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The Quality of Pharmacologic Care for Vulnerable Older Patients

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Background: Although pharmacotherapy is critical to the medical care of older patients, medications can have considerable toxicity in this age group. To date, research has focused on inappropriate prescribing and policy efforts have aimed at access, but no comprehensive measurement of the quality of pharmacologic management using explicit criteria has been performed.

Objective: To evaluate the broad range of pharmacologic care processes for vulnerable older patients.

Design: Observational cohort study.

Setting: 2 managed care organizations enrolling older persons.

Patients: Community-dwelling high-risk patients 65 years of age or older continuously enrolled in the managed care organizations from 1 July 1998 to 31 July 1999.

Measurements: Patients' receipt of care as specified in 43 quality indicators covering 4 domains of pharmacologic care: 1) prescribing indicated medications; 2) avoiding inappropriate medications; 3) education, continuity, and documentation; and 4) medication monitoring.

Results: Of 475 vulnerable older patients, 372 (78%) consented to participate and had medical records that could be abstracted.

The percentage of appropriate pharmacologic management ranged from 10% for documentation of risks of nonsteroidal anti-inflammatory drugs to 100% for avoiding short-acting calcium-channel blockers in patients with heart failure and avoiding β -blockers in patients with asthma. Pass rates for quality indicators in the "avoiding inappropriate medications" domain (97% [95% CI, 96% to 98%]) were significantly higher than pass rates for "prescribing indicated medications" (50% [CI, 45% to 55%]); "education, continuity, and documentation" (81% [CI, 79% to 84%]); and "medication monitoring" (64% [CI, 60% to 68%]).

Limitations: Fewer than 10 patients were eligible for many of the quality indicators measured, and the generalizability of these findings in 2 managed care organizations to the general geriatric population is uncertain.

Conclusions: Failures to prescribe indicated medications, monitor medications appropriately, document necessary information, educate patients, and maintain continuity are more common prescribing problems than use of inappropriate drugs in older patients.

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Pharmacotherapy is an essential component of medical treatment for older patients, but medications are also responsible for many adverse events in this group. Ninety percent of people 65 years of age or older take at least one medication (1). This age group, which represents only 13% of the population, accounts for one third of all prescription drug expenditures in the United States (2). Many older persons take multiple drugs for the treatment of several conditions, which increases the chance of adverse drug reactions, drug-drug interactions, and drug-disease interactions. The frequency of adverse drug events in elderly outpatients ranges from 10% to 35%, depending on the setting (3-5). Recognizing the magnitude of medication-related issues, panels of geriatric experts rate medication problems among the most important quality-of-care problems for older patients (6-8).

Reflecting the severity and frequency of adverse drug events in older patients, many investigations have focused on the appropriateness of medication prescribing to elderly persons. Implicit review mechanisms include the Medication Appropriateness Index, which consists of 10 medication characteristics (including indication, effectiveness, and dosage) that a trained pharmacist reviewer can judge as "appropriate," "marginally appropriate," or "inappropri-

ate." An application of the Medication Appropriateness Index to elderly veterans taking 5 or more prescription medications found that 74% had at least 1 inappropriate aspect to their prescriptions (9, 10). Reviews using explicit criteria usually focus on medications that should be avoided in the care of older patients. The list of medications to avoid, which was developed by Beers and colleagues on the basis of a formal consensus of geriatric experts (11-13), has been applied to various groups of patients, revealing a high prevalence of inappropriate drug use (14-20). In addition, explicit criteria about drug-drug interactions, treatment duration, and drug contraindications were created by Tamblin and colleagues and applied to medications prescribed to older patients in Canada (21). They found that more than half of older patients took at least one "high-risk medication."

Health policy efforts, on the other hand, have focused predominantly on finding ways to pay for the medication needed by older patients. Proposals aim to improve access to pharmacologic care but do not strive to develop mechanisms to evaluate or improve the quality of medication management for older patients. Improvement in access to medications without quality assurance may result in a mere increase in care without change in outcomes.

To provide a more comprehensive evaluation of the quality of pharmacologic care for older patients, we systematically evaluated medication management for a sample of older patients by taking advantage of a set of explicit process of care quality indicators developed and implemented in the Assessing Care of Vulnerable Elders (ACOVE) project (22). Whereas the earlier ACOVE analysis described overall quality of care and compared care quality for geriatric and medical conditions, this study focuses on pharmacologic care and identifies improvement needs in medication management. Our quality evaluation covered the continuum of pharmacologic care, from recognizing the indications for medications to choosing medication, prescribing appropriately, educating and documenting, and monitoring after prescribing.

