



DRUG FORMULARY R • E • V • I • E • W™

Utilization, Criteria and Outcomes

May 2010: Vol. 26, No. 5 Pages 49-60

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Hospital improves safety, quality by having pharmacists involved in admission

Pharmacist involvement is key

Pharmacist involvement in medication reconciliation is so crucial to patient safety that one 450-plus-bed Wisconsin hospital invested considerable staff resources to make this a smooth process from admission through discharge.

“Pharmacists as medication experts are ideal to do medication reconciliation, but it is a labor-intensive process,” says **Kristin Hanson, MS, RPh**, medication safety officer at Froedtert Hospital in Milwaukee, WI.

In a recently-published study, the hospital showed that the medication reconciliation process has resulted in a reduction of medication errors from 90% to 47% on the surgical unit since pharmacists were assigned to this role. Also, the error rate decreased from 57% to 33% on the medicine unit.¹

“We’ve made significant improvements in patient safety, and I feel confident that this is how we want to handle it,” Hanson says. “This is not an inexpensive and easy improvement to do, but we feel it’s the right thing to do.”

After collecting some preliminary data in 2005, the hospital decided it made sense from a quality and safety perspective to have pharmacists involved in medication reconciliation for all patients, she adds.

The hospital leadership’s decision was reinforced by the Joint Commission’s focus on admission and transfer in its National Patient Safety goals and

by the Institute for Healthcare Improvement’s 5 Million Lives Initiative’s focus on reducing medical harm, Hanson notes.

“We decided to start efforts with the admission history and get as accurate a medication history as we could when the patient is admitted,” Hanson says. “The key piece is getting that accurate medication list for what the patient is on at home.”

SUMMARY POINTS

- Hospital’s medication errors decreased dramatically when pharmacists began conducting admission medication interviews.
- All pharmacists are trained to take medication histories.
- Pharmacists remain involved throughout patient’s hospital stay.

The hospital's administration saw the pharmacy's proposal to have pharmacists conduct the medication history at admission, spending an average of 20 minutes per patient, and agreed to fund 3.5 additional FTEs of pharmacist time, she adds.

"With the administration's support and with safety being a top priority, these were our new positions," Hanson says.

All of the pharmacists at Froedtert Hospital are clinical pharmacists who work in a decentralized environment. They are involved with 11 decentralized teams in inpatient care, divided by intensive care units (ICUs) and floors. So each pharmacist is trained to obtain medication histories at admission.

Since pharmacists became involved, the hospital has identified and addressed more medication discrepancies at admission and discharge than

previously, says **Carolyn Oxencis**, PharmD, clinical pharmacist at Froedtert Hospital.

"When I came on board, my portion of the project was admission medication history and reconciliation of orders," Oxencis says. "I collected information from the regular patient care unit and different patient populations."

Oxencis found that 53% of patient cases had some type of medication discrepancy, including both intentional and unintentional.

The intentional discrepancies would be when a physician purposely changed a patient's medication after hospital admission because the hospital either had a different drug on the formulary or because the physician needed to hold back on the patient's regular drugs for safety issues. An example would be a physician stopping warfarin or aspirin when a patient was admitted for a bleeding problem.

But the unintentional discrepancies could pose safety problems.

For instance, Oxencis recalls reviewing the home and hospital-initiated medications of a new patient and finding that the hospital surgeon had prescribed Coumadin[®] despite the patient having a normal INR and no history of clotting.

"When I did further digging into it, I found out the patient was taking Coricidin[®], an over-the-counter cough and cold medication, and the doctor had misunderstood," Oxencis says.

The doctor had read the order incorrectly, thinking Coricidin was Coumadin.

"So the doctor was about to give the patient an anticoagulant when all the patient had been taking was Tylenol[®] and a cold medicine," she adds. "This made me realize how easily a medication error could occur."

By having a pharmacist involved in the admission medication reconciliation, a potential adverse event was averted. (*See story on how admission medication reconciliation program works, p. 51.*)

"There are all types of different errors or discrepancies that can occur in a hospital," Oxencis notes. "Each of these could have a potentially different impact on an individual patient."

Examples of potential medication discrepancies include the following:

- Wrong strength;
- Wrong directions;
- Unacceptable abbreviation;
- Missing strength;
- Missing route of administration;
- Missing directions;
- Inpatient medication omitted;
- Home medication omitted.¹

Drug Formulary Review (ISSN#1548-2790) is published monthly by AHC Media LLC, 3525 Piedmont Road, Building Six, Suite 400, Atlanta, GA 30305. Telephone: (404) 262-7436. Periodicals Postage Paid at Atlanta, GA 30304 and at additional mailing offices.

POSTMASTER: Send address changes to *Drug Formulary Review*, P. O. Box 740059, Atlanta, GA 30374.

Subscriber Information

Customer Service: (800) 688-2421 or fax (800) 284-3291, (customerservice@ahcmedia.com) Hours of operation: 8:30 a.m.-6 p.m. Monday-Thursday; 8:30 a.m.-4:30 p.m. Friday.

