

Inappropriate Drug Prescribing for the Community-Dwelling Elderly

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Objective.—To examine the amount of inappropriate drug prescribing for Americans aged 65 years or older living in the community.

Design.—Cross-sectional survey of a national probability sample of older adults.

Setting.—The 1987 National Medical Expenditure Survey, a national probability sample of the US civilian noninstitutionalized population, with oversampling of some population groups, including the elderly.

Subjects.—The 6171 people aged 65 years or older in the National Medical Expenditure Survey sample, using appropriate weighting procedures to produce national estimates.

Main Outcome Measures.—Incidence of prescribing 20 potentially inappropriate drugs, using explicit criteria previously developed by 13 United States and Canadian geriatrics experts through a modified Delphi consensus technique. Three cardiovascular drugs identified as potentially inappropriate were analyzed separately since they may be considered appropriate for some noninstitutionalized elderly patients.

Results.—A total of 23.5% (95% confidence interval [CI], 22.4% to 24.6%) of people aged 65 years or older living in the community, or 6.64 million Americans (95% CI, 6.28 million to 7.00 million), received at least one of the 20 contraindicated drugs. While 79.6% (95% CI, 77.2% to 82.0%) of people receiving potentially inappropriate medications received only one such drug, 20.4% received two or more. The most commonly prescribed of these drugs were dipyridamole, propoxyphene, amitriptyline, chlorpropamide, diazepam, indomethacin, and chlorthalidone, each used by at least half a million people aged 65 years or older. Including the three controversial cardiovascular agents (propranolol, methyldopa, and reserpine) in the list of contraindicated drugs increased the incidence of probably inappropriate medication use to 32% (95% CI, 30.7% to 33.3%), or 9.04 million people (95% CI, 8.64 million to 9.44 million).

Conclusion.—Physicians prescribe potentially inappropriate medications for nearly a quarter of all older people living in the community, placing them at risk of drug adverse effects such as cognitive impairment and sedation. Although most previous strategies for improving drug prescribing for the elderly have focused on nursing homes, broader educational and regulatory initiatives are needed.

(*JAMA*. 1994;272:292-296)

PEOPLE aged 65 years or older account for about one third of all prescription drug use¹ and are at high risk for adverse drug effects.² Polypharmacy sharply increases the risk of side effects.³⁻⁶

Many previous studies of adverse drug effects in the elderly have focused on

nursing homes.⁷⁻¹³ Measuring adverse effects among people living in the community is logistically more difficult. One common approach has been to use a proxy measure such as the prevalence of drug-related adverse effects among community residents admitted to hospitals.¹⁴⁻²⁰ However, since only a small proportion (7% in one study²¹) of drug-related adverse effects directly result in hospitalization, subtle but important side effects such as sedation or cognitive impairment resulting in falls may easily go unrecognized.

An alternative to monitoring clinically

apparent adverse drug effects is to use population-based data on the prevalence of prescribing patterns that unnecessarily place patients at risk.²²⁻²⁶ Typically, such studies compare actual prescribing patterns to a priori, explicit criteria based on expert opinion and literature review.

See also p 316.

In 1991, Beers et al²⁶ published a comprehensive set of explicit criteria for inadequate prescribing based on the following three concepts: prescription medicines that should be entirely avoided in the elderly, excessive dosage, and excessive duration of treatment.²⁶ Using a subset of their list of medicines that should be entirely avoided in the elderly, we developed conservative estimates of the incidence of potentially inappropriate prescribing for community-dwelling elderly persons in the United States.

METHODS

Sample

The 1987 National Medical Expenditure Survey (NMES), conducted by the Agency for Health Care Policy and Research (AHCPR), collected nationally representative information on health status, service use, and expenditures.

The NMES compiled data on about 14 000 households and 35 000 individuals, 6171 of them aged 65 years or older. The sample was a stratified, multistage-area probability design with oversampling of population groups of particular policy interest, including the elderly, poor and low-income families, the functionally impaired, and black and Hispanic minorities.

Each family was interviewed four times at 4-month intervals, either in person or by phone, to obtain data for calendar year 1987. At each round, interviewers collected information on illnesses, health services use and expenditures, household

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composition, employment, and insurance status. Between rounds, respondents recorded use of medical services including prescription drugs in a calendar/diary that was reviewed at each interview. The survey sample includes only the 34 459 people who responded for the entire period of their eligibility.