METHODS

The ACOVE project developed a set of explicit quality indicators to evaluate the care provided to vulnerable older persons (22–24). The system focuses on processes of care within the domains of prevention, diagnosis, treatment, and follow-up and covers the spectrum of care contained in 22 conditions that are important in the care of older patients (7). The methods for selecting conditions and developing the quality indicators are described in detail elsewhere (7, 23). Methods included systematic literature reviews and multiple layers of expert judgment (23). The literature review resulted in proposal of candidate quality indicators, which were reviewed by an expert panel that rated each of the proposed quality indicators for validity and feasibility. This set was modified and approved by a clinical committee of national geriatric experts and by the American College of Physicians Task Force on Aging (24). From the final ACOVE set of quality indicators, 43 quality indicators (Table 1 and Appendix Table, available at www.annals.org) that pertained to pharmacologic care and had more than 5 eligible patients are included in this analysis.

Patients and Data Collection

We assessed care provided to older persons who were enrolled in 2 managed care organizations. Each managed care organization, one in the U.S. Northeast and the other in the Southwest, had more than 20 000 senior enrollees and contracted with a network of providers to deliver care. A random sample of community-dwelling persons 65 years of age or older was drawn from enrollees in each managed care organization. Eligibility criteria included continuous enrollment in the managed care organization for at least 13 months, no out-of-plan care, and no active treatment for malignant conditions (excluding nonmelanoma skin cancer) during the period. In addition, persons who did not speak English were excluded because our interview instruments were not available in other languages. Among the enrollees, we targeted “vulnerable elders,” defined as persons 65 years of age and older who are at increased risk for death or functional decline. Vulnerable elders were identi-

Context

Prescription and management of medications are important issues for older adults.

Contribution

Among elders enrolled in two managed care organizations, most quality problems were related to failure to prescribe indicated medications; failure to monitor medications; and failure to provide medication along with proper documentation and education in concert with other physicians.

Implications

Prescribing inappropriate medications for older adults is less of an issue than other aspects of drug therapy. Quality improvement efforts should focus on avoiding errors of omission in prescribing indicated medications, monitoring, patient education, and follow-up.

—The Editors

fied on the basis of self-report (or proxy report) by using a brief screening survey (the Vulnerable Elders-13 [VE-13] Survey [25]) administered by telephone. The RAND Institutional Review Board approved the study protocol.

Data were derived mainly from abstracting medical records. For participating patients, we identified all inpatient and outpatient medical records during the 13-month period of 1 July 1998 to 31 July 1999. These medical records were abstracted by trained nurses with experience in quality assessment. The abstractor considered all of a patient’s medical records when assessing whether a patient was eligible for and received the indicated care processes. Information on eligibility for a quality indicator could be derived from one medical record (such as a primary care physician starting an appropriate antidepressant) and the care process delivered and documented from records in another setting (such as a psychiatric consultant escalating the antidepressant dosage in response to lack of improvement). A senior nurse-reviewer assessed each completed medical record abstract, and physician overreaders reviewed quality indicators that required a clinical assessment, such as whether there was follow-up to newly started long-term therapy with a medication or whether newly started therapy with a highly anticholinergic drug had acceptable alternatives. We evaluated inter-rater reliability by re-abstracting a random sample of 10% of the medical records. These records contained 698 quality indicators; 97% had identical eligibility and 95% demonstrated identical eligibility and score. Details of study enrollment and data collection can be found elsewhere (22).