Subscription rates: One year (12 issues), \$499. Add \$17.95 for shipping & handling. Outside U.S., add \$30 per year, total prepaid in U.S. funds. Discounts are available for group subscriptions, multiple copies, site-licenses or electronic distribution. For pricing information, call Tria Kreutzer at 404-262-5482. Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issue date. Back issues, when available, are \$83 each. (GST registration number R128870672.)

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Editorial Questions

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Froedtert Hospital's pharmacist-conducted medication reconciliation was implemented for all inpatients admitted to the hospital, except for patients admitted for observation or 24-hour admits, Hanson says.

"We did a few extensive pilots before implementing it," she adds. "And we did extensive training for pharmacists on how to do the best job and finding the best resources to pull from."

Each pharmacist attended a training session that lasts up to two hours, and they were given competency testing.

"Then there were also some one-on-one training and observation," Hanson says. "We've built in this training for all new pharmacists now."

The pharmacy department added the additional pharmacist FTEs into its practice model and made patient care area pharmacists responsible for conducting histories of patients in their area.

"Rather than having one person do all of the medication histories and reconciliations in the hospital, each pharmacist does it for their patients," Hanson says.

Pharmacists take patients' medication histories when they're admitted, but are also available for consultations during the patients' stay and at discharge. The medication history information is placed in the hospital's electronic medical record, which makes it easier for physicians to review.

"When we started this it was a much more paper-based system," Hanson notes.

"Because we have such a complete medication history up-front and throughout the continuum of care, it should provide quite accurate information for the discharge component," she says. "And now with the electronic piece improving the workflow, they don't need to have a pharmacist involved intimately with every single patient."

There are some plans to expand the pharmacist's role in the hospital, including adding more pharmacist time to working in the emergency department and putting a pharmacist in the pre-operative clinic, Hanson says.

"Patients come in to the clinic a week or two before surgery, which is the ideal time to interview them about their medications," she says.

REFERENCE

1. Murphy EM, Oxencis CJ, Klauck JA, et al. Medication reconciliation at an academic medical center: Implementation of a comprehensive program from admission to discharge. *Am J Health-Syst Pharm* 2009;66:2126-2131. ■

How hospital's pharmacist admissions medication history program works

Pharmacists assist throughout hospital stay

One direct way to improve hospital medication safety is to have pharmacists involved in taking medication histories at admission and medication reconciliation from admission to discharge, one hospital has learned.

Froedtert Hospital in Milwaukee, WI, has improved its medication reconciliation process, enhanced patient care, and reduced medication errors and unintended discrepancies by having hospital pharmacists work with patients from the beginning.

Here's how the hospital's program works:

- **Meet with patients soon after admission:**

"Pharmacists see patients who were admitted to the hospital within 24 hours of admission," says **Kristin Hanson, MS, RPh**, medication safety officer at Froedtert Hospital in Milwaukee, WI.

The hospital has an alert system that let's staff know about new admissions, says **Carolyn Oxencis, PharmD**, clinical pharmacist at Froedtert Hospital.

Pharmacists will meet with the new patients as soon as it's feasible, but first will do some preliminary work to see whether the patient has been admitted previously, Oxencis says.

If patients are unable to talk about their medications, then pharmacists meet with their family members, she adds.

The first step is to enter the room and double-check the patient's identification by verifying the patient's name and date of birth, she explains.

Oxencis introduces herself by her first name and explains that she's a pharmacist on that unit, and that she's there to ask about their medications.

"I say, 'We want to make sure physicians are

SUMMARY POINTS

- It's important to quickly meet with patients after admission to conduct medication histories.
- Search for medications/supplements that doctors may have missed.
- Compile findings and reconcile these with physician reports.

aware of everything you've been taking; we're an important check to prevent mistakes," Oxencis says.

- **Use detective skills to obtain complete medication list:** By the time pharmacists

meet new patients, a resident typically has already conducted a preliminary medication history and written orders, Hanson notes.

“But pharmacists do a much more extensive medication history, and they explain to patients what they’re doing,” she says.

For some patients, this interview process is straight forward, but for others it will take longer than 20 minutes to complete, Hanson adds.

Pharmacists ask patients about all of their prescription or over-the-counter (OTC) medications, including dietary supplements.

They’ll ask about herbal teas, which some oncology patients take to help with the fatigue, or fish oil, which patients sometimes take for their cardiovascular health, or brewers yeast for cholesterol, Oxencis says.

“Sometimes patients are on more OTC supplements than medications,” she adds.

“We talk about drug allergies and make sure our information is up to date about any allergies they might have,” Oxencis says. “We talk about immunizations for flu, pneumonia, and hepatitis, and we ask where they pick up their medications.”

Pharmacists also might ask patients who their community physician is so they can call the doctor’s office for more medication information.

