System</td>
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<td>Garden City Hospital</td>
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<td>Latrobe Area Hospital</td>
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<tr>
<td>Lucile Salter Packard</td>
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<tr>
<td>Children's Hospital at Stanford</td>
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<tr>
<td>Maine Medical Center</td>
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<tr>
<td>Northwest Covenant Medical Center</td>
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<tr>
<td>Pontiac Osteopathic Hospital Medical Center</td>
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<tr>
<td>Promina Gwinnett Health System</td>
</tr>
<tr>
<td>The Valley Hospital</td>
</tr>
</tbody>
</table>
### Change Concept

#### Improve Access to Information

**Ordering Problems**
- Medical records and nursing charts do not make information easily available. Few are on-line.
- Drug information is not easily available at the time it is needed.
- Communication among multiple caregivers is often incomplete.

**Useful Process Changes**
- Use a computerized medical record.
- Use computerized order entry.
- Have a pharmacist make rounds with doctors and nurses.
- Have a pharmacist available on the unit rather than in the pharmacy.
- Make protocols available at order entry.
- Provide for effective recovery and display of allergy information.
- Provide for effective feedback of lab findings.

**Examples of Process Changes Tested**

**Have a pharmacist make rounds with doctors and nurses.**

Several organizations have begun to include a clinical pharmacist on the nursing units. Having pharmacists available when physicians are writing orders (during rounds) allows for a dialogue between physicians and pharmacists concerning specific medications and makes it easier to get the order right the first time. This also prevents the delay in ordering that occurs when an incorrect order goes to the pharmacy before the error is identified and corrected, usually requiring an additional call to the physician.

Figure 4.1 shows the increase in the number of days between medication interventions that occurred at one hospital when a pharmacist began participating in ICU rounds in October 1996. When this pilot test stopped in November, the interventions again became more frequent.

![Figure 4.1 Increase in Days Between Medication Interventions](image)

**Tested and implemented by:**
- The Cambridge Hospital
- Dana-Farber Cancer Institute
- Dartmouth-Hitchcock Medical Center
- Deaconess-Waltham Hospital
- Kaweah Delta Health Care District
- Northwest Covenant Medical Center
- Pontiac Osteopathic Hospital Medical Center
- The Valley Hospital
## Changes to Improve the Dispensing Process

<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Reduce Reliance on Memory</th>
</tr>
</thead>
</table>
| **Dispensing Problems** | • Drug and patient information is too extensive and complicated to remember.  
• Look-alike and sound-alike drugs are difficult to distinguish. |
| **Useful Process Changes** | • Use computerized order entry.  
• Use computer profiling of patient data.  
• Use computerized drug information.  
• Use computerized alerts.  
• Use preprinted orders.  
• Use robotic dispensing.  
• Bar-code drugs.  
• Label boldly and clearly.  
• Print recommended rate of administration on label. |

### Examples of Process Changes Tested

<table>
<thead>
<tr>
<th>Use computer profiling of patient data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many pharmacies use computers to profile patients’ medications and monitor utilization. These systems use a checking program to identify drug-drug interactions. When a new prescription is entered for a patient, the program searches available patient information and identifies contraindications for use of that drug.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tested and implemented by:</th>
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<tr>
<td>The Cambridge Hospital</td>
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<tr>
<td>Children’s Hospital, Boston</td>
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<tr>
<td>Kaiser Foundation Health Plan, Inc.</td>
</tr>
<tr>
<td>Latrobe Area Hospital</td>
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<tr>
<td>Maine Medical Center</td>
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<tr>
<td>Morton Plant Mease</td>
</tr>
<tr>
<td>Health Care</td>
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</table>
### Change Concept

#### Simplify

<table>
<thead>
<tr>
<th>Dispensing Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Multiple dosage forms increase the opportunity for error.</td>
</tr>
<tr>
<td>- Multiple steps in the dispensing process increase the likelihood of error.</td>
</tr>
</tbody>
</table>

#### Useful Process Changes

- Limit the choice of drugs.
- Limit the doses for each drug.
- Limit the number of administration times.
- Institute a pharmacy IV admixture program.
- Repackage drugs to eliminate look-alikes.
- Allow automatic drug dispensing on the nursing unit.

#### Examples of Process Changes Tested

**Limit the doses for each drug.**

Several organizations have limited the concentrations of heparin solutions available on the nursing units to one. Nurses report fewer near misses—times when they almost used the wrong strength.

Most hospital pharmacies are able to identify the two or three IV solutions that are used most often and how much of these solutions is used each day. In several organizations, the pharmacy mixed a stock of these solutions in a batch each day so that during the press of a busy day only a few had to be mixed to order. There was occasional waste when solutions expired, but teams believed that the errors prevented by doing the admixture on the slower-paced night shift more than compensated for this cost.
<table>
<thead>
<tr>
<th>Change Concept</th>
<th><strong>Standardize</strong></th>
</tr>
</thead>
</table>
| **Dispensing Problems** | - Manufacturers do not provide standardized products or packaging.  
- Pharmacists sometimes have idiosyncratic practices. |
| **Useful Process Changes** | - Standardize the following: doses, dosing times, storage locations, concentrations, packaging, labels, delivery times.  
- Institute an IV admixture program.  
- Use protocols for hazardous drugs.  
- Conduct a systematic review of every order. |
| **Examples of Process Changes Tested** | **Standardize doses.** Restricting the number of dose choices reduces errors. Not only is there less for everyone to remember, but when doctors, pharmacists, and nurses become accustomed to the standard doses, they instantly recognize when an error has been made.  
**Tested and implemented by:**  
Allegheny General Hospital  
Bay Medical Center  
Children's Hospital, Boston  
Children's Hospital of Philadelphia  
Dartmouth-Hitchcock Medical Center  
Fairview Health System  
Good Samaritan Regional Health Center  
Grand View Hospital  
Lucile Salter Packard Children's Hospital at Stanford  
Maine Medical Center  
Morton Plant Mease Health Care  
Paoli Memorial Hospital  
Promina Gwinnett Health System  
The Valley Hospital |
| **Standardize packaging and labels.** One organization stocked two concentrations of morphine sulfate in identical cartridges. In order to prevent wrong-dose errors, the pharmacy labeled the higher concentration cartridge with bright orange tape. This extra packaging step prevented mix-ups in administering the morphine and averted cases of overdose.  
**Tested and implemented by:**  
Allegheny General Hospital  
Bay Medical Center  
Children's Hospital, Boston  
Dartmouth-Hitchcock Medical Center  
Deaconess-Nashoba Hospital  
Grand View Hospital  
Kaiser Foundation Health Plan, Inc.  
Morton Plant Mease Health Care  
Promina Gwinnett Health System  
The Valley Hospital |
## Change Concept

<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Use Constraints and Forcing Functions</th>
</tr>
</thead>
</table>
| **Dispensing Problems** | - Stylistic practices exist in the pharmacy; different pharmacists dispense and label medications differently.  
- Medication orders can be processed without the pharmacy knowing a patient's clinical conditions (for example, allergies or renal failure).  
- Toxic drugs can be ordered in excessive doses. |
| **Useful Process Changes** | - Program the computer not to process an order unless key information has been entered.  
- Dispense epidural medications only in unique spinal syringes.  
- Remove hazardous drugs of limited value from the formulary.  
- Use automatic dose reduction for the elderly and patients with renal failure. |
| **Examples of Process Changes Tested** | Program the computer not to process an order unless key information has been entered.  

An effective way to eliminate errors is to program the pharmacy computer to require entry of certain critical information (such as drug allergies, height, weight, date of birth) before an order for medication can be processed. The responsibility for obtaining these data still rests with the nurse, but this change ensures a fail-safe check before any medication is dispensed. |  

**Tested and implemented by:**  
Bay Medical Center  
Dana-Farber Cancer Institute  
Garden City Hospital  
Grand View Hospital  
The Valley Hospital
### Use Protocols and Checklists Wisely

#### Dispensing Problems
- Complicated processes are difficult to remember.
- Variation in the use of hazardous drugs increases the likelihood of error.

#### Useful Process Changes
- Use protocols for hazardous drugs.
- Require double check by a second person for hazardous drugs.

### Examples of Process Changes Tested

**Require second checks for hazardous drugs.**

Checklists and preprinted protocols are especially useful in dealing with hazardous drugs where errors can potentially be fatal.

In the pharmacy, most chemotherapeutics and total parenteral nutrition (TPN) solutions are double checked by a second pharmacist before dispensing.