Because some aspects of care might not be adequately captured in the medical record (for example, patient education about medications), these data were supplemented

Table 1. Medication Quality Indicators, Number of Eligible Patients, and Pass Rates*

Quality Indicator Descriptort	Eligible Patients, n	Pass Rate (95% CI), %
Prescribing indicated medications		
PPI or misoprostol for patient with ulcer or gastrointestinal bleeding risk factors who is taking an NSAID	38	11 (4–25)
ACE inhibitor for diabetic patient with proteinuria	5	20 (3–69)
Calcium and vitamin D for patient with osteoporosis‡	59	27 (17–41)
Daily aspirin therapy for patient with diabetes	59	41 (29–54)
Prophylaxis for hospitalized patient at risk for stress peptic ulcer	10	45 (20–73)
Lipid-lowering drugs for IHD patient with LDL cholesterol level >3.4 mmol/L (>130 mg/dL) and no diet response	16	47 (25–70)
β-Blocker for patient with heart failure	21	48 (28–68)
β-Blocker for patient who had a myocardial infarction	53	53 (39–66)
Osteoporosis treatment medication (HRT or bisphosphonate or calcitonin)	10	60 (30–84)
ACE inhibitor for patient with hypertension and renal insufficiency	19	63 (40–81)
Medication for hypertension if no nonpharmacologic therapy response	11	64 (34–86)
ACE inhibitor for patient with heart failure	23	65 (44–82)
Aspirin for patient with coronary artery disease	73	66 (54–76)
Calcium and vitamin D for patient taking long-term steroid therapy	7	71 (32–93)
Bowel regimen to prevent constipation for patient taking opiate†	6	83 (37–98)
Antibiotics started within 8 hours after admission for pneumonia	8	88 (46–98)
Warfarin or aspirin, as appropriate, for patient with atrial fibrillation	18	94 (69–99)
Avoiding inappropriate medications		
Acetaminophen as first-line medication treatment for patient with osteoarthritis‡	96	79 (70–86)
Avoid tertiary amine tricyclic, MAOI, benzodiazepine, or stimulant as first-line antidepressant	10	90 (53–99)
Long-acting medications should be used to treat hypertension	59	93 (83–97)
Avoid strongly anticholinergic medications if alternatives exist	366	98 (96–99)
Avoid barbiturates unless patient has a seizure disorder	372	99 (92–100)
Avoid meperidine	369	99 (99–100)
Avoid chlorpropamide	89	99 (98–100)
Avoid first- or second-generation short-acting calcium-channel blocker for patient with heart failure	9	100 (100–100)
Avoid β-blockers if patient has asthma	15	100 (100–100)
Education, continuity, and documentation		
Documentation of ulcer or gastrointestinal bleeding history and, if present, justification for NSAID use	50	10 (4–22)
Documentation of medications prescribed by other physicians	6	42 (15–74)
Patient apprised of risks when NSAID started‡	52	54 (40–67)
Postdischarge outpatient record documentation of inpatient medication changes	11	55 (27–80)
Drug regimen review at least annually‡	223	70 (64–76)
Outpatient ophthalmology drugs continued when patient is hospitalized	6	83 (37–98)
Documentation of indication for newly started therapy with medication	258	98 (96–99)
Patient education about newly started therapy with medication‡	222	99 (96–100)
Medication monitoring		
Dose adjustment or drug change by week 8 if no response to antidepressant therapy	9	22 (6–58)
Dose adjustment or drug change by week 16 if inadequate antidepressant response	8	25 (6–62)
Potassium and creatinine level check within 1 month after starting diuretic	25	34 (19–53)
Potassium and creatinine level check within 1 month after starting ACE inhibitor	23	37 (20–57)
INR checked within 4 days after starting warfarin	11	45 (20–73)
INR checked at least every 6 weeks for patient receiving warfarin	44	53 (42–64)
Follow-up on response to newly started long-term therapy with medication within 6 months	136	62 (54–69)
Follow-up on newly started long-term therapy with medication at next visit with same provider	189	66 (60–72)
Electrolytes checked at least annually for patient taking diuretic	127	80 (72–86)

* ACE = angiotensin-converting enzyme; HRT = hormone replacement therapy; IHD = ischemic heart disease; INR = international normalized ratio; LDL = low-density lipoprotein; MAOI = monoamine oxidase inhibitor; NSAID = nonsteroidal anti-inflammatory drug; PPI = proton-pump inhibitor.

† For a complete description of each quality indicator, see the Appendix Table (available at www.annals.org).

‡ Quality indicator measured by patient interview. All other quality indicators were measured from the medical record.

by a quality-of-care interview with study participants (or, if necessary, their proxies). During the interview, patients were asked to list all of their medications. On the basis of conditions and medications reported during the interview, patients were asked about specific processes of care they had received. The interview was conducted by telephone between August and October 2000. To minimize recall bias, we asked about most recent care when implementing quality indicators that may include multiple events (for example, education about newly started therapy with a

medication). Information was obtained from medical records for 37 quality indicators and from the patient interview for 6 quality indicators.