Variables

Respondents were asked whether they had purchased or otherwise obtained a prescribed medication during the previous 4-month period and the medical conditions associated with each prescription.

The AHCPR coded prescribed medications using the system developed by the National Center for Health Statistics as part of the 1980 National Ambulatory Medical Care Survey.²⁷ Medical conditions were coded using the ninth revision of the *International Classification of Diseases*, as revised for use in the National Health Interview Survey.²⁸

Data Analyses

To define inappropriate prescribing for the elderly, we used criteria previously developed through a modified Delphi consensus technique by a panel of 13 experts in geriatrics and pharmacology.²⁶ The consensus panel defined as inappropriate any medications that should be entirely avoided, excessive dosage of medicines, and excessive duration of treatment. Since the NMES did not collect data on dosage or frequency of use, our analysis is limited to the list of 23 drugs that the consensus panel indicated should be entirely avoided. These drugs include the following: three long-acting benzodiazepines (chlorthalidoxepoxide, diazepam, and flurazepam), which are associated with daytime sedation and increased risk of falls; meprobamate, considered less safe than short-acting benzodiazepines for treatment of anxiety and sleep disturbances; two short-duration barbiturates (pentobarbital and secobarbital), since short-acting benzodiazepines are safer for sedation and phenobarbital is preferable for epilepsy; amitriptyline, since anticholinergic effects and orthostatic hypotension are greater than with other tricyclic antidepressants; combination antidepressants/antipsychotics, since geriatric doses are difficult to titrate in fixed-dose combinations; the nonsteroidal anti-inflammatory drugs [NSAIDs] indomethacin (greater central nervous system [CNS] toxicity than other NSAIDs, but may be indicated for acute gout, Reiter's syndrome, or ankylosing spondylitis) and phenylbutazone (risk of bone marrow toxicity); chlorpropamide, because of long half-life and risk of syndrome of inappropriate antidiuretic

hormone secretion (can be used for combined diabetes mellitus and diabetes insipidus); the analgesics propoxyphene (relatively ineffective, low toxic-to-therapeutic ratio may cause CNS and cardiac toxicity from accumulation of toxic metabolite) and pentazocine (overdose associated with seizures and cardiac toxicity); the dementia treatments cyclandelate and isoxsuprine (no demonstrated efficacy for either drug); dipyridamole (except as adjunct to warfarin for patients with artificial heart valves; efficacy in other circumstances doubted, and can cause headache, dizziness, and CNS disturbances at higher doses); the muscle relaxants/antispasmodics cyclobenzaprine, orphenidrate, methocarbamol, and carisoprodol (potential for CNS toxicity is greater than potential benefit); the antiemetic trimethoprim (less effective than other agents and may cause drowsiness, diarrhea, rash, and extrapyramidal reactions); and propranolol, methyl dopa, and reserpine (analyzed separately herein).

The consensus panel criteria were originally developed for nursing home residents aged 65 years or older. However, we believe that prescription of these drugs to the community-residing elderly would rarely be justifiable because they are ineffective or more toxic than equally effective alternatives. We refer to these drugs as "potentially inappropriate" to reflect the rare instances when they could be used appropriately, such as for those diagnoses where the drug may be appropriate as indicated herein.

We analyzed propranolol, methyl dopa, and reserpine separately. All have relatively frequent CNS side effects in the elderly but have been proven to decrease morbidity and mortality in some circumstances. When patients are doing well on an established regimen, clinicians might reasonably opt to continue these drugs under close monitoring.

We developed a comprehensive list of medication names including brand names, generic equivalents, and combination drugs corresponding to the 23 contraindicated drugs. Data were analyzed using SAS-PC (SAS Institute Inc, Cary, NC). Table 1 reports the sample size and national population estimates based on this sample that were used in the current study. All other text and tables report estimates for the entire noninstitutionalized elderly population of the United States derived from the NMES data using weights provided by the AHCPR that adjust for nonresponse and the complex sample design. Confidence intervals (CIs) were calculated based on SE tables provided by the AHCPR, which yield conservative estimates.²⁹

Table 1.—Sample Size and Population Estimates From the National Medical Expenditure Survey (NMES) for the 1987 Noninstitutionalized US Population Aged 65 Years or Older

Age, y	NMES Sample, No.	Population Based on Weighting Estimates
65-69	1991	9 624 700
70-74	1658	7 540 411
75-79	1277	5 567 606
80-84	722	3 198 775
85-89	358	1 629 304
≥90	165	734 200
Total	6171	28 294 996