**Tested and implemented by:**

- Bay Medical Center
- Cedars-Sinai Medical Center
- Children's Hospital, Boston
- Dana-Farber Cancer Institute
- Deaconess-Nashoba Hospital
- Deaconess-Waltham Hospital
- Morton Plant Mease Health Care

- Northwest Covenant Medical Center
- Promina Gwinnett Health System
- The Valley Hospital
### Change Concept

**Improve Access to Information**

<table>
<thead>
<tr>
<th>Dispensing Problems</th>
<th>Useful Process Changes</th>
</tr>
</thead>
</table>
| Important patient information (for example, presence of allergies and laboratory data) is not always sent to the pharmacy. | • Use computerized order entry.  
• Use computer profiling of patient data.  
• Use computerized drug information.  
• Make the formulary available on-line.  
• Use computerized alerts.  
• Use preprinted orders.  
• Print IV administration guidelines and compatibility charts.  
• Use on-line laboratory data.  
• Include critical information on drug labels. |

<table>
<thead>
<tr>
<th>Examples of Process Changes Tested</th>
<th>Tested and implemented by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use computerized alerts.</td>
<td>Bay Medical Center</td>
</tr>
<tr>
<td>Program pharmacy computers to deliver a warning when an abnormal laboratory finding (such as a very high PT or PTT) is obtained, as well as when the patient is taking another medication that is incompatible with a new drug being ordered.</td>
<td>The Cambridge Hospital</td>
</tr>
<tr>
<td></td>
<td>Children's Hospital, Boston</td>
</tr>
<tr>
<td></td>
<td>Dana-Farber Cancer Institute</td>
</tr>
<tr>
<td></td>
<td>Northwest Covenant</td>
</tr>
<tr>
<td></td>
<td>Medical Center</td>
</tr>
<tr>
<td></td>
<td>Promina Gwinnett Health System</td>
</tr>
<tr>
<td>Change Concept</td>
<td><strong>Decrease Reliance on Vigilance</strong></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| **Dispensing Problems** | - Look-alike and sound-alike drugs increase the chance of errors.  
- Pharmacists may fail to intercept out-of-range doses.  
- Errors will occur when only one person is responsible for preventing them. |
| **Useful Process Changes** | - Institute automatic, daily monitoring of doses of toxic drugs (for example, chemotherapy).  
- Eliminate look-alike drugs. Repackage as needed.  
- Store look-alike drugs separately.  
- Develop a system to differentiate sound-alike drugs.  
- Enlist the patient and family in vigilance tasks. |

### Examples of Process Changes Tested

**Institute automatic, daily monitoring of doses of toxic drugs (for example, chemotherapy).**

Have another observer monitor the use of toxic drugs. One hospital used a clinical pharmacist to monitor daily the use of high-hazard substances on specific units. Heparin, aminoglycosides, chemotherapeutics, and experimental drugs are examples of the types of medications that require increased attention.

**Eliminate look-alike drugs. Repackage as needed.**

One organization stocked two concentrations of morphine sulfate in identical cartridges. To reduce wrong-dose errors, the pharmacy labeled the higher concentration cartridge with bright orange tape. (See “Standardize packaging and labels” on p. 100.)

**Tested and implemented by:**
- Dana-Farber Cancer Institute
- Fairview Health System
- Promina Gwinnett Health System

**Tested and implemented by:**
- Bay Medical Center
- Children’s Hospital, Boston
- Dartmouth-Hitchcock Medical Center
- Deaconess-Nashoba Hospital
- Fairview Health System
- Garden City Hospital
- Grand View Hospital
- Kaweah Delta Health Care District
- Munson Medical Center
- Northwest Covenant Medical Center
- Promina Gwinnett Health System
<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Reduce Handoffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispensing Problems</td>
<td>• Multiple participants—pharmacists, technicians, clerks, and others—increase the chance of error.</td>
</tr>
</tbody>
</table>
| Useful Process Changes | • Use computerized order entry.  
 • Use computerized order transfer.  
 • Use a satellite pharmacy.  
 • Use a computerized medication administration record (MAR).  
 • Use robotic dispensing.  
 • Use unit dosing.  
 • Use automatic dispensing. |
| Examples of Process Changes Tested | Use a satellite pharmacy.  
 Decentralization of pharmacy functions increases the ease of communication and reduces the number of people involved in each drug handoff. In addition, the principle of “going where the action is” not only makes the pharmacist more accessible, but enhances the job satisfaction of some pharmacists by making them more personally involved in the patient care process. |

Tested and implemented by:  
Children’s Hospital, Boston  
Promina Gwinnett Health System
Changes to Improve the Administration

**Reduce Reliance on Memory**

**Administration Problems**
- There are too many drugs and too many facts to remember. Nurses may forget patients’ drug allergies.
- On-time administration of medications depends on the nurse’s memory.

**Useful Process Changes**
- Make allergy information readily available.
- Use patient allergy color-coded wristbands.
- Partner with the patient.
- Make drug information readily available.
- Bar code drugs.
- Use timers or reminder systems.
- Use IV guidelines.
- Use protocols for hazardous drugs.
- Use protocols for epidural medications.
- Use guidelines for the use of infusion pumps.
- Reduce variation in equipment and supplies.

**Examples of Process Changes Tested**

**Partner with the patient.**
Enlist the assistance of conscious and cooperative patients by asking them to double check what medications they are getting and when. In one organization, the patients received a list of their medications daily. When the nurse came to administer medications, the nurse reviewed the list with the patients. This offered both a double check and an opportunity to educate the patient. Using this method prevented many errors, and the patients liked being involved in their care as well.

**Use timers or reminder systems.**
In one organization, the IV antibiotics often “ran out” and were not switched back to the main IV bag because the nurse, busy with other patients, forgot to change the bag. The solution: Nurses hung small digital timers on the doors of patients’ rooms to remind them when to change specific IV piggyback medications. If the patient’s nurse was not nearby, someone else would hear the alarm and notify the nurse, who could then make the appropriate change.
Use IV guidelines.

One organization wanted to ensure the accuracy of cardiovascular drip rates for NICU patients, concerned that the process of calculating drips under urgent conditions was prone to error. To prevent miscalculations, the team in the NICU developed a guideline for mixing the solutions and setting the drip rate to maintain the proper dose and fluid volume per hour.
<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Simplify</th>
</tr>
</thead>
</table>
| Administration Problems | • The need for the nurse to mix medications provides an opportunity for error.  
• Some hospitals use multiple types of infusion pumps.  
• Multiple participants, multiple drugs, and multiple dose strengths make administration complex and susceptible to error. |
| Useful Process Changes | • Limit the following: choice of drugs, access to the medication room, doses for each drug, number of administration times.  
• Institute a pharmacy IV admixture program.  
• Institute automatic drug dispensing on the nursing unit.  
• Reduce the number of protocols for hazardous drugs (for example, KCl, insulin, anticoagulants, chemotherapy).  
• Use unit dosing.  
• Have a single record for entry of medications.  
• Use standard equipment with simple instructions and a convenient user interface. |

**Examples of Process Changes Tested**

<table>
<thead>
<tr>
<th>Limit the number of administration times.</th>
<th>Tested and implemented by:</th>
</tr>
</thead>
</table>
| M any organizations have shifted to once-per-day aminoglycoside doses, thus preventing the need to adjust the dose throughout the day based on blood levels from the lab. | Deaconess-Nashoba Hospital  
Deaconess-Waltham Hospital  
Morton Plant Mease Health Care  
Northwest Covenant Medical Center  
Promina Gwinnett Health System  
St. Marys Hospital Medical Center |

<table>
<thead>
<tr>
<th>Institute a pharmacy IV admixture program.</th>
<th>Tested and implemented by:</th>
</tr>
</thead>
</table>
| In most organizations, the pharmacy places additives in IV solutions. Removing the task of calculating and mixing additives such as KCl from nursing staff simplifies the administration process for the nurses. The pharmacy is better organized to carry out this process, providing the required accuracy and a distraction-free environment. The properly mixed solution comes from pharmacy when needed, and the nurse need only verify correctness and calculate the flow rate (perhaps using an IV drip rate “cheat sheet”). Purchasing premixed solutions from the manufacturer reduces the risk of errors even further. | Children's Hospital, Boston  
Grand View Hospital  
Promina Gwinnett Health System |
Use equipment with simple instructions and a convenient user interface.

Hospitals frequently use infusion pumps to regulate the flow of IV fluids. Nursing staff rely on the accuracy and good working order of these pumps. Pumps that frequently deliver false alarms are annoying, and the nursing staff may respond by ignoring the alarms or turning them off. Select pumps that give information about the cause for the alarm, have moderate sensitivity, and prevent free flow when the unit is turned off. Also, stock only one or two types of pumps per nursing unit.