For 4 quality indicators reported previously by using medical record data (22), we used interview data in this analysis because subsequent evaluation revealed that interview data on information transfer quality indicators yielded higher pass rates that were aligned with a priori hypotheses and provided more conservative estimates of quality of care.

Statistical Analysis

A quality indicator was scored for a patient if he or she met the eligibility criteria to receive the specified care process. The quality indicator was passed if the care process was implemented for the patient. If the medical record indicated that the patient declined the care process, the quality indicator was considered to be passed. On the other hand, if the patient had a prespecified contraindication to the care process (such as a patient with asthma who otherwise was eligible to receive a β -blocker after a myocardial infarction), the patient was considered ineligible for the quality indicator. Quality scores were calculated as the proportion of eligible patients who received indicated care. If a patient had multiple events eligible for a quality indicator, the proportion of the events with care provided was computed as the quality score. For example, if a patient had therapy with 2 medications started during the study period and the prescribing provider followed up on only 1, this quality indicator was scored 0.5.

For this analysis, we grouped the quality indicators into 4 domains: 1) using indicated medications; 2) avoiding inappropriate medications; 3) education, continuity, and documentation; and 4) medication monitoring. These domains correspond to the 4 steps of prescribing medications: recognizing indications for a medication; choosing the right medication; providing medication along with proper documentation and education in concert with the care of other physicians; and following up the patient (26). We calculated the overall pass rates for quality indicators in each domain and compared the scores across domains by using a Pearson chi-square test. Because domain pass rates could include multiple contributions from a single patient, standard errors and statistical tests were adjusted for the clustering of indicators within patients (27). Because quality of care did not differ between the 2 managed care organizations (22), we used pooled data for this analysis.

Sensitivity Analysis

The number of patients eligible for each quality indicator varied dramatically, with few patients eligible for disease-specific quality indicators and almost all patients eligible for medication avoidance. Therefore, we repeated the comparison across domains after assigning a weight to each quality indicator, defined as the inverse of the number of patients eligible for the indicator. These weights make each quality indicator, contribute equally to the overall domain pass rate and eliminate domination of the overall score by quality indicators that have large numbers of eligible patients.

In addition, for 3 of the quality indicators in the "avoiding inappropriate medications" domain, it was difficult to precisely specify eligible patients on the basis of medical record information. Therefore, almost the entire sample was included in the denominator for indicators focused on "avoid meperidine," "avoid barbiturates," and "avoid anticholinergic medications." We repeated the anal-

Table 2. Frequency of Long-Term Medications, by Class, Newly Prescribed to the Older Patients in the Sample

Medication Class*	Medications Prescribed, n (%)
Cardiovascular–renal	142 (32.0)
Analgesic	74 (16.7)
Respiratory	54 (12.2)
Central nervous system	51 (11.5)
Gastrointestinal	38 (8.6)
Metabolic/nutrient	21 (4.7)
Hormone	17 (3.8)
Neurologic	16 (3.6)
Hematology	8 (1.8)
Dermatology, ophthalmology, or others	22 (5.0)
Total	444 (100.0)

* Medication class was based on the therapeutic class of the National Drug Code. Four hundred forty-four new medications were prescribed for long-term use to 209 of 372 patients over a 13-month period.

ysis excluding these 3 quality indicators. Statistical analysis was performed by using Stata software, version 7.0 (Stata Corp., College Station, Texas).

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The funding source had no role in the design, analysis, and interpretation of the study or in the decision to submit the manuscript for publication.

RESULTS

Of 3207 older persons randomly selected from 2 managed care plans, 2278 (71%) were interviewed and 475 were identified as "vulnerable." Among 420 (88%) who consented to participate, 372 (89%) had medical records that could be abstracted. Of 341 patients who survived until the interview period, 245 (72%) completed the interview. The mean age (\pm SD) of participants was 80.6 ± 6.8 years (range, 65 to 98 years); 64% were female. Thirty-seven percent had not completed high school; 28% received some post-high school education. Twenty-three percent and 43% had at least one activity of daily living and instrumental activity of daily living disability, respectively. During the 13-month study period, therapy with 444 new medications was started for chronic conditions (mean, 1.2 new medications for chronic conditions per patient; range, 0 to 7) in 209 patients. **Table 2** shows the frequency of new prescriptions by medication class over 13 months. Cardiovascular–renal medications were the most frequently prescribed.

