The Institute of Medicine has reported that medication errors cause an estimated 7000 deaths annually. Additionally, drug-related adverse events increase the risk of mortality by 1.88, with approximately 27% of reported adverse drug events attributed to negligence. As the healthcare system is faced with the challenge of reducing medication errors and adverse drug events, one viable solution may be to increase physician-pharmacist collaboration. According to the recent literature, increasing physician-pharmacist collaboration may result in a reduction in total drug morbidity and mortality.

(Key words: physician, pharmacist, medication errors, adverse drug events)

A recent report from the Institute of Medicine of the National Academies has targeted patient safety and improved outcomes as a new focus for the healthcare system. The Institute estimates that medical errors have a financial impact of $37.6 billion per year and may be implicated in causing between 44,000 and 98,000 deaths annually in hospitals in the United States. One important component of medical errors is medication errors, which cause an estimated 7000 deaths per year. As part of the recommended strategies set forth by the Institute to reduce medication errors, pharmacists should be included during rounds in patient care units and physicians should have access to pharmacists’ expertise while making drug-related decisions.

Should pharmacists be more involved with patient care in the new millennium?

In 1986, the New England Journal of Medicine published a letter indicating that more “physician-pharmacist cooperation” was needed. This letter focused on pharmacists having greater access to drug-drug interactions via computers. However, the letter went on to state that such access to information may adversely affect the health of patients if pharmacists do not consult with physicians about an interaction’s clinical significance. In 1999, Leape et al reported that having a pharmacist on a patient care team in a medical intensive care unit was associated with a lower rate of adverse drug events caused by prescribing errors. Although collaboration between physicians and pharmacists was emphasized in each case, the focus was different.

Older literature suggests that physicians were less favorable toward pharmacists’ interventions. But is the physician perspective of pharmacists changing? The more recent literature indicates that physicians may be more accepting of integrative pharmacy services. This change may have evolved from the transitioning scope of pharmacy practice during the 1990s. National surveys conducted in 1989, 1992, 1995, and 1998 revealed that the percentage of hospital pharmacies providing pharmacokinetic consultations doubled from 40% in 1989 to 80% in 1998. Pharmacists also provided drug therapy management under specific protocols in 70% of hospitals—a 2.8-fold increase since 1989. Other pharmacy services commonly reported by hospitals are routine monitoring of drug therapy, adverse drug reaction monitoring, nutrition (parenteral and enteral) monitoring, cardiopulmonary resuscitation team response, drug counseling, and rounds with medical teams.

Congruent with the changes in pharmacy practice are modifications in pharmacy education. During the past 50 years, colleges of pharmacy have transitioned to more clinically based curriculums. The colleges are training pharmacists to assist physicians in implementing and monitoring therapeutic regimens, assess patient-specific data to optimize drug therapy, evaluate the quality of drug literature, and effectively communicate to patients. The colleges also provide more in-depth experiential programs allowing for greater experience in managing drug therapy and interacting with physicians on medical teams.

Scope of the problem

Medication errors are only one component of overall negative outcomes associated with drug therapy. Numerous reports have indicated that the problems surrounding drug therapy are significant. Although the magnitude of adverse events and misadventures attributed to drug therapy is difficult to quantify, sufficient data are available to conclude that a problem exists. The focus of most studies has been on events within institutional settings; however, events within the ambulatory set-
Increased mean length of stay due to ADEs (1.74 days) was may be even higher. The estimated costs in private nonteaching hospitals in major teaching hospitals is lower than in nonteaching hospitals. Technology affords more opportunities to collect data in rural and small community settings.

In 1995, Bates et al reported that during a 6-month period, 247 adverse drug events (ADEs) and 194 potential ADEs were identified in the medical and surgical units of two tertiary care hospitals. Of those events reported, 28% were evaluated as preventable. Forty-two percent of the life-threatening ADEs were considered to be preventable. Most (56%) errors occurred at the time of ordering, with 4% of errors occurring during the dispensing process. Two physician reviewers retrospectively defined and classified the events. The drugs most frequently associated with adverse events were analgesics (30%) and antibiotics (24%).

In 1991, Brennan et al reported the results of a 1984 chart review from 51 nonpsychiatric hospitals. Of the 30,121 records reviewed, adverse drug events occurred in 3.7% of hospitalizations, with 27.6% of those events attributed to negligence. Almost 14% (6895) of the drug-related events were fatal, with 2.6% (877) resulting in permanent disability. Two physician reviewers assessed the events.

Classen et al reported that of all the patients admitted to a 520-bed tertiary care hospital between January 1, 1990, and December 31, 1993, ADEs affected 2.43% of patients. Patients who had adverse drug events had a mortality rate of 3.5% versus 1.05% in the control group (P < .001). This study was a matched case-control study in which patients with ADEs were identified as cases and patients without ADEs from the identical time frame were considered matched controls. Patients who had ADEs had a mean length of stay of 7.69 days versus 4.46 days in the control group (P < .001). Further analysis indicated an ADE increased the risk of mortality by 1.88 (95% confidence interval, 1.54–2.22; P < .001).

Not only are negative outcomes regarding drug therapy important to review, but also the costs associated with them. Johnson and Bootman reported that drug-related morbidity and mortality cost an estimated $76.6 billion per year (ranging from $30.1 billion to $136.8 billion) in the ambulatory setting.