Reduce the number of protocols for hazardous drugs (for example, potassium chloride, insulin, anticoagulants, chemotherapy).

Many organizations have simplified their work by restricting the number of protocols for the same medication. When nurses have three or four heparin protocols, it is easier for them to confuse which protocol is being used. Using only one protocol for deep vein thrombosis prophylaxis and one for treatment of embolism helps staff remember what is required.

Use unit dosing.

In most organizations, medications arrive at the floor ready to be packaged and administered specifically to each patient. The pharmacy fills a drawer for each patient with single-dose packages of the medications ordered for the patient for the day and brings the drawer to the unit. The nurse need not prepare the medications from a vast floor stock, a task that requires making calculations and drawing up or mixing the medications. The task is simplified: the nurse finds the medication ordered in the drawer, verifies the correctness (right dose, drug, time, patient, and route), and administers it to the patient.

<table>
<thead>
<tr>
<th>Examples of Process Changes Tested (continued)</th>
<th>Tested and implemented by:</th>
</tr>
</thead>
</table>
| **Reduce the number of protocols for hazardous drugs** (for example, potassium chloride, insulin, anticoagulants, chemotherapy). | Children's Hospital of Philadelphia  
Dartmouth-Hitchcock Medical Center  
Fairview Health System  
Garden City Hospital  
Good Samaritan Regional Health Center  
Maine Medical Center |
| **Use unit dosing.** | Children's Hospital, Boston  
Deaconess-Nashoba Hospital  
Promina Gwinnett Health System |
| **Use equipment with simple instructions and a convenient user interface.** | |
Change Concept

Standardize

Administration Problems

• For certain drugs, ordered doses vary widely.
• Administration times for ordered drugs vary widely.
• Physicians use multiple dosing scales for insulin, heparin, and other medications.
• Complex drug regimens are difficult to follow.

Useful Process Changes

• Standardize the following: doses, administration times, delivery times, storage locations, concentrations, infusion pumps
• Institute an IV admixture program.
• Use preprinted orders.
• Use protocols for hazardous drugs.
• Use protocols for epidural infusion.

Examples of Process Changes Tested

Standardize administration times.

One organization established a protocol for administration of prophylactic, preoperative antibiotics that require that the first dose be given in the holding area just before wheeling the patient into the operating room. Thus, they reduced the interval from first dose to incision time to 60 minutes—a reduction of 66% from previous levels.

Standardize storage locations.

Every medication room in a hospital is laid out in the same way and medications are stored in the same place. One organization decided to store the two concentrations of IV heparin on separate shelves in the medication room. Storing look-alike bags side-by-side had been a case of wrong-dose errors waiting to happen. After changing the location of the higher-dose bag and notifying nurses of the change, the number of near misses (taking the wrong concentration off the shelf) decreased.
Use protocols for hazardous drugs.

Many organizations used insulin sliding-scales and chemotherapy, potassium replacement, and other protocols. The protocols educated staff such that everyone knew what was expected. Completing the task the same way each time eliminated confusion among staff as to what would be the next step or who was responsible. In addition, protocols eliminated the need for time-consuming ad hoc communication with the prescriber about lab results and dosing.

Sliding-Scale Insulin Protocol for Adults
(p. 129)
Garden City Hospital

Testing and implementation:

- Allegheny General Hospital
- The Cambridge Hospital
- Children's Hospital of Philadelphia
- Deaconess-Nashoba Hospital
- Deaconess-Waltham Hospital
- Fairview Health System
- Garden City Hospital
- Lucile Salter Packard Children's Hospital at Stanford
- Maine Medical Center
- Northwest Covenant Medical Center
- Pontiac Osteopathic Hospital Medical Center
- Promina Gwinnett Health System
### Change Concept

#### Use Constraints and Forcing Functions

<table>
<thead>
<tr>
<th>Problems</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Availability of concentrated potassium chloride permits accidental fatal injection.</td>
<td>• Remove hazardous drugs from the nursing unit (for example, concentrated KCl).</td>
</tr>
<tr>
<td>• Similar fittings permit accidental IV injection of gastrostomy feeding solution.</td>
<td>• Use special fittings to prevent the mismatch of enteral and parenteral medications to the wrong route.</td>
</tr>
<tr>
<td>• Certain drugs (for example, KCl, insulin) can easily be fatal if the wrong dose is accidentally given.</td>
<td>• Limit access to the medication room.</td>
</tr>
</tbody>
</table>

#### Examples of Process Changes Tested

<table>
<thead>
<tr>
<th>Remove hazardous drugs from the nursing unit (for example, concentrated KCl).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many organizations removed concentrated potassium from floor stock, thus forcing the admixture process to the pharmacy. This constraint prevents the accidental infusion of concentrated potassium (which causes eight to twelve deaths annually in U.S. hospitals) and also decreases the likelihood of inaccurate dosing due to admixture mistakes on the nursing units.</td>
</tr>
</tbody>
</table>

#### Tested and implemented by:

- Allegheny General Hospital
- Dartmouth-Hitchcock Medical Center
- Deaconess-Nashoba Hospital
- Deaconess-Waltham Hospital
- Fairview Health System
- Garden City Hospital
- Grand View Hospital
- Kaiser Foundation Health Plan, Inc.
- Kaweah Delta Health Care District
- Morton Plant Mease Health Care
- Munson Medical Center
- Northwest Covenant Medical Center
- Paoli Memorial Hospital
- Pontiac Osteopathic Hospital Medical Center
- Promina Gwinnett Health System
- The Valley Hospital
Use Protocols and Checklists Wisely

Administration Problems
- Multiple dosing schedules for hazardous drugs increase the potential for error.
- On-time administration of medications (for example, preoperative antibiotics) depends on nurse memory.
- Complex processes are difficult to remember accurately.
- Some regimens (for example, chemotherapy) must be carried out precisely.

Useful Process Changes
- Use protocols for hazardous drugs.
- Use protocols for epidural drugs.
- Use protocols for preoperative antibiotics.
- Coordinate insulin dosing with labs and meals.
- Use double check systems for blood products and high-hazard substances.

Examples of Process Changes Tested

Use protocols for hazardous drugs.

By establishing one weight-based heparin protocol for prophylaxis, organizations eliminated the constant phoning and dosage adjustment that occurs in the absence of the protocol. The nursing staff learn just one protocol and become familiar with it, which, in turn, allows them to speed up the steps required to respond to lab results. As a result of one organization's work, the average time required to reach a therapeutic level dropped from more than 24 hours to less than 8 hours, and the number of dosage adjustments decreased as well.

Heparin Protocol Dosing Order Sheet (p. 130)
Latrobe Area Hospital

Tested and implemented by:
- Children's Hospital, Boston
- Garden City Hospital
- Latrobe Area Hospital
- Northwest Covenant Medical Center
- Promina Gwinnett Health System
- The Valley Hospital
<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Improve Access to Information</th>
</tr>
</thead>
</table>
| **Administration Problems** | • Medical records and nursing charts are not organized to make information easily available. Few are on-line.  
• Drug and patient information is not readily available when and where nurses need it.  
• There are too many drugs and too many facts for nurses to remember. |
| **Useful Process Changes** | • Make allergy information prominently available on the medication administration record (MAR).  
• Provide a pharmacist on the unit.  
• Make computerized drug information easily accessible.  
• Make patient clinical and lab information available on-line.  
• Display protocols in the medication room.  
• Have patients wear color-coded allergy wristbands.  
• Partner with patients about drug names, doses, and times.  
• Locate the MAR at the bedside.  
• Place commonly used information where it is needed.  
• Post generic/trade name “translation” charts. |

**Examples of Process Changes Tested**

<table>
<thead>
<tr>
<th>Test Concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Have patients wear color-coded allergy wristbands.</strong></td>
<td>One organization instituted a red identification wristband for patients with drug allergies. The red color prompted the nursing staff to recheck allergies prior to giving any medications, thus preventing the patient from receiving the wrong medication.</td>
</tr>
<tr>
<td><strong>Locate the medication administration record (MAR) at the bedside.</strong></td>
<td>One organization moved the medications and the medication administration record to the bedside. With this information available at the point of administration, it was much easier to see what the patient needed, and omissions, wrong doses, and wrong-drug errors were prevented. This system required extra steps to update medication administration records when orders changed, but the errors averted by having information available at the bedside more than compensated for the extra work.</td>
</tr>
</tbody>
</table>

**Tested and implemented by:**

- Bay Medical Center
- Pontiac Osteopathic Hospital Medical Center
- Morton Plant Mease Health Care
- Promina Gwinnett Health System
Examples of Process Changes Tested (continued)

Medication Administration Times for Food/Drug Interactions (pp. 131–132)
Methodist Hospital/HealthSystem Minnesota

Place commonly used information where it is needed.

