Potentially Undesirable Prescribing and Drug Use Among the Elderly

Measurable and remediable

JEFF A. BLOOM, MD, CCFP
JOHN W. FRANK, MD, CCFP
M. SHARON SHAFIR, MD, CCFP
PAUL MARTIQUET, MD, CCFP

SUMMARY

Forty-seven patients older than 65 years were randomly selected for structured chart review of all long-term medications documented during the prior year and the number of instances of potentially undesirable prescribing for each patient. A trained nurse subsequently made home visits to assess all long-term medications used regularly during the same period. Forty-five percent of elderly patients had one or more instances of potentially undesirable drug use, all of which appeared to be readily remediable. Commercial drug interaction software identified less than half of the potentially undesirable instances.

RÉSUMÉ

On a sélectionné par randomisation 47 patients de plus de 65 ans dont les dossiers ont fait l'objet d'une vérification structurée afin d'identifier tous les médicaments prescrits à long terme au cours de l'année précédente et d'identifier pour chacun des patients le nombre de prescriptions potentiellement indésirables. Par la suite, une infirmière expérimentée fit des visites à domicile pour évaluer toutes les médications à long terme utilisées régulièrement pendant la même période de temps. Quarante-cinq pourcent des personnes âgées présentaient au moins un exemple d'utilisation médicamenteuse potentiellement indésirable, situation à laquelle on pouvait facilement remédier dans tous les cas. Un logiciel d'interactions médicamenteuses disponible dans le commerce a identifié moins de 50% des cas d'interactions potentiellement indésirables.

Can Fam Physician 1993;39:2337-2345.

ELDERLY PEOPLE RECEIVE MORE prescriptions per year than any other age group (approximately 12 per person in one study[1]) and are the most susceptible to adverse drug reactions.[2-4] Efforts to improve this situation must first solve the problem of how to measure potentially undesirable prescribing in a defined, objective fashion.

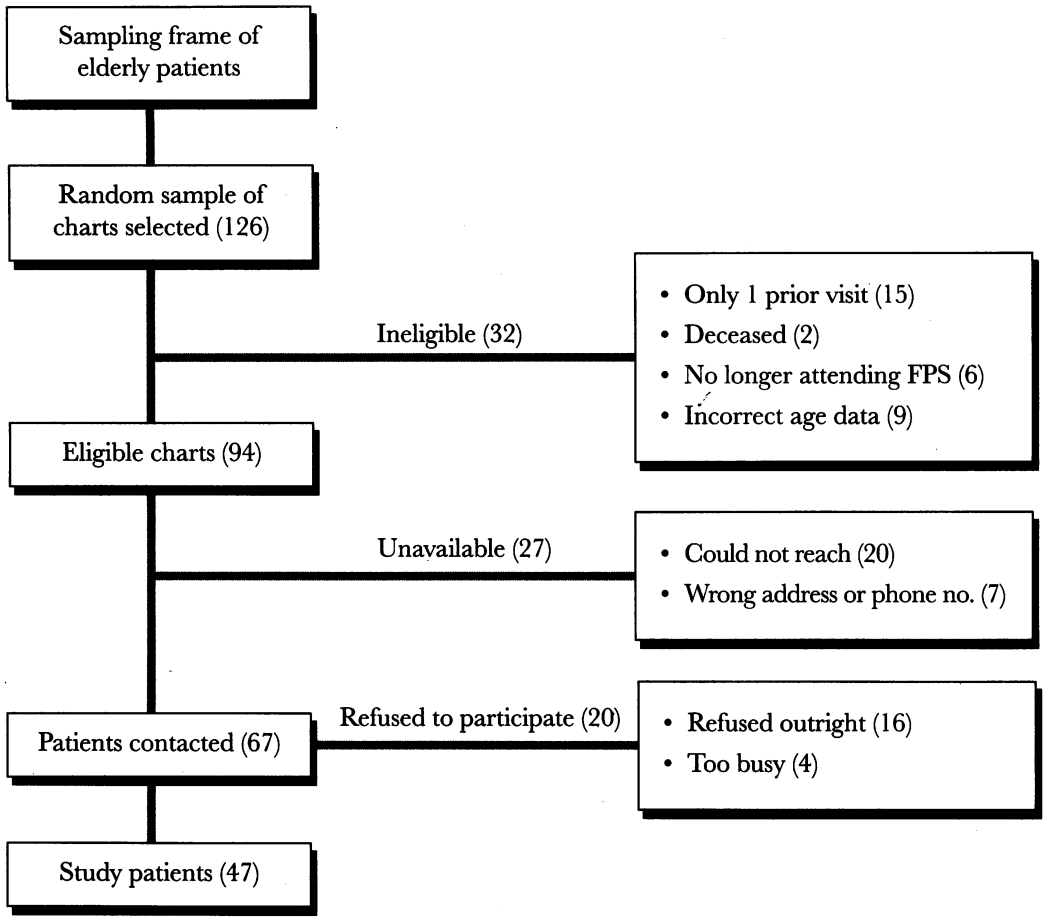
A necessary prerequisite for such measurement, in turn, is an accurate, efficient method of ascertaining what drugs elderly patients are actually taking – an aspect of the problem often thought to be trivial. However, one of the best studies on this question recently showed that general practitioners in the United Kingdom frequently did not know what drugs their elderly patients were supposed to be taking, let alone what prescriptions patients actually used.[5]