Table 1 shows the number of patients eligible for the 43 quality indicators related to pharmacologic care, as well as the percentage of patients passing each quality indicator. The indicators were stratified into 4 domains of pharmacologic care as described earlier. The "prescribing indicated medications" domain contained 17 indicators, with individual pass rates ranging from a low of 11% to a high of 94% (overall pass rate, 50% [CI, 45% to 55%]). Notable among these quality indicators was that only 11% of patients at high risk for gastrointestinal bleeding (defined as

being older than 75 years of age, being treated with warfarin, or having a history of peptic ulcer disease or gastrointestinal bleeding) who were prescribed nonsteroidal anti-inflammatory drugs received appropriate gastrointestinal prophylaxis. Angiotensin-converting enzyme inhibitors tended to be underused, but use varied considerably by indication. Approximately half of the patients in whom β -blockers were indicated because of coronary artery disease or heart failure did not receive these medications. Aspirin was underused as prophylaxis, as were calcium, vitamin D, and medications to prevent and treat osteoporosis.

The “avoiding inappropriate medications” domain contained 9 indicators. The overall pass rate of the quality indicators was 97% (CI, 96% to 98%). Seven quality indicators proscribed use of specific drugs or drug classes, and 2 quality indicators specified choice of drug or drug class to treat a certain condition. Few patients received these drugs. The lowest pass rate in this domain pertained to pharmacologic treatment of osteoarthritis. Only 79% of patients reported that physicians had instructed them to try acetaminophen as the first-line agent for this condition. All other quality indicators had pass rates of 90% or higher.

Eight indicators were contained in the “education, continuity, and documentation” domain. The overall pass rate was 81% (CI, 79% to 84%). Doctors documented the indications for medications and provided patient education about those medications almost always, but only 10% of medical records of patients using nonsteroidal anti-inflammatory drugs included documentation about gastrointestinal risks of these medications or justification for their use if risks were present. However, about half of patients, when interviewed, mentioned that risks had been discussed. Seventy percent of patients reported that in the last year their provider had reviewed their drug regimen with them.

The “monitoring” domain included 9 quality indicators. Five pertained to a laboratory evaluation for toxicity or therapeutic level, 2 required checking for a response to medication, and 2 monitored follow-up of treatment for depression. The pass rates ranged from 22% to 80%, with an overall pass rate of 64% (CI, 60% to 68%). Electrolyte and renal function monitoring after initiation of therapies with angiotensin-converting enzyme inhibitor and diuretic medications was poor. Quality indicators related to anti-coagulant monitoring were satisfied about half the time. Follow-up on a response to medication was documented for about two thirds of patients.

Comparison of performance on the 43 quality indicators by domain showed that “avoiding inappropriate medications” indicators generally achieved high pass rates, whereas other domains had lower performance with large variations. The difference in the pass rates was significant ($P < 0.001$ [Pearson chi-square test]) across domains. Pairwise comparisons of pass rates for all pairwise combinations of domains were statistically significant ($P < 0.001$).

Repeated analysis using weights to adjust for the different numbers of patients eligible for quality indicators

demonstrated a large difference in pass rate between “avoiding inappropriate medications” and the other domains. The difference between “prescribing indicated medications” and “education, continuity, and documentation” also remained significant ($P = 0.006$), but the pass rate for “prescribing indicated medications” in this analysis was not significantly different from the pass rates for “medication monitoring” ($P = 0.16$) and “education, continuity, documentation” ($P = 0.13$). The additional comparison excluding the quality indicators “avoid meperidine,” “avoid barbiturates,” and “avoid anticholinergic medications” decreased the overall pass rate in the “avoiding inappropriate medication” domain to 91% (CI, 87% to 94%). The difference across domains overall and pairwise remained statistically significant.

DISCUSSION

Contrary to the previous focus on avoiding medications in older patients, our study shows that greater improvement is needed in prescribing indicated medications, monitoring, and education and continuity. In particular, physicians seemed to inadequately attend to the potential for adverse effects of medications, as demonstrated by low pass rates in the area of evaluating patients’ risk for adverse reactions, educating patients and documenting risks, and monitoring.