Nursing staff cannot reliably recall all the necessary information concerning protocols, drug interactions, trade and generic names, and other facts. To address this problem, many organizations placed easy-to-read laminated information sheets or cards where they are needed. Dosing protocols are printed on laminated cards that clinicians can keep in their lab coat pockets. A listing of times that medications need to be given in order to avoid negative interactions with food is posted on the medication cart. IV drip rate calculation sheets are hung on IV pumps. Such “cheat sheets” serve to make information available at the point of use.

Post generic/trade name “translation” charts.

One hospital was concerned about sound-alike and look-alike narcotics in the narcotics cabinet, as well as confusion of trade and generic names. The team put together a generic/trade name chart and attached it to the narcotics box. As a result, nurses could correctly identify the right medication, regardless of whether the ordering physician used a trade or generic name, and wrong-drug errors decreased.

Tested and implemented by:
The Cambridge Hospital
Children’s Hospital, Boston
Deaconess-Nashoba Hospital
Deaconess-Waltham Hospital
Good Samaritan Regional Health Center
Grand View Hospital
Kaiser Foundation Health Plan, Inc.
Pontiac Osteopathic Hospital Medical Center
St. Marys Hospital Medical Center

Tested and implemented by:
Deaconess-Nashoba Hospital
Fairview Health System
Grand View Hospital
Morton Plant Mease Health Care
Northwest Covenant Medical Center
Promina Gwinnett Health System
## Change Concept

### Decrease Reliance on Vigilance

#### Administration Problems
- Fatigue, overwork, complexity of tasks, and responsibility for multiple patients make it difficult for nurses to maintain vigilance.

#### Useful Process Changes
- Remove high-hazard medications from the nursing unit.
- Use automatic drug dose checking.
- Use checklists.
- Use premixed IV bags.
- Use a double check system for hazardous drugs.
- Eliminate look-alike drugs.
- Use distinctive, clear labels.
- Use targeted monitoring for hazardous drugs.

### Examples of Process Changes Tested

#### Use a double check system for hazardous drugs.

Many organizations use a double check system for administering blood products and insulin. The nurse administering the medication shows another nurse the order and the dose and explains how it was calculated. This procedure, while cumbersome, can be extended to apply to other high-hazard drugs such as narcotics, chemotherapy, and heparin. While the risk is that the double checks will be cursory, if done with care they can detect errors.

#### Use targeted monitoring for hazardous drugs.

Monitors that track the therapeutic effects and side effects of specific drugs reduce reliance on vigilance. One organization noticed excessive narcotics doses and instituted routine monitoring of respiration rate every hour for patients on narcotics. The use of antidotes for narcotic overdose decreased to near zero.

Monitoring the electrocardiogram for any patient on cardiac active drugs and monitoring blood pressure electronically for patients on vasopressors are other examples of targeted monitoring.

### Tested and Implemented by:

- Bay Medical Center
- The Cambridge Hospital
- Cedars-Sinai Medical Center
- Children's Hospital, Boston
- Dana-Farber Cancer Institute
- Deaconess-Nashoba Hospital
- Deaconess-Waltham Hospital
- Northwest Covenant Medical Center
- Promina Gwinnett Health System
- The Valley Hospital

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Narcotic Flowsheet (p. 133)
Kaweah Delta Health Care District
<table>
<thead>
<tr>
<th>Change Concept</th>
<th>Reduce Handoffs</th>
</tr>
</thead>
</table>
| **Administration Problems** | • Late delivery of medications from the pharmacy can result in omissions and late administration.  
• Multiple staff working with medications increase handoffs on the nursing unit. |
| **Useful Process Changes** | • Use unit dosing.  
• Use automatic drug-dispensing machines.  
• Use patient self-administration of drugs.  
• Use patient partnering. |

**Examples of Process Changes Tested**

<table>
<thead>
<tr>
<th>Use automatic drug-dispensing machines.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic drug-dispensing machines stock up to 70% of the most commonly used medications on each nursing unit. A copy of the physician's order is sent to the pharmacy for review. If the order is appropriate, the pharmacist enters the order into the pharmacy system. Through an interface, the order is shared with the automatic drug-dispensing machine, and the nurse may access the medication directly from the machine. These systems help to prevent the administration of a medication to a patient with a known allergy and minimize confusion over brand and generic names. However, the systems have their own potential for errors—they must be filled correctly, and the nurse must still select the correct medication.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use patient self-administration of drugs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In some hospitals, capable patients are allowed or even encouraged to administer their own medications. Particularly for pain control or medications taken over a long period of time (such as insulin or cardiac medications), patients can assume continuing self-care. This reduces the need for both pharmacy and nursing to be involved in the administration process and allows patients some control over their medication regimen. It also eliminates another opportunity for error—handoffs from pharmacy to nursing to patient.</td>
</tr>
</tbody>
</table>

**Tested and implemented by:**

| Bay Medical Center  
Latrobe Area Hospital  
Morton Plant Mease Health Care  
Pontiac Osteopathic Hospital Medical Center  
Promina Gwinnett Health System  
The Valley Hospital |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Promina Gwinnett Health System</td>
</tr>
</tbody>
</table>
## Resources

### The Medication System

<table>
<thead>
<tr>
<th>Resource</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic Order Form</td>
<td>Children’s Hospital, Boston</td>
</tr>
<tr>
<td>Creatinine Clearance Protocol</td>
<td>Fairview Health System</td>
</tr>
<tr>
<td>Adult Medication Order Guidelines</td>
<td>Dartmouth-Hitchcock Medical Center</td>
</tr>
<tr>
<td>Orders for Chemotherapy</td>
<td>Fairview Health System</td>
</tr>
<tr>
<td>Cardiac Drip Worksheet</td>
<td>Lucile Salter Packard Children’s Hospital at Stanford</td>
</tr>
<tr>
<td>How to Stagger Antibiotics to Get Them on Standard Times</td>
<td>St. Marys Hospital Medical Center</td>
</tr>
<tr>
<td>Sliding-Scale Insulin Protocol for Adults</td>
<td>Garden City Hospital</td>
</tr>
<tr>
<td>Heparin Protocol Dosing Order Sheet</td>
<td>Latrobe Area Hospital</td>
</tr>
<tr>
<td>Medication Administration Times for Food/Drug Interactions</td>
<td>Methodist Hospital/HealthSystem Minnesota</td>
</tr>
<tr>
<td>Narcotic Flowsheet</td>
<td>Kaweah Delta Health Care District</td>
</tr>
</tbody>
</table>
**Antibiotic Order Form**

Use this form to document all new antibiotic orders. A new form must be used for changes or additions.

Rewrites every 7 days.

**Patient Weight** ___________________________ kilograms

**Allergies** ___________________________  □ None known

**Routine Surgical Prophylaxis:** Single dose recommended to be administered at time of incision.

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Recommended Dose</th>
<th>Route</th>
<th>Interval</th>
<th>Circle # of Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>cefazolin</td>
<td>30 mg/kg per Dose</td>
<td>IV</td>
<td>q8h</td>
<td>1 2 3 doses</td>
</tr>
</tbody>
</table>

**Routine Antibiotic Orders:** Circle choice, fill in dose, duration and circle interval, route.

<table>
<thead>
<tr>
<th>Circle Antibiotic</th>
<th>Unit Dose (Fill in: mg)</th>
<th>Daily Dose Range (divided by administration frequency for unit dose)</th>
<th>Circle Route</th>
<th>Circle Interval every “x” hours</th>
<th>Fill in Duration of Rx (Max 7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>amphotericin B</td>
<td>0.25–1 mg/kg/day</td>
<td>IV</td>
<td>24</td>
<td>6 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>ampicillin</td>
<td>100–400 mg/kg/day</td>
<td>IV IM</td>
<td>6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>amp/sulbactam</td>
<td>100–200 AMP (mg/kg/day)</td>
<td>IV IM</td>
<td>6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>cefazolin</td>
<td>50–100 mg/kg/day</td>
<td>IV IM</td>
<td>8</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>clindamycin</td>
<td>15–40 mg/kg/day</td>
<td>IV IM</td>
<td>8</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>gentamicin</td>
<td>4.5–7.5 (mg/kg/day)</td>
<td>IV IM (6 12 24)</td>
<td>6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>metronidazole</td>
<td>30 (mg/kg/day)</td>
<td>IV PO</td>
<td>6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>oxacillin</td>
<td>150–200 (mg/kg/day)</td>
<td>IV IM</td>
<td>4 6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>piperacillin</td>
<td>200–300 (CF300–500) (mg/kg/day)</td>
<td>IV IM</td>
<td>6</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>tobramycin</td>
<td>4.5–7.5 (CF/6–10) (mg/kg/day)</td>
<td>IV IM</td>
<td>8 12 24</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
<tr>
<td>vancomycin</td>
<td>40–60 (mg/kg/day)</td>
<td>IV</td>
<td>8 12</td>
<td>3 days or 3 doses</td>
<td></td>
</tr>
</tbody>
</table>

