Drug Use in the Nursing Home

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■ Some of the most intensive pharmacotherapy today occurs in nursing homes in very complex and vulnerable patients. The nursing home provides an opportunity for highly effective drug use, but it also presents risks for polypharmacy and adverse events. Nursing homes are complex social institutions, in which physicians, nurses, consultant pharmacists, other health care professionals, aides, and administrators must interact to make decisions about drug use for patients who generally are frail and have numerous comorbid conditions. Federal regulations have recently been implemented to direct the ways in which specific drugs are to be used in this setting. The nursing home environment can present an ideal opportunity for comprehensive drug regimen review, an exercise too often neglected in the care of elderly patients in all clinical settings. Psychoactive medications, analgesics, and laxatives are examples of drugs that should receive such review. The possible underuse of drug therapies that may be beneficial to nursing home residents, including antidepressant, antihypertensive, and antithrombotic agents; calcium supplements; and vaccines, must be further quantified and must receive increased attention. Morbidity and functional incapacity can be substantially reduced by applying currently established principles of geriatric pharmacology in the nursing home setting, but enormous gaps still exist in the knowledge base necessary to guide this aspect of geriatric medical practice. Data on the efficacy, toxicity, and cost-effectiveness of pharmacotherapeutic choices in nursing home patients are in short supply; considerably more clinical and epidemiologic research is needed to define the relations between the benefits and risks of drugs for this unique population.

Ann Intern Med. 1995;123:195-204.

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With increasing pressure on hospitals to shorten acute-care stays, and the unprecedented aging of the population in industrialized societies, pharmacotherapy for the nursing home patient has become an area of increasing importance. The demographic changes are most pronounced in the age group older than 85 years, which is the fastest-growing segment of the U.S. population; this is also the group with the greatest likelihood of requiring institutional care.

Medication Use in Long-Term Care

Not surprisingly, nursing home residents receive more medication than noninstitutionalized older persons (1, 2). One study of 12 nursing homes in a large U.S. city reported that the 1106 residents studied were prescribed an average of 7.2 medications (3). Another study of more than 800 residents in 12 representative intermediate care facilities in another state indicated that residents were prescribed an average of 8.1 medications (4). The most commonly prescribed medications found in our study are listed in Table 1.

Although it has been cause for some concern, this frequent prescribing of medication does not necessarily indicate poor quality of care. The use of numerous medications in the care of a complex, elderly nursing home resident can be appropriate and may be necessary to optimize medical and functional status. Further, determining the magnitude of inappropriate drug use in the nursing home is not a straightforward process. Defining ideal or even acceptable prescribing is limited by controversy and by the absence of adequate data. Therapy that is proper for a middle-aged patient may have greater risks and lower benefits for an institutionalized patient with several impairments.

The challenges of defining criteria for inappropriate medication use in nursing home residents have been underscored in a study that used a national panel of experts in an attempt to reach a consensus on guidelines for medication use in the elderly population (5–7). The panelists agreed about many aspects of medication use, but they could not agree on issues such as the use of antipsychotic medications in nonpsychotic patients, the use of diphenhydramine as a hypnotic agent, and the safety of cimetidine relative to other histamine-2 (H_2)–receptor antagonists. The criteria developed through this consensus were applied to actual patterns of drug use in the nursing home setting. More than 40% of 1106 nursing home residents studied were reported to have at least one "inappropriate" prescription (3) using these conservative criteria. Table 2 summarizes the most common types of "problematic" prescribing according to the criteria.

Drug Regimen Accretions and Drug Holidays

Although it is often an occasion of turmoil and perceived loss for residents and families, admission to a

Table 1. Most Commonly Prescribed Medications for 823 Residents of 12 Intermediate Care Facilities in Massachusetts

Medication	Orders per 100 Residents
Gastrointestinal medication	
Laxatives and enemas	179
Acid–peptic medication*	36
Other†	41
Analgesic agents	
Acetaminophen	96
Aspirin	26
Opioids	15
Nonsteroidal anti-inflammatory drugs	12
Cardiovascular medication	
Digoxin	27
Loop diuretics	26
Nitrates	23
Thiazide diuretics	15
β-blockers	10
Calcium channel blockers	5
Antiarrhythmic agents	3
Other‡	9
Vitamins and supplements	
Multivitamins	45
Potassium	19
Iron	15
Calcium	4
Psychoactive medication	
Sedatives and hypnotics§	29
Antipsychotics	28
Antidepressants	16
Diphenhydramine	9
Antibiotic and antifungal agents	20
Endocrine and metabolic medication	
Hypoglycemic agents	12
Thyroid replacement drugs	8
Respiratory medication	
Theophylline	7
β-sympathomimetics	6
Neurologic medication	
Antiseizure drugs	8
Antiparkinsonian drugs	5
Anticoagulant and antiplatelet medication	
Dipyridamole	6
Warfarin	4
Ophthalmic medication	
Artificial tears	6
Glaucoma	4
Steroids	4
Urinary medication	1

* Includes antacids, histamine-2 blockers, and sucralfate.
† Includes attapulgite, simethicone, and metoclopramide.
‡ Includes angiotensin-converting enzyme inhibitors and potassium-sparing diuretics.
§ Excluding diphenhydramine.

