

This publication was rescinded by National Health and Medical Research Council on 17/9/2004 and is available on the Internet ONLY for historical purposes.

Important Notice

This notice is not to be erased and must be included on any printed version of this publication.

- This publication was rescinded by the National Health and Medical Research Council on 17/9/2004. The National Health and Medical Research Council has made this publication available on its Internet Archives site as a service to the public for historical and research purposes ONLY.
- Rescinded publications are publications that no longer represent the Council's position on the matters contained therein. This means that the Council no longer endorses, supports or approves these rescinded publications.
- The National Health and Medical Research Council gives no assurance as to the accuracy or relevance of any of the information contained in this rescinded publication. The National Health and Medical Research Council assumes no legal liability or responsibility for errors or omissions contained within this rescinded publication for any loss or damage incurred as a result of reliance on this publication.
- Every user of this rescinded publication acknowledges that the information contained in it may not be accurate, complete or of relevance to the user's purposes. The user undertakes the responsibility for assessing the accuracy, completeness and relevance of the contents of this rescinded publication, including seeking independent verification of information sought to be relied upon for the user's purposes.
- Every user of this rescinded publication is responsible for ensuring that each printed version contains this disclaimer notice, including the date of rescision and the date of downloading the archived Internet version.

MEDICATION FOR THE OLDER PERSON

**Series on clinical management
problems in the elderly**

No 7

Report of the Health Care Committee
Expert Panel for health care of the elderly

National Health and Medical Research Council

NHMRC

RESCINDED

Commonwealth of Australia 1994

ISBN 0 644 353252

This work is copyright. It may be reproduced in whole or in part for study or training purposes subject to the inclusion of an acknowledgement of the source and no commercial usage or sale. Reproduction for purposes other than those indicated above, requires the written permission of the Australian Government Publishing Service, GPO Box 84, Canberra ACT 2601.

The objective of the National Health and Medical Research Council is to advise the Australian community on the achievement and maintenance of the highest practicable standards of individual and public health and to foster research in the interests of improving those standards.

This report was prepared by an expert panel of the former Health Care Committee. It was considered by the Health Care Committee in April 1992 and was endorsed by the NHMRC at its 117th Session in June 1994.



This document is sold through the Australian Government Publishing Service at a price which covers the cost of printing and distribution only.

National Health and Medical Research Council documents are prepared by panels of experts drawn from appropriate Australian academic, professional, community and government organisations. NHMRC is grateful to these people for the excellent work they do on its behalf. Often, such work is performed in addition to other substantial work commitments.

Publications and Design (Public Affairs)
Commonwealth Department of Human Services and Health

Editing: Janet Salisbury
Cover: AGPS Design

Produced by the Australian Government Publishing Service

RESCINDED

Foreword

The management of medication for older people, especially prescription drugs, is one of the most important areas in geriatric medicine. The potential for causing morbidity is great but, unlike other conditions in this age group, the opportunity to improve outcomes is also great through an awareness of, and a willingness to act on, the issues involved, by health professionals, carers and patients.

This paper provides an overview of the different way that older people respond to drug therapy and the adverse drug reactions experienced by this age group. It also highlights the particular problem of compliance with medication regimens by older people, especially when multiple medications are used. This information forms a background against which prescribing principles and guidelines for older people are discussed, with an emphasis on the importance of public and professional education.

Dr David Fonda
Chairman
Expert Panel for
Health Care of the Elderly

Dr Len Gray
President
Australian Society for
Geriatric Medicine

Contents

Membership	vii
Executive summary	1
Introduction	3
Drug effects in older people	4
Pharmacokinetics	4
Pharmacodynamics	8
Other factors	10
Prescribing for older people — special considerations	11
Polypharmacy and compliance problems	18
Extent	18
Causes	19
Consequences	21
Prevention of medication problems	23
Management of polypharmacy	25
How the doctor can reduce the number of medications	25
Which medications should be reduced?	26
Overcoming compliance barriers	28
Recommendations	30
References	33

Tables

1	Drug kinetics and responses in older people	6
2	Clinical correlations of diminished albumin binding in old age	8
3	Drugs which can adversely affect homeostatic mechanisms in older people	9
4	Special considerations when prescribing for older people	12
5	Overcoming compliance problems in older people	28

Membership

This publication is one of a series on clinical management problems in the elderly produced by various Working Groups of the Health Care Committee Expert Panel on Health Care of the Elderly Other publications in the series are:

1. Pneumonia in the elderly (1991)
2. ***Exercise and the older person (1994)***
3. ***Minimising the adverse consequences of hospitalisation in the older person (1994)***
4. ***Musculoskeletal disorders in the older person (1994)***
5. ***Incontinence and the older person (1994)***
6. ***Falls and the older person (1994)***

Medication for the older person was prepared by a Working Group which comprised:

Dr Michael Woodward (Convenor)	Consultant Geriatrician, Heidelberg Repatriation Hospital
Mr John Bell	Principal Advisor, Pharmacy Self Care; Liaison Officer, Pharmaceutical Society of Australia (NSW Branch)
Professor Nicholas Christophidis	Director of Geriatric Medicine, Alfred Hospital
Ms Jan Donovan	National Policy Officer, Australian Council on the Ageing
Dr Susan Schlicht	General practitioner