**Other unrestricted Antibiotics:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit Dose (Fill in: mg)</th>
<th>Circle Route</th>
<th>Interval (Fill in)</th>
<th>Duration of Rx (Fill in: Max 7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IV IM PO</td>
<td>Every</td>
<td>hours</td>
<td>days or doses</td>
</tr>
<tr>
<td>2.</td>
<td>IV IM PO</td>
<td>Every</td>
<td>hours</td>
<td>days or doses</td>
</tr>
</tbody>
</table>

**Restricted Antibiotic Orders:** Describe intended use and provide required information.

- **Preapproved indications:** (Refer to directions on form back.)
  - Important: Automatic stop order at 72 hours.
  - Some restricted antibiotics may be used for up to 72 hours while cultures are pending. Look up the code for preapproved indications from table on reverse side of this form. Place the code after the drug name in the order box. Example: cephalothin (2B)

- **All other use of restricted antimicrobials:** (Requires ID approval.)
  - Indication: ________________________
  - Fill in name of ID physician approving use: ________________________

<table>
<thead>
<tr>
<th>Restricted Antibiotic</th>
<th>(Code)</th>
<th>Unit Dose (Fill in: mg)</th>
<th>Circle Route</th>
<th>Interval (Fill in)</th>
<th>Duration of Rx (Fill in: Max 7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>( )</td>
<td>IV IM PO</td>
<td>Every</td>
<td>hours</td>
<td>days or doses</td>
</tr>
<tr>
<td>2.</td>
<td>( )</td>
<td>IV IM PO</td>
<td>Every</td>
<td>hours</td>
<td>days or doses</td>
</tr>
</tbody>
</table>

**Physician’s signature** ___________________________ Date __/__/__ Time ______ Beeper ______

**RN transcribing order** ___________________________ Date __/__/__ Time ______ Beeper ______

**RN verifying transcription** ________________________ Date __/__/__ Time ______ Beeper ______
**Antibiotic Order Form (continued)**

The restricted antibiotics may be used for listed indications without prior infectious disease approval. Only drugs and indications listed below are preapproved. All other use of restricted antibiotics, antifungals, and antivirals must be explicitly approved by infectious diseases prior to use.

<table>
<thead>
<tr>
<th>Restricted Antibiotic (dose range)</th>
<th>Route</th>
<th>Interval</th>
<th>Preapproved Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>amikacin 15–22.5 mg/kg/day</td>
<td>IV/IM</td>
<td>q8h</td>
<td>No preapproved indications: Call infectious Diseases.</td>
</tr>
<tr>
<td>aztreonam 90–120 mg/kg/day (CF150–200)</td>
<td>IV</td>
<td>q6h or q8h</td>
<td>1A: Substitute for other beta-lactam antibiotics to provide gram-negative coverage if patient allergic to penicillin/cephalosporin. 1B: Substitute for aminoglycosides for gram-negative coverage in patients with or at high risk for renal insufficiency or hearing loss. 1C: Cystic fibrosis only if piperacillin or ceftazidime not appropriate.</td>
</tr>
<tr>
<td>cefotaxime 100–200 mg/kg/day</td>
<td>IV</td>
<td>q6h or q8h</td>
<td>2A: R/O sepsis in newly admitted patient (not nosocomial r/o sepsis). 2B: Meningitis, probable bacterial (with vancomycin if gram-positive). 2C: R/O sepsis if penicillin-resistant pneumococcus is likely (or vancomycin).</td>
</tr>
<tr>
<td>ceftriaxone (CF150–200)</td>
<td>IV</td>
<td>q8h</td>
<td>3A: Cystic fibrosis only when piperacillin not appropriate (allergy, resistance). 3B: Empiric treatment for fever and neutropenia when piperacillin + gentamicin not appropriate due to allergy.</td>
</tr>
<tr>
<td>imipenem 60–100 mg/kg/day</td>
<td>IV</td>
<td>q6h</td>
<td>4A: One dose for early discharge from hospital. 4B: One dose IM for temporary IV access problem.</td>
</tr>
<tr>
<td>vancomycin (not restricted) 40–60 mg/kg/day</td>
<td>IV/PO</td>
<td>q8h</td>
<td>Vancomycin is not restricted. Guidelines for empiric use: Do not use vancomycin for empiric therapy of suspected CVL infection, post op wound infection, C. difficile diarrhea, or fever and neutropenia unless patient is critically ill. Use alternative abx until cultures confirm need for vanco.</td>
</tr>
</tbody>
</table>

**Antivirals/Antifungals**

| Acyclovir 750–1500 mg/day         | IV | q8h      | 8A: Per approved protocol. Oral acyclovir is not restricted. Switch to PO form as soon as feasible. |
| Ganciclovir 7.5–10 mg/kg/day     | IV | q12h     | 9A: Per approved protocol |
| Fluconazole 3–6 mg/kg/day        | IV/PO | qd | 10A: Per approved protocol |
| Itraconazole 3–5 mg/kg/day       | PO | qd       | 11A: Per approved protocol |

### Antibiotic Unit Doses Available from the Pharmacy

<table>
<thead>
<tr>
<th>Dosing Groups</th>
<th>Available Doses (All orders should be in these increments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All penicillins and cephalosporins, aztreonam, erythromycin, imipenem</td>
<td>50, 100, 150, 200, 250, 300, 400, 500, 750 mg: 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4 gm etc.</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>50, 100, 150, 300, 450, 600, 750, 900 mg</td>
</tr>
<tr>
<td>Gentamicin, tobramycin</td>
<td>1–6 mg by 0.25 mg increments; 7, 8, 9, 10, 12, 14, 16, 18, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 mg etc.</td>
</tr>
<tr>
<td>Acyclovir, chloramphenicol, vancomycin</td>
<td>10–100 mg by 10 mg increments; 125–250 by 25 mg increments; 250–800 mg by 50 increments; 900, 1000 mg</td>
</tr>
</tbody>
</table>

**General Dosing Rule:** If the calculated dose (mg/kg/dose) is in the lower third of the increment, round **down**. If the calculated dose is in the upper two-thirds of the increment, round **up**.
### Creatinine Clearance Protocol

<table>
<thead>
<tr>
<th>Drug</th>
<th>Usual Dosage</th>
<th>30-50 mL/min</th>
<th>10-30 mL/min</th>
<th>&lt;10 mL/min</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>acyclovir (IVHSV)</td>
<td>5 mg/kg q8h</td>
<td>q12h</td>
<td>q24h</td>
<td>q48h</td>
<td>Consult MD prior to dosage adjustment</td>
</tr>
<tr>
<td>acyclovir VSV</td>
<td>10 mg/kg q8h</td>
<td>q12h</td>
<td>q24h</td>
<td>q48h</td>
<td>Consult MD prior to dosage adjustment</td>
</tr>
<tr>
<td>allopurinol</td>
<td>300 mg qd</td>
<td>200 mg qd</td>
<td>100 mg qd</td>
<td>100 mg qod</td>
<td></td>
</tr>
<tr>
<td>ampicillin/ sulbactam</td>
<td>1.5–3 g q6–12h</td>
<td>unchanged</td>
<td>q12h</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td>aztreonam</td>
<td>500–2000 mg q6–12h</td>
<td>unchanged</td>
<td>50%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>cefazolin</td>
<td>500–2000 mg q8h</td>
<td>q12h</td>
<td>q12h</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td>cefotaxime</td>
<td>1–2 g q6–8h</td>
<td>unchanged</td>
<td>q12h</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td>cefotetan</td>
<td>1–2 g q12h</td>
<td>unchanged</td>
<td>q24h</td>
<td>q48h</td>
<td></td>
</tr>
<tr>
<td>ceftazidime mild/mod</td>
<td>1 g q8–12h</td>
<td>q12h</td>
<td>q24h</td>
<td>500 mg q24h</td>
<td></td>
</tr>
</tbody>
</table>
Adult Medication Order Guidelines

1. All medication orders must be complete. A complete medication order includes:
   • Medication name
   • Date order written
   • Dose
   • Route
   • Frequency
   • Ordering provider's signature
   • Printed name or pager number of ordering provider

2. If the medication order is time sensitive (STAT, ASAP), the time the order is written must be included. Use “STAT” or “ASAP” when an order is time sensitive. Do not use “now.”