Table 2.—Use of All Prescription Drugs and Use of 20 Inappropriate Drugs by Age*

Age, y	Percentage Using Prescription Drugs	Percentage Using Inappropriate Drugs	
		Total Population	Population Using Any Prescription Drugs
65-69	77.8	22.5	29.0
70-74	80.5	21.7	26.9
75-79	85.2	26.4	31.1
80-84	87.5	26.9	30.7
85-89	87.6	23.3	26.6
≥90	86.9	16.8	19.3
≥65	81.9	23.5	28.7

*All figures are estimates for the noninstitutionalized US population.

RESULTS

Population Exposure to Potentially Inappropriate Prescribing

The age-specific utilization of all prescription drugs and the 20 inappropriate prescription drugs in community residents aged 65 years or older is shown in Table 2. Prescription medications were used by 81.9% (95% CI, 80.8% to 83.0%) of all older persons. Almost one quarter (23.5%) (95% CI, 22.4% to 24.6%) of all elderly people, or 6.64 million people (95% CI, 6.28 million to 7.00 million), received at least one potentially inappropriate drug during 1987. Moreover, 28.7% (95% CI, 27.3% to 30.1%) of those prescribed any medication received at least one potentially inappropriate drug.

Inappropriate drug use rose slightly from age 65 years to peak in those aged 80 to 84 years. However, the majority of those at least 65 years of age who received an inappropriate medication were aged 65 to 74 years (accounting for 57% [95% CI, 54.1% to 59.9%] of all older people receiving inappropriate drugs). Only 8% (95% CI, 6% to 10%) of affected people were aged 85 years or older.

Table 3 presents the number and proportion of elderly community residents receiving the 20 contraindicated drugs and the three additional agents included in the original consensus panel list. The most commonly used of the 20 drugs were dipyridamole, propoxyphene, amitriptyline, chlorpropamide, diazepam, in-

Table 3.—Number and Percentage of US Community Residents Aged 65 Years or Older Using Inappropriate Drugs*

Drugs	No. of People Receiving Drug	Percentage of Total Population Receiving Drug	No. of Prescriptions
Sedative or hypnotic agents			
Diazepam	798 946	2.82	1 547 111
Chlordiazepoxide	552 784	1.95	1 135 497
Flurazepam	355 090	1.25	578 459
Meprobamate	232 786	0.82	538 278
Pentobarbital	33 093	0.12	60 696
Secobarbital	8486	0.03	25 459
Antidepressants			
Amitriptyline	886 629	3.13	1 966 922
NSAIDs			
Indomethacin	747 729	2.64	1 300 212
Phenylbutazone	80 023	0.28	83 327
Oral hypoglycemics			
Chlorpropamide	589 218	2.08	1 638 666
Analgesics			
Propoxyphene	1 367 478	4.83	2 412 308
Pentazocine	85 641	0.30	105 118
Dementia treatments			
Isoxsuprine	87 088	0.31	221 376
Cyclandelate	71 847	0.25	198 835
Platelet inhibitors			
Dipyridamole	1 822 300	6.44	4 832 889
Muscle relaxants or antispasmodic agents			
Cyclobenzaprine	198 731	0.70	263 671
Methocarbamol	117 806	0.42	134 589
Carisoprodol	108 298	0.38	149 108
Orphenadrine	93 609	0.33	174 069
Antiemetic agents			
Trimethobenzamide	77 022	0.27	99 990
Antihypertensives			
Propranolol	1 774 370	6.27	4 995 356
Methyldopa	1 280 297	4.52	3 663 512
Reserpine	597 655	2.11	1 467 226

*All figures are estimates for the noninstitutionalized US population. NSAIDs indicates nonsteroidal anti-inflammatory drugs.

domethacin, and chlordiazepoxide. Each of these drugs was prescribed more than 1 million times a year to more than half a million elderly people.

Multiple Use of Potentially Inappropriate Drugs

We considered individuals to have been prescribed multiple inappropriate drugs if, during 1987, they used more than one of the 20 drugs listed in Table 3. We did not count as multiple use the use of more than one brand of a single generic drug (eg, Darvocet-N and Darvon, both of which contain propoxyphene).