Or if a patient seems uncertain about a medication, the pharmacist might call the patient’s pharmacy to check on which prescriptions the patient has and which have been recently filled, Oxencis says.

• **Compile information for medication reconciliation:** Pharmacists watch for drug omissions, incorrect names, wrong doses, and other potential problems.

“I put the medication list into computer systems, and then reconciliation begins,” Oxencis says.

The information collected is put into the hospital’s electronic medical record (EMR), which can then be compared to what the physician has put into the record.

“This is what pharmacists are trained to do,” Oxencis says. “We learn patient interviewing skills, and we know the names of all medications, generic brands, how they’re dosed,” Oxencis explains. “So we get the best and the most accurate medication lists.”

The EMR has a system for alerting staff to any major drug interactions. But there’s also room in the electronic record for the pharmacist to note how reliable the list is.

“Sometimes the medication list is very reliable; sometimes it’s not,” Oxencis says. “Sometimes the patient lives alone, and sometimes we put a nota-

tion in our notes so doctors and nurses can see that this patient is really reliable, and we’re really confident that they’re taking these medications.”

Pharmacists compare the physician’s list to their own list and follow-up on any discrepancies they discover.

“We have to think about what we’ll do about it and how significant it is,” Oxencis explains. “Do I need to page the physician right away because this could be dangerous, or does the patient take a stool softener at home and would like to take one here, but I don’t need to page the physician right away.”

The hospital’s policies and procedures provide guidance for how to deal with high alert medications or missed doses.

“Ideally, we want to reconcile everything within 24 hours of admission,” Oxencis says. “Depending on the time, sometimes the day shift or the night shift pharmacist will take care of it.”

• **Follow-up with patients through discharge:** Froedtert Hospital pharmacists stay involved with patient care throughout the patient’s hospital stay, Hanson says.

“Pharmacists review all orders,” she explains. “If there are any transfers, the pharmacist also is involved in reconciling those orders at transfer.”

Also, pharmacists review medication orders for pre-operative and post-operative care, and they make recommendations throughout the hospitalization process, she adds.

Pharmacists do not provide medication reconciliation for every patient at discharge, primarily because the admission medication information and electronic EMR make this unnecessary.

“Most of the time, physicians and nurses can do the discharge part,” Hanson says. “But we’re continuing to look at opportunities for pharmacists and seeing what additional value a pharmacist could provide patients.” ■

Survey shows recession’s impact and changes on pharmacy workforce

More pharmacists rate workload as high

Pharmacy practice both in the community and in hospitals continues to change and evolve with some trends increasing as a result of the 2009

SUMMARY POINTS

- Pharmacists have stuck to current jobs during economic downturn.
- Part-time work increased in 2009.
- Increasing percentages of pharmacists say they have high workloads.

recession, a national pharmacy workforce survey finds.

For instance, a trend that likely is due to the current economic downturn is that hospital pharmacists increasingly are staying longer in their jobs. The

proportion of hospital pharmacists who have been working at their current jobs for less than three years has dropped from 26% in 2000 to 13% in 2009, the survey reports.

Another trend related to the recession is that the proportion of pharmacists working part-time has increased from 14.9% in 2000 to 20.9% in 2009, according to the 2009 national pharmacist workforce survey prepared by the Midwest Pharmacy Workforce Research Consortium and sponsored by Pharmacy Manpower Project Inc. of Alexandria, VA.

“We’ve been tracking part-time work, which is 30 hours or less per week, and we’ve had an interesting finding between the surveys in 2000, 2004, and 2009,” says **Jon Schommer**, PhD, RPh, the director of graduate studies and associate department head of pharmaceutical care and health systems at the University of Minnesota, College of Pharmacy in Minneapolis, MN. Schommer presented the survey’s findings at the ASHP meeting in December, 2009, in Washington, DC.

“There’s a straight line trend going up, showing that pharmacists are working part-time more now than they ever have,” Schommer says.

“We analyzed this trend by gender and age and found that for men there is a straight-line increase where they work part-time more when they hit age 60,” he adds. “For females, there are two segments: One is during childbearing and child rearing years, where there is an increase in part-time work, and then it goes back down before swinging up again.”

Schommer notes that gender-blind workplace parental leave policies might result in more men turning to part-time work in their 30s, as well.

“As this new generation comes through, we don’t know what their values are regarding taking time off work,” he says.

The survey also found that more pharmacists now report having an excessively high workload

than in previous years.

In 2004, 54% of pharmacists rated their workload as high or excessively high, while in 2009, this percentage jumped to 68% of pharmacists.

“Across all categories there is evidence of increased workload,” Schommer says.

About 64% of hospital pharmacists reported having a high or excessively high workload in 2009, compared with 61% making this claim in 2004, Schommer says.

