Improving Prescribing Patterns for the Elderly Through an Online Drug Utilization Review Intervention: A System Linking the Physician, Pharmacist, and Computer

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Context.—Pharmacotherapy is among the most powerful interventions to improve health outcomes in the elderly. However, since some medications are less appropriate for older patients, systems approaches to improving pharmacy care may be an effective way to reduce inappropriate medication use.

Objective.—To determine whether a computerized drug utilization review (DUR) database linked to a telepharmacy intervention can improve suboptimal medication use in the elderly.


Setting.—Ambulatory care.

Patients.—A total of 23 269 patients aged 65 years and older throughout the United States receiving prescription drug benefits from a large pharmaceutical benefits manager during a 12-month period.

Intervention.—Evaluation of provider prescribing through a computerized online DUR database using explicit criteria to identify potentially inappropriate drug use in the elderly. Computer alerts triggered telephone calls to physicians by pharmacists with training in geriatrics, whereby principles of geriatric pharmacology were discussed along with therapeutic substitution options.

Main Outcome Measures.—Contact rate with physicians and change rate to suggested drug regimen.

Results.—A total of 43 007 alerts were triggered. From a total of 43 007 telepharmacy calls generated by the alerts, we were able to reach 19 368 physicians regarding 24 266 alerts (56%). Rate of change to a more appropriate therapeutic agent was 24% (5860), but ranged from 40% for long half-life benzodiazepines to 2% to 7% for drugs that theoretically were contraindicated by patients’ self-reported history. Except for rate of change of β-blockers in patients with chronic obstructive pulmonary disease, all rates of change were significantly greater than the expected baseline 2% rate of change.

Conclusions.—Using a system integrating computers, pharmacists, and physicians, our large-scale intervention improved prescribing patterns and quality of care and thus provides a population-based approach to advance geriatric clinical pharmacology. Future research should focus on the demonstration of improved health outcomes resulting from improved prescribing choices for the elderly.

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the elderly take at least 1 medication that should be avoided. Inappropriate prescribing in the elderly is often attributed to the lack of training in geriatrics in medical and pharmacy education. An effective way to overcome this problem may be through a concurrent drug utilization review (DUR) program. This type of utilization management system is designed to send a warning to pharmacists when potentially inappropriate drugs are prescribed. The warning provides an opportunity to change therapy, or (3) consideration of the disease history information that could be aggravated by the drug. The disease history information was self-reported by the patient during enrollment in the Partners for Healthy Aging Program, a health management program for the elderly designed and implemented by MMMC. These senior-specific DUR criteria were then computerized and coded by the National Drug Code to identify prescriptions requiring intervention.

Pharmacist training for the DUR program was conducted by a team of geriatric pharmacy experts at all of the 13 MMMC mail-service pharmacies. These pharmacists were instructed in both the pharmacy science around the DUR alerts, as well as communication theory to conduct telephone one-to-one educational outreach with physicians. If a potentially unsafe medication was requested, the computer sent the pharmacist a warning. The pharmacist subsequently attempted to call the physician to discuss the alert, possible therapeutic alternatives, and applicable withdrawal recommendations. The intervention outcomes included the following: (1) a discontinuation or change in therapy, (2) no change in therapy, or (3) consideration of a change in therapy at the next patient visit. Both the physician and the patient received an explanatory confirmation letter in the mail if the original prescription was changed. The prescription or changes were then filled and dispensed to the patient through the MMMC mail-service channel. All relevant data pertaining to the intervention were recorded electronically in MMMC DUR files.

**Study Intervention**

An independent medical advisory board, established by MMMC, consisting of geriatric specialists in pharmacy, medicine, and nursing adopted the criteria of Beers et al to identify the most dangerous drugs for the elderly from a safety perspective. The MMMC Department of Medical Affairs developed an integrated DUR education and intervention program centered around a computerized online database aimed at decreasing the use of these potentially unsafe drugs.

These senior-specific criteria covered 3 DUR categories: drug-age, maximum daily dose, and drug-disease (Table). The drug-age category defined drugs with pharmacokinetic, pharmacodynamic, or ADE profiles known to be harmful in the elderly and for which safer alternatives exist. Maximum daily dose alerts were limited to the short-acting benzodiazepines, for which specific dosing recommendations exist for individuals older than 65 years. Drug-disease criteria defined drugs that should not be used in an older patient in the presence of a specific condition that could be aggravated by the drug. The disease history information was self-reported by the patient during enrollment in the Partners for Healthy Aging Program, a health management program for the elderly designed and implemented by MMMC. These senior-specific DUR criteria were then computerized and coded by the National Drug Code to identify prescriptions requiring intervention.

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**Statistical Analysis**

Frequency distributions as well as univariate and bivariate statistics were computed to measure use of the targeted medications and the number of physician contacts. The DUR change rate was determined as a function of the number of interventions completed during the 1-year period of surveillance. Specifically, the DUR change rate was equal to the percentage of events in which calls to physicians were completed and recommended action was taken (DUR change rate = number of accepted recommendations/number of recommendations) × 100.