Bates et al reported that the additional length of stay (2.2 days) due to an ADE within a tertiary care hospital cost an additional $3244 compared to the control group. The control patients were identified as patients on the same units as the study group with similar “pre-event” lengths of stay. For preventable ADEs, the additional length of stay was 4.6 days, costing an additional $5857. When data were adjusted for sampling, an estimated annual cost associated with ADEs for a 700-bed teaching hospital was $5.6 million, with $2.8 million associated with preventable errors. Additionally, Rosenthal et al reported that the mean length of stay for patients treated in major teaching hospitals is lower than in nonteaching hospitals. The estimated costs in private nonteaching hospitals may be even higher.

Classen et al estimated the cost associated with an increased mean length of stay due to ADEs (1.74 days) was $2013 at a 520-bed teaching hospital. The annual estimated cost associated with adverse drug events for the hospital studied was more than $1 million. The authors commented that if 50% of ADEs are preventable, successful intervention programs could save the hospital more than $500,000 and prevent 450 extra days of hospitalization.

**Pharmacists: A viable solution**

Traditionally, pharmacists have been primarily associated with the dispensing of medication. Although this is a vital component of providing drug therapy to patients, should pharmacists be used to a greater extent within the healthcare system? Lesar et al looked at specific factors associated with errors in medication prescribing. In a 631-bed tertiary care teaching hospital, 2103 errors were found to have potential clinical significance during the 1-year data collection period. Of the 966 evaluated errors, 30% were associated with knowledge or application of knowledge of the drug therapy. Twenty-nine percent were associated with knowledge of patient factors, and 17.5% were associated with mathematical errors.

By increasing physician-pharmacist collaboration during the prescribing process, the possibility of reducing errors may be greatly improved. However, reduction of medication errors would be only one benefit to increased physician-pharmacist interaction. Physicians would also potentially benefit from this type of relationship with improved patient outcomes, reduced cost (direct and indirect), and improved patient compliance and satisfaction. The published literature indicates that physician-pharmacist collaborative efforts are producing positive outcomes.

In 1999, Leape et al reported that when a senior pharmacist participated on physician rounds within the intensive care unit, preventable adverse drug events decreased by 66% (P < .001). The participating pharmacist made 366 recommendations to physicians, with a 99% acceptance rate. Incidents were identified by one pharmacist and one nurse and evaluated by two physician reviewers. Estimated cost savings of the interventions were $270,000 per year.

Gattis et al reported that when patients with acute heart failure were evaluated by a clinical pharmacist, mortality decreased (P = .005) and increased doses of angiotensin-converting enzyme inhibitors were used (P < .001). Services provided by the clinical pharmacist included medication evaluation, therapeutic recommendations to the attending physician, patient education, and follow-up telemonitoring. Usual care was provided to the control group. Additionally, Rainville suggested that clinical pharmacists’ interventions could decrease readmissions due to heart failure.

The cost impact of six hospital pharmacists’ recommendations was assessed by McMullin et al. Seventy-nine percent of pharmacists’ interventions reported from a 1200-bed teaching hospital were focused at improving quality of care, and 21% improved quality of care with reduced cost. Pharmacists provided recommendations to the physicians in the intervention...
group; however, patients were only observed within the control group. The intervention group had a 41% lower drug cost compared with the control group. With data extrapolation, an estimated $394,000 in hospital costs could be saved annually through pharmacists’ patient care involvement.

Looking at overall hospital mortality rates, a study analyzing 1029 US hospitals found institutions that provided clinical pharmacy services were associated with lower mortality rates. Specifically, four services were associated with lower mortality rates: drug information services, clinical research, cardiopulmonary resuscitation team participation, and admission drug histories. When hospital staffing increased for dispensing pharmacists, overall drug costs increased for the institution, but when staffing increased for clinical pharmacists, drug costs decreased. The clinical services that pharmacy provided that decreased total cost of care were drug use evaluation, drug information, adverse drug reaction monitoring, drug protocol management, medical rounds participation, and admission drug histories.

Not only have pharmacy services within hospital settings been shown to be beneficial for patients, but also within ambulatory settings and nursing facilities. Several reports have described models promoting ambulatory physician-pharmacist collaboration. However, improved documentation is needed to truly assess the overall impact pharmacists have on morbidity and mortality in the outpatient setting.

Conclusions

Drug therapy management is more complex than ever. The rate of new drug approvals has been increasing with a parallel increase in drug-drug, drug-disease, and drug-herb interactions. Pharmacoeconomic considerations are becoming increasingly important as managed care organizations begin to aggressively monitor the costs of healthcare. Evidence-based medicine and positive outcomes are the bases for standards of care, which will increase the emphasis of optimizing drug therapy. Extensive drug and disease information is readily available to patients via the Internet, books, magazines, and direct-to-consumer advertising by the pharmaceutical manufacturers, thus leading to changes in patient expectations from the healthcare industry. The consumer use of herbs and dietary supplements is increasing, leading to a greater complexity in managing drug therapy. Our healthcare community is in a conundrum as technology, information, and medicine merge. How does the healthcare system improve patient outcomes and patient satisfaction, yet curb the increasing costs of providing patient care? One viable solution may be to increase physician-pharmacist collaboration in both the inpatient and outpatient settings.

References