This compares with 72% of pharmacists who work for chain drug stores reporting having a high or excessively high workload

“Where we saw the biggest jump was among pharmacists at supermarket pharmacies where only 35% reported a high or excessively high workload in 2004, and this jumped to 69% in 2009,” he adds. “Our take-home message is that every single pharmacy workplace has over 60% of pharmacists reporting a high workload.”

The positive news for hospital pharmacies is that other workplaces have caught up or passed the hospital pharmacy with regard to the workload stress for employees, and this might make recruiting new staff easier.

“Hospital pharmacies have developed new programs and are utilizing pharmacy in ways that attract new pharmacy graduates,” Schommer says. “Health-system pharmacists are given opportunities to provide direct patient care services, and their responsibility for dispensing is quite low.”

These changes, along with the fact that community pharmacy practice no longer is low-stress, have made the hospital setting more appealing.

“There have been some advancements in patient care practices for the hospital pharmacy,” Schommer says.

The survey also found that the proportion of older pharmacists, who are actively practicing pharmacy has increased, while the proportion of pharmacists age 40 and younger has decreased.

Pharmacists, ages 40 and younger, accounted for 44.1% of practicing pharmacists when a similar survey was taken in 2000. But in 2009, the proportion of pharmacists in this age group was 24.4%. In 2009, 32.5% of practicing pharmacists were older than age 55; in 2000, only 16.8% were older than age 55, according to the survey’s results.

Another continuing trend is the increasing proportion of practicing pharmacists who are women.

It's risen from 44.8% in 2000 to 46.4% in 2009, the report says.

Younger pharmacists and those with the PharmD designation are more likely to be female than older pharmacists and those with RPh designations, Schommer says.

"We found a trend that older pharmacists and their cohort are typically male; they have no PharmD, no residency training, and they spend a lot of time in dispensing activities," Schommer says. "The cohort of PharmD-trained pharmacists are more likely to be residency-trained — up to one-third; they're more likely to be female, and they're engaged in patient care activities much more than dispensing."

New graduates of pharmacy schools are looking for patient care-type jobs, he adds.

"The question is: If we are changing our profession and we have most of new job creation in patient care, then how many pharmacists do we need to do patient care?" Schommer says. "If we're building efficiencies in dispensing, do we have a shortage or surplus, and what are our needs for the future?"

One answer to this question can be found in the numbers of new pharmacy school graduates.

"The number of pharmacy graduates in the nation is going up to almost 11,000 per year," Schommer says.

Pharmacy is the third-largest health care profession, following nursing and physicians, Schommer says.

"There are about 250,000 licensed pharmacists in this country, and that includes me and I don't practice," he adds.

"This profession has developed the capacity to solve medication therapy problems in society," he says. "Part of our role is to assure that prescription drugs are evaluated and dispensed perfectly, but also there are a lot of problems that pharmacists can help solve."

Future roles for pharmacists might include coordinating patients' medical homes, pharmacists stepping in when there is a shortage of primary care providers, and pharmacists increasingly working on interdisciplinary teams, Schommer predicts.

"If our profession starts doing that, and we get more efficient with the dispensing side, then what does that mean for the numbers of pharmacists we need?" he says. "The profession is changing so much, it will be interesting to see if there are shortages or surpluses of pharmacists." ■

Sepsis bundle reduces hospital mortality from 61% to 24%

ED more quickly diagnoses sepsis

Community hospitals can implement an effective and successful sepsis bundle program despite some initial obstacles, including obtaining buy-in from physicians, a Plano, TX, hospital has shown.

The Medical Center of Plano implemented new sepsis bundles for both diagnosing suspected sepsis and treating severe sepsis in January, 2007, through a collaboration of the hospital's pharmacy department, intensive care unit (ICU), and emergency department (ED).

This effort resulted in the hospital reducing its overall sepsis mortality rate from 61.1% in 2006 to 24% by the end of 2007, say **Gita Wasan Patel**, RPh, PharmD, BCPS, clinical pharmacy coordinator, and **Nicki Roderman**, RN, MSN, CCRN, clinical nurse specialist for critical care at The Medical Center. The sepsis program received a 2009 award from the American Society of Health-System Pharmacists (ASHP).

The sepsis bundle also resulted in cost-avoidance, including a savings of about \$500,000 from sepsis patients not spending time on ventilators and dialysis machines, as they would have had their disease been diagnosed and treated later as often occurred before the hospital began to use the order sets, Patel says.

"The bundle itself doesn't cost a whole lot of money, but by using it and diagnosing patients up front you can avoid all extraneous costs that go along with treating a sepsis patient," she adds.

Physician adherence to the sepsis diagnostic orders has increased from about 50% after the two years of implementation to 80% now, Roderman says.

The ED's compliance rate for using the diagnostic orders is 100%, and many physicians now follow the order sets' guidelines by memory, she notes.

But it took a while to get most of the hospital's community-based physicians on board, she notes.

"We had to collect a lot of data to show how it was working," Roderman says. "Once we got the medical executive team to recommend the order sets, that's when things changed."