In addition, the underuse of potentially beneficial medications is a considerable problem, which is consistent with previous research demonstrating that older patients are less likely than their younger counterparts to receive necessary drugs (28–32). Possible reasons include insufficient evidence of clinical benefit due to underrepresentation of older patients in clinical trials (33, 34), physicians’ nonspecific fear of polypharmacy (35), and financial barriers resulting from the lack of or insufficient insurance coverage of outpatient prescription drugs (36). Of note, such underuse was determined on the basis of data collected from both medical records and patient interview, taking into consideration patient intolerance or patients declining to use the prescribed medication.

Our study has several limitations. First, persons were selected from only 2 managed care plans that enrolled older adults. The findings may not be generalizable to other settings, particularly fee-for-service Medicare. All study participants had a pharmaceutical benefit covering brand and generic prescriptions with a copayment of \$10 or less per prescription through the managed care organizations. Although managed care pharmacy coverage is imperfect (37), 37% of Medicare beneficiaries have no pharmaceutical benefit (38). The pass rates we present may overestimate those for patients in fee-for-service settings. On the other hand, our sample is sicker and less educated than the general Medicare population (39). These demographic differences may have offset the advantage of having good prescription coverage. Second, our study relied primarily on medical records, and previous research has shown that a

substantial portion of care is not documented (40). It is possible that many of the required care processes were implemented but never charted. In an effort to remedy this, we used interview data in cases in which the patients were likely to be able to report on care processes. In addition, previous work has demonstrated that quality measurement based on medical records correlates with patient outcomes (41). Furthermore, in some cases, lack of documentation itself may constitute poor quality because it hampers continuity of care and contributes to miscommunication among health care professionals, which in turn increases the chance of adverse outcomes. On the other hand, patient interview about care may not accurately reflect care received. In implementing interview items, we attempted to minimize recall bias. For example, patient education was queried regarding only the most recently started medication.

Finally, in calculating pass rates for quality indicators in the “avoiding inappropriate medications” domain, denominators of patients potentially eligible for specified medications (that is, strong anticholinergics, barbiturates, and meperidine) were difficult to define. We chose as the denominator the entire study sample, excluding patients who received these medications with appropriate reasons clearly documented. This may overestimate the pass rate for these quality indicators. Nonetheless, the absolute numbers of failed cases for these 3 indicators were small (6 cases for potent anticholinergics, 2 for barbiturates, and 2 for meperidine), confirming that the magnitude of this quality problem is small compared with the concerns in other medication prescribing domains. The sensitivity analysis that excluded these 3 indicators slightly decreased the overall pass rate of the “avoiding inappropriate medications” domain to 91%, yet this pass rate is significantly higher than those of the other 3 domains. A second sensitivity analysis that assigned equal weights to all quality indicators eliminated the difference in the number of eligible patients and showed that the score for “avoiding inappropriate medication” remained significantly higher than the scores for each of the other domains.

Despite the limitations, we successfully evaluated a broad range of pharmacologic care that older patients received in 2 managed care plans enrolling older adults. Collection of medical records from various settings, conducting interviews to supplement chart information, and using physician abstractors for selected medical record elements enhanced the quality of our data. Broad coverage of the various aspects of pharmacologic care permitted comparison across domains of care. In addition, explicit quality indicators have the potential to fit into medical information systems. Computerized physician order entry systems have become increasingly popular as a tool to improve prescription practice. Explicit quality indicators integrated into such systems could provide automated evaluation of care or real-time feedback to clinicians (42–45). Evaluation and quality improvement can be implemented in all 4

domains of medication management if such systems also integrate data from laboratory and appointment databases.

These findings also have implications for health policy. Although the data cannot be construed to comment on access of older persons without medication insurance coverage to obtain needed medications, our results show that pharmacologic management concerns run far deeper. Even patients with drug coverage are at risk for not receiving indicated medications, and monitoring, continuity, and follow-up need improvement. Focusing solely on medication payment coverage is unlikely to solve deficits in medication management for most older Americans. Physician education and feedback concerning medication prescribing for older patients is needed.