3. Generic names are preferable, but the use of trade (brand) names is acceptable in two circumstances:
   (a) Combination products containing two or more drugs within one formulation (e.g., Bactrim DS Percocet)
   (b) Extended or sustained release formulations must be indicated with the name of the medication (e.g., Procan SR 500 mg OR Cardizem CD 120 mg).

4. Do not abbreviate medication names.

5. An order cannot be changed once it has been transcribed. It must be rewritten.

Legibility and Completeness of Medication Orders:
Medication orders that are illegible, unclear, or incompletely written will not be carried out until rewritten or clarified in writing. The individual who wrote the original order will be contacted. If that person is unavailable, the covering provider will be contacted.

<table>
<thead>
<tr>
<th>Do (acceptable)</th>
<th>Don’t (not acceptable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write out “microgram” or “mcg”*</td>
<td>Don’t abbreviate: “µg”*</td>
</tr>
<tr>
<td>Write out “units”*</td>
<td>Don’t abbreviate: “u” or “U”*</td>
</tr>
<tr>
<td>Write out “days” or “doses”</td>
<td>Don’t abbreviate: “d” or “D”</td>
</tr>
<tr>
<td>Use a leading “0” (for example: 0.2 mg)</td>
<td>Don’t use trailing “0” (for example: 2.0 mg)</td>
</tr>
</tbody>
</table>

*“µg” “u” “U” as abbreviations have led to dosing errors; these are no longer acceptable. Other metric units may be abbreviated.

Some common reasons why medication orders are unclear or incomplete:
1. Injectable formulation of medication must be ordered by dosage, not volume, for example: potassium phosphate 15 mmol (not 15 mL vial).

2. The use of “prn” must be accompanied by a frequency and/or indication, for example: q 6h prn; and prn loose stool max 8 tablets/24 hr (not just prn).
Verbal Orders:
Anyone taking a verbal order will write the order in the same manner as described above and be held responsible for rewriting or clarifying the order as needed. The individual taking a verbal order must write and read back the order as written to the prescriber. The verbal order must be co-signed by a physician.

Reference Sources:
The following reference sources are available to clinicians:
- American Hospitals Formulary Services: Drug Information
- Physicians’ Desk Reference
- Electronic resources (being developed)
In addition, pharmacists are available for consultation. Please contact the Pharmacy at ext. XXXX.

Approved by:
ADE Core Team
April 24, 1997
## Orders for Chemotherapy

<table>
<thead>
<tr>
<th>Today’s Date</th>
<th>Date of Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>Height</td>
</tr>
</tbody>
</table>

### 1. Labs
- **Draw the following labs:**
  - Call office for faxed results.
- **CBC**
- **Lys**
- **Creatinine**
- **SMA-12**
- **Other**

- **Labs done in office:**
  - WBC
  - Hgb
  - Creatinine

### 2. IV: D5 1/2 NS with 20 mEq KCl at mL/hr

- **Standard Dosing**
- **High Dose Regimen**
- **Research Protocol**
- **CCOP**
- **Other Protocol: Source**
- **Tumor**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Special Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>One-time dose on</td>
<td>One-time dose on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Daily for days</td>
<td>Daily for days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>q hours for doses</td>
<td>q hours for doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On day numbers</td>
<td>On day numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Special Instructions</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Daily for days</td>
<td>Daily for days</td>
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<td>q hours for doses</td>
<td>q hours for doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On day numbers</td>
<td>On day numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Special Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>One-time dose on</td>
<td>One-time dose on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Daily for days</td>
<td>Daily for days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>q hours for doses</td>
<td>q hours for doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On day numbers</td>
<td>On day numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>
Orders for Chemotherapy (continued)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Special Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>□ IV push</td>
<td>□ One-time dose on</td>
<td>□ Daily for _______ days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ IV over 24 hours</td>
<td>□ q ______ for _______ doses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ IV over _______ hours</td>
<td>□ On day numbers _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Subcutaneous</td>
<td>□ Other _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Oral</td>
<td>□ Other _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Other _______</td>
<td></td>
<td></td>
</tr>
<tr>
<td>______ mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>______ mg/m2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>______ units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Antiemetics (prophylactics):**
Start 30 min before chemotherapy:
Give every day of chemotherapy or _______

- _____ granisetron 0.01 mg/kg IV (not to exceed 1 mg)
- _____ granisetron 1 mg po q12h x ______ doses
- _____ ondansetron □ 10 mg □ 30 mg IV
- _____ dexamethasone □ mg IV
- _____ prochlorperazine 10 mg IV or PO
- _____ other _________________________

**Antiemetics (rescue):**

- _____ lorazepam 0.5 – 2 mg IV or PO q4h prn
- _____ prochlorperazine 10 mg IV or PO q4h prn
- _____ ondansetron 10 mg IV q4h prn
- _____ other _________________________

Follow paclitaxel or cisplatin routines (see separate page). Check here to omit □.
Give test dose prior to bleomycin or asparaginase. Check here to omit □.

Other instructions

Readmission date _______  Physician’s signature ____________________

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## Cardiac Drip Worksheet

Name  Baby NICU  
Acct # 1234567  
Unit # 1234567  
Sex  F  
Patient Location  SW  

<table>
<thead>
<tr>
<th>Medication</th>
<th>Amount to Add</th>
<th>Stock Concentration</th>
<th>Med. Vol. to Add</th>
<th>Total Vol. in D5W:</th>
</tr>
</thead>
<tbody>
<tr>
<td>alprostadil</td>
<td>1020 mcg</td>
<td>500 mcg/mL =</td>
<td>2.04 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>dopamine</td>
<td>102 mg</td>
<td>40 mg/mL =</td>
<td>2.55 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>dobutamine</td>
<td>102 mg</td>
<td>12.5 mg/mL =</td>
<td>8.16 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>epinephrine</td>
<td>1.02 mg</td>
<td>1 mg/mL =</td>
<td>1.02 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>esmolol</td>
<td>1020 mg</td>
<td>250 mg/mL =</td>
<td>4.08 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>isoproterenol</td>
<td>1.02 mg</td>
<td>0.2 mg/mL =</td>
<td>5.10 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>milrinone</td>
<td>1.02 mg</td>
<td>1 mg/mL =</td>
<td>1.02 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>nitroglycerin</td>
<td>20.4 mg</td>
<td>5 mg/mL =</td>
<td>4.08 mL</td>
<td>QS to 50 mL</td>
</tr>
<tr>
<td>nitroprusside*</td>
<td>10.2 mg</td>
<td>10 mg/mL =</td>
<td>1.02 mL</td>
<td>QS to 50 mL</td>
</tr>
</tbody>
</table>

Total Fluid Intake:  
- 60 mL/kg/day  
- 80 mL/kg/day  
- 100 mL/kg/day  

*Nitroprusside: Dissolve 50 mg vial in 5 mL D5W; then dilute as above.