nursing home presents an ideal opportunity for comprehensive drug regimen review, an exercise too often neglected in the care of elderly patients in all clinical settings. Over many years and through many care providers, the elderly patient can accumulate a regimen of many drugs; admission to a nursing home provides an opportunity for a fresh look at each one. The need for this review is heightened for residents who enter the nursing home from the hospital, where additional medications may have been added to treat acute problems that may not persist beyond the hospital stay (8). In some patients, routine administration of many medications is continued, even though the indication that initially prompted the use of these drugs is no longer present (or never was). For example, digoxin is one of the drugs most commonly prescribed to nursing home patients (Table 1), but considerable controversy surrounds its role in elderly patients with diagnoses of compensated congestive heart failure (9), especially in the setting of preserved systolic ventricular function. Forman and coworkers (10) studied 47 nursing home residents (mean age, 87 years) receiving long-term digoxin therapy. Thirty-five had normal ejection fractions (50% or greater), and 23 of these had normal sinus rhythm. The physicians of 14 of these 23 patients were willing to discontinue digoxin therapy. None of the patients in whom therapy was discontinued had ejection fractions decrease to less than 50%, and none showed signs of clinical deterioration during 2 months of follow-up. Although these were the first such data to come from a long-term care setting, they replicated findings from studies done in community settings. In contrast, more recent findings suggest that withdrawal of digoxin in patients with impaired systolic function can be detrimental (11).

The stable, supervised environment of the nursing home allows for the slow, cautious withdrawal of medications of uncertain benefit in a given patient. It is possible to watch closely for clinical signs that the drug may indeed be necessary (for example, a slow increase in blood pressure may indicate the need to restore an antihypertensive drug). Although some practitioners advocate keeping a "time-tested" regimen intact even if the validity of its original indications is obscure, we take a different view of the risks and benefits involved. A patient taking a medication without a clear ongoing indication for its use remains at risk for all potential toxicities (particularly at a time of intercurrent illness or other metabolic insult) without deriving any benefit.

Aside from a comprehensive annual examination or visit to a geriatric assessment unit, few elderly patients have the opportunity for a thorough reassessment of every medication in their regimen; this reassessment can be done soon after admission to a nursing home. Such assessment must be done more gradually if the patient is still recovering from an acute illness. As many as 50% of residents entering from the community who have been prescribed long-term medications have not been taking them as prescribed (12). Thus, it is all the more important to thoroughly review the drug regimen early in the nursing home stay: Diligent dispensing of every medication the resident is thought to have been taking before admission could result in toxicity in those who had been substantially nonadherent.

In response to concerns about the overuse of medications in long-term care facilities, some nursing homes have instituted policies of complete cessation of most or all medications on admission, or they implement regularly scheduled "drug holidays," particular intervals in the week or month during which no medications are administered. Although well intentioned, such simplistic solutions can be counterproductive. Drug regimen review and drug withdrawal should be done systematically and selectively, altering the use of one agent at a time; this will minimize the risk for hard-to-trace withdrawal symptoms or other deterioration. Excessively rapid cessation of some drugs can precipitate withdrawal symptoms ranging

from extreme discomfort in the case of benzodiazepines (13, 14) to severe cardiovascular compromise and even death in the case of β-blockers (15).

Unique Aspects of the Nursing Home as a Setting for Drug Use

The use of medication in the nursing home represents a complex blending of issues from several diverse realms of medical practice. At its foundation lie basic concepts from the practice of clinical geriatrics, such as the atypical presentation of disease in the elderly; the propensity of elderly persons to manifest central nervous system dysfunction as a "final common pathway" for various metabolic insults; and the reduced physiologic reserve, or "homeostenosis," that marks the response of the aging organism to stressors of various kinds. Built on this are the pharmacokinetic and pharmacodynamic differences seen with senescence: the reduced renal and hepatic function that occur even in healthy aging persons; the increased proportion of body fat at the expense of skeletal muscle, which together with reduced drug clearance can result in the marked elevation of drug half-lives and serum concentrations; and age-related increases in intrinsic sensitivity to medications such as benzodiazepines and opioids and reduced sensitivity to others, such as β-adrenergic agonists and antagonists (16).

Layered on top of these general aspects of geriatric pathophysiology and pharmacology are the special circumstances of the long-term care facility. Drug use in the nursing home occurs in some of the frailest patients in the elderly population in institutions with the potential for 24-hour clinical observation in a supervised setting. Paradoxically, however, the nursing home environment may also include little physician input, particularly in relation to the severity and complexity of the patients cared for in these facilities. Nursing homes are what sociologists refer to as "total institutions," places in which residents live, eat, socialize, and spend their leisure time; they often do not leave its walls. They are complex social institutions in which physicians, nurses, consultant pharmacists, other health professionals, aides, and administrators interact to make decisions about drug prescribing and drug administration.

These interactions often play themselves out in unconventional ways in relation to medication use. The physician writes a prescription, but a nurse (or an aide) in much closer contact with the nursing home resident often spurs the decision to prescribe and guides the physician's prescribing decisions by telephone or in brief visits. Furthermore, although the physician authorizes the prescription of a drug for pro re nata use (such as psychoactive medications, analgesics, and laxatives), it is the nursing staff or their assistants who frequently make the crucial decision about whether the drug will actually be administered and how often, and even in what dose and by what route (17).