Among the total population of community-residing elderly, the average use of the 20 inappropriate drugs was 0.29 per person during 1987 (0.61 prescriptions per person per year). Among those who used at least one inappropriate drug, the average number of inappropriate drugs used was 1.25 drugs (with 2.6 prescriptions) per person per year.

Table 4 shows the distribution of use of inappropriate drugs among those us-

ing any of the 20 inappropriate drugs. Four fifths used only one inappropriate drug; one fifth, or about 1.35 million (95% CI, 1.16 to 1.53 million), used two or more. The maximum number used by any individual was five.

Generally, the frequency with which an inappropriate drug was prescribed in combination with other inappropriate drugs corresponded to the frequency of its total use. The most common pair, prescribed to 81 000 elderly individuals, was diazepam and propoxyphene, a particularly worrisome combination given their potentially additive CNS depressive effects. The third most common combination, amitriptyline and chlordiazepoxide, prescribed for 66 000 elderly persons, raises similar concerns.

At-Risk Populations

As expected, higher total use of prescription drugs predicted a higher risk of probably inappropriate drug use (Pearson correlation coefficient of 0.42), suggesting that a generally parsimonious prescribing style might reduce the

Table 4.—Multiple Use of the 20 Inappropriate Drugs for Persons Aged 65 Years or Older*

No. of Inappropriate Drugs Received	Percentage of Those Receiving at Least One Inappropriate Drug	No. of People Receiving Inappropriate Drugs
1	79.6	5 283 139
2	16.5	1 095 173
3	3.0	196 822
4	0.9	56 417
5	0.1	4997

*All figures are estimates for the noninstitutionalized US population.

likelihood of inappropriate prescribing. Table 5 identifies a range of other population characteristics associated with a higher risk of inappropriate prescribing. Individuals most at risk were women, people living in the South census region, people who rated their health status as poor, and individuals covered by Medicaid.

Circumstances Where Use May Be Indicated

The rare circumstances in which some of the 20 contraindicated drugs may be appropriate accounted for almost none of their use. For instance, not a single respondent using chlorpropamide had concurrent diabetes mellitus and diabetes insipidus. Less than 1% of those using indomethacin suffered from gouty arthropathy, Reiter's Syndrome, or ankylosing spondylitis. The NMES data did not include an indication of the number of individuals with artificial heart valves (for whom dipyridamole may be indicated as an adjunct to warfarin). However, only 36 000 Americans (half of them older than 65 years) underwent valve replacement in 1987.³⁰ Even assuming a long life expectancy, artificial heart valve recipients cannot account for many of the 1.8 million older people using dipyridamole in 1987.

Propranolol, Methyldopa, and Reserpine

We repeated our analysis using the consensus panel's original list of 23 contraindicated drugs (ie, adding propranolol, methyldopa, and reserpine to the 20 other drugs examined). Thirty-two percent (95% CI, 30.7% to 33.3%) of community-residing seniors, or 9.04 million (95% CI, 8.64 million to 9.44 million) individuals, were exposed to at least one of the 23 drugs. Propranolol was prescribed 5 million times for 1.8 million (95% CI, 1.6 million to 2.0 million) elderly persons, methyldopa was prescribed 3.7 million times for 1.3 million (95% CI, 1.1 million to 1.5 million) elderly persons, and reserpine was prescribed 1.5 million times for 600 000 (95% CI, 420 000 to 780 000) elderly persons.

Including these three drugs with the 20 others on the consensus panel list did not substantially alter the pattern of those at high risk of receiving inappropriate drugs.

Fewer than 1.5% of individuals aged 65 years or older using propranolol carried diagnoses of migraine or essential tremor (situations where propranolol's increased CNS penetration relative to other β -blockers may make it the drug of choice) or hyperthyroidism. No one using propranolol suffered from porphyria, akathisia, or esophageal varices. No elderly persons in the NMES sample who used reserpine or methyl dopa suffered from Raynaud's syndrome or systemic sclerosis, for which these drugs may be indicated.

COMMENT

We found a disturbingly high level of potentially inappropriate prescribing for older people living in the community. Over the course of 1 year, almost one quarter of older Americans were unnecessarily exposed to potentially hazardous prescribing.