The Medical Center began to focus on improving sepsis outcomes when the Surviving Sepsis

SUMMARY POINTS

- Hospital's new sepsis bundles result in huge cost avoidance savings.
- Emergency department has complete compliance with using sepsis order sets.
- Pharmacists collect data to offer proof to physicians of sepsis bundles' value.

Campaign (SSC) was launched five years ago, Patel says.

The SSC originally was an initiative of the European Society of Intensive Care Medicine (ESICM), the International

Sepsis Forum (ISF), and the Society of Critical Care Medicine (SCCM). The SCCM and ESICM continue to maintain its web site and database. SSC materials can be found at www.survivingsepsis.org.

Here are the steps the hospital took when initiating its sepsis bundle program:

1. For an interdisciplinary sepsis team.

The hospital formed a team that was led by Patel and Roderman. Its other members included the medical director of the hospitalist group, an intensivist, and the medical director of the ED.

"We developed this team to look at the Surviving Sepsis guidelines and to develop an order set," Patel says.

2. Develop a sepsis order set.

One of the problems with the previous sepsis program was that physicians were not diagnosing sepsis in the ED as quickly as ideal, Patel says.

So the team created both a suspected sepsis order set and a diagnosed severe sepsis order set.

"We wanted to efficiently diagnose patients and get them started as quickly as possible on therapy," Roderman explains. "We used guidelines and myriad order set examples that we could find on-line, including material from the Institute for Healthcare Improvement (IHI)."

The order sets are concise with boxes for check marks in front of instructions. To make it simpler for physicians, the appropriate boxes are pre-checked, so all they need to do is sign the order set. Nurses and pharmacists will carry out the instructions.

Here are some sample instructions from the Diagnosed Severe Sepsis Order Set:

- For MAP < 65 mmHg or SBP < 99 mmHg set:
 - Norepinephrine (Levophed®) 8 µg in 250 mL D5W at 4 µg per minute — Titrate up or down by 2 µg per minute every 15 minutes to keep SBP > 100 mmHg to maximum of 30 µg per minute.
 - Vasopressin 200 units in 500 mL D5W at 0.6 units per hour — Titrate up or down by 0.2 units per hour every 15 minutes to keep SBP > 100

mmHg to maximum of 2.4 units per hour. Use only if Levophed is more than 20 µg per minute.

- Dopamine 400 mg in 250 mL D5W at 2 µg per kg per minute. Use only if Levophed is more than 20 µg per minute and vasopressin is infusing — Titrate up or down by 2 µg per kg per minute every 15 minutes to keep SBP > 100 mmHg to a maximum of 20 µg per kg per minute. Wean dopamine as possible to keep SBP > 100 mmHg as patient improves.

3. Review and edit order sets.

The sepsis team's order sets were reviewed and edited and then sent to the hospital's special care committee to be reviewed, Patel says.

The sepsis team used order set templates in creating the sheets, but changed these to reflect the institution's specific policies.

For instance, The Medical Center of Plano uses specific antibiotics, and these were put in the order sets, Patel says.

"Our drug choice was determined by our particular antibiogram," she explains. "We do pharmacokinetic/pharmacodynamic dosing of our antibiotics, which means we optimize the mathematical parameters of the drug itself in an effort to maximize efficacy."

For example, in some cases it's wiser to give more frequent smaller doses than less frequent large doses, she adds.

"We use a more aggressive combination than we do for hospital-acquired pneumonia patients," Patel says. "One thing we recently changed was we have added more potent gram-positive agents to the order set."

After receiving input from the special care committee, the order sets were reviewed by the hospital's pharmacy and therapeutics committee. Then they were sent to the medical executive team for final approval, she adds.

4. Educate staff.

The sepsis team held one-hour inservices about the order sets for nursing and emergency department staff. Nurses were educated about how to identify sepsis patients and how to treat them, Roderman says.

The special care committee and medical director helped disseminate information to physicians and others, she says.

They educated staff on an as-needed basis, as well.

"Patients on the oncology floor are more prone to sepsis, so our medical director had conversations with the oncology group and nurses," Roderman says. "All emergency department physi-

cians were inserviced by an educator in the ED.”

Whenever a new physician began working with patients in the hospital, the medical director or assistant director would go over the order sets and update the doctor about what the hospital was doing for sepsis patients, she adds.

Also, nurses annually take a competency exam about sepsis.

5. Collect data.

“At first we just looked at everybody who was placed on the orders, and we started seeing a dramatic improvement in mortality rates,” Roderman says.

“Then in 2007, I picked up data on patients who were not placed on order sets and looked at them and saw a common theme,” she adds.

Physicians who used the sepsis order sets had lower mortality rate among their sepsis patients than those who did not, she explains.

“Then in 2008 we gave reports back to different groups of physicians, including internal medicine and critical care physicians, about what their mortality rates and adherence were on order sets,” Roderman says.

Seeing data on the mortality differences helped to convince physicians to use the sepsis bundles.