This decision-making process is further complicated by the unique role of the pharmacist in nursing homes. Since 1974, the Health Care Financing Administration (18) has required that a consultant pharmacist periodically review the drug regimens of all residents of skilled nursing facilities. Thus, the nursing home is the only component of the health care system in which regular pharmacist involvement in monitoring drug use is required. Although often dramatically beneficial in specific clinical instances, the overall effect of this mandated review has been more modest than originally anticipated (17).

Table 2. Most Common Types of Inappropriate Prescribing in 12 Nursing Homes in California*

Drugs to be avoided
Long-acting benzodiazepines
Dipyridamole
Propoxyphene
Amitriptyline
Methyldopa
Propranolol
Trimethobenzamide
Pentazocine
Chlorpropamide
Muscle relaxants
Indomethacin
Cerebral vasodilators
Gastrointestinal antispasmodic agents
Meprobamate
Reserpine
Excessive duration of treatment
Histamine-2–receptor antagonists
Short-acting benzodiazepines
Oral antibiotics
Excessive drug dosage
Iron supplements
Histamine-2–receptor antagonists
Antipsychotic agents

* Adapted from Beers and colleagues (3).

Recently, medication regulation has been extended to apply to prescribing decisions made for individual patients in nursing homes. Federal legislation requiring the regulation of the use of antipsychotic medication in Medicare- and Medicaid-certified nursing homes became law in 1987 as the Nursing Home Reform Amendments of the Omnibus Budget Reconciliation Act (OBRA '87) (19, 20). Guidelines to assist regulators in evaluating nursing homes were developed by the Health Care Financing Administration. Intended to limit psychoactive drug use to specific indications, they require explicit documentation in the medical record to justify psychoactive therapy. After public review and comment, guidelines for antipsychotic drug use were implemented in October 1990, and guidelines for anxiolytics and sedatives were implemented in April 1992. For the first time, the federal government issued explicit medical practice criteria defining the proper use of particular medications in individual clinical situations. This occurred in part because of the widespread perception that only a powerful regulatory approach could control what was seen as the excessive use of psychoactive medications in long-term care facilities. Unfortunately, the implementation of these regulations on a national scale was done without concurrent provision for the evaluation of their effect on patient outcomes; thus, this is one of the largest uncontrolled health care experiments of modern times. Nonetheless, some post hoc evaluations of drug use patterns have been done since implementation, albeit without benefit of before and after comparisons of residents' actual clinical status. The use of antipsychotics in nursing homes was substantially reduced after implementation of the guidelines for use of this class

of drugs (21). The effect of the guidelines for anxiolytic and sedative drug use remains to be determined.

Adding still another dimension to drug use in the nursing home is the fiscal situation of the nursing home. Most hospitals in the United States are nonprofit institutions, but most long-term care facilities in the United States are for-profit entities. Both nonprofit and for-profit institutions face reimbursement constraints that influence many aspects of care: Because Medicaid programs are the main payers for about half of the nation's nursing home residents, even nonprofit facilities must confront the limited per diem reimbursement rate provided by these state programs. Although drugs are generally covered separately and in full, limited reimbursement to the institution can constrain the level of staffing in both nonprofit and for-profit homes. Insufficient staffing, in turn, can influence the incentive for the use of psychoactive medications, as well as the capacity for monitoring both the therapeutic and the adverse consequences of drug use.

Thus, as a setting for care, the nursing home lies in a vortex of forces and relations that heavily influence the ways in which medications are used. In addition, nursing home residents are far more likely than noninstitutionalized elderly persons to be chronically ill, to have more than one functional impairment, to lack economic resources and family caregivers, to be older than 85 years of age, and to be burdened by cognitive deficits (22). Taken together, all of these factors make the nursing home one of the most complex and challenging pharmacotherapeutic settings in all of medicine.

The Special Case of Psychoactive Drugs

Sedation of Residents with Dementia

For decades, the use of psychotropic drugs has remained extensive in nursing homes. Although recent regulatory changes may have had some effect, numerous studies done through the early 1990s indicated that about half of all nursing home residents were regularly being given one or more psychoactive drugs. Antipsychotic drugs were, until recently, given to about one fourth of all nursing home residents (4). A few studies suggest that antipsychotic drugs may be effective in the treatment of agitation in geriatric patients with dementia (23), but the literature on this topic is both limited and ambiguous. Clear evidence, however, links the use of these drugs with extrapyramidal symptoms, gait instability, falls, and hip fractures (24–26). Benzodiazepines, frequently used for agitation associated with dementia, can also be troublesome; benzodiazepines with long elimination half-lives pose their own risks for falls, fractures (27, 28), and other side effects, including daytime somnolence, confusion, and ataxia (29), although not for parkinsonian symptoms.

Cross-national studies indicate that patients with dementia are managed in long-term care facilities in Western Europe and Japan with much less reliance on sedating medications than in the United States; these facilities apparently maintain good control of agitated behavior. A retrospective review of the medical records of 1996 residents of 60 nursing homes in the United States from 1976 through 1985 suggested that half of the recorded uses of neuroleptic therapy would be considered improper under regulations mandated by OBRA '87 (30). Concern has been raised over whether these regulations might result in increases in behavioral problems or agitation in residents and over whether a shift would occur from antipsychotic drugs to potentially hazardous sedating agents that are not regulated. Initial reports indicate that the prescribing of antipsychotic drugs in nursing homes has been substantially reduced coincident with the implementation of the regulations and that the use of other psychotropic drugs (cyclic antidepressants, benzodiazepines, and nonbenzodiazepine sedatives) has not concomitantly increased (21, 31).