We became interested in this problem as physicians affiliated with the Family Practice Service (FPS) at The Toronto Hospital – General Division. The FPS consists of two teams, each with five certified family physicians and seven family medicine residents. Of the 2140 monthly visits to the FPS, 20% are by patients older than 65 years. On-site team physicians are responsible for seeing patients and for repeating prescriptions on behalf of staff physicians or residents who are unavailable.

We independently became concerned about the quality of prescribing for elderly persons served by this unit as we attempted to ascertain from the charts of other physicians' patients what medications were being prescribed for these patients. These concerns developed in spite of an established FPS policy that a "cumulative patient profile" be located on the inside

Dr Bloom *is an Assistant Professor in the Department of Family and Community Medicine at the University of Toronto and is at the Family Practice Service of The Toronto Hospital – General Division.*
Dr Frank, *an Associate Professor, is also in the Department of Preventive Medicine and Biostatistics at the University of Toronto, is a Fellow in the Population Health Program at the Canadian Institute of Advanced Research, and is Director of Research at the Ontario Workers' Compensation Institute.*
Dr Shafir *is an Associate Professor in the Department of Family and Community Medicine at the University of Toronto and is at the Family Practice Service of The Toronto Hospital – General Division.*
Dr Martiquet, *a Resident in Community Medicine at the University of Toronto when the article was written, is now at the Coast Garibaldi Health Unit at Gibson Landing, BC.*

Figure 1. **Subject selection for study**



cover of each chart. The cumulative patient profile includes a large area for recording current medications, but it frequently seemed to be incomplete or out-of-date. In addition, anecdotal evidence suggested that physicians in the FPS frequently prescribed long-term benzodiazepines and non-steroidal anti-inflammatory drugs (NSAIDs) and that this was often unjustified by the diagnosis and disease severity of the patients receiving them.

This paper describes a pilot project that studied the frequency and pattern of drug prescribing recently recorded in charts for a representative sample of elderly patients seen in the FPS. They were assessed via standardized chart abstraction and compared with contemporaneous patterns of actual medication use determined by nurse home visits. In addition, the rates of various types of "potentially undesirable" prescribing and drug use for these patients are assessed, using an instrument we developed. Results are compared with the drug interactions per se detected, in the same patient-drug lists, by a standard software package designed for this purpose.

All patient's physicians were informed of these results by letter. Finally, follow-up chart review 1 year later was carried out to determine whether the identified instances of potentially undesirable prescribing had been dealt with.

METHODS

Patient selection. Computer-generated lists of all patients 65 years and older, seen at least once during the past 2 years by the 10 staff physicians, were used as the over-

all sampling frame. Patients were initially selected from each physician's lists; those unavailable for or not consenting to study participation were replaced, until approximately five patients were entered from each of the 10 staff physicians' practices. This sample size (50 patients' complete drug lists) was considered adequate for a descriptive pharmaco-epidemiologic exploratory study, given the high cost of patient home visits, which are not part of routine care in this setting.