Executive summary

- Polypharmacy (the use of multiple medications), difficulties complying with medication regimens, adverse drug reactions and lack of medication efficacy are common problems amongst older people. The extent and causes of these problems, as well as prevention and management approaches, are the subject of this paper.
- Altered drug kinetics and responses as well as altered sensitivity to drugs, impaired compensatory mechanisms, unusual disease presentation and multiple diseases all increase the risk of adverse drug reactions in older people.
- The risk of adverse drug reactions is further increased by polypharmacy and compliance problems.
- Biological and social changes of ageing, medical factors, multiple prescribing sources, complex drug formulation and delivery systems, failure to dispose of medications and drug marketing practices all contribute to the problem.
- Some medications present special problems for older people and require particular consideration before prescribing for this age group.
- Problems can be prevented by:
 - clearly defining the disease to be treated;
 - where possible, predetermining the duration of treatment;
 - regularly reviewing medications and compliance;
 - carefully monitoring for and reporting adverse drug reactions;
 - modifying drug dosages and simplifying regimens;
 - providing simple easily-read instructions and information; and
 - utilising a patient-held medication record.
- Medical practitioners need educational programs in the form of authoritative and objective information on drugs in order to balance the more specific brand-oriented information provided by drug manufacturers. Quality assurance programs, educational programs for older people, and the development of a national formulary including treatment guidelines are also important.
- Hospitals have a special responsibility to promote patient compliance and adequate follow-up when medications are changed.

- In long-term residential care settings, doctors, nurses and pharmacists must work closely together to develop and implement good prescribing practices.

A number of recommendations are presented in this paper which aim to improve drug prescribing for older people and reduce the risk of our seniors suffering adverse effects from the very medications developed to improve their health.

RESCINDED

Introduction

Responding to the health needs of an ageing population is a major challenge for the Australian economy and society. Over the next 30 years there will be a significant increase in the proportion of older people in the community. Older Australians (those over the age of 65 years) currently make up 11.4 per cent, of the total Australian population and this is estimated to increase to 13.4 per cent by the year 2011 and to 20 per cent by the year 2031. By the year 2001, older migrants born in non-English speaking countries will number approximately 666 000, or 25 per cent of all older people.

There will be a dramatic increase in the size of the 'old old' group — the number of people aged 80 years and over — which is estimated to rise from 0.6 million in the year 2001 to 1.4 million in the year 2031. It is likely that the consumption of pharmaceutical medications will continue to be high in this age group.

Older people are at particular risk of experiencing problems with drug therapy due to the physiological changes of age, social circumstances and the increasing incidence of chronic conditions associated with older age.

Polypharmacy (use of multiple medications) and medication management problems are two separate but interrelated issues with special relevance to older people. The problems arise because, although modern drugs are more effective, there is often a lack of awareness in the community of the potential for adverse side effects which accompany this increased benefit when drug therapy is not appropriately prescribed or used.

This paper aims to increase the awareness of these issues amongst health professionals including doctors, nurses and pharmacists, consumers and other interested parties, and put forward suggestions which may, at least in part, overcome some of the problems associated with medication use by older people.

Drug effects in older people

The majority of adverse drug reactions in older people are not individual (idiosyncratic) reactions but are dose related.¹ It should therefore be possible to anticipate and prevent many of such reactions.

The two major mechanisms which account for altered drug effects in older people are age-related changes in pharmacokinetics and pharmacodynamics (that is, the metabolic and biological responses to the drugs). These age-related changes are discussed below and summarised in Table 1. Atypical disease presentation, coexisting diseases, polypharmacy and compliance problems also all increase the prevalence of adverse drug reactions in older people and are discussed below.

Pharmacokinetics

There are important age-related changes in body composition and functioning which are relevant to the pharmacokinetics (absorption, distribution, protein binding, and elimination) of drugs. These are:

- . decline in lean body mass;
- . increase in body fat stores;
- . decline in total body water;
- . decline in renal mass;
- . decline in hepatic blood flow; and
- . decline in glomerular filtration.

Absorption

For most drugs, absorption is determined by passive diffusion during contact with the proximal small bowel. There is little evidence to suggest that this process is significantly impaired in old age,² although decreased absorption of prazosin with age has been reported.³ However, some evidence suggests that subtle changes in drug absorption occur in older people. For instance, the oral bioavailability of digoxin has been shown to be similar in young and old subjects but the time taken to reach maximum plasma concentration is increased in the latter.⁴ Concurrent administration of medications, pathological conditions and surgical alterations to the gut can all alter drug absorption. In addition, the bioavailability of some drugs may be increased by reduced first pass liver metabolism in older people.

Distribution — body composition

With ageing, average lean body mass falls and adipose tissue increases (from 18 per cent to 36 per cent in men and from 33 per cent to 48 per cent in women between the second and eighth decades). Total body water falls both in absolute terms and as a percentage of body weight⁵ These changes markedly affect the volume of distribution of highly fat or water soluble drugs.

- **Water soluble drugs** such as paracetamol, digoxin, cimetidine and ethanol have decreased distribution to tissues resulting in higher serum concentrations.
- **Fat soluble drugs** such as diazepam, chlordiazepoxide, chlormethiazole, lignocaine and thiopentone are distributed more extensively in older people resulting in prolonged plasma half-life and action since plasma half-life is directly proportional to volume of distribution.

The implication is that a reduction in dose and/or dose frequency may be required when prescribing drugs which are highly lipid or water soluble, particularly if toxicity is a problem.⁶ For example, the highly lipid soluble drug diazepam may have a prolonged elimination half-life (up to 100 hours) in older people partly due to its extensive distribution.⁷

Protein binding

An age-related decline in serum albumin has been reported⁸ but this probably reflects poor nutrition, chronic illness, and debility rather than being an age effect itself.⁹ A fall in serum albumin leads to an increase in the free concentration of extensively bound drugs. It is the amount of the free form of the drug which is responsible for therapeutic effects. Examples of drugs affected by changes in albumin binding are listed in Table 2. Particular note of this effect should be taken with warfarin and tolbutamide because of the potentially serious effects of excessive action.