Drips will be made in 60 mL syringes.
## Final Dose Equivalence

<table>
<thead>
<tr>
<th>Final Dose Equivalence</th>
<th>Dose Range</th>
<th>Final Drip Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mL/h = 100 ng/kg/min</td>
<td>25–100 ng/kg/min</td>
<td>0.0204 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 10 mcg/kg/min</td>
<td>2–10 mcg/kg/min</td>
<td>2.04 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 10 mcg/kg/min</td>
<td>2–12 mcg/kg/min</td>
<td>2.04 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 100 ng/kg/min</td>
<td>20–200 ng/kg/min</td>
<td>0.02 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 100 mcg/kg/min</td>
<td>50–200 mcg/kg/min</td>
<td>20.4 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 100 ng/kg/min</td>
<td>20–200 ng/kg/min</td>
<td>0.0204 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 0.100 mcg/kg/min</td>
<td>0.375–0.75 mcg/kg/min</td>
<td>0.0204 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 2 mcg/kg/min</td>
<td>0.5–2 mcg/kg/min</td>
<td>0.408 mg/mL</td>
</tr>
<tr>
<td>1 mL/h = 1 mcg/kg/min</td>
<td>0.5–2 mcg/kg/min</td>
<td>0.204 mg/mL</td>
</tr>
</tbody>
</table>
How to Stagger Antibiotics to Get Them on Standard Times

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2400</td>
<td>0600</td>
<td>0700–1400</td>
<td>1000–2000</td>
<td>Time</td>
</tr>
<tr>
<td>0100</td>
<td>0600</td>
<td>0700–1400</td>
<td>1000–2000</td>
<td>assigned</td>
</tr>
<tr>
<td>0200</td>
<td>0700–1200</td>
<td>0800–1400</td>
<td>1100–2000</td>
<td>will be</td>
</tr>
<tr>
<td>0300</td>
<td>0700–1200</td>
<td>1200–2200</td>
<td>1700–0800</td>
<td>initial</td>
</tr>
<tr>
<td>0400</td>
<td>1100–1800</td>
<td>1300–2200</td>
<td>1800–0800</td>
<td>starting</td>
</tr>
<tr>
<td>0500</td>
<td>1200</td>
<td>1400</td>
<td>1800–0800</td>
<td>time</td>
</tr>
<tr>
<td>0600</td>
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<td>1400</td>
<td>1900–0800</td>
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</tr>
<tr>
<td>0700</td>
<td>1200</td>
<td>1400</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>0800</td>
<td>1300–1800</td>
<td>1500–2200</td>
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<td></td>
</tr>
<tr>
<td>0900</td>
<td>1300–1800</td>
<td>1500–2200</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>1700–2400</td>
<td>1600–2200</td>
<td>2100–0800</td>
<td></td>
</tr>
<tr>
<td>1100</td>
<td>1800</td>
<td>2000–0600</td>
<td>2100–0800</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>1800</td>
<td>2100–0600</td>
<td>2200–0800</td>
<td></td>
</tr>
<tr>
<td>1300</td>
<td>1800</td>
<td>2200</td>
<td>2200–0800</td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td>1900–2400</td>
<td>2200</td>
<td>2300–0800</td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>1900–2400</td>
<td>2200</td>
<td>2300–0800</td>
<td></td>
</tr>
<tr>
<td>1600</td>
<td>2300–0600</td>
<td>2300–0600</td>
<td>0600–2000</td>
<td></td>
</tr>
<tr>
<td>1700</td>
<td>2400</td>
<td>2300–0600</td>
<td>0600–2000</td>
<td></td>
</tr>
<tr>
<td>1800</td>
<td>2400</td>
<td>2400–0600</td>
<td>0700–2000</td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>2400</td>
<td>0400–1400</td>
<td>0800</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>0100–0600</td>
<td>0500–1400</td>
<td>0800</td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td>0100–0600</td>
<td>0600</td>
<td>0800</td>
<td></td>
</tr>
<tr>
<td>2200</td>
<td>0500–1200</td>
<td>0600</td>
<td>0900–2000</td>
<td></td>
</tr>
<tr>
<td>2300</td>
<td>0600</td>
<td>0600</td>
<td>0900–2000</td>
<td></td>
</tr>
</tbody>
</table>

- Hang first dose of antibiotic ASAP — don’t wait to get on schedule. (You can potentially shorten the patient’s length of stay depending on how quickly you hang the first dose.)
- Antibiotics ordered by pharmacokinetics (for example: gentamicin, vancomycin, etc.) are an exception to the above schedule. Pharmacy will inform you regarding the scheduling of these drugs.
- If a staggered time extends into the next day’s MAR, make sure to indicate on the next day’s MAR when the next dose is due.
- If you must deviate from the standard times, make sure to communicate this to Pharmacy, but BEWARE — any doses already dispensed by Pharmacy need to be corrected on the next day’s MAR by the nurse doing that evening’s MAR check.
Sliding-Scale Insulin Protocol for Adults

1. Check blood glucose with glucometer before meals and at bedtime if patient is eating or every 6 hours if the patient is not eating.
2. Administer regular human insulin subcutaneously according to the following dosage schedule:

<table>
<thead>
<tr>
<th>Glucose Result</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;60 * STAT random blood sugar by lab draw. Call House Officer and notify of lab results.</td>
<td>No coverage</td>
</tr>
<tr>
<td>60–150</td>
<td>5 units</td>
</tr>
<tr>
<td>151–200</td>
<td>10 units</td>
</tr>
<tr>
<td>201–250</td>
<td>15 units</td>
</tr>
<tr>
<td>251–300</td>
<td>20 units</td>
</tr>
<tr>
<td>301–350</td>
<td>25 units</td>
</tr>
<tr>
<td>&gt;300 STAT random blood sugar by lab draw. Give insulin; call House Officer with results. Recheck One Touch in 2 hours.</td>
<td>30 units</td>
</tr>
</tbody>
</table>

3. This protocol is optional for prescribers.
4. This protocol is not recommended for patients in ketoacidosis.
5. Patients with a hematocrit < 25% or > 60% or dialysis patients require a lab draw for glucose due to limitations of the One Touch. (Refer to Nursing Policy and Procedure Manual, Metabolic/Endocrine Section, page 1, number 4.)
   - See Nursing Policy and Procedure Manual, Metabolic/Endocrine Section, page 8, Hypoglycemia Treatment.
Heparin Protocol Dosing Order Sheet

(Protocol is recommended for the treatment of patients with DVT, PE, A. Fib., Unstable Angina, and Acute MI who have not received thrombolytics during this admission.)

1. **Weigh patient and record:** _____________ kgs or _____________ lbs
   (Weights expressed in pounds must be converted to kilograms for subsequent calculations.)

2. **Initial Therapy:**
   **Bolus:**
   Protocol: 75 units/kg = _____________ Units IV over 2 to 3 minutes
   Alternative: ___ units/kg = _____________ Units IV over 2 to 3 minutes
   Round dose to nearest 500 units. Do not exceed 10,000 units bolus.

   **Infusion:**
   Protocol: 15 units/kg/hour = _____________ units/hour
   Alternative: ___ units/kg/hour = _____________ units/hour
   Round dose to the nearest 50 units.
   Standard concentration is 25,000 units/500mL D5W (50 units/mL).

3. **Laboratory Procedure:**
   A. Draw baseline aPTT and CBC now, if not already done within the past 24 hours.
   B. Initiate therapy and draw first aPTT in 6 hours.
   C. CBC with platelets every 3 days.
   D. Urinalysis and stool guaiac on initiation or within 24 hours.
   E. aPTT 6 hours after any dosage change, adjustment as per below sliding scale.
   *When 2 consecutive 6 hour aPTTs are therapeutic, order aPTT every AM while on heparin.

4. **Adjust heparin infusion according to sliding-scale below:**

<table>
<thead>
<tr>
<th>aPTT (sec)</th>
<th>Repeat Bolus (units)</th>
<th>Hold Infusion (hours)</th>
<th>Patients ≤ 200 lbs</th>
<th>Patients &gt; 200 lbs</th>
<th>Draw Next aPTT Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35</td>
<td>5000</td>
<td>0</td>
<td>↑ by 150</td>
<td>↑ by 200</td>
<td>6 hours</td>
</tr>
<tr>
<td>35–45</td>
<td>0</td>
<td>0</td>
<td>↑ by 100</td>
<td>↑ by 150</td>
<td>6 hours</td>
</tr>
<tr>
<td>46–70</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Next AM*</td>
</tr>
<tr>
<td>71–80</td>
<td>0</td>
<td>0</td>
<td>↓ by 50</td>
<td>↓ by 100</td>
<td>6 hours</td>
</tr>
<tr>
<td>81–100</td>
<td>0.5</td>
<td>0</td>
<td>↓ by 100</td>
<td>↓ by 150</td>
<td>6 hours</td>
</tr>
<tr>
<td>&gt;100</td>
<td>1.0</td>
<td>0</td>
<td>↓ by 150</td>
<td>↓ by 200</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

   **Adjust Rate (unit/hr)**
   **Adjust Rate (mL/hr)**

   **Valid infusion rate adjustments for standard dilution only (50 units/mL)**

5. **Inspect** for abnormal bleeding or bruising, changes in mental status or level of consciousness, black tarry tools, hematuria, hemoptysis, or back pain every shift. If any of these occur, contact the physician immediately.