Measuring drugs prescribed and used. Two assessments were made for each patient of medications administered at least three times weekly for more than 1 month in the prior year (both prescription-only and over-the-counter): a standardized chart abstraction of medications recorded as prescribed and a structured home visit, to assess medications reported by the patient as used in the prior year, by a practice-based nurse who had already reviewed the patients' charts and who telephoned (repeatedly if necessary) after an explanatory letter had been sent to obtain patient consent to carry out the visit. The nurse also asked each patient to show her all "medicine bottles" in his or her home and used them to reconstruct the recent history of medication use and particularly to ascertain which drugs had been used concurrently. No attempt was made to assess compliance per se (eg, pill counts).

Chart abstraction was standardized by the use of a pre-tested chart abstraction form, designed to provide a "best guess" as to the patient's long-term medications, based only on information available to the nurse research associate from each patient's primary care chart. During pretesting of the chart abstraction forms, interrater agreement was found to be virtually 100% if sources used to obtain each patient's drug list were limited to the CPP and recent progress notes.

Other sources of information, eg, consultants' letters, drug renewal or "control" sheets, and home care forms, were sometimes informative as to long-term medications, but too inconsistently to make them worth finding in large charts. Also, interrater agreement dropped precipitously if these other sources were included in the standardized abstraction procedure, because abstractor time and effort spent to search for them varied.

Classification of undesirable prescribing or use. For each patient assessed, the team ascertained and classified potentially undesirable prescribing (PUP) based on chart abstraction data and potentially undesirable drug use (PUU) based on home-visit data according to four categories *(Table 1*[6-11]): more than one drug of the same family; combinations of agents with well-known potential for adverse drug interactions; agents potentially inappropriate for long-term use in elderly patients due to risks (eg, physical dependence or renal damage) that can be reduced by intermittent administration; and outdated agents no longer preferred for certain common indications.

We acknowledge that legitimate indications exist for many of the prescribing patterns listed on *Table 1.*[6-11] However, these patterns were identified by local experts,

Table 1. **Classification of potentially undesirable prescribing and potentially undesirable drug use:** *The team classified PUPs (based on chart abstraction data) and PUUs (based on home visit data) into four categories.*

CATEGORY I
More than one drug from the same drug family, eg, benzodiazepines, NSAIDs, β-blockers*[6]
CATEGORY II
Known drug interactions, eg, digoxin and thiazide or loop diuretic without potassium supplements; potassium supplement with a potassium-sparing diuretic; lithium and a thiazide; a β-blocker and verapamil or certain other calcium channel blockers; potassium-sparing diuretic and an ACE inhibitor*[6-8]
CATEGORY III
Prolonged use, eg, NSAIDs, benzodiazepines, codeine, or barbiturate-containing analgesic compounds prescribed for more than 1 month[9,10]
CATEGORY IV
Outdated indication, eg, barbiturate or meprobamate for anxiety, hypertension, or sedation; flurazepam HCl or triazolam for the elderly[11]

** Ferguson's list of PUPs was based on an extensive literature review, complemented by structured consultation with university-hospital geriatricians.[6]*
Data from Ferguson,[6] Hansten and Horn,[7] Hogan,[8] Schlegel and Paulus,[9] Schiralli and McIntosh,[10] and Joint Committee on Drug Utilization.[11]

researchers, and family physicians as occurring more frequently than credible indications for them.[6] In other words, their occurrence is to be interpreted as only a *screen* for *potentially* undesirable prescribing, warranting review of the patient's medications to ensure that risks outweigh benefits.

Table 2. **Most commonly charted and used medications**

MEDICATION	NO. OF PATIENTS PRESCRIBED AND USING MEDICATION (N = 47)	
	PRESCRIBED IN CHART	ACTUALLY USED
Acetylsalicylic acid or enteric-coated ASA	13	23*
Benzodiazepines	12	12
Hydrochlorothiazide	10†	9
NSAIDs	6	9*
Digoxin	9	9
Nitroglycerin	6	6
Acetaminophen	4	10*
Thyroxine	9	9
β-Blockers	6	6
Acetaminophen and codeine	1	6*

** Total instances of medication used but not charted = 24, all but 3 of which involve over-the-counter agents*
† Charting error; the physician had discontinued this medication for one patient but not recorded this action in the chart.