Competition between drugs for specific albumin binding sites may also lead to increased free drug levels. Studies have shown that certain acidic drugs are bound at the same site: phenylbutazone and warfarin; diazepam and the arylpropionic acid group of non-steroidal anti-inflammatory drugs (NSAIDs eg naproxen, ibuprofen).¹⁰

Elimination

A drug is eliminated from the body either by metabolism, predominantly in the liver, or by excretion, predominantly by the kidney.

Metabolism. Drug metabolism in the liver occurs via either phase one or phase two reactions. Phase one reactions are mediated by microsomal enzymes and include oxidations, reductions and hydrolyses which result in a pharmacologically inactive, less active, or occasionally more active, compound. Phase two reactions, usually glucuronidation, generally produce an inactive compound. There is evidence to suggest that oxidative metabolism (phase one) falls with age,¹¹ whereas conjugative metabolism (phase two) appears to be unaffected by ageing.

Oxidative metabolism may be significantly influenced by other factors such as

Table 1 Drug kinetics and responses in older people

Drug response	Change	Cause	Significance	Examples of drug affected
Absorption	Generally none	—	Same amount of the drug available as in younger people	-
First pass metabolism	Reduced	Reduced liver mass, blood shunting around liver	Greater bioavailability of some drugs, increasing risk of adverse effects	Aspirin, chlorpromazine, metoprolol, nortriptyline, propranolol, prazosin
Distribution	Altered	More body fat, less body water	Fat soluble drugs-prolonged half-life	Diazepam, lignocaine, thiopentone
			Water soluble drugs-higher serum concentrations	Cimetidine, digoxin, ethanol, paracetamol
Protein binding	Reduced in unwell elderly	Lower serum albumin (probably NOT reduced in well elderly)	Increased free concentration of extensively albumin-bound drugs	Diazepam, phenytoin, tolbutamide, warfarin
Metabolism — oxidative	Reduced	Reduced liver mass, reduced liver oxidative microsomal enzymes	Prolonged elimination half-life, accumulation and greater steady-state concentrations (for same dose) of some medications	Diazepam, imipramine, metoprolol, nitrazepam, phenytoin, propranolol, theophylline
Metabolism-conjugative	Unchanged	Preserved liver conjugative enzymes	Medications which are conjugated are largely unaffected	Lorazepam, oxazepam, temazepam, most NSAIDs
Excretion	Reduced	Reduced glomerular filtration, tubular excretion also reduced	Prolonged elimination half-life, accumulation and greater steady-state concentrations (for same dose) of some medications	Cephalexin, digoxin, lithium, quinidine, tetracycline

NSAID non-steroidal anti-inflammatory drug

continued . . .

Table 1 continued

Drug response	Change	Cause	Significance	Examples of drug affected
Receptor-target sensitivity	Increased	Receptors more sensitive — eg benzo-diazepine receptor	Greater sensitivity to some medication	Diazepam, nitrazepam
	Unchanged —		Sensitivity to many medications same as in younger people	
	Decreased	Receptors less sensitive eg beta-adrenoreceptor	Reduced sensitivity to some medication	Beta-blockers and beta-stimulants
Compensatory (homeostatic) mechanisms	May be reduced	Reduced homeostatic control — eg reduced compensatory tachycardia and vase-constriction in response to hypotension	Postural hypotension, fails and confusion more common	Antihypertensives, diuretics, ethanol, phenothiazines, some anti-depressants, some hypnotics

smoking genetics, sex, disease states and particularly ‘frailty’ rather than age alone.¹² Frail older people may be defined as those who require assistance with mobility and activities of daily living, who often have abnormalities on laboratory investigations, who are often taking prescribed drugs and commonly suffer with one or more conditions such as Alzheimer’s disease, multi-infarct cerebrovascular disease, parkinsonism, osteoporosis, osteoarthritis and healed fractures.¹³ Examples of drugs which undergo oxidation (and hence may show an age-related decline in metabolism) include: diazepam, chlordiazepoxide, clobazam, flunitrazepam, alprazolam, quinidine, theophylline, propranolol and nortriptyline.

Examples of drugs which undergo hepatic conjugation (and show little or no age-related decline in metabolism) include: ethanol, isoniazid, oxazepam, temazepam and lorazepam. Liver volume falls, on average, by 37 per cent between the ages of 24 and 91, the decline being more marked in females (44 per cent) than in males (28 per cent). There is also a 35 per cent decline in liver blood flow in the elderly.¹² These facts may also explain much of the observed decline in hepatic drug metabolism with age.

Excretion. Renal excretion depends on glomerular filtration, which falls by an average of 35 per cent by the age of 90.¹⁴ It should also be emphasised that serum creatinine may not accurately reflect declining glomerular function with age, as creatinine turnover falls with a decline in lean body mass. Creatinine clearance is a more accurate indicator of renal function. Examples of drugs which accumulate with decline in renal function include: digoxin, gentamicin, lithium,

Table 2: Clinical correlations of diminished albumin binding in old age

Medication	Effect of reduced albumin binding
Acetazolamide	Haemolysis due to erythrocyte accumulation
Chlormethiazole	Sedation
Diazepam	Increased sedation
Penicillin	Little effect
Phenylbutazone	Marrow toxicity
Phenytoin	Cerebellar toxicity
Salicylic acid	Gastrointestinal bleeding
Tolbutamide	Hypoglycaemia
Warfarin	Bleeding

Source: Tregaskis BF, Stevenson IH. *Pharmacokinetics in old age. British Medical Bulletin* 1990; 46: 14..

chlorpropamide, procainamide, tetracycline, trimethoprim, sulphamethoxazole and the penicillins.