   Physician Signature _______________ RN _______________ Date/Time _______________

   White — Patient Chart    Yellow — Pharmacy

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Medication Administration Times for Food/Drug Interactions

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Generic Name</th>
<th>Special Instructions</th>
<th>Time</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA</td>
<td>aspirin</td>
<td>Take with food.</td>
<td>8:30 a.m.</td>
<td>Food helps to decrease GI irritation.</td>
</tr>
<tr>
<td>Capoten</td>
<td>captopril</td>
<td>Take on an empty stomach.</td>
<td>6—15 — 22</td>
<td>Food decreases absorption by 30–40% time as is tid or q8hr. 7–20 for BID schedule.</td>
</tr>
<tr>
<td>Carafate</td>
<td>sucralfate</td>
<td>Take on an empty stomach.</td>
<td>7:30—11:30—17—22</td>
<td>Sucralfate may bind to the protein in food.</td>
</tr>
<tr>
<td>Cefin</td>
<td>cefuroxime</td>
<td>Take with whole milk or food; give HS snack with dose.</td>
<td>8:30—20:30</td>
<td>Milk increases absorption significantly (food less so).</td>
</tr>
<tr>
<td>Cipro</td>
<td>ciprofloxacin</td>
<td>Do not give with dairy products or Ca, Mg, or Fe supplements.</td>
<td>10—22</td>
<td>Ca, Mg, Fe can bind and inactivate Cipro.</td>
</tr>
<tr>
<td>Cortef</td>
<td>hydrocortisone</td>
<td>Take with food.</td>
<td>8:30—12:30—17:30—21</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Cortone</td>
<td>cortisone</td>
<td>Take with food.</td>
<td>8:30 a.m.</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Diabeta, Micronase</td>
<td>glyburide</td>
<td>Take 30 minutes before meals.</td>
<td>7:45—11:45—17</td>
<td></td>
</tr>
<tr>
<td>Dilantin suspension</td>
<td>phenytoin suspension</td>
<td>Hold tube feedings 1 hour before and 2 hours after dose, give with or after meals.</td>
<td>8—14—20</td>
<td>Tube feedings may bind inactive phenytoin suspension.</td>
</tr>
<tr>
<td>Fosamax</td>
<td>alendronate</td>
<td>Take on an empty stomach—first thing in the morning: Give with a full glass of water. Patient should not lie down for about 1 hour after the dose.</td>
<td>6:30 a.m.</td>
<td>Calcium in food binds with the drug and inactivates it. Make sure to pull dose out of unit dose drawer before cart exchange.</td>
</tr>
<tr>
<td>Glucophage</td>
<td>metformin</td>
<td>Take with food.</td>
<td>8:30—17:30</td>
<td>Food decreases GI upset and helps increase compliance.</td>
</tr>
<tr>
<td>Glucotrol</td>
<td>glipizide</td>
<td>Take 30 minutes before meals.</td>
<td>7:45—11:45—17</td>
<td></td>
</tr>
<tr>
<td>Indocin</td>
<td>indomethacin</td>
<td>Take with food.</td>
<td>8:30—12:30</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Lanoxin</td>
<td>digoxin</td>
<td>Avoid high-fiber foods or products within 2 hours of dose.</td>
<td>11:00 a.m.</td>
<td>Fiber may reduce absorption or cause erratic absorption.</td>
</tr>
<tr>
<td>Lescol</td>
<td>fluvastatin</td>
<td>When ordered once a day, give in evening or HS.</td>
<td>22</td>
<td>Maximum cholesterol synthesis is at night.</td>
</tr>
<tr>
<td>Macroantin, Macrobid</td>
<td>nitrofurantoin</td>
<td>Take with whole milk or food, give HS snack with dose.</td>
<td>8:30—12:30—17:30—21</td>
<td>Food significantly increases absorption.</td>
</tr>
<tr>
<td>Medrol</td>
<td>methyl-prednisolone</td>
<td>Take with food.</td>
<td>8:30—12:30—17:30—21</td>
<td>Food helps reduce GI irritation.</td>
</tr>
</tbody>
</table>
# Medication Administration Times for Food/Drug Interactions (continued)

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Generic Name</th>
<th>Special Instructions</th>
<th>Time</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motrin, Advil</td>
<td>ibuprofen</td>
<td>Take with food, give HS snack with dose.</td>
<td>8:30–12:30–17:30–21</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>multiple</td>
<td>potassium chloride</td>
<td>Take with food (do not hold now doses for empty stomach).</td>
<td>8:30–12:30–17:30–21</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Naprosyn</td>
<td>naproxen</td>
<td>Take with food.</td>
<td>8:30–17:30</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Orasone, Deltasone</td>
<td>prednisone</td>
<td>Take with food.</td>
<td>8:30 a.m.</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Pepcid</td>
<td>famotidine</td>
<td>If ordered once a day, give HS.</td>
<td>22</td>
<td>Maximum output of stomach acid is at night.</td>
</tr>
<tr>
<td>Phoslo</td>
<td>calcium acetate</td>
<td>Take with meals.</td>
<td>8:30–12:30–17:30</td>
<td>Med works by binding phosphorous in food so it is not absorbed.</td>
</tr>
<tr>
<td>Pravachol</td>
<td>pravastatin</td>
<td>When ordered once a day, give in evening or at HS.</td>
<td>22</td>
<td>Maximum cholesterol synthesis is at night.</td>
</tr>
<tr>
<td>Precose</td>
<td>acarbose</td>
<td>Take with food.</td>
<td>8:30 a.m.</td>
<td>Food decreases GI irritation.</td>
</tr>
<tr>
<td>Prilosec</td>
<td>omeprazole</td>
<td>Take before eating.</td>
<td>8:00+</td>
<td>Food decreases absorption. Give at 17:30 if BID.</td>
</tr>
<tr>
<td>Propulsid</td>
<td>cisapride</td>
<td>Take 1/2 hour AC (and if HS ordered).</td>
<td>7:30–11:30–17</td>
<td>Med stimulates gastric motility, so take before meals.</td>
</tr>
<tr>
<td>Relafen</td>
<td>nabumetone</td>
<td>Take with food.</td>
<td>8:30–17:30</td>
<td>Food helps reduce GI irritation.</td>
</tr>
<tr>
<td>Sumycin, others</td>
<td>tetracycline</td>
<td>Avoid foods high in Ca or Fe within 2 hours of dose.</td>
<td>6–11–16–22</td>
<td>Ca or Fe may bind and inactivate tetracycline. Time as is for qid or q6hr.</td>
</tr>
<tr>
<td>Tagamet</td>
<td>cimetidine</td>
<td>If ordered once a day, give HS.</td>
<td>22</td>
<td>Maximum output of stomach acid is at night.</td>
</tr>
<tr>
<td>Veetids, others</td>
<td>penicillin</td>
<td>Food decreases absorption, along with carbonated bev., and citrus juice.</td>
<td>6–11–16–22</td>
<td></td>
</tr>
<tr>
<td>Zantac</td>
<td>ranitidine</td>
<td>If ordered once a day, give at bedtime (unless patient has symptoms during the day).</td>
<td>8:30–22</td>
<td>Gastric acid production increases at night.</td>
</tr>
<tr>
<td>Zithromax</td>
<td>azithromycin</td>
<td>Take on an empty stomach.</td>
<td>11:00 a.m.</td>
<td>Food decreases absorption by up to 50%.</td>
</tr>
<tr>
<td>Zocor</td>
<td>simvastatin</td>
<td>When ordered once a day, give in evening or HS.</td>
<td>22</td>
<td>Maximum cholesterol synthesis is at night.</td>
</tr>
</tbody>
</table>

Any HS dose on this list can be given earlier if the patient goes to bed early. Empty stomach is 2 hours after a meal and 1/2–1 hour before a meal. Meals on 5W are 8:15–12:15–17:30.
## Narcotic Flowsheet

**Date ______________________________**

Narcotic Ordered ____________________  Continuous Dose ____________________
PCA/Bolus Dose Frequency ____________  Titration Orders ____________________

| Time         | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Sedation *(0-5) q 1h |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Respirations q 1h |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Initials |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

**Document the following information every 4 hours and as needed**

Pain intensity ***(0-10)***

Medication

Narcotic concentration (mg: cc)

Continuous rate (cc/hr)/dosage (mg)

PCA dosage (mg)

PCA/lock out (mins)

# Attempts

Loading dose

4 hour limit

Vial changed

Narcotic gtt Bolus (time and dose)

Total mg dispensed

q 4h

RN initials

RN initials (verifying)

**Signature _______________________

Signature _______________________

Signature _______________________

Signature _______________________

Signature _______________________

Signature _______________________

**Sedation Scale**

0 = Wide awake

1 = Drowsy

2 = Dozing intermittently

3 = Sleepy, responds to commands

4 = Responds only to tactile stimulation

5 = No response to tactile stimulation

**Pain Intensity** 0 1 2 3 4 5 6 7 8 9 10

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