An analogous process, of counting instances of undesirable prescribing and drug use in each patient's chart-based and home-visit drug lists, was carried out using the Drug Interactions Advisor software[8] to detect potentially undesirable medication patterns as defined by that software. This commercially available package uses information from several authoritative sources to establish its interaction criteria. Drugs can be entered using the generic or trade name. Six possible levels of side effect severity (from "nuisance effect" to "life-threatening") can be listed by this software for any set of drugs entered. In this study, all six levels were considered in order to capture all potential interactions.

RESULTS

We surveyed 126 charts in order to obtain 47 patients eligible and willing to participate in both chart abstraction and home-visit aspects of the study (*Figure 1*). Thirty-two charts were eliminated as ineligible, and 27 patients were unavailable for home visits. Twenty persons refused to participate when asked on the telephone before the home visit.

Representativeness of patients studied. One hundred twenty-six patients were selected at random from the 4760 persons older than 65 years on the practice lists. Of the 47 patients actually studied, 30 (64%) were female. The average age of these participants was 78 years. Seventy-nine patients excluded from the study, for any of the reasons listed in *Figure 1*, were similar in age and sex: 50 (63%) were female, averaging 75 years of age. Statistical testing for differences on these proportions (χ^2) and means (Student's t and z tests) showed no statistically significant differences but was of limited power.

Chart review. The chart abstractions for the 47 study participants revealed that the number of long-term drugs prescribed per patient in the prior year ranged from zero to 10 (mean 4.2, SD 2.1).

Home visit. The number of long-term medications used per patient in the prior year ranged from zero to 14 (mean 6.0, SD 2.9).

Medications mentioned most frequently. *Table 2* demonstrates how the "prevalent" picture of most commonly "used" medications would differ, for the set of patients studied here, depending on whether it is based on chart abstraction or home-visit information. The number of patients using nine of the 10 most frequently prescribed medications was greater than or equal to the number of patients prescribed them. Hydrochlorothiazide, on the other hand, was found to be used by one less person than charted. It could thus be considered a "chart false-positive" medication for that patient.

All four drugs for which the frequency of *use* exceeded the *prescribed* frequency

(chart false-negative medication) are available over-the-counter (including one type of NSAID: ibuprofen), whereas none of the other 10 most commonly prescribed agents (*Table 2*) can be bought in Ontario without a prescription.

Counting PUPs and PUUs by our method. *Table 3* provides a summary breakdown of PUPs and PUUs for all study subjects, according to the classification scheme in *Table 1*.[6-11] Overall, 21 (45%) of the 47 patients assessed had one or more PUPs, and 22 (47%) had at least one PUU. Patients with no PUUs (n = 25) took an average 5.12 (SD 2.76) medications. Patients with at least one PUU (n = 22) took an average of 7.00 (SD 2.85) medications. The difference between the two groups' mean number of agents taken per patient was statistically significant ($t = 2.29$, $P = 0.026$). However, the frequency distributions of "number of drugs taken" overlapped substantially for the two groups of subjects so that no cutoff value discriminated well between subjects with and without PUUs (*Figure 2*).

Counting PUPs and PUUs by software. The Drug Interactions Advisor program (1987 edition)[8] was found to be user-friendly, gave references for its interactions, and gave additional information about some individual drugs' important side effects, such as "sedating" or "occasional hypokalemia." However, it covered only Category II and IV PUPs in our classification scheme, detecting essentially the same instances in these patients as shown in *Table 1*.[6-11] Further, it did not have the capacity to assess any interactions with potassium supplements, nor did the printout list specific warnings (eg, "sedating" for benzodiazepines) involving the last drug entered on the screen for each patient. Most importantly, neither this program (nor any other currently available drug interaction software we found on the commercial market) appeared to detect PUPs or PUUs reliably in our Categories I and III (*Table 1*[6-11]).