Our findings are consistent with data from studies of inappropriate prescribing for nursing home residents and the incidence of self-reported adverse drug effects in community-residing elders.^{21,31} Twenty-one percent of 1100 California nursing home residents received at least one of our 23 inappropriate medications during a 1-month period, most commonly long-acting benzodiazepines, dipyrindamole, propoxyphene, amitriptyline, and methyl dopa.³¹ When dosage or length of use were considered, inappropriate use rose to 40%.³¹ Relative to this nursing home sample, we found more frequent use of propranolol and reserpine among community-residing elderly persons. Consistent with our findings, an Iowa study of community-residing elders found that propranolol was the fourth most frequently implicated medication (after aspirin, ibuprofen, and digoxin) in self-reported adverse drug reactions.²¹ (Adverse reaction rates reported in the Iowa study were not standardized for frequency of use of the drugs.)

Some clinicians may question the consensus group's contraindicated drug list on which we based our analysis. Most of the agents are either ineffective or more toxic than equally effective alternatives. Others place the elderly in any setting at risk for subtle CNS dysfunction that may go unrecognized as a cause of functional deterioration or may first present as a fall, car accident, or other catastrophe. Certainly there are circumstances where the consensus group's rules should be broken, such as a ter-

Table 5.—Use of the 20 Inappropriate Drugs and of Any Prescription Drugs by Sex, Region, Race, and Other Demographic Features for Persons Aged 65 Years or Older*

Variable	Percentage Using Prescription Drugs	Percentage Using Inappropriate Drugs	
		Total Population	Population Using Any Prescription Drugs
Total population	81.9	23.5	28.7
Sex			
Male	78.5	21.8	27.8
Female	84.3	24.7	29.3
Census region			
Northeast	79.5	19.0	23.9
Midwest	80.5	21.8	27.1
South	83.4	28.0	33.6
West	83.6	22.3	26.7
Race			
American Indian	73.7	25.1	34.1
Alaskan Native	63.9	9.9	15.5
Asian/Pacific	79.4	20.1	25.3
Black	82.5	23.9	29.0
White	78.8	27.3	34.6
Education			
High school not completed	82.6	24.8	30.0
High school completed	80.7	22.4	27.8
Some college	85.4	24.1	28.2
College degree	81.6	21.7	26.6
Self-rated health			
Excellent	62.3	9.0	14.4
Good	77.6	17.5	22.6
Fair	89.6	29.4	32.8
Poor	95.6	40.8	42.7
SMSA			
19 largest	80.6	19.4	24.1
Other SMSA	82.2	25.0	30.4
No SMSA (rural)	82.5	24.6	29.8
English native language			
Yes	83.1	23.9	28.8
No	76.3	21.2	27.8
Have usual source care			
Yes	86.7	25.1	29.0
No	43.2	9.3	21.5
Medicare status			
Medicare only	71.3	18.2	25.5
Medicare and private insurance	83.6	23.8	28.5
Medicare and Medicaid	88.9	30.4	34.2

*All figures are estimates for the noninstitutionalized US population. SMSA indicates standard metropolitan statistical area.

minally ill patient who has received propoxyphene for years and insists on continuing, but such exceptions must be rare.

Standard published sources support the view that the 20 drugs in our primary analysis should virtually never be prescribed for the elderly.³² Dementia treatments isoxsuprine and cyclandelate are ineffective, as is dipyrindamole in most situations. Propoxyphene is a weak analgesic and causes frequent toxic and occasionally lethal effects. Indomethacin and phenylbutazone are more toxic than other NSAIDs. In the treatment of anxiety and insomnia, short-acting benzodiazepines are safer than barbiturates, meprobamate, or long-acting benzodiazepines that often cause daytime sedation and have been

associated with falls and hip fractures in the elderly.³³ For seizures, phenobarbital is preferable to the shorter acting barbiturates. Drugs with prominent anticholinergic effects, such as amitriptyline, pose particular hazards for the elderly; many safer antidepressants are available.

Because more controversy surrounds the three antihypertensive agents on the consensus group's original list, which clearly are effective but have common adverse effects, we analyzed these drugs separately. Recently, the consensus group affirmed the applicability of its original list to the noninstitutionalized elderly, with the exceptions of propranolol and methyl dopa (M. H. Beers, MD, written communication, March 3, 1994).

Our study probably underestimates

the incidence of inappropriate prescribing for the elderly. We did not consider excessive drug dosage or duration, medication interactions, or the prescribing of a sometimes useful drug in an inappropriate clinical situation.

The data that we analyzed are the most comprehensive and accurate source of nationwide information on prescription drug use by the elderly. However, the NMES does not provide data on the clinical consequences of hazardous drug prescribing. Hence, we cannot estimate the incidence of adverse effects caused by the poor prescribing patterns that we observed. Since the NMES included only 523 people older than 84 years, findings for this age group should be interpreted cautiously.