In a randomized trial, a comprehensive educational outreach program ("academic detailing") was directed at physicians, nurses, and aides to reduce the use of psychoactive drugs in nursing homes. The use of antipsychotic drugs was subsequently discontinued in more residents in nursing homes receiving the intervention (32%) than in those in control homes (14%); these reductions did not adversely affect the overall behavior and level of functioning of the residents (32) or the level of distress among staff (33). In a similar study, designed to train nursing home caregivers in the proper use of psychoactive drugs, Ray and colleagues (34) reported somewhat larger reductions, although their sample of homes was smaller.

Considerably more needs to be learned about the relative clinical efficacy of interpersonal interventions, benzodiazepine therapy, and antipsychotic agents in calming agitated, demented nursing home residents. Some studies have found that reliance on sedative drugs is more common in larger nursing homes, in facilities with lower staff-to-patient ratios, and among physicians with larger nursing home practices (35, 36), but these findings have not been consistently replicated. The interplay among economic constraints, staffing patterns, and sedative use is a crucial topic for further investigation.

In deciding whether pharmacologic intervention is required to manage agitated behavior in an elderly nursing home resident, two basic facts should be considered. Unusual behavior in the elderly is not necessarily an indication for drug intervention. Incoherent babbling or constant repetition of inappropriate requests may require increased tolerance from staff members rather than sedation. Other problems, such as wandering, might have environmental solutions—for example, a facility design that enables disoriented patients to move about freely while remaining under staff supervision. If intervention is warranted, the safest therapeutic approach is personal attention and support, which can be highly effective and is often preferable to sedation.

Among antipsychotic drugs used in the nursing home setting (Table 3), high-potency drugs such as haloperidol have side-effect profiles that differ from those of agents with lower potency, such as thioridazine. Low-potency antipsychotic medications tend to be strongly sedating, hypotensive, and anticholinergic, but they produce less marked extrapyramidal symptoms. Commonly used doses of high-potency agents produce more prominent extrapyramidal symptoms but are less anticholinergic, sedating, and hypotensive. However, two recent studies document that, in moderate to high doses, the "low-potency" antipsychotics are still important causes of extrapyramidal side effects (25, 26). New data suggest that at least some

Table 3. Side Effects of Antipsychotic Drugs*

Agent	Potency	Sedation	Hypotension	Extrapyramidal Symptoms	Anticholinergic Symptoms
Chlorpromazine	Low	Marked	Marked	Moderate	Marked
Chlorprothixene	Low	Marked	Marked	Moderate	Marked
Thioridazine	Low	Marked	Marked	Mild–moderate	Moderate
Acetophenazine	Moderate	Moderate	Moderate	Moderate	Moderate
Perphenazine	Moderate	Moderate	Moderate	Moderate	Moderate
Loxapine	Moderate	Moderate	Moderate	Moderate	Moderate
Molindone	Moderate	Moderate	Moderate	Moderate	Moderate
Trifluoperazine	Moderate	Moderate	Moderate	Moderate–marked	Moderate–mild
Thiothixene	Moderate	Moderate	Moderate	Moderate–marked	Moderate–mild
Fluphenazine	High	Mild	Mild	Marked	Mild
Haloperidol	High	Mild	Mild	Marked	Mild

* Reprinted with permission from Lohr and colleagues. Treatment of disordered behavior. In: Salzman C, ed. Clinical Geriatric Psychopharmacology. Second edition. Baltimore: Williams & Wilkins; 1992:79-113.

of the frequently observed propensity for extrapyramidal side effects associated with haloperidol may be attributable to its use in relatively higher doses compared with other antipsychotic drugs, after correction for potency differences (26).

One particularly important extrapyramidal symptom is akathisia, in which the patient develops an irresistible urge to move about. Patients may repeatedly cross and uncross their legs, stamp their feet, change posture, rock, sway, or pace. These actions may be misinterpreted as signaling a need for a higher, rather than a lower, dose of the offending antipsychotic drug. Tardive dyskinesia is another important consequence of antipsychotic drug use; its frequency is more common in elderly persons, particularly institutionalized elderly persons. It may be irreversible even after cessation of the offending agent (37).

A new antipsychotic agent, respiridone, is gaining increasing popularity for use in elderly persons. Extrapyramidal symptoms may be less common with this agent, but they do occur: Sedation, orthostatic hypotension, and reflex tachycardia are among the reported side effects of this drug.

Use of Hypnotics

Hypnotics are among the drugs most frequently prescribed in long-term care settings. However, the long-term daily use of any hypnotic agent is associated with tachyphylaxis in most patients after several weeks to months. After this time, the drug primarily prevents withdrawal symptoms if the patient has become habituated to the long-term use of benzodiazepines. Such withdrawal is often misinterpreted as evidence for the ongoing need for hypnotic drugs, when in fact it is continuing evidence of the hazards of the routine use of these drugs. It is preferable to institute a more biologically appropriate approach to sleep hygiene that would include the following elements.