DISCUSSION

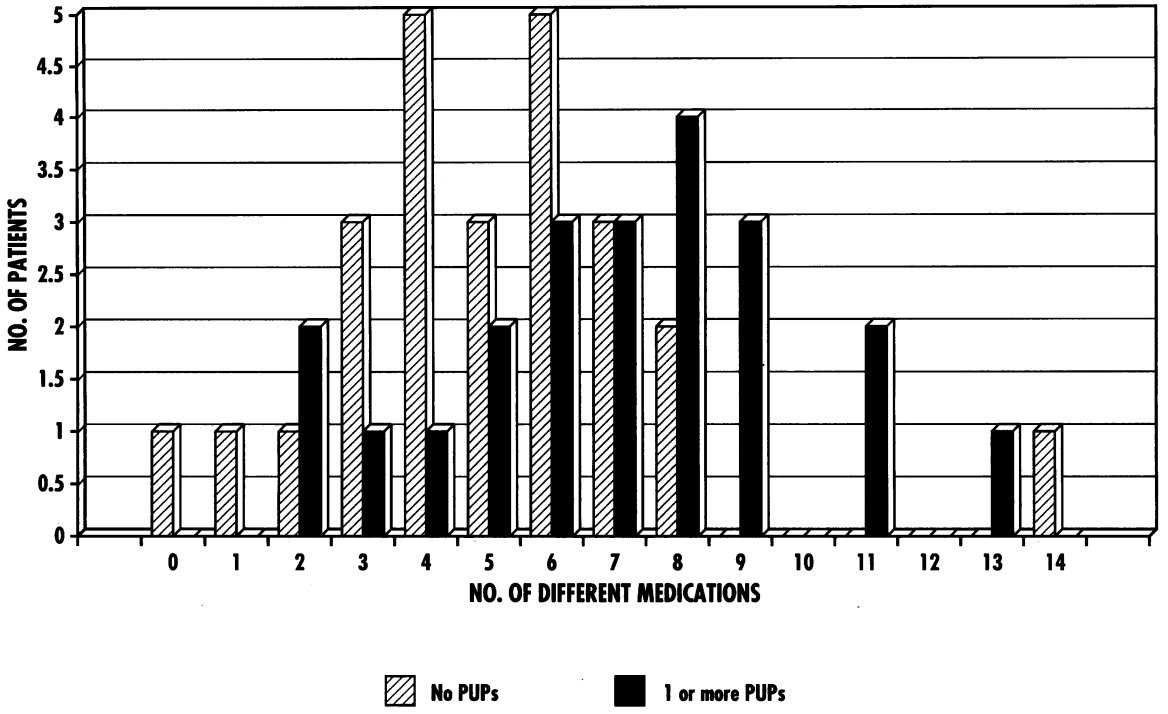
The findings in this small pilot study of prescription and drug-use patterns among the elderly are comparable to those reported elsewhere, including the high frequency of long-term benzodiazepine use (more than one quarter of the patients studied). Data from Saskatchewan have shown that a 25% increase in the use of formulary drugs over a 10-year period in that province was mainly due to increased prescribing for the elderly.[1] The increase was mostly for sedative-hypnotics and other drugs in the mood-modifying category.

Another study from Saskatchewan has shown that the elderly use 42.6% of prescription drugs but are only 15.7% of the

Table 3. **Classification of PUPs and PUUs detected:** *There were 26 instances of potentially undesirable prescribing (in 21 patients) and 39 instances of potentially undesirable usage (in 22 patients).*

UNDESIRABLE DRUG USE	PUP	PUU
CATEGORY I		
More than one benzodiazepine	0	2
More than one NSAID	0	1
SUBTOTAL	0	3
CATEGORY II		
Magaldrate in the presence of kidney disease	1	1
NSAID toxicity with sulfonamide	0	1
Coadministration of β-blockers and nifedipine	2	2
Potassium and potassium sparing diuretic	1	1
Potassium and ACE inhibitor	1	1
β-Blocker and oral hypoglycemic	1	1
SUBTOTAL	6	7
CATEGORY III		
Long-term benzodiazepine	11	14
Long-term NSAID	4	7
Long-term codeine	0	2
SUBTOTAL	15	23
CATEGORY IV		
Flurazepam HCl or triazolam, poor choices for the elderly	5	6
TOTAL	26	39

Figure 2. **Number of patients with potentially undesirable drug use and number of medications used**



overall population.[12] Of all Saskatchewan prescriptions for persons aged 60 to 69, 50% were for psychoactive drugs, increasing to 56% in those older than 70 years.[12] Another Canadian report in an ambulatory care setting found that thiazides were prescribed more than benzodiazepines, followed in frequency by salicylates, digoxin, and codeine, all of which can have significant side effects and require monitoring.[13] Common over-the-counter medications prescribed were analgesics, antacids, laxatives, antitussives, and expectorants, none of which are entirely benign.[13]

Medication use tends to be high among elderly women. This is especially true for benzodiazepines, which are prescribed in higher doses, more often, and frequently more than one at a time.[10,12] A recent British study[5] found that 23% of some 800 elderly people had been receiving repeat prescriptions for more than 1 year without seeing their physicians; 15% of those taking drugs thought they were suffering from drug-related side effects, but most persisted with their treatment.