The overall change rate was calculated for the 3 drug classes and separately for drugs within the 3 groups. We also used z tests to determine the significance of these DUR change rates from 2%, a level reported in another comprehensive summary article to be the baseline rate of change in prescribing over time.12,13

<table>
<thead>
<tr>
<th>Description</th>
<th>Alerts, No.*</th>
<th>DUR Alert Change Rate, %†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug-age interaction (n = 19362)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long elimination half-life benzodiazepine hypnotics (flurazepam)</td>
<td>1679</td>
<td>40‡</td>
</tr>
<tr>
<td>Anti diabetic (chlorpropamide)</td>
<td>728</td>
<td>33‡</td>
</tr>
<tr>
<td>Short acting barbiturates (pentobarbital, secobarbital)</td>
<td>44</td>
<td>25‡</td>
</tr>
<tr>
<td>Long elimination half-life benzodiazepine anxiolytics (clorazepoxide, clorazepate, diazepam, quazepam)</td>
<td>11 344</td>
<td>24‡</td>
</tr>
<tr>
<td>Anxiolytics (meprobamate)</td>
<td>835</td>
<td>23‡</td>
</tr>
<tr>
<td>Cardiovascular (methyl dopa)</td>
<td>1300</td>
<td>22‡</td>
</tr>
<tr>
<td>Anticholinergic antidepressants (amitriptyline, doxepin)</td>
<td>2856</td>
<td>17‡</td>
</tr>
<tr>
<td>Narcotic analgesic (meperidine, pentazocine)</td>
<td>576</td>
<td>19‡</td>
</tr>
<tr>
<td>Maximum daily dose exceeded (n = 4532)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate- or short-acting benzodiazepine (alprazolam, lorazepam, oxazepam, temazepam, triazolam)</td>
<td>4532</td>
<td>25‡</td>
</tr>
<tr>
<td>Drug-disease interaction (n = 372)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any non steroidal anti-infl ammatory drug and peptic ulcer disease</td>
<td>238</td>
<td>7‡</td>
</tr>
<tr>
<td>Any β-adrenergic receptor antagonist and chronic obstructive pulmonary disease</td>
<td>134</td>
<td>2‡</td>
</tr>
</tbody>
</table>

*pAlert refers to specific computer-based DUR criteria with a recommended change in prescribing as categorized by drug-age (inappropriate use due to age of patient); maximum daily dose (prescribed level outside of therapeutic dose); drug-disease (possible adverse reaction based on known disease state).

†DUR alert change rate is indicated by the percentage of events in which physicians were contacted and recommended action was taken (change rate = number of accepted recommendations/number of recommendations) × 100.

‡P < .001 vs no change.
RESULTS

A total of 43,007 alerts among 23,269 elderly patients were triggered during the study period across the 3 DUR categories. The median age of the study population was 72 years (25%-75% interquartile range, 67-77 years); 24% were 80 years or older. Women constituted 62% of the population; 35% of patients lived in the South, 31% in the Midwest, and 24% in the Northeast. Patients received a median number of 8 unique prescriptions during the study period. Approximately 25% of the patients completed medical history information, reporting an average of 6 comorbidities. The most common reported comorbid conditions included the following: (1) hypertension, (2) osteoarthritis, (3) hypercholesterolemia, (4) peptic ulcer disease, and (5) angina.

The contact rate for reaching the targeted physicians of these patients was 56% (24,266/43,007 alerts; average intervention time, 15 minutes), decreasing the number of actionable alerts to 24,266. A total of 19,368 physicians were contacted for the actionable alerts (average, 1.25 alerts per physician). Most physicians were male (95%), between the ages of 40 and 60 years (66%); 40% were located in the South. Approximately 1 actionable alert was generated per patient (24,266 alerts per 23,269 patients). The overall DUR change rate, defined as the percentage of accepted recommendations divided by the total number of recommendations, was 24% (N = 5,860/24,266). Fifteen percent (3,599/24,266) of alerts resulted in immediate change to a therapeutic alternative, and 9% (2,261/24,266) resulted in a physician’s indication to review the therapeutic alternative at the patient’s next visit. For the purpose of this analysis, we present the DUR change rate as the sum of these 2 results above, since more than 90% of these patients did not receive the targeted medication within the next 6 months.

The data were first analyzed by type of DUR alert (Table). The intervention had the greatest impact on alerts in the drug-age category (N = 19,362), resulting in a 24% rate of change. Although the number of alerts was lower for the maximum daily dose category (N = 4,532), this intervention resulted in a similar 25% rate of change. Interventions involving the drug-disease category (N = 372) resulted in a 5% rate of success. The overall DUR change rate compared with an expected change rate of 2% was significant at the P < .001 level. All change rates were significant except for the β-adrenergic receptor antagonist-chronic obstructive pulmonary disease drug-disease category.

