Achieve Cost Efficiencies and More Through **IV to PO Therapeutic Substitutions**

**Advantages of Oral Therapies**
The oral route has many advantages, including:
- Increased patient acceptance and comfort
- Increased mobility and, therefore, decreased risk of deep vein thrombosis
- Ease of administration
- Easier preparation
- Decreased risks associated with IV therapy, such as phlebitis, bloodstream infections, fluid overload, and so on, which may consequently shorten the patient’s length of stay

Because of the cost differential between the IV form and the oral form, the switch to oral therapies can also lead to significant cost efficiencies.

**Advantages of IV Therapy**
IV administration is known for its rapid ability to generate a high blood level of the drug agent and a fast onset of activity. The agents you target for an IV to PO conversion program should have a very high bioavailability with the oral form, which should perform as well as the IV form. For example, oral fluconazole doses are essentially the same as IV doses. The slight difference in the maximum serum level with the IV form is not clinically significant. Some physicians are not aware of the pharmacokinetics of the drugs so the use of “blood-level versus time” charts can easily illustrate the bioavailability and the equivalence of the chosen oral agents (See Figure 1.). Keep in mind that a graphic illustration can get the point across to physicians more effectively than words alone.

**Patient Criteria**
Patients must have a properly functioning GI tract in order to be considered for an IV to PO conversion. Many patients in the ICU have multiple organ system problems and/or sepsis, which eliminate them as candidates for conversion. Following are criteria for qualifying appropriate candidates for conversion:
- On IV therapy for 48 to 72 hours
- Functioning GI tract without abnormalities, such as ileus, vomiting, and diarrhea, and a soft or normal diet
- Taking other oral medications
- No life-threatening infections or sepsis
- Showing signs and symptoms of clinical improvement (i.e., decreased temperature, white blood cells less than 15,000, respiratory rate of less than 24 breaths per minute, systolic blood pressure greater than 90mm Hg)
- Not receiving pressor agents

At MountainView Hospital in Las Vegas, we use the following criteria to identify candidates for IV to PO conversion:
- On IV therapy for 24 hours (48 hours for the initial 12 months of our IV to PO conversion program)
- Able to swallow or on tube feedings
- Currently receiving other medications by mouth or via G-tube
- Hemodynamically stable (not receiving vasopressors)
- No active GI bleed
- Not on TPN therapy

Exceptions might include:
- ICU patients who do not qualify due to hemodynamic instability
- Patients with ongoing nausea and vomiting
- Patients with malabsorption syndromes

We have experienced a monthly cost savings averaging $15,000 to $20,000, with an estimated 400 conversions per month.
Agents Included in the Protocol
The agents selected for inclusion in the IV to PO protocol must have excellent bioavailability. While there are many antibiotics and GI acid-controlling agents that fall into this category, MountainView selected only five agents, based on their strong financial payback:
- Levofloxacin/ciprofloxacin
- Moxifloxacin
- Fluconazole
- Linezolid
- Pantoprazole
- Famotidine

Protocol Development
A protocol that defines the process of patient selection, drug selection, and implementation without physician contact must be developed in conjunction with the medical staff to establish exactly how the process will work and how the patients will be selected. Typically, you should gain the support of a few physicians and then present the protocol to the P&T committee for approval. It is essential to have one or two “champion” physicians on the protocol development committee. The physician champion is usually the chairman of the P&T committee and will present the proposal at the other medical staff meetings. Once the P&T committee approves the protocol, it will typically be forwarded to other physician committees, such as section committees, medicine, cardiac, OB/GYN, surgery, and the medical executive committee.

Most physicians do not have a problem with the concept of changing routes, but the mechanics of the process can get in the way. They are concerned about the notes left in charts, phone calls at all hours just to change one dose, and designating a physician to act on requested changes. A protocol that establishes the agreed upon criteria for the interchange and an automatic implementation by the pharmacist — without interaction with the physician — is a win-win situation for both pharmacy and medical staff.

Order Sheets
Once the medical executive committee approved our protocol, we trained all of our pharmacists in the program. When the pharmacist receives a medication order for one of the
drugs in the program, the pharmacist reviews the patient’s record in the computer system, as well as other information that might be on the order sheet. Most of the time, the pharmacist can determine if the patient meets the conversion criteria from the information contained in the computer record and the order sheet. The computerized patient record contains the diagnosis and history (i.e., possible GI bleed, history of nausea and vomiting, malabsorption syndrome, etc.). The order sheet will contain any orders for other oral medications, in addition to the targeted IV drug. If the patient is taking other oral medications, they may be able to take the target drug orally.

If the patient meets the criteria, the pharmacist initiates the conversion by filling out a “change in therapy” order sheet that states the therapy is being changed from “X” to “Y”, based on a medical staff-approved protocol. This order sheet is sent to the nursing floor and is placed in the patient’s chart. The pharmacist then enters the changed order into the computer system. If the pharmacist cannot determine if the patient meets criteria from the available information, the pharmacist will call the nursing floor to discuss the patient’s condition with the nurse. The physician is contacted only when he or she countermands the order change, which has only happened five times in the past five years at our facility.