Eighty percent of all adverse drug reactions (ADRs) are due to the extension of known pharmacologic properties and are potentially avoidable.[2] An ADR surveillance project sponsored by the Ontario Medical Association has shown that 33% of all reported ADRs are for persons older than 60 years of age, with 20% for those older than 70.[3]

Of all admissions to hospital due to ADRs, 41% are in the over-60 age group.[4] The notable causes of ADRs in these studies were found to be polypharmacy, self-medication, lack of compliance, improper storage, physicians' lack of training in geriatric prescribing and their poor supervision of elderly patients, dual prescribing systems in hospitals and general practice, and increased drug sensitivity among the elderly.[2-4]

Other studies have specifically examined why polypharmacy occurs so frequently among the elderly.[13-16] Reasons suggested include legitimate health needs, "age-grading" and bias of health services and their staff, physicians' lack of awareness of the volume of medications that they

are prescribing to the elderly (especially benzodiazepines), inaccurate diagnosis, lack of careful drug history, failure to set clear therapeutic goals, inadequate knowledge of pharmacology, and the need for increased continuing medical education.[17]

The prescribing habits of the family physicians in this study demonstrated a similar need for improved skills in choosing appropriate medications and dosage, avoiding duplicate prescribing, and recognizing possible interactions and contraindications. Regular medication review, while taught in the FPS, appeared not to be implemented consistently.

Implications. Only half of the 94 patients that fulfilled the eligibility criteria for this small pilot study were actually entered into it. Patient interviewing was carried out in March 1989 and could have been affected by winter travel to warmer climates by the mobile (and probably healthier) elderly. The nurse research associate's impression was that several factors played a role in the high rate of refusals for home visits (30%), including "big-city paranoia" about visitors to the home (even a nurse from their own doctor's office!). In addition, a number of relatively healthy elderly persons said they were simply "too busy" to participate, which could constitute a polite refusal.

The average number of medications per patient, as assessed by chart abstraction and home visit, was high (4.2 and 6.0, respectively) as compared with averages reported in the literature.[1,6,13,14,18] This could be because many patients enroled in the FPS at The Toronto Hospital – General Division are referred from other services of this tertiary care facility and tend to have multisystem disease. They are probably not representative of the elderly population in general. An increased average number of medications per patient seems to increase the probability of PUUs, as might be reasonably expected.[18] However, no cutoff point for "number of medications used" discriminated well between patients with and without PUP.

Chart abstraction presented an unexpected challenge. Often the writing was difficult to decipher, and the information on currently prescribed medications was not easy to locate within thick charts. The resultant "best-guess" medication list from each patient's chart was, despite pre-tested and standardized abstraction, frequently found to be inaccurate when its content was compared with the list of drugs apparently in actual use, as assessed by the home visits (*Table 2*).

One can categorize the disagreements between medications charted as prescribed, and those actually in use as determined at the home visit, as either chart false positives or chart false negatives. The only case of a chart false positive in this small pilot study was one patient charted as taking, but not actually taking, hydrochlorothiazide (*Table 2*). In this case, the discrepancy reflected the chart's failure to note the discontinuation of this drug by the physician – although it could have instead resulted from patient noncompliance. On the other hand, no true assessment of prescription compliance per se was made on this study (eg, pill counts), so that some medications could have been falsely reported to the nurse on the home visit as being taken regularly.

Chart false negatives could have occurred if prescriptions, especially new ones, from the family physician were not charted; if medications prescribed by other physicians were not recorded in the family practice chart; if patients "borrowed" medications; or if over-the-counter drugs were not recorded on the family practice charts. The last situation was surprisingly common (accounting for virtually all 24 false-negative chart entries for four different drugs (*Table 2*), despite the fact that the Ontario Drug Benefit Plan pays for most of these drugs only if they are prescribed by a physician. Unfortunately we were unable reliably to ascertain whether these agents had been initiated by the physician (which seems unlikely if no prescriptions were being written, as the charts seemed to suggest) or the patient.