Allow Appropriate Sleep Hours

The organizational constraints of nursing home life may require that patients be put to bed in the evening to reduce the need for care by the night staff. As a result, a patient may be put to bed at 9:00 p.m. and may need only 6 hours of sleep. If this is the case, the resident will awaken at 3:00 a.m., may be diagnosed as "having insomnia," and may be prescribed a hypnotic drug. It is far more reasonable to allow the patient to remain awake later, as many community-dwelling elderly persons do, and thus to remain asleep until later in the morning.

Omit Coffee after 1:00 p.m.

Caffeine is a stimulant and can have as disproportionally strong an effect on elderly persons as other psychoactive drugs. It makes little sense to offer a resident a stimulant at one point in the evening and a depressant an hour or two later.

Promote Exercise and Discourage Daytime Napping

Normal sleep is unlikely in a resident who remains immobile all day, particularly if daytime sleep comes to replace nighttime sleep. Although plasma benzodiazepine concentration and clinical effect are not always clearly related (38), the problem of daytime somnolence can be exacerbated if a hypnotic with a long elimination half-life is routinely administered (Table 4). This drug may remain at therapeutic levels well into the following afternoon, potentially reducing activity, causing lethargy, and inducing daytime somnolence. Unfortunately, the further deterioration of sleep that results may in turn provoke additional use of the offending hypnotic at night, creating a vicious cycle.

When pharmacologic intervention is required, the altered pharmacokinetics and pharmacodynamics of the elderly patient suggest that low doses of short-acting agents should be used initially whenever possible. Oxaze-

Table 4. Elimination Half-Lives of Benzodiazepines

Long elimination half-life
Chlorazepate
Chlordiazepoxide
Clonazepam
Diazepam
Flurazepam
Halazepam
Prazepam
Medium to short elimination half-life
Alprazolam
Lorazepam
Oxazepam
Temazepam
Very short elimination half-life
Triazolam

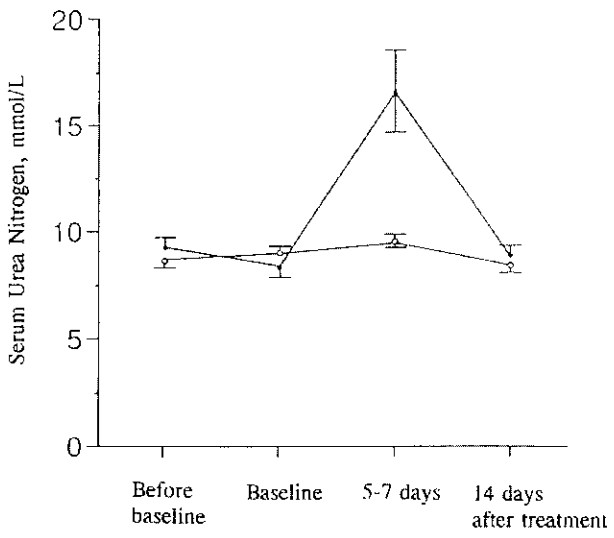

Figure 1. Mean ± SE serum urea nitrogen levels for patients receiving nonsteroidal anti-inflammatory drugs (NSAIDs) before baseline, at baseline, after 5 to 7 days of therapy, and 14 days after discontinuation of therapy. Of 114 patients studied, 15 (13%) had an increase in serum urea nitrogen levels of more than 50% during NSAID therapy (*closed circles*) (42).

pam is a benzodiazepine with a satisfactorily short half-life. Triazolam has been advocated as ideal for the elderly because of its ultra-short half-life, but it may cause more cognitive impairment and anterograde amnesia in the elderly than similar doses of other drugs (39). The hypnotic drug flurazepam, like its anxiolytic cousins chlordiazepoxide and diazepam, has a long half-life and should rarely be used in the care of institutionalized elderly persons. No compelling evidence indicates that the clinical outcomes of the newer nonbenzodiazepine hypnotic zolpidem differ from those of older, less costly benzodiazepines. Although diphenhydramine is commonly used as a hypnotic, its strong anticholinergic side effects make it undesirable for use in nursing home residents (40).

Antidepressants

Despite questions about the excessive use of antipsychotic drugs and hypnotic agents in the nursing home setting, concern exists over the possible underuse of another class of medications, antidepressants. Clinical depression is common among nursing home residents, and, in many cases, it goes undiagnosed and untreated (41–43). In a study based on data collected between 1976 and 1983, Heston and colleagues (44) reported that only 10% of 868 nursing home residents with a diagnosis of depression equivalent to DSM-III-R major depression were being treated with antidepressant drugs. Residents more often received antipsychotics or benzodiazepines than antidepressants, but most (52%) were receiving no psychoactive drug therapy. Although awareness of depression in the elderly has increased somewhat, continued vigilance is still needed. Symptoms of depression can be inappropriately dismissed as reasonable reactions to chronic illness or as an understandable response to institutionalization (45, 46). This is particularly unfortunate because depression in the elderly often responds well to therapy. In contrast, untreated depression is associated with increased mortality and causes an obvious decrement in quality of life.