Pharmacodynamics

The effects of ageing on pharmacodynamics (altered responsiveness to a given drug level) may be due to alterations in receptor and/or target organ responses or, perhaps more importantly, changes in homeostatic responses.

Changes at specific receptor and target sites

Age-related changes at specific receptor and target sites have been far less extensively studied than pharmacokinetic changes. Drug receptor numbers or affinity may be affected, the transduction of the signal may be altered, or the target tissue may exhibit age-related changes. Older people have been shown to exhibit increased sensitivity to benzodiazepine compounds. The effects on psychomotor performance for oral doses of nitrazepam, and diazepam have been shown to be accentuated in the absence of any difference between old and young subjects in plasma total or free concentrations of these drugs or their metabolites.^{15,16}

Beta-adrenoreceptor mediated responses have been shown to be reduced in older people. Lower levels of cyclic AMP and adenylate cyclase activity following beta-adrenergic stimulation have been found in lymphocyte preparations from older, when compared with younger, subjects. There is evidence of reduced beta-adrenoceptor numbers, decrease in high affinity binding sites and changes in post-receptor transduction mechanisms.¹⁷ The beta-adrenoceptor blocking activity of propranolol decreases with age.¹⁸ The chronotropic and vasorelaxant effects of isoprenaline have also been shown to be diminished in older people.¹⁷

Both angiotensin converting inhibitors and calcium channel blocking agents have been shown to produce a greater fall in blood pressure in older people although this may reflect a reduction in homeostatic response.¹⁷ Older people appear to require lower doses of warfarin to achieve anticoagulation and have been shown to obtain a greater anticoagulant response than younger controls at the same plasma warfarin concentrations.¹⁹

Compensatory mechanisms

Adverse drug effects in older people often result from impaired secondary compensatory mechanisms including: baroreceptor responses, thermoregulation, thirst, volume regulation, electrolyte and glucose control, control of body sway, alertness etc. Homeostatic reserve is diminished in older people and many drug effects may be manifestations of the reduction of homeostatic mechanisms (see Table 3). The ageing brain has a reduced threshold for the development of acute confusion as a result of drug reactions. The combination of impaired homeostasis, multiple pathologies and polypharmacy can have a compounding effect on the brain resulting in acute confusion, gait imbalance and falls.

Table 3: Drugs which can adversely affect homeostatic mechanisms in older people

Homeostatic mechanisms	Drug	Effect
Higher cognitive function	Anticholinergic agents, benzodiazepines, butyrophenones, phenothiazines, non-steroidal anti-inflammatory agents	Delirium, impaired memory
Postural control	Benzodiazepines, butyrophenones, phenothiazines	Falls
Orthostatic circulatory response	Antihistamines, antihypertensive agents, antiparkinson agents, barbiturates, butyrophenones, diuretics, narcotic analgesics, phenothiazines	Postural hypotension
Thermoregulation	Barbiturates, benzodiazepines, ethanol, phenothiazines, tricyclic antidepressants	Hypothermia
Visceral muscle function	Anticholinergic agents, tricyclic antidepressants	Constipation, ileus, urinary retention, glaucoma

Other factors

Unusual disease presentation

Atypical presentation of both diseases and adverse drug reactions are likely occurrences for older people and may lead to difficulties in diagnosis and drug prescribing. For instance, anaemia due to a NSAID may present as falls and even fractures. Thus, adverse drug reactions may not be recognised as such in older people or recognition could be delayed.

Coexisting disease

Diseases other than the one for which the medication is being used may increase the likelihood of adverse drug reactions. For instance, wasting diseases may reduce the volume of distribution for the medication. Diseases can impair homeostatic mechanisms beyond that due to age alone: diabetic autonomic neuropathy may further increase the risk of orthostatic hypotension from a diuretic.

Polypharmacy and compliance

The role of polypharmacy and compliance problems in adverse drug reactions is discussed in the section on the consequences of these problems, below.

Prescribing for older people — special considerations

There are no established guidelines for the identification of medications which require special attention. However, the pharmacokinetic and pharmacodynamic information discussed above show that some drug categories are more likely to cause problems for older consumers. These 'problem' drugs include the following:

Antihypertensive agents

Since homeostatic mechanisms may be altered in the older person, the effect of antihypertensive medications may require special monitoring.

Centrally active drugs

In older people there is an increased sensitivity to medications which affect the central nervous system, so reduced doses are required. As well, any dosage increases should be made more gradually

Drugs with low therapeutic-to-safety ratio

Examples include agents such as warfarin, phenytoin, theophylline, digoxin, and the aminoglycosides. Many of these medications have established therapeutic serum levels or measurable laboratory endpoints. Therapeutic drug monitoring can therefore be used to help achieve these endpoints, thus improving patient outcome.

Drugs eliminated via the kidneys

As discussed, renal function declines significantly in older people, so medications whose primary route of elimination is via the kidneys should be used in reduced doses and/or with increased dosage intervals. The aminoglycosides, digoxin, allopurinol and lithium are in this category. Several classes of drugs can adversely affect renal function. These include the aminoglycosides and the NSAIDs. Careful monitoring of renal function (by **creatinine** clearance) is required to identify adverse drug effects.