Although chart abstraction underestimated by 30% the average total number of medications being used per patient, all of these omissions represented over-the-counter analgesics or NSAIDS. On the other hand, relative contraindications to acetylsalicylic acid are common among the elderly, and to NSAIDS in particular. One must be concerned that the charted

list of medications omitted any mention of regular recent use of these agents by one quarter of these patients. Do physicians expect this level of omission, or could they be falsely reassured?

Chart abstraction did detect (as PUPs) 26 of 39 instances of potentially undesirable drug use as assessed at home visit; ie, it had a "sensitivity" of 67% (*Table 3*). More importantly, PUUs of Categories I and III were particularly likely to be missed by chart review. Whether the specific PUUs missed on chart review are clinically important is open to debate. Surely, however, most physicians caring for elderly patients would be concerned that their charts mentioned long-term or doubly prescribed benzodiazepines, NSAIDS, or codeine for almost one quarter of the patient population.

The home visit is probably the "gold standard" for determining medication use; however, home visits are costly, about $50 per visit in this setting, including nurse preparation, travel, and recording time. Even home visits could underestimate actual drug use if patients hold back information, although we found no direct evidence of this in 47 visits. Finally, one has to wonder about the acceptability of nurse home visits for elderly urban populations, given the 30% effective refusal rate in this setting.

The 39 PUUs detected in this study overall occurred among 22 of the 47 study patients (47%). This could be expressed as a mean of 0.83 PUUs per patient, but it is perhaps more informative to state that the half of all patients assessed who had PUUs averaged 1.8 instances each. This is a discouraging finding in an academic teaching unit. Most PUUs were in Category III, most notably long-term use of benzodiazepines (14/39 PUUs) and NSAIDs (7/39 PUUs). Again, although legitimate indications for such prescribing patterns exist (eg, active rheumatoid or severe osteoarthritis), they appeared to be absent among the 77 subjects in this primary care study. Yet more than one quarter of the study patients visited were using one or both of these classes of drugs more or less indefinitely. We find these patterns of chronic prescribing worrisome in a setting that aims to provide exemplary primary care.

The Drug Interactions Advisor[8] was able to identify Category II PUPs and PUUs (drug interactions per se) accurately. It occasionally hinted at some Category III PUUs, such as prolonged use of benzodiazepines, by warning that these agents are sedating. Thus the software, and other similar programs currently on the market, is really intended only for use as a pharmacologic interactions detector and misses most PUPs and PUUs as defined in this study.

Future directions. There is much interest internationally in studies designed to test the effectiveness of interventions that would affect physician or patient behaviour to improve both drug prescribing and use. An important first step could be to develop and test software that will automatically detect current PUPs from routinely collected prescription data. Ideally, such software should provide immediate feedback during the patient visit in which the prescribing occurs, thus allowing prescription correction even before the patient leaves the practitioner's office. Current implementation of a computerized prescribing system in our FPS can include routine use of PUP-detection software to provide this feedback.

In the long run, by far the most promising technology for this sort of "real time" quality assurance is the use of patient-held "smartcard" summaries of current medications, currently under development by many third-party payers of drug benefit plans. These summaries would be machine-readable and capable of being updated on microcomputers in physicians' offices.

In Ontario and some other provinces, there is also an automated database for government-funded drug plans for seniors. Preliminary investigations[19] reveal that these longitudinal data are complete and accurate in Ontario for drugs *dispensed*, although not necessarily for those actually *used*. However, access to such a database currently requires individual patients' consent, which is unwieldy for quality control in large clinical practices. Also, the Ontario Drug Benefit Plan database lags some months behind current prescribing and dispensing patterns, making it a potential research tool but an unat-

tractive means of actually improving the quality of day-to-day geriatric care.

Do physicians change their patterns? More by accident than by design, we had an opportunity to assess the impact of a simple notification letter to our physician colleagues in the FPS whose patients we had studied. The letter politely indicated the PUP and PUU results of our drug audit, from both chart abstraction and home visit, for each patient. This activity was ethically mandated, and also part of the feedback process essential to any quality assurance program.