Though the NMES data was collected in 1987, it has only recently been made available for analysis because of the

lengthy process needed to prepare it for research use. No more recent, similarly valid, and comprehensive data have been collected. Prescribing patterns for most of the drugs we examined have probably not changed dramatically since 1987. According to the National Ambulatory Medical Care Survey, the number of prescriptions (for patients of all ages) for the 20 drugs on our core list decreased 21.6% between 1985 and 1989 (1987 data are not available) but increased 5.7% between 1989 and 1991 (S. Schappert, MA, Division of Health Care Statistics, Ambulatory Care Statistics Branch, National Center for Health Statistics, Centers for Disease Control and Prevention, written communication, February 17, 1994). In 1992, retail pharmacies filled more than 65 million prescriptions for the 20 drugs on our core list.³⁴

CONCLUSION

This study presents the first national estimates of potentially inappropriate prescribing to elderly people living in the community. In 1987, at least 6 million elderly Americans (about one in every four) were exposed to potentially hazardous prescribing. Much more vigorous physician education and increased pharmaceutical regulation are needed to improve the safety of prescribing.

This study was supported in part by grant 22608 from the Robert Wood Johnson Foundation, Princeton, NJ, and a gift from Mrs Anne Cerf.

Sidney Wolfe, MD, gave inspiration and data, and his book *Worst Pills Best Pills* stimulated this research. Jerry Avorn, MD, and Mark Monane, MD, of Harvard Medical School and Brigham and Women's Hospital, Boston, Mass, provided helpful guidance on study design. Roy Harvey, MEd, offered useful advice. Donna Pound provided administrative assistance.

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The results highlighted in these articles dramatically demonstrate that real public health improvements can be accomplished through concerted government action. These actions followed major battles that were fought and won in Washington. Achieving further dramatic gains in the war against childhood lead poisoning will require armies of people fighting small battles—house to house—in many communities in this country. It will require education and involvement. It will require a commitment to environmental justice and ensuring a safe, healthy environment of these communities for all children.

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Suboptimal Medication Use in the Elderly

The Tip of the Iceberg

The problem of inappropriate prescribing of medications to older patients is widely acknowledged and has been publicized by professional societies, governmental organizations, advocacy groups for the elderly, and the media. However, the true magnitude of the problem remains unclear. Although the use of antipsychotic medications in the nursing home setting has come under considerable scrutiny,¹ it is generally recognized that suboptimal prescribing to the elderly extends well beyond excessive prescribing of this single drug category. Yet, to date, information regarding the quality of drug prescribing to geriatric patients in other clinical settings has been extremely limited, and claims about suboptimal prescribing have been based more on anecdote and conjecture than on actual data. Which pharmacotherapeutic domains comprise the most serious problem areas and how frequently inappropriate prescribing actually occurs are just some of the questions that need to be more fully answered to develop strategies to improve the quality of medication use in older patients. In this issue of *THE JOURNAL*, Willcox and colleagues² have shed some light on these questions by applying explicit criteria defining inappropriate medication use to data derived from the 1987 National Medical Expenditure Survey.

In 1991, Beers et al³ published explicit criteria for determining inappropriate medication use in nursing home residents. These criteria were developed through the consensus of 13 experts in clinical geriatric pharmacology, psychopharmacology, pharmacoepidemiology, clinical geriatrics, and long-term care. Two aspects of medication use were emphasized in designing these criteria: (1) individual medications or drug categories that should be avoided in nursing home residents

except under unusual circumstances, and (2) doses, frequencies, or durations of medication prescriptions that should not be exceeded. These criteria were particularly designed to examine computerized medication data assuming limited availability of information on the clinical status of the patient. A study of 1106 residents of 12 nursing homes in the greater Los Angeles, Calif, area indicated that 40% had at least one inappropriate medication prescription based on the full list of criteria, which addressed 16 different drug categories.⁴