Older tertiary amine antidepressants, such as amitriptyline, are generally not recommended for most depressed nursing home residents because of their sedative and highly anticholinergic properties. Secondary amines, such as desipramine or nortriptyline, are preferable because of their lower rate of side effects. Remarkably little evidence exists to guide the use of any of these agents in very elderly patients, and the characteristics of geriatric patients who participate in and complete studies of these agents often cast doubt on the generalizability of research findings (47–49). Few studies have been attempted in institutional settings. Recently, concern has been raised about the possible arrhythmogenic role of tricyclic antidepressants in elderly patients with cardiac ischemia, but little information exists from clinical or epidemiologic studies to guide the clinician in this difficult area (50). The absence of relevant data on efficacy is particularly acute for newer agents, such as fluoxetine and other selective serotonin re-uptake inhibitors; they are often promoted as much better tolerated than tricyclic antidepressants in older patients, despite some reports to the contrary (51, 52). Data on their efficacy or side effects in frail, institutionalized, elderly persons are inadequate.

Mild to Moderate Pain

Apart from insomnia and constipation (*see* below), the treatment of mild to moderate pain is one of the most common issues in pharmacotherapy in the long-term care setting. Nonsteroidal anti-inflammatory drugs (NSAIDs) are among the most popular agents for this ubiquitous problem; however, two important lines of research have begun to emerge, suggesting an alternative approach. The first is the increasing body of data documenting the hazards of NSAID therapy in very old persons; these hazards include renal insufficiency, gastrointestinal hemorrhage, and blood pressure elevations. The second is the demonstration that in many residents with degenerative joint disease (probably the most common indication for analgesics in the nursing home), acetamenophen often provides satisfactory pain relief with a much lower risk for side effects than is produced by NSAID therapy (53).

The NSAIDs all inhibit the biosynthesis of prostaglandins, some of which mediate various important protective physiologic effects. Prostaglandins maintain renal blood flow and glomerular filtration in the face of reduced effective or actual circulatory volume (such as that caused by congestive heart failure or volume depletion due to diuretic therapy). Under such conditions, the vasoconstrictive effects on renal blood flow are mitigated by the effects of vasodilatory renal prostaglandins, preserving renal perfusion. When this prostaglandin-mediated compensatory mechanism is suppressed by NSAID therapy, impairment in renal function can result. A prospective study of 114 elderly residents of a large long-term care facility who were newly treated with NSAIDs showed that 13% developed azotemia over a short course of therapy (Figure 1) (54). It is of clinical relevance that the factors associated with this adverse effect included higher NSAID doses and concomitant loop diuretic therapy. Prostaglandins also mediate several effects that protect the gastric and duodenal mucosa. Reduction of the biosynthesis of

prostaglandins induced by NSAIDs can lead to impaired mucosal defense, and acid and peptic activity can then overpower mucosal protective mechanisms to produce ulcers. Epidemiologic studies investigating the association between NSAIDs and severe upper gastrointestinal bleeding have suggested that older patient age may be associated with a higher risk for gastrointestinal toxicity (55). In addition, prostaglandins play a role in modulating two major determinants of blood pressure—vasoconstriction of arteriolar smooth muscle and control of extracellular fluid volume—thus raising concerns about the effect of NSAIDs on blood pressure control (56). A recently published study of drug use in a very large population of Medicaid enrollees indicated that NSAIDs increased the risk for the initiation of antihypertensive therapy in this population (57). To limit the occurrence of side effects, NSAID therapy should be limited to those clinical situations in which it is absolutely required. Inflammation is a rare cause of pain in chronic osteoarthritis, and thus an analgesic with limited or no anti-inflammatory properties (such as acetaminophen or nonacetylated salicylates) may be appropriate to manage this condition in many older patients. A study comparing the analgesic effects of acetaminophen (4 g/d) with those of ibuprofen (1.2 g/d and 2.4 g/d) in patients with osteoarthritis of the knee found no difference in pain relief (53). Although acetaminophen is free of NSAID-related side effects, its dose should not exceed 4 g/d and its toxicity is increased in the presence of hepatic insufficiency, heavy alcohol intake, or fasting (58). When NSAID therapy is required, the lowest feasible dose should be prescribed for the shortest time necessary to achieve the desired therapeutic effect. The best treatment of NSAID-associated nephrotoxicity, gastropathy, or hypertension is discontinuation of NSAID therapy.

Bowel Function

Laxatives and stool softeners are among the drugs most commonly prescribed in long-term care facilities (Table 1). Yet, despite their widespread use and the firm belief many residents have in their benefits, it is often difficult to assess the efficacy of such therapy in institutional geriatric practice. In long-term care, the evaluation of constipation is often inadequate (59); it is frequently considered the domain of the nursing staff rather than of the physician. As with psychoactive drugs, excessive reliance on pharmacologic solutions sometimes occurs even when these solutions are not necessary and may be counterproductive. For example, the long-term use of stimulant laxatives has been reported to damage the myenteric plexus, leading to the "cathartic syndrome," which is characterized by impairment of motility, dilatation of the colon, worsening constipation, and the diminished effectiveness of laxatives (60).

Although good progress has been made in many institutions, some nursing home diets tend to be low in fiber, adding to the risk for constipation already generated by reduced exercise, modest dehydration, changes in gut motility, and the effects of constipating medications. Although the importance of medications as a cause of constipation is frequently emphasized, few epidemiologic data support such associations. Medications with strong anticholinergic properties (such as some antipsychotics and tricyclic antidepressants), narcotics, diuretics, calcium channel blockers, iron supplements, antacids containing aluminum, and calcium supplements require careful evaluation.