A recheck of the charts of all patients originally found to have any PUPs, approximately 1 year later, unexpectedly revealed to our satisfaction that every one of the 26 instances of PUP we had documented a year earlier had been corrected by the physician in charge of the affected patient's care. This is in spite of the well-known difficulties of weaning elderly subjects off chronic habituating agents, such as benzodiazepines and codeine. Our experience augurs well for the utility of providing this sort of prescribing feedback, on a regular basis, as part of routine quality assurance activities in primary care. ■

Acknowledgment

We gratefully acknowledge the assistance of the following in carrying out this research: The Pharmaceutical Inquiry of Ontario (and its chairman Dr Frederick Lowy), for their generous funding and their critical discussion of our preliminary results; Joyce Ferguson, PhD, for the original stimulus for our PUP and PUU classification; Susan Yake, RN, for her indefatigable chart reviews and home visits for the study subjects; Kathleen Sullivan, MD, CCFP, for her involvement as a resident in the project; Dr David Kels, for his help with data management and analysis; and Ms Carolyn Hicks, for her secretarial support.

Requests for reprints to: *Dr J.A. Bloom, Toronto General Hospital Family Practice Unit, 200 Elizabeth St, 1st Floor, Toronto, ON M5G 2C4. Telephone (416) 340-3658, fax (416) 340-5110*

References

1. Skolly SL, August FJ, Johnson GE. Drug prescribing for the elderly in Saskatchewan during 1976. *Can Med Assoc J* 1979;121:1074-81.
2. Reynolds JL. A survey of adverse drug reactions in family practice. *Can Fam Physician* 1984;30:81-4.
3. Gowdey CW, Brennan M. Adverse drug reaction reporting program of the Ontario Medical Association: the first 3 years. *Can Med Assoc J* 1985;132:19-23.
4. Ogilvie RI, Ruedy J. Adverse drug reactions during hospitalization. *Can Med Assoc J* 1967;97:1450-7.
5. Need we poison the elderly so often? *Lancet* 1988;2:20-2.
6. Ferguson JA. A community pharmacoepidemiologic study of potentially undesirable prescribing [thesis]. Toronto: University of Toronto, 1989.
7. Hansten PD, Horn JR. *Drug interactions & updates.* Philadelphia: Lea and Febiger, 1988.
8. Hogan RW. *Drug interactions advisor* [computer program]. Baltimore: Williams & Wilkins, 1988.
9. Schlegel SI, Paulus HE. Nonsteroidal and analgesic therapy in the elderly. *Clin Rheum Dis* 1986;12(1):245-73.
10. Schiralli V, McIntosh M. Benzodiazepines: are we overprescribing? *Can Fam Physician* 1987;33:927-34.
11. Joint Committee on Drug Utilization. *Triazolam use in Saskatchewan.* Regina: Saskatchewan Health; 1983 (Sept) Report No. 9.
12. Harding J, Wolf N, Chan GA. *Socio-demographic profile of people prescribed mood-modifiers in Saskatchewan.* Regina: Saskatchewan Alcoholism Commission, 1978.
13. Hlynka JN, Danforth DH, Kerr SE. Drug usage review. Part two: implementing the ambulatory program. *Can Pharm J* 1981;114:467-70.
14. Danforth DH, Hlynka JN, Soon JA. Drug usage review. Part three: Implementing the long-term care program. *Can Pharm J* 1982;115:9-12.
15. Segal HJ, Bornstein NS. Drug use by the elderly in long-term facilities. *Ont Med Rev* 1984;51:15-20.
16. Preiksaitis HG, Gordon M. Prescribing drugs for the elderly: reaching therapeutic goals. *Can Fam Physician* 1986;32:2633-7.
17. Ogilvie RI, Ruedy J. An educational program in digitalis therapy. *JAMA* 1972;222:50-5.
18. Gilchrist WJ, Lee YC, MacDonald JB, Williams BO. Prospective study of drug reporting by general practitioners for an elderly population referred to a geriatric practice. *BMJ* 1987;294:289-90.
19. Pharmaceutical Inquiry of Ontario, Lowy F, Chairman. *Prescription for health – report of the Pharmaceutical Inquiry of Ontario.* Toronto: Ministry of Health, Province of Ontario, 1989.

•••