Although the Beers criteria have been generally well accepted, some items have been subject to controversy. The unconditional characterization of the antihypertensive agents propranolol, methyldopa, and reserpine as inappropriate has been questioned.⁵ Issues concerning other drug categories (eg, nonsteroidal anti-inflammatory drugs [NSAIDs]) are only partially addressed by the criteria. Indomethacin is one of two NSAIDs specified as inappropriate, but all NSAIDs have been associated with gastrointestinal bleeding and nephrotoxicity, and this risk is probably more related to the presence of underlying clinical conditions and higher NSAID dose than which agent is prescribed.⁶⁻⁸ In addition, the criteria are based on data available prior to 1990 and require some updating to incorporate more recently published literature. For example, the expert panelists participating in criteria development could not reach consensus on the appropriateness of ergoloid mesylates for Alzheimer's disease and the use of diphenhydramine as a hypnotic agent. Recent study findings would suggest that in both cases inappropriate ratings are justified.^{9,10}

To estimate levels of inappropriate prescribing to community-dwelling elderly, Willcox and colleagues² used only a subset of the Beers criteria, a list of 20 drugs considered to be contraindicated in older patients regardless of dose, duration of therapy, or indication. These included long elimination half-life benzodiazepines and oral hypoglycemics, short-duration barbiturates, antidepressants with strong anticholinergic properties, less effective and less safe opioid analgesics (eg, propoxyphene), ineffective dementia treat-

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ments, dipyridamole, and selected NSAIDs, muscle relaxants, gastrointestinal antispasmodics, and antiemetics. Among the study population, 23.5% received at least one of the 20 drugs considered inappropriate based on the criteria. Similar to findings in the nursing home setting, long elimination half-life benzodiazepines, dipyridamole, propoxyphene, and the strongly anticholinergic antidepressant amitriptyline were the most commonly used of the contraindicated agents.

As Willcox et al² indicate in their article, there are a number of limitations to their study. The investigators were unable to apply the full set of criteria to their drug data because they did not possess information on drug dosage, frequency, or duration of use. Important issues in drug prescribing that are addressed in the Beers criteria including the use of chronic hypnotic therapy and excessive dosing of antipsychotic medications, hydrochlorothiazide, histamine (H₂) blockers, and iron supplements could not be explored in the context of this study. The findings clearly underestimate levels of problematic prescribing that would have been detected if the full list of criteria were applied.

The authors did not fully consider serious interactions between drugs in their analyses, nor did they consider the prescribing of "appropriate" medications in an inappropriate fashion or the underuse of clearly indicated drug therapies. Many of these issues were not encompassed under the Beers criteria, and adequate clinical data would have been required to fully elucidate these problem areas. However, these situations account for a large proportion of the problematic prescribing that occurs in the geriatric population. Recent publications have documented suboptimal use of H₂ blockers and antibiotics in older patients.^{11,12} Undermedication with analgesic drugs of patients with metastatic cancer was recently reported, with patients aged 70 years or older at the greatest risk for inadequate treatment.¹³ Concerns with underdiagnosis and treatment of depression in the frail elderly have also been raised.¹⁴

The historical nature of the data employed in the Willcox study must be mentioned, as the findings may not be entirely relevant to the situation in 1994. Although representative of medication utilization in 1987, overall patterns of prescribing look different today. Use of agents like amitriptyline and chlorpropamide has declined substantially.¹⁵⁻¹⁸ In many cases, the prescription of newer, more costly agents does not represent an improvement in drug therapy over older, less expensive agents with proven records of safety and effectiveness, such as prescribing calcium channel blockers in preference to thiazide diuretics for hypertension.¹⁹ However, reductions in the use of profoundly anticholinergic tricyclic antidepressants and long half-life hypoglycemic agents attributable to shifts in prescribing to selective serotonin reuptake inhibitors and second-generation sulfonylureas must be considered a net improvement in the care of the elderly.

Despite these limitations, the findings of this study remain germane to the care currently given to many older patients. The elderly tend to be overrepresented among patients maintained on these less appropriate agents simply because many have been receiving them for years without adequate consideration of their risks relative to alternatives.

In summary, findings reported in this issue of THE JOURNAL confirm many of our concerns about medication use in the elderly. More data are required from clinical and epidemiologic studies to guide decision making in the use of drug therapies in older patients. Criteria for assessing prescribing patterns need to be continually updated based on the most current medical literature, taking into account the introduction of new agents and changing patterns of medication use. Evaluations of the quality of medication use need to move beyond simple descriptions of prescribing patterns and begin to measure the adverse clinical and economic consequences of poor pharmacotherapeutic decision making in the elderly. As we steer a course toward improved medication use in this vulnerable population, we are finally beginning to realize the true size of the iceberg that lies before us.

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