Drugs metabolised in the liver by phase one (oxidative) reactions

Most older people have a decreased function of the oxidative system so medications metabolised in this way require dosage reduction in older people. Examples of longer-acting benzodiazepines are diazepam and nitrazepam.

Table 4 lists some of the drugs used to treat conditions in older people, the possible problems that can occur and ways to minimise the likelihood of these problems. The list of drugs is by no means exhaustive and includes only the more commonly used brand names. The medications are grouped according to their modes of

action, which are listed alphabetically. Additional information can be found in the current series of booklets published by the Victorian Drug Usage Advisory Committee (VDUAC). These booklets offer prescribing guidelines for analgesics, antibiotics, cardiovascular, gastrointestinal, psychotropic and respiratory drugs.

Table 4 Special considerations when prescribing for older people

Drug	Possible adverse effects	Special considerations for older people
ANALGESICS		
Non-steroidal anti-inflammatory drugs (NSAIDs)		
eg aspirin, diclofenac (Voltaren [®]), naproxen (Naprosyn [®]), piroxicam (Feldene [®]), diflunisal (Dolobid [®]), ibuprofen (Nurofen [®] , Brufen [®]), ketoprofen (Orudis [®]), sulindac (Clinoril [®])	Gastrointestinal ulceration and bleeding, renal impairment, confusion, fluid retention, antagonises antihypertensives	Try a regular paracetamol regimen first; monitor renal function, cardiac status, blood pressure; take after food; may mask signs of infection
Narcotics		
eg codeine (Panadeine Forte [®]), pethidine, morphine, oxycodone (Endone [®])	Excess sedation, respiratory depression, constipation, hypotension	Try simple analgesic first; take measures to prevent constipation
Dextropropoxyphene (Doloxene [®] , Digesic [®])	Sedation, constipation, dependence	High likelihood of dependence; questionable effectiveness; consider increasing dosage interval; additive effect with central nervous system depressants
ANTIBIOTICS		
Aminoglycosides		
eg gentamicin (Garamycin [®])	Hearing loss, renal impairment	Reduced dose appropriate; monitor serum levels; 3rd generation cephalosporins are a safer but more expensive alternative
trimethoprim/sulfamethoxazole (Septrin [®] , Bactrim [®])	Varied hypersensitivity reactions including Stevens-Johnson syndrome, blood dyscrasias	Trimethoprim alone is as effective in urinary tract infection
Tetracyclines		
eg doxycycline (Vibramycin [®])	Renal impairment, cholestasis	Consider alternatives if possible
ANTICOAGULANTS		
eg warfarin (Marevan [®] , Coumadin [®])	Haemorrhage	Risk of drug interactions; monitor prothrombin time (PT or INR) regularly especially when altering drug regimen

continued . . .

Table 4 continued

Drug	Possible adverse effects	Special considerations for older people
ANTICONVULSANTS		
eg phenytoin (Dilantin [®]), carbamazepine (Tegretol [®]), valproate (Epilem [®])	Confusion, ataxia, nausea, vomiting, hyponatraemia, rash, liver dysfunction	Essential to monitor serum levels
ANTI-GOUT AGENTS		
eg colchicine (Colgout [®]) allopurinol (Zyloprim [®])	Diarrhoea Renal failure, rash	Short course only preferred Reduce dose in older people to 100-200mg per day; treat acute attack before reintroducing allopurinol
ANTIHYPERTENSIVES		
Beta blockers		
eg atenolol (Tenormin [®]), metoprolol (Betaloc [®]), propranolol (Inderal [®]), pindolol (Visken [®]), oxprenolol (Trasicor [®]), timolol (Timoptol [®] Eye Drops)	Depression, lethargy, sexual dysfunction, bronchospasm, exacerbation of peripheral vascular disease, masking of hypoglycaemia, hypotension, heart failure, bradycardia, headache, vivid dreams	Avoid in chronic obstructive airways disease (COAD), peripheral vascular disease or diabetes. Prefer use of atenolol, pindolol, timolol; older people may be less responsive; advise first dose be taken at night and outline measures the patient can take to prevent postural hypotension
Centrally acting vasodilators		
eg methyl dopa (Aldomet [®])	Depression, postural hypotension	Not a first choice in hypertension
Peripherally acting vasodilators (alpha blockers)		
eg prozosin (Minipress [®])	Stress incontinence, postural hypotension	Not a first choice in hypertension, use with caution if fluid depleted
Calcium channel blockers		
eg verapamil (Isoptin [®]), nifedipine (Adalat [®]), felodipine (Plendil [®]), omlodipine (Norvasc [®])	Verapamil — constipation, heart failure Nifedipine — reflex tachycardia, dependent c-edema, flushing. Felodipine and amlodipine probably similar to nifedipine	Nifedipine capsules result in rapid absorption and may cause acute hypotension

continued . . .