Slowly over a three-year period, increasing numbers of non-employee hospital physicians began to use the order sets.

Data collection helped with staff buy-in to the sepsis programs. Both physicians and nurses were more motivated to make the changes after learning how much the mortality rate had dropped, Roderman says.

“We posted information in the unit, in the X-ray room, and even in the bathrooms so everyone could see what was going on,” she says. “We calculated the mortality rate and let people know how many sepsis patients would have died in the program’s first year if we had done nothing.” ■

Smaller hospitals can do well with medication management programs

Here’s one good example

Pharmacy directors of small hospitals might think that offering medication therapy management (MTM) services is a little out of their reach.

SUMMARY POINTS

- A 25-bed hospital successfully implemented medication therapy management program led by a pharmacist.
- Providers indicate enthusiasm for the assistance.
- Key is to review patient’s medications and update list.

But at least one 25-bed hospital has proven that this is a short-sighted view.

New Ulm Medical Center, an Allina facility, in New Ulm, MN, successfully has launched a pilot

MTM program that uses part of the time of one pharmacist.

“We have grants from the state for the pilot stage,” says **Sarah Leslie**, PharmD, pharmacy coordinator at New Ulm Medical Center.

“This is a billable service, but it’s complicated to set up the billing,” Leslie adds.

Leslie works with four providers and has seven collaborative practice agreements in which she can make medication adjustments in the treatment involving hypertension, diabetes, smoking cessation, asthma, chronic obstructive pulmonary disease (COPD), etc.

The patients she sees typically have multiple issues, including the following:

- Their average age is 70 years;
- Their median number of diagnoses is 10, and the range is 5-40 diagnoses;
- Their median number of medications is 14, including over-the-counter vitamins and analgesics;
- A significant proportion of the patients also have suboptimal blood cholesterol and blood glucose levels.

“These are pretty complicated patients,” Leslie says.

The program is too new to have produced outcomes, but it has been a success so far with providers. Some doctors have made referrals even without collaborative practice agreements, and Leslie sees these patients for a poly-pharmacy review.

“So far the program seems to be working,” Leslie says. “We haven’t allocated additional time for this, so I just hop over there when I have a patient.”

Using the case study of a patient who was referred because of multiple statin intolerance, Leslie describes how the program works:

- **Physicians who have collaborative practice agreements make a full service referral.**

“We’re an integrated medical center, and our clinic is attached to the hospital,” Leslie says. “Say we have a family practitioner who doesn’t know what to do about a patient who has tried different

statins, and none are working.”

The physician orders a consultation with the MTM pharmacist, and Leslie sees the patient on a scheduled clinic day. The referral reason is listed as multiple statin intolerance. The patient arrives with a bag of medications.

Leslie has an hour to spend with the patient to review her medications and problems with the statin drugs.

- **Review all medications and update med list.**

“We go through the patient’s medications and I update her medication list,” Leslie explains. “There will be things she’s no longer taking.”

Leslie reviews the patient’s medication schedule, talks to her about the drugs she should be taking and how to best take them, and she reminds the patient about why medication adherence is important to improving the patient’s health.

Here are her other questions and instructions to MTM patients:

- Do you have any problems with your medications?

- Have you been taking your medications each day and time?

- Do you use a medication reminder device or pill box?

- If you don’t have one of these, would you like one?

- Do you take your medicine in the morning or at night?

“Then I do a brief review of systems, looking for adverse reactions to specific types of drugs,” Leslie says.

- Do you have muscle aches or cramps (if the patient takes statins)?

- Do you get dizzy when you stand up?

- Do you have problems with constipation (if the patient takes narcotic painkillers)?

- Do you have edema (if the patient takes a diuretic)?

- **Solve the patient’s medication problem.**

In the case of the patient with statin intolerance, Leslie discovered that the patient had muscle aches from the drugs.

“Her liver enzyme tests were normal, so I wasn’t worried about that and thought we could try another statin,” Leslie says. “She had been adherent until she couldn’t tolerate the side effects.”

The patient’s cholesterol would go down, but then she’d quit taking the drugs because of her discomfort from muscle aches.

“She wasn’t on the drugs long enough to get the full effect,” Leslie says.

“I asked her to describe the muscle aches because a lot of times people think they have muscle aches from a statin, but it’s really not the problem,” she adds.

For instance, a patient who describes a shin splint pain probably does not have a side effect of the statin drugs.

“Usually, the statin drugs could cause a flu-like ache, and it’s usually in the large muscles like biceps and quads, with some weakness, as well,” Leslie explains.

In the case of the patient whose cholesterol was not well-controlled, Leslie found that she had tried most available statin drugs with the exception of fluvastatin and lovastatin.

“So I tried her on lovastatin, which was the one that I felt could get her to the goal of having an LDL of less than 100,” Leslie explains. “Then I told her to take CoQ10 (Coenzyme Q10), a supplement, as there’s some evidence that it helps prevent muscle ache.”