**Newsletter**

Sometimes a newsletter is a helpful way to inform physicians about changing processes and new protocols. Figure 1 is an example of the one in use at MountainView Hospital. It contains information about pharmokinetics, inclusion criteria, and an example order change.

**Cost Savings Estimates and Monitoring**

Many facilities try to estimate the resulting cost savings from an IV to PO conversion program by tracking the number of clinical interventions made by the pharmacists. They then apply a savings formula based on an estimated number of days of IV therapy avoided. For example, the pharmacist intervened on day two of IV therapy and the average length of stay is five days. Therefore, the facility saved the cost of three days of IV therapy minus the cost of three days...
of PO therapy. Other facilities have tried to track the individual patients and count the actual days of IV therapy saved. They document the details of each intervention — using the number of days on IV therapy and oral therapy to calculate the cost savings for each individual intervention — and then come up with a total for the month. This is very time-consuming and a misuse of a clinical pharmacist’s time, which could be used in other, more rewarding endeavors.

During a review of published literature, MountainView found a facility in Canada that calculated their savings in a rather unique manner, which is somewhat similar to the method we ended up using. The facility had a conversion program in place for some time, but felt they were not maximizing the potential benefits. They developed an analysis plan for “inappropriate” IV ciprofloxacin doses, defined as instances in which a patient met the criteria for an IV to PO switch but was not converted. They looked at the total cost of therapy between two periods of time and factored in the cost of inappropriate IV ciprofloxacin doses. They also identified a “pharmacist preventable” IV ciprofloxacin dose as an IV dose administered to a patient considered to have met the conversion criteria during the time the clinical pharmacist was on duty (Monday through Friday, 8:00AM to 4:00PM).

We elected to simplify our estimation of the cost savings by directly measuring the cost of a therapy day for the targeted drugs before and after the implementation of the conversion program. We took the utilization numbers for the billing record monthly summary for each charge code of the involved drugs (all dose sizes and both

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MountainView Hospital realized significant cost savings through its systematic IV to PO conversion program.
IV and PO dosage forms). The number of therapy days was calculated by dividing the total number of doses by the daily frequency number of doses. For example, for a BID drug, the total number of doses was divided by two, and for a drug given four times daily, the total was divided by four. None of the drugs in our conversion program were adjusted for renal impairment by changing the dosing frequency, so we did not have to account for that effect.

In the spreadsheet we developed for monitoring drug therapy usage, we entered the cost of the dosage form for each item in our program. For this calculation, we did not vary the cost from pricing increases or decreases, because we were only interested in determining the cost savings from making the IV to PO switch. We calculated the cost of a therapy day for each of the drugs in our program for the three-month period prior to implementing the program—the baseline cost period. To calculate the cost savings in future months, we took the cost difference between the baseline period and the month in question and multiplied that difference by the number of therapy days for the month in question. This gives us a directly calculated cost savings based on our activities of converting the IV form to the oral form.

After the spreadsheet was built, all we need to enter on a monthly basis is the utilization quantity of the drugs included in the program and the total number of patient days for the month. The main spreadsheet calculates the cost of drugs per patient day and the number of therapy days. These two numbers are entered into another spreadsheet that contains the baseline period treatment numbers, and the total cost savings for the month is then calculated.

**Results**

We have experienced a monthly cost savings averaging $15,000 to $20,000, with an estimated 400 conversions per month. Over the course of some months, in which we had a spike in our patient census, the staff pharmacists simply did not have the time to initiate the conversions. Physician acceptance has been close to 100%. We do experience very rare cases in which a physician might change the therapy back to the IV route, but there have been only about five such cases over the five-year period.

An IV to PO conversion protocol can be implemented in most any facility. Start by selecting four or five drugs with the most advantageous cost differential, and then "sell" the protocol to your physicians by demonstrating how convenient it will be. Physicians are certainly aware of the benefits of such a protocol and will likely approve it, so long as it does not interfere with their normal activities. Using this method, you can ensure the success of your conversion protocol, thereby improving patient care and decreasing medication-related costs for your institution.

### Examples of Drugs Covered by this Protocol:
- Famotidine – Pepcid
- Fluconazole – Diflucan
- Levoﬂoxacin – Levaquin
- Linezolid – Zyvox
- Pantoprazole – Protonix

### Medical Staff Protocol:
The Medical Staff (through the P&T Committee and MEC) has approved a protocol which allows the pharmacists to make automatic route changes if patients meet a set of criteria:

- Patient has been on IV therapy for 48 hrs.
- Patient is able to swallow (or is receiving tube feedings) and is currently receiving other medications by mouth or by G-tube.
- Patient is hemodynamically stable (ie not receiving vasopressor drips such as Dopamine).
- Patient does not have an active GI-bleed.

When all these conditions are met, the pharmacist will write an order on the patient’s chart which will take effect the next day.

Example: “Change Levoﬂoxacin 500mg IV q24h to Levoﬂoxacin 500mg PO q24h starting tomorrow morning unless otherwise ordered by Dr. _____ per Medical Staff Protocol”

This procedure gives the physician about 24hrs to countermand the order if necessary.

**Note:** The “blood level versus time” chart for Fluconazole in MountainView’s newsletter.

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