Table 4 continued

Drug	Possible adverse effects	Special considerations for older people
Angiotensin converting enzyme inhibitors		
eg captopril (Capoten [®]), enalapril (Renitec [®])	Hyperkalaemia, renal impairment, hypotension, cough. Captopril may cause taste disturbance	Useful drugs in hypertension and heart failure (especially if both present); initial treatment should be in small doses; monitor blood pressure, renal function, potassium level and hydration; reduce diuretics and potassium supplements; 100mg of aspirin daily or sodium cromoglycate (Intal [®]) may prevent cough
ANTIPARKINSONIAN AGENTS		
eg L-dopa/carbidopa (Sinemet [®]), L-dopa/bensemzide (Madopar [®])	Confusional states, hallucinations, postural hypotension, nausea, involuntary movements	Use low dose frequently rather than high dose infrequently, consider slower release preparation
bromocriptine (Parlodel [®])	All of the above effects, particularly confusion	Tends to be used in older people when L-dopa does not provide adequate control
omantodine (Symmetrel [®])	Confusional states, peripheral oedema, vasculitic rash	Not recommended in older people, if used, lower dose
Anticholinergics		
eg orphenadrine (Disipal [®]), benzotropine (Cogentin [®]), benzhexol (Artane [®])	Confusional states, urinary retention, constipation, postural hypotension	Generally not appropriate for older people — sometimes useful if tremor refractory to other treatment
ANTI-ULCER AGENTS		
H₂ antagonists		
eg cimetidine (Tagamet [®]), ranitidine (Zantac [®]), famotidine (Pepcidine [®])	Confusion, disorientation, numerous drug interactions with cimetidine	Ranitidine or famotidine are safer agents in older people, especially if renal impairment
Antacids		
eg Mylanta [®] , Gaviscon [®]	May reduce absorption of drugs, may constipate or cause diarrhoea	Generally antacid not recommended within 2 hours of other medication

continued ...

Table 4 continued

Drug	Possible adverse effects	Special considerations for older People
CARDIAC AND VASCULAR AGENTS		
Cardiac glycosides		
eg digoxin (Lanoxin PG [®] , Lanoxin [®])	Confusion, bradycardia, arrhythmias, nausea, vomiting, hallucinations, muscle weakness, fatigue, diarrhoea	Indicated for heart failure with atrial fibrillation; of value if sinus rhythm not well established; low dose if renal impairment; avoid hypokalaemia; monitor serum levels regularly
oxpentifylline (Trental [®])	Dizziness, gastrointestinal upsets	Effectiveness not established; reduce dose in older people, especially if renal or hepatic impairment or low or labile blood pressure
CORTICOSTEROIDS		
eg prednisolone (Deltasolone [®]), prednisone (Panafcort [®]), dexamethosone (Dexamethosone [®])	Muscle weakness, confusion, depression, hyperglycaemia, osteoporosis, peptic ulceration, skin atrophy	Use as low a dose as possible (less than 10mg prednisolone daily maintenance) to reduce long-term adverse effects; calcitriol may reduce risk of osteoporosis; prefer inhaled steroids for chronic airways disease
DIURETICS		
Loop and thiazide		
eg chlorothiazide (Chlotride [®]), bendrofluzide (Aprinox [®]), frusemide (Lasix [®]), bumetanide (Burinex [®]), indapamide (Natrilix [®])	Dehydration, electrolyte imbalance (hyponatraemia, hypokalaemia), hypotension, hyperglycaemia, hyperuricaemia, incontinence, confusion, muscle weakness	Monitor electrolytes and glucose; if symptoms of gout, check urate. Consider other methods to control peripheral oedema
Potassium sparing		
eg amiloride (Midomor [®]), triamterene (Dytac [®]), spironolactone (Aldactone [®])	Hyperkalaemia	Establish need by checking potassium levels after commencing diuretic; monitor potassium; avoid combining with angiotensin converting enzyme (ACE) inhibitors

continued . . .

Table 4 continued

Drug	Possible adverse effects	Special considerations for older people
Combination		
eg hydrochlorothiazide/amiloride (Moduretic [®]), hydrochlorothiazide/triamterene (Dyazide [®])	As for thiazides and potassium sparing. Moduretic [®] is particularly associated with hyponatraemia	As for thiazides and potassium sparing
PSYCHOTROPIC AGENTS		
Phenothiazines		
eg thioridazine (Melleril [®]), chlorpromazine (Largactil [®]), prochlorperazine (Stemetil [®])	Confusion, drowsiness, extra pyramidal syndrome, tardive dyskinesia, akathisia	Ensure appropriate indication for treatment; use lowest dose to control symptoms; avoid long-term use if possible
Butyrophenones		
eg haloperidol (Serenace [®])	As above	As above
Benzodiazepines		
eg diazepam (Valium [®]), oxazepam (Serepax [®]), nitrazepam (Mogadon [®]), temazepam (Normison [®]), flunitrozapam (Rohypnol [®])	Confusion, memory impairment, drowsiness, unsteady gait, falls, fractures, depression, withdrawal syndrome	Reduce dose if hepatic impairment; avoid long half-life drugs, eg nitrazepam, diazepam, flunitrazepam; use for short periods or irregularly; try alternative strategies for insomnia and anxiety
Antidepressants		
<i>lithium (Lithicarb[®])</i>		
	Electrolyte imbalance, weight gain, oedema, gastrointestinal tract and central nervous system toxicity	Monitor serum levels and clinical condition; use low dose or increase dosage interval if renal impairment
<i>Tricyclic antidepressants</i>		
eg amitriptyline (Tryptanol [®]), doxepin (Sinequan [®]), dothiepin (Prothiaden [®])	Anticholinergic effects (constipation, urinary retention), hypotension, falls, cardiac arrhythmias	Start with low dose and gradually build up as tolerated; recommend single night time dosing
<i>Tetracyclic antidepressants</i>		
eg mianserin (Tolvon [®])	Anticholinergic effects less likely but blood dyscrasias more likely	

continued . . .