Leslie explained that the evidence for CoQ10 was mixed and that there was no evidence from randomized, controlled trials.

“But there’s virtually no disadvantage other than you have to pay for it,” she adds.

- **Assess patient’s other disease states.**

Since the MTM patients invariably have multiple chronic diseases and health problems, Leslie typically spends some time going over their other health issues.

The statin patient also had diabetes, and Leslie assessed whether she had been adherent with those medications, as well as finding out the answers to these questions:

- What is her diet like?

- Had she been exercising?

- If she hadn’t been adherent, why not?

Leslie might add sulfonylurea to the patient’s medication regimen if diabetes control has become an issue. This drug is within her collaborative practice agreement.

If a patient’s diabetes control is very poor, she might start the patient on insulin or refer the patient to a diabetes educator.

- **Send report to providers.**

“Then I send an electronic note to the patient’s provider, saying what I did,” Leslie says.

If Leslie has a question about taking an action outside her collaborative agreement, then she’ll contact the provider with this question, as well.

For instance, a patient might ask to be taken off a particular medication that is outside of the agree-

ment, so Leslie will contact the provider with this question and later get back to the patient with an answer.

- **Schedule a follow-up appointment.**

At the end of the MTM session, Leslie gives patients a letter that summarizes the changes to their medications.

“I type the letter while visiting with them, and it goes home with them,” she adds.

The letter states their next appointment and how they need to have their lab tests done before they return. It also lists their medications, times of day to take them, and any other instructions.

For the statin patient, the follow-up appointment would be in 6-8 weeks, unless there are problems that necessitate an earlier visit, Leslie says.

“Or some patients might be asked to call me with their blood sugar numbers in two weeks time,” she says. “Some patients know what they’re doing and are more independent, while others need closer follow-up.”

The follow-up appointment typically lasts a half hour, and Leslie makes certain the patient’s lab results are available before the appointment begins.

In the case of the statin patient, the lab results showed that the statin drug change was working. The patient’s LDL had dropped 40 points, and she had no intolerable muscle aches, Leslie recalls.

“She’s still on the medication and CoQ10,” she says.

“If I’ve done everything I can do for a patient, I’ll discharge them from the service and say, ‘If in the future you are on new medication or have questions, then you can come back to see me,’” she adds. ■

in doing so can be complicated.

“Over the last three to four decades there have been a number of methods proposed to estimate renal function,” says **Gary R. Matzke**, PharmD, FCP, FCCP, FASN, DPNAP, professor of pharmacy and pharmaceuticals and professor of medicine at the Medical College of Virginia, Virginia Commonwealth University in Richmond, VA.

The Cockcroft-Gault method for creatinine clearance (CrCl) emerged as the primary way to estimate renal function, and it’s been accepted as the standard approach for decades, Matzke says.

Pharmacists can make modifications to this method to accommodate its use for morbidly obese patients, as well as for patients who have lost limbs, had traumatic injuries, and are elderly, he says.

During the last 10 years, there was a renaissance of new approaches introduced for estimating renal function, Matzke says.

These include a method introduced by **Andrew S. Levey**, MD, and colleagues from The Institute for Clinical Research and Health Policy Studies, Tufts Medical Center in Boston, MA.

“Levey and colleagues looked at a unique set of data from over 1,600 patients with chronic kidney disease (CKD), who had measured renal function,” Matzke explains. “They looked at the patients’ characteristics of age, weight, gender,

SUMMARY POINTS

- The last decade has seen a renaissance of new approaches for estimating renal function.
- There are too few data to confirm which new methods are equivalent.
- One key is to study the medication’s FDA label.

urea nitrogen concentration, albumin, serum creatinine, and they came up with an equation for estimating the glomerular filtration rate (GFR).”

Levey’s method

BEST PRACTICE SPOTLIGHT

Use best practices when estimating renal function

Variety of options available

Adjusting drug dosage for patients with chronic kidney disease is a core function of clinical pharmacy practice, but deciding on best practices

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was published in 1999 as the Modification of Diet in Renal Disease (MDRD) study equation.¹

“They followed up that six variable equation about two years later with a four variable equation,” Matzke says. “That methodology began to receive lots of support as a foundation for staging chronic kidney disease.”

The researchers’ intent was to identify patients at risk of experiencing progression from mild renal disease to moderate, severe disease and even to the need for dialysis, he notes.

In the decade since this introduction, public health officials and others have focused attention on the need to identify people at risk of CKD and have advocated having hospital laboratories use the four variable method to estimate GFR and report it as a part of their standard practice, he adds.

“In a survey that Tom Dowling, John Murphy, and I conducted last year, we found that 90% of the surveyed pharmacists stated that their hospital now has this as a standard in their hospital lab,” Matzke says.

So the use of MDRD evolved from a method with useful public health benefits to a method that some have proposed may be a useful means for adjusting drug dosing regimens, he explains.