In conclusion, our study applied a quality measurement system that targets the continuum of pharmacologic care for older patients enrolled in 2 managed care organizations and demonstrated that opportunities for improvement lie in many areas of medication management. Efforts to improve the quality of pharmacologic care for older patients should focus on prescribing indicated medications and avoiding adverse events by monitoring, documentation, education, and continuity.

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Appendix Table. Quality Indicators of Pharmacologic Care

Prescribing indicated medications

- IF a vulnerable elder is older than 75 years of age, is treated with warfarin, or has a history of peptic ulcer disease or gastrointestinal bleeding AND is being treated with a cyclooxygenase nonselective nonsteroidal anti-inflammatory drug, THEN he or she should be offered concomitant treatment with either misoprostol or a proton-pump inhibitor.
- IF a diabetic vulnerable elder has proteinuria, THEN he or she should be offered therapy with an angiotensin-converting enzyme inhibitor.
- IF a vulnerable elder has osteoporosis, THEN use of calcium and vitamin D supplements should be recommended at least once.
- All diabetic vulnerable elders who are not receiving anticoagulant therapy should be offered daily aspirin therapy.
- IF a hospitalized vulnerable elder has risk factors for peptic stress ulcers, THEN the patient should receive prophylaxis with an H₂-blocker, sucralfate, or a proton-pump inhibitor.
- IF a vulnerable elder has established coronary heart disease and a low-density lipoprotein cholesterol level greater than 3.4 mmol/L (130 mg/dL) and a trial of step II diet therapy was not offered or was ineffective, THEN he or she should be offered cholesterol-lowering medication.
- IF a vulnerable elder has heart failure, left ventricular ejection fraction of 0.40 or less, and New York Heart Association class I to III disease, THEN a β -blocker should be offered unless the patient has a documented contraindication (for example, uncompensated heart failure).
- IF a vulnerable elder has had an acute myocardial infarction, THEN he or she should be offered a β -blocker.
- IF a vulnerable elder is newly diagnosed with osteoporosis, THEN the patient should be offered treatment with hormone replacement therapy or a bisphosphonate or calcitonin within 3 months of diagnosis.
- IF a vulnerable elder has hypertension and has renal parenchymal disease with a serum creatinine concentration greater than 133 μ mol/L (1.5 mg/dL) or more than 1000 mg/d of protein in collected urine, THEN therapy with an angiotensin-converting enzyme inhibitor should be offered.
- IF a vulnerable elder remains hypertensive after nonpharmacologic intervention, THEN pharmacologic antihypertensive treatment should be initiated.
- IF a vulnerable elder has left ventricular dysfunction with a left ventricular ejection fraction of 0.40 or less, THEN an angiotensin-converting enzyme inhibitor should be offered.
- IF a vulnerable elder has established coronary heart disease and is not receiving warfarin, THEN he or she should be offered antiplatelet therapy.
- IF a vulnerable elder is taking corticosteroids for more than 1 month, THEN he or she should be offered calcium and vitamin D.
- IF a vulnerable elder with chronic pain is treated with opioids, THEN he or she should be offered a bowel regimen or the medical record should document the potential for constipation or explain why bowel treatment is not needed.
- IF a vulnerable elder is admitted to the hospital with pneumonia, THEN antibiotics should be administered within 8 hours of hospital arrival.
- IF a vulnerable elder has atrial fibrillation for more than 48 hours' duration and has any "high-risk" condition (impaired left ventricular function; woman older than 75 years of age; hypertension or systolic blood pressure greater than 160 mm Hg; or previous ischemic stroke, transient ischemic attack, or systemic embolism), THEN he or she should be offered oral anticoagulant therapy or antiplatelet therapy if the medical record documents a reason not to give anticoagulant therapy.