Table 4 continued

Drug	possible adverse effects	Special considerations for older people
Monoamine oxidase inhibitors (MAOIs)		
-non-selective		
eg phenelzine (Nardil [®]), tranylcypromine (Parnate [®])	Postural hypotension, hypertensive crises with some food	Useful agents in selected patients; need tyramine-free diet — may be difficult to comply
-selective		
eg moclobemide (Aurorix [®])	—	Reduce dose if severe hepatic impairment; advise hypersensitive patients to avoid large quantities of tyramine rich food
Serotonin uptake inhibitors		
eg fluoxetine (Prozac [®]), paroxetine (Aropax [®]), sertroline (Zoloft [®])	Anorexia, agitation, sleep disturbance	Not first line drugs
RESPIRATORY AGENTS		
Bronchodilators		
eg theophylline (TheoDur [®] , Nuelin [®])	Confusion, nausea, vomiting, cardiac arrhythmias	Not first line bronchodilator; monitor serum levels
Inhaled beta-agonists		
eg salbutamol (Ventolin [®] , Respolin [®] , Asmol [®]), terbutaline (Bricanyl [®])	Tremor, tachycardia, difficulties with method of administration	Consider method and ease of administration eg spacer device, Turbuhaler [®] , Haleraid [®] , nebuliser unit
Inhaled steroids		
eg beclomethasone (Becotide [®] , Aldecin [®] , Becloforte [®]), budesonide (Pulmicort [®])	Oral candidiasis, vocal cord atrophy	Advise patients to use spacer; gargle and spit out fluid after use

Polypharmacy and compliance problems

The main problems associated with the prescribing of drugs and management of medication for older people are polypharmacy and reduced compliance. The extent, causes and consequences of these factors are discussed in this section.

Extent

Polypharmacy

Polypharmacy is the term used to describe the concurrent use of multiple medications. Because older people consume more medications than younger people they are more likely to be exposed to polypharmacy. In Australia, age pensioners comprise 9.2 per cent of the population but they consume 22 per cent of all prescribed drugs and 55 per cent of psychotropic drugs.^{20,21} Ten per cent of the Australian population aged 65 years and over use 41 per cent of all sleeping pills and 26 per cent of all tranquillisers, sedatives and other medicines for nervous conditions. Recent figures for the National Health Survey indicate that 17.2 per cent of those aged 65 to 74 years and 23.4 per cent of those aged 75 and over take sleeping medications.²²

The extent of polypharmacy in older people has been revealed in a number of recent Australian studies. In a study of non-institutionalised Dubbo residents aged 60 years and over, 18 per cent of men and 25 per cent of women were found to be currently using three or more classes of prescription drugs. The corresponding values for two or more classes of non-prescription drugs were 29 per cent and 44 per cent. Of those who were using multiple prescription drugs, 56 per cent of men and 76 per cent of women were also using multiple non-prescription (over the counter) drugs.²³

Other studies have shown that: (i) the mean number of medications consumed by Australians over the age of 60 years and dwelling in the community was 4.8;²⁴ and (ii) for 1093 residents aged 70 to 86 years living either in independent units or hostel accommodation the median number of medications taken on a continuous basis was three (range: 0-10).²⁵

Nolan and O'Malley²⁶ summarised overseas studies on older people living in the community, showing means of between 2.5 and 3.2 prescribed drugs per patient. This increased for hospitalised older people to means of between 2.5 and 6.3

medications per patient. For nursing homes the overseas studies showed that 74-98 per cent of residents receive at least one prescribed medication with a range of 1.5 to 7.2 (mean) prescribed medications per week.²⁶ An Australian study²⁷ has shown that 79 per cent of residents in nursing homes receive at least one prescribed medication.

Compliance

Because large numbers of medications are prescribed for older people, compliance can frequently be a problem.

Estimates of non-compliance amongst the elderly vary from one-third to one half.²⁸ Under-adherence is particularly prevalent. One study found that 90 per cent of non-compliance cases are due to under-medication.²⁹ Other forms of non-compliance, apart from polypharmacy, include overdosage, taking old medication from old prescriptions stocked at home, and taking other people's tablets.³⁰ As many as 70 per cent of elderly patients alter their intake of prescribed medications intentionally, for a variety of reasons, including the attempt to minimise adverse effects.³¹

MacDonald et al showed 40 per cent of older patients were taking fewer than half the medications prescribed, one week after discharge from hospital. This is partly attributable to poor communication between the hospital and the general practitioner.³²

Causes

The factors which contribute to polypharmacy and compliance problems in older people are discussed below.

Biological changes of ageing

Although disease is not an intrinsic part of ageing, older people are more prone to disease. Thirty-one per cent of people aged 65 years and over suffer from a health handicap and this rises to 50 per cent for those beyond the age of 75 years. Thus, older people are more likely to be prescribed and to consume medications.

Some of the diseases and changes of ageing may reduce medication compliance. The older person may not hear or be able to read instructions. Acute confusion or dementia may also affect compliance. Instructions may not be remembered. Depression may reduce an older person's motivation to comply. Reduced manipulative skills, often due to arthritis, may prevent opening of medication containers or administration of the medication. Reduced saliva production, oropharyngeal problems and impaired oesophageal motility may prevent adequate swallowing of the medication.

Adverse drug reactions themselves, probably more common in older people, may reduce compliance. For example, nausea or dizziness may cause a person to cease a medication or take it irregularly. Indeed, reduced compliance may protect some older people from some adverse effects.