The National Kidney Foundation now recommends that hospitals use the MDRD study equation to estimate GFR.

And this change raises questions for hospital pharmacists who need to know the most appropriate way to adjust drug dosage in patients, Matzke says.

“The controversy in drug dosing is that creatinine clearance is not the same as GFR,” he says. “And currently, the industry guidance the Food and Drug Administration published in 1997 urged that companies use creatinine clearance as the index of renal function for determining the relationship between drugs pharmacokinetic parameters and renal function.”

The key is to find another marker of kidney function that can be used, as well. (*See expert guidelines for measuring renal function, right.*)

“We’re entering an era where there will be an expanded need for assessment of renal function,” he says. “There are some good ways, some bad ways, and some really ugly ways which have been proposed.”

But even the method that now looks the worst or the most complicated could prove to ultimately be the most useful.

“Right now, everybody in the pharmacy community and everyone who takes care of patients

who have CKD or acute kidney injury need to be on their toes so they’ll know what they’re estimating (CrCl or GFR),” Matzke says. “If the equation to estimate the dose is based on renal function measure or estimate X, Y, or Z, then the clinician needs to know what measure of renal function was used in that dosing equation so they’re putting in the appropriate value to arrive at the right dose for the patient.”

Now there are a variety of methods available and emerging, and there is a lack of prospective data to confirm that all the methods are equivalent.

One key is to study the product’s FDA label. If the label says the drug dosage adjustment is by creatinine clearance, the pharmacist at this time should use creatinine clearance, especially for drugs with a narrow therapeutic range, Matzke suggests.

If the label is not specific as to the renal function estimation methodology, then the pharmacist might be able to substitute the MDRD-estimated GFR or use a serum cystatin C method, he adds.

Finally, it’s important that pharmacy directors keep up with the latest studies on this topic since it’s been evolving so rapidly.

“There are at least 10 to 15 other equations that have been proposed in the last few years, while we used to have one predominant one until MDRD was developed in 1999,” he adds.

REFERENCE

1. Levey AS, Bosch JP, Lewis JB, et al. A more accurate method to estimate glomerular filtration rate from serum creatinine: A new prediction equation. *Ann Intern Med* 1999;130:461-470. ■

Expert offers these guidelines for measuring renal function

Hospital pharmacists have a variety of options now for the estimation of renal function for the purpose of drug dose adjustment, and it’s sometimes difficult to decide the best approach.

An expert offers some suggestions and best practice guidelines for making this determination.

Gary R. Matzke, PharmD, FCP, FCCP, FASN, DPNAP, professor of pharmacy and pharmaceuticals and professor of medicine at the Medical College of Virginia, Virginia Commonwealth University in

Richmond, VA, spoke about methods for estimating renal function in a talk at the 44th American Society of Health-System Pharmacists (ASHP) clinical meeting and exhibition, held Dec. 6-10, 2010, in Las Vegas, NV. The following suggestions are based on his talk and slide presentation on the topic:

- **Follow these learning objectives:**
 - Pick the best marker of renal function on the basis of the component it measures;
 - The accuracy and limitations of the various procedures that can be utilized to measure GFR are considerable, but one should measure when estimation methods yield divergent results;
 - Know strengths and weaknesses of the various methodologies for estimating CrCl or GFR, and choose the best method for the population of patients you predominantly care for.
- **Review these practical considerations for adjusting drug doses:**
 - GFR has historically been expressed as mL/min/1.73 m² body surface area (BSA). The MDRD equation is designed to report GFR in these same units.
 - The original Cockcroft-Gault equation used the patient's total body weight (TBW) without additional BSA adjustments and yielded units of mL/min.
 - Over time, this equation has evolved to replace TBW with either ideal body weight (IBW) or an adjusted body weight.
 - Although the units with the C&G method are different than GFR, if one uses IBW instead of TBW no additional adjustments are necessary.
- **Here are some considerations with MDRD:**
 - Make sure you use the right equation based on the methodology the hospital laboratory uses to measure serum creatinine;
 - Most labs report "eGFR" values only when eGFR < 60 mL/min/1.73 m² (otherwise reported as "GFR > 60 mL/min/1.73 m²");
 - FDA labeling for most drugs now gives renal drug dosing recommendations based on CrCl (Cockcroft-Gault);
 - Studies evaluating relationship between MDRD (eGFR) and total drug clearance currently are rarely available.
- **Refer to these best practice recommendations:**
 - MDRD eGFR (4-variable) or CKD-EPI should be limited to CKD classification for the present time;
 - CrCl using Cockcroft-Gault (mL/min) should be used for drug dosing algorithms;
 - Accurately timed measured 24-hour CrCl, or estimated CG with weight index specified, should be used to stratify patients into renal pharmacokinetic studies;
 - Prospective pharmacokinetic studies should identify the relationship between MDRD eGFR, as well as C&G estimated CrCl and drug clearance. ■

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