There was marked variability in the change rate for specific DUR rules within the 3 categories as described above. The drug-age alert resulted in change rates of 17% to 40%; within this category, the long elimination half-life benzodiazepine hypnotics had the highest rate of change at 40%. The maximum daily dose category included only 1 class of drugs, the intermediate- or short-acting benzodiazepines, and resulted in a 25% rate of success. There were 2 classes of drugs included in the drug-disease category, with success rates ranging from 2% to 7%. The reasons physicians gave for not changing were as follows: agreed with intervention but it was not applicable to the patient (55%; 10,123/18,406), disagreed with intervention (41%; 7,546/18,406), agreed with intervention but it was inconvenient for the patient (2%; 368/18,406), agreed with the intervention but the patient did not (1%; 184/18,406), or the physician terminated the call without giving an explanation (1%; 184/18,406).

COMMENT

This large-scale study examined a computerized online DUR database designed to help reduce inappropriate prescribing and improve quality of care in an elderly population. More than 43,000 prescriptions in more than 23,000 patients were evaluated in this study. The telepharmacy intervention yielded a contact rate with physicians greater than 50%, and the content of each intervention call focused on quality-of-care messages based on best practices as determined by the scientific literature and clinical guidelines. Messages linking the computer, pharmacist, and physician led to improved quality of care with nearly a quarter of all DUR alerts accepted by physicians, but varied from 40% for long-acting benzodiazepines to 2% for use of β-adrenergic receptor antagonist agents in patients with chronic obstructive pulmonary disease. Efforts to provide alerts to physicians at the point of care are thought to provide ever greater changes in prescribing and represent the next frontier for DUR intervention.

The use of prescription claims data offers major advantages in drug surveillance, including the ability to document all health service use without recall bias or incomplete drug history. Yet the limitations of claims-based information must be recognized.14,15 This study used information on medications that were actually prescribed and dispensed and does not include nonprescription drug use. No information is monitored in a medication profile, this study may have underestimated the number of medication alerts. Nonetheless, tracking of prescribing patterns represents an intermediate outcome that can be easily monitored in a large database and facilitates the identification and measurement of an important indicator of quality of care.

As reported earlier, when estimating the impact on the quality of prescribing, one should not compare the overall effect size of 24% with a theoretical 100% change rate, but rather against the 2% baseline rate of change that occurs in physicians’ prescribing over time.31 Furthermore, the drug alerts chosen for this computer-based intervention represent probable quality-of-care indicators and may be more effective studying a population than applying them in a case-by-case setting. Also, the drug criteria used here are likely to represent the most clinically relevant issues in geriatric pharmacy, thus small changes may have a major impact on clinical and economic outcomes.15 The validity of these drug criteria is based on the best available medical and pharmacy literature, as established by consensus panels of experts or other methods to develop clinical protocols.30 The physician contact rate of 56% was less than optimal for improving the overall care of older patients. While some physician feedback suggested an unavailability or unwillingness to participate in our DUR intervention, other physicians stated their appreciation for this patient-specific information.

Furthermore, if we considered all alerts generated and called on (N = 43,007) vs the actionable alerts when a physician was successfully contacted (N = 24,266), the overall change rate drops from 24% to 14%. We believe the actionable rate is the more appropriate figure to use as it estimates the population exposed to the intervention. The ability to merge computer online databases, pharmacist intervention, and physician involvement will continue to be a major hurdle given resource constraints as discussed above. Yet within the current environment of cost and resource containment, our change rate may represent the best that...
can be achieved, as well as a useful barometer for physician feedback concerning our intervention.

Despite these limitations, the results of this study suggest that such an intervention based on computer-generated DUR linked to systems that enhance communication between pharmacists and physicians can be successful and can improve prescribing of drug therapy for large patient populations. Our change rates of 15% (immediate changes) and 9% (consider change later) are further evidence of the ability of our program to both track prescriptions and intervene on inappropriate medications before the medication reaches the patient. Furthermore, in a follow-up analysis of physicians who stated they would “change medication later,” more than 90% of the targeted patients did not receive the inappropriate medication in the following 6 months. While we did not recontact the physicians, these data support the physicians’ initial decisions in response to the DUR intervention.

What is the future of such an intervention program? The need for intervention models targeted toward drugs with less than optimal risk-benefit profiles in the elderly patient is evident, especially to reduce drug-drug interactions. Second, the use of these drug-based quality indicators represents an intermediate outcome as mentioned above, with the final end points that should be measured being overall health status, functional status, and quality of life. Third, an assessment of the cost-effectiveness of the intervention is needed. Fourth, the technology of communication must be further examined, such as fax and Internet approaches. Finally, the ideal scenario involves an intervention at the point of care, when the physician and patient can discuss therapeutic options in the most logical place, the office setting.

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References