In contrast to almost every other area of pharmacotherapy, laxative treatment has had few advances during the past 50 years. Further, few well-controlled, comparative trials of laxatives have been done in the elderly (61); management strategies are necessarily empiric. One randomized, double-blind, crossover trial comparing sorbitol with lactulose in the treatment of elderly men (65 to 86 years of age) with chronic constipation found no clinically significant differences in laxative effect between the two osmotic agents (62). Sorbitol is an effective and much less costly alternative to lactulose for the treatment of constipation in the elderly. Although stool softeners are popular treatments for constipation in some nursing homes, evidence suggests that they often work poorly in this clinical setting (61, 63). As with insomnia, the most rational mainstays of therapy are behavioral rather than pharmacologic: a high-fiber diet, adequate hydration, and as much physical activity as possible.

Opportunities for Prevention

Although the treatment of acute problems or the management of chronic disease often absorbs most of the staff's attention, the nursing home can be an ideal setting in which to practice preventive care. Protection against infectious disease is one example. The objectives of the Department of Health and Human Services, as summarized in *Healthy People 2000* (64), include having at least 80% of nursing home residents immunized for pneumococcal pneumonia and influenza. Data on pneumococcal vaccine coverage are not available, although a study describing vaccination levels among elderly Medicare beneficiaries (institutionalized and noninstitutionalized) suggests that the current proportion of nursing home residents immunized for pneumococcal pneumonia is low and is far lower than the proportion immunized for influenza (65).

Along with homeless persons and patients with the acquired immunodeficiency syndrome, nursing home residents have become an important population at risk for the resurgence of tuberculosis (66). Immunosenescence, frailty, and close contact between institutionalized elderly patients can enhance contagion, and the clinical manifestations of tuberculosis in the elderly may be missed by the unwary physician. It has been recommended that new tuberculin converters in the nursing home be treated, because 10% to 20% of them will develop clinical tuberculosis if left untreated, resulting in additional cases and spread of infection (67). Although the risk for isoniazid-induced hepatic toxicity does increase with advancing age, most elderly patients can tolerate isoniazid therapy without difficulty (68).

Hip fractures are a major problem in the nursing home population and are associated with high long-term morbidity and mortality. Until recently, approaches to prevention in the nursing home focused primarily on reducing the risk for falls. Chapuy and colleagues (69) recently published the results of a randomized clinical trial in 3270 ambulatory elderly women living in nursing homes; they

compared a regimen of 1.2 g/d elemental calcium and 20 μg (800 U) of vitamin D_3 with placebo. After 18 months, the women receiving treatment had 43% fewer hip fractures and 32% fewer vertebral fractures. As summarized by Heaney (70), persuasive evidence now indicates that some age-related bone loss in elderly women is due to insufficient intake of calcium and vitamin D and that some osteoporotic fractures can be prevented by ensuring higher intake of both nutrients. It is never too late to consider such treatment. The effectiveness of other pharmacologic measures (such as estrogens and thiazide diuretics) in preventing risk for fracture in elderly nursing home residents requires further study (71–76).

Cardiovascular disease presents two contrasting opportunities for the preventive use of drugs in the nursing home. On the positive side, the ubiquity of nursing personnel means that detection of hypertension (including isolated systolic hypertension) should be universal. The nursing home provides an ideal opportunity for the identification, treatment, and surveillance of this important cause of preventable morbidity in the elderly (77). On the negative side, the ready availability of blood chemistry analysis makes it possible to identify hundreds of thousands of cases of mild hypercholesterolemia and to initiate treatment with lipid-lowering drugs. Before seizing this apparent opportunity to practice preventive care, it should be recognized that almost all data on the efficacy of lipid-lowering medications are derived from interventions in middle-aged men. No compelling data exist to justify the widespread treatment of mild to moderate hyperlipidemia in very old persons, particularly for primary prevention (78, 79).

Reducing Medication Use to Contain Costs: Histamine-2 Blockers

As pressures mount in all sectors of health care to control expenditures, the cost of drugs used in long-term care has come under increasing scrutiny. This is particularly true of expensive drugs that are often used for extended periods without evidence of clinical benefit; H_2-receptor antagonists are one example.

Since cimetidine was introduced in the 1970s as a breakthrough drug, H_2-receptor antagonists have become the primary mode of treatment of many acid–peptic disorders, including peptic ulcer disease and gastroesophageal reflux. However, as with many other categories of medication, overuse of these agents has become apparent in all settings of care (80). A survey of H_2-receptor antagonist use in one large long-term care facility indicated that more than 40% of patients receiving these agents were receiving them for reasons unsubstantiated by the medical literature (81). These reasons included treatment of nonulcer dyspepsia; treatment of and prophylaxis for gastropathy associated with NSAID therapy; gastrointestinal prophylaxis in the setting of steroid therapy; and the ongoing empiric treatment of occult gastrointestinal bleeding of undetermined cause. In an intervention trial done in that facility, educational interventions involving group discussions with the medical staff, printed educational materials, and physician-specific listings of patients receiving H_2-blockers did result in substantial and therapeutically appropriate reductions in the use of these agents. However, inappropriate discontinuation of H_2-blocker therapy was also seen in some patients for whom such therapy was indicated and necessary. Unintended consequences of well-intentioned interventions to improve prescribing always need to be considered when the effects of such interventions are evaluated (82).