Avoiding inappropriate medications

- IF oral pharmacologic therapy is initiated to treat osteoarthritis in a vulnerable elder, THEN acetaminophen should be the first drug used, unless there is a documented contraindication to use.
- IF a vulnerable elder is started on an antidepressant medication, THEN the following medication should not be used as first- or second-line therapy: tertiary amine tricyclics, monoamine oxidase inhibitors (unless atypical depression is present), benzodiazepines, or stimulants (except methylphenidate).
- IF a vulnerable elder requires pharmacotherapy for treatment of hypertension in the outpatient setting, THEN a once- or twice-daily medication should be used unless there is documentation regarding the need for agents that require more frequent dosing.
- All vulnerable elders should not be prescribed a medication with strong anticholinergic effects if alternatives are available.
- IF a vulnerable elder does not need control of seizures, THEN barbiturates should not be used.
- IF a vulnerable elder requires analgesia, THEN meperidine should not be used.
- IF a vulnerable elder is prescribed an oral hypoglycemia drug, THEN chlorpropamide should not be used.
- IF a vulnerable elder has heart failure, has left ventricular ejection fraction of 0.40 or less, and does not have atrial fibrillation, THEN from among the 3 generations of calcium-channel blocker medications, he or she should not be treated with a first- or second-generation calcium-channel blocker.
- IF a vulnerable elder has hypertension and asthma, THEN β -blocker therapy for hypertension should not be used.

Education, continuity, and documentation

- IF a vulnerable elder has been prescribed a cyclooxygenase nonselective nonsteroidal anti-inflammatory drug for the treatment of chronic pain, THEN the medical record should indicate whether he or she has a history of peptic ulcer disease and, if a history is present, justification of use of the nonsteroidal anti-inflammatory drug should be documented.
- IF a vulnerable elder is under the outpatient care of 2 or more physicians and 1 physician has prescribed a new prescription medication or a change in medication (medication termination or change in dosage), THEN subsequent medical record entries by the nonprescribing physician should acknowledge the medication change.
- IF a patient is treated with a cyclooxygenase nonselective nonsteroidal anti-inflammatory drug, THEN there should be evidence that the patient was advised of the risk for gastrointestinal bleeding associated with these drugs.
- IF a vulnerable elder is discharged from a hospital to home and he or she received a new prescription medication or a change in medication (medication termination or change in dosage) before discharge, THEN the outpatient medical record should acknowledge the medication change within 6 weeks of discharge.
- All vulnerable elders should have a drug regimen review at least annually.
- IF a vulnerable elder who has been prescribed an ocular therapeutic regimen becomes hospitalized, THEN the regimen should be administered in the hospital unless discontinued by an ophthalmologic consultant.
- IF a vulnerable elder is prescribed a new drug, THEN the prescribed drug should have a clearly defined indication documented in the record.
- IF a vulnerable elder is prescribed a new drug, THEN the patient (or, if incapable, a caregiver) should receive education about the purpose of the drug, how to take it, and the expected side effects or important adverse reactions.

Medication monitoring

- IF a vulnerable elder with depression has no meaningful symptom response after 6 weeks of treatment, THEN one of the following treatment options should be initiated by the eighth week of treatment: medication dose should be optimized or the patient should be referred to a psychiatrist (if initial treatment was medication), or medication should be initiated or referral to a psychiatrist should be offered (if initial treatment was psychotherapy alone).
- IF a vulnerable elder with depression responds only partially after 12 weeks of treatment, THEN one of the following treatment options should be instituted by the 16th week of treatment: switch to a different medication class or add a second medication to the first (if initial treatment includes medication), add psychotherapy (if the initial treatment was medication), try medication (if initial treatment was psychotherapy without medication), consider electroconvulsive therapy, or refer to a psychiatrist.
- IF a vulnerable elder is prescribed a thiazide or loop diuretic, THEN serum potassium level should be checked within 1 month of initiation of therapy.

Appendix Table—Continued

- IF a vulnerable elder begins receiving an angiotensin-converting enzyme inhibitor, THEN serum potassium and creatinine levels should be checked within 1 month of initiation of therapy.
- IF a vulnerable elder is prescribed warfarin, THEN an international normalized ratio should be determined within 4 days after initiation of therapy.
- IF a vulnerable elder is prescribed warfarin, THEN an international normalized ratio should be determined at least every 6 weeks.
- EVERY new drug that is prescribed to a vulnerable elder on an ongoing basis for a chronic medical condition should have documentation of the response to therapy within 6 months.
- IF an outpatient vulnerable elder is started on a new prescription medication and he or she has a follow-up visit with the prescribing physician, THEN the medical record at the follow-up visit should document one of the following: 1) the medication is being taken, 2) the physician asked about the medication (for example, side effects or adherence or availability), or 3) the medication was not started because it was not needed or was changed.
- IF a vulnerable elder is prescribed a thiazide or loop diuretic, THEN he or she should have electrolytes checked at least yearly.

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