When prescribed in proper doses, H_2 blockers have relatively few side effects (83); drug interaction problems can generally be addressed through product selection and adequate monitoring (84). Therefore, the continued use of these agents despite the lack of a substantiated clinical indication or obvious therapeutic benefit is primarily an issue of economics rather than of quality of care. However, no drug is risk-free, and an adverse reaction in a frail elderly patient is particularly unfortunate if no therapeutic benefit was derived from the offending drug in the first place. Additionally, bad therapy can drive out good therapy if reflexive use of an H_2 blocker displaces an adequate work-up of abdominal pain or the finding of fecal occult blood that prompted its use. At a time when such drugs may consume as much as 10% of a state's Medicaid drug expenditure, it is reasonable to ask whether the resources thus used could not be deployed more effectively elsewhere in nursing homes.

Making Pharmacotherapeutic Decisions in the Nursing Home

The following questions should be asked in evaluating any medication use in a nursing home resident.

1. What is the target problem being treated?
2. Is the drug necessary?
3. Are nonpharmacologic therapies available?
4. Is this the lowest practical dose?
5. Could discontinuing therapy with a medicine help reduce symptoms?
6. Does this drug have adverse effects that are more likely to occur in an older patient?
7. Is this the most cost-effective choice?
8. By what criteria, and at what time, will the effects of therapy be assessed?

Conclusions and Recommendations for Research

Pharmacotherapy in the nursing home represents a particular challenge for the physician and for all who care for the institutionalized patient, combining as it does all of the complexities of geriatric pharmacology with the unique features of the institutional setting. Although improvements in quality of care could be achieved by the application of currently established principles of geriatric pharmacology, enormous gaps still exist in the knowledge base necessary to guide this aspect of geriatric practice. Prerelease clinical trials of many agents under-represent the elderly populations who eventually receive them; this problem is even more intense in the assessment of the risks and benefits of drugs in complex, frail, older patients typical of the nursing home population (85). The problem is pervasive in geriatric pharmacology, but some aspects of it are particularly urgent in relation to nursing home care.

First, despite the large volume of drugs dispensed for managing agitated behavior in nursing home patients with dementing illness, surprisingly little is known about the

relative efficacy and risks of alternative approaches to this problem. Researchers in this area should emphasize nonpharmacologic interventions as well as the examination of newer pharmacologic therapies.

Second, little is known about the best ways to treat depression in very old persons; this is a problem of particular importance in long-term care. Parallel comparisons of several kinds of therapeutic approaches, including interpersonal approaches, pharmacologic approaches, or a combination of these, need to be made in depressed, elderly nursing home residents. Within pharmacology, more needs to be learned about the relative benefits and risks of tricyclic agents, monoamine oxidase inhibitors, and selective serotonin re-uptake inhibitor drugs in elderly depressed nursing home residents.

Third, given the proliferation of federal regulations governing drug use in the long-term setting, research on the optimal mix of regulation, credentialing, and education is needed to improve the outcomes of drug therapy in nursing home residents. It is particularly important to document the clinical consequences of changes in prescribing rather than simply considering the end point of an intervention to be the changes themselves.

Fourth, further attention should be directed to the potential underuse of beneficial drug therapies, including antidepressant, antihypertensive, and antithrombotic agents, vaccines, and opioid analgesics in patients with metastatic cancer.

Fifth, practical guidelines for the safe discontinuation of unneeded chronic therapy in the nursing home setting, including therapy with antihypertensives, digoxin, psychoactive drugs, and laxatives, should be developed, tested, and disseminated.

Sixth, more institutionalized elderly persons need to be enrolled in clinical trials of new drug therapies that will be widely used in this population.

Seventh, systematic postmarketing surveillance studies should be done for currently used drugs to better define their risks and benefits in this unique population. Despite important methodologic hurdles, Medicaid claims data are well suited for such pharmacoepidemiologic research because of their detailed depiction of drug use in nursing home care.

Eighth, cost-effective drug choices should be defined for the nursing home setting to specifically address the special patterns of illnesses found there, the unique nature of reimbursement (usually capitated), and the mix of health care professionals available.

Ninth, as prescribing authority is given to nurse practitioners and physicians' assistants caring for institutionalized elderly persons in several states, it is crucial to monitor the effect of such policy changes in prescribing practices and to evaluate the best means of improving decisions about drug use in this setting by both traditional and new prescribers.

In the past, being admitted to a nursing home was often referred to pejoratively as "being put in an institution." Today, a greater understanding of geriatric pharmacology and a move to acknowledge long-term care as a vital and increasingly important component of the health care system make it possible to take advantage of the institutional setting to enhance the way medications are used within it.

Acknowledgments: The authors thank Mark Monane, MD, MS, for providing data used in Table 1 and Ms. Rita Bloom for assistance in the manuscript preparation.

Grant Support: In part by a grant from the Medications and Aging Program of the John A. Hartford Foundation of New York. Dr. Gurwitz is the recipient of a Clinical Investigator Award (K08 AG00510) from the National Institute on Aging, Bethesda, Maryland.

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