Social changes of ageing

Older people are more likely to live alone and the lack of a carer to prompt or supervise medications may affect compliance. Inadequate finances may prevent purchase of a prescribed medication. Lack of access to transport may prevent collection of the medication. Poor accommodation facilities may affect storing and access to medications.

In residential care, reliance on others to supply and administer medication may paradoxically reduce compliance, and co-residents may tamper with medications and instructions.

Medical factors

The prescriber may not have defined the disease state properly, leading to over-prescription or inappropriate prescription of medications. There may be an unrealistic expectation by the patient or the doctor that a medication must be used, even for self-limiting diseases or diseases not affected by currently available medications.

The medications may not be reviewed by the doctor frequently enough. Too large a quantity of an individual medication may be prescribed. Drug regimens may be unnecessarily complicated.

Multiple prescribing sources

The patient may be receiving medications from multiple doctors and hospitals, as well as self-prescribed over-the-counter medications. There may be a lack of communication between these prescribers. For instance, inadequate discharge planning may lead to a failure of the hospital to inform the patient's general practitioner of an altered drug regimen, or to inform the patient of the need to see the general practitioner before the discharge medications are all consumed. The hospital may prescribe medications not on the Pharmaceutical Benefits Scheme, or that have a price premium, thereby discouraging compliance. The patient may be supplied by several pharmacies.

Formulation and delivery system

Medication packaging may be difficult to open, even for older people without arthritis. Tablets may be difficult to pick up or break. Some delivery systems used to attempt to enhance compliance may actually reduce it — multidose containers can be too difficult to open or multiple doses can be opened inadvertently and mixed together. Instructions on packages or delivery systems may be incomplete or too small to read.

Lack of medication disposal

Expiry dates may not be read, may be too small to read or may not be adhered to. The medication may be hoarded, especially by older people brought up in economic hardship. There may be no adequate disposal system — the rubbish bin may be regarded as unsafe.

Pharmaceutical company and marketing practices

Although difficult to quantify, there is a perception that overzealous claims and marketing practices may increase medication prescription and consumption, especially if inappropriate claims are made about the benefits of a medication. More advertisements for medications are appearing in the medical and lay press, and more of these advertisements are directed specifically at older people.

Lay press

Although well-meaning, consumer groups, advocates and lay press may, through dominant media coverage, cause fear of medications among consumers and this may lead to poor compliance, for example, corticosteroids.

Regulatory bodies

Changes to medication charges may lead to hoarding before an anticipated price rise or within a year covered by 'safety net' regulations. Substitution of brands, on the basis of cost, can cause confusion and reduce compliance.

Consequences

The major consequences of polypharmacy and poor compliance in older people are:

- iatrogenic illness and hospital admissions;
- adverse drug reactions;
- lack of medication efficacy; and
- wastage of medications and increased cost to the community.

Hospitalisations

The percentage of all hospitalisations of older people that is attributable to medication-induced illness has been shown in various studies to range from 2.9 per cent to 31 per cent.^{33,34} In a recent Australian study, over a five-month period, 2.45 per cent of the 5623 general admissions of patients of all ages (but predominantly older people) to a Melbourne teaching hospital were drug related. Some 1.6 per cent of admissions were due to an adverse drug reaction and of these 30 per cent were due to a drug interaction.³⁵ Others have reported that 28 per cent of 315 admissions of older people to hospital were drug related.³⁶

The most frequent drug-related causes of hospitalisations in the Melbourne study³⁵ were gastrointestinal bleeding, cardiac arrhythmias, blood dyscrasias and postural hypotension. The most commonly implicated drugs were NSAIDs, digoxin, warfarin and theophylline, prescribed mainly for joint pain, cardiac disease, prevention of thromboembolism and respiratory disease, respectively. Patients at higher risk were older females and those taking a greater number of medications. This increased risk of hospitalisation for drug-induced illness for those taking a greater number of medications has been shown in other studies. For example, Colt and Shapiro found older patients hospitalised for such illnesses were taking on average 6.3 medications compared with 3.8 medications per patient admitted for other causes.³³

A recent report on the effects of inappropriate prescribing in Australia estimated that 40 000 hospitalisations per year were due to medications, resulting in 900 deaths.³⁷

Adverse drug reactions

Adverse drug reactions, not necessarily leading to hospitalisations, are probably more common in older people than in younger people. Whilst some investigations have found a positive correlation between patient age and the incidence of adverse effects,³⁸ many have failed to demonstrate this relationship.³⁹ Nevertheless, adverse drug reactions are common in older people and cause considerable morbidity and mortality.

Inpatient studies have shown between 1.5 per cent and 43.5 per cent of patients suffering adverse drug reactions⁴⁰ whereas outpatient and general practice studies have found prevalences ranging from 1.7 per cent to 50.6 per cent.⁴¹ These widely varying prevalence figures reflect differing definitions of adverse drug reactions and difficulties in identifying cases.

Lindley et al⁴² showed that 50 per cent of adverse drug reactions in hospitalised older patients were due to contraindicated or unnecessary medications, suggesting that much drug-related morbidity in the older population is due to inappropriate prescribing.

Adverse drug effects more commonly found in older people include postural hypotension, falls and fractures, confusion and memory disturbances, gastrointestinal bleeding, renal failure, dehydration, electrolyte disturbances, cardiac rhythm disturbances, congestive cardiac failure, skin rashes, gout, liver dysfunction, constipation and diarrhoea, depression, sleep disturbances and acute glaucoma. Some of these have been discussed in more detail above in the section on special considerations for prescribing drugs for older people.

lack of medical efficacy/wastage

Lack of medication efficacy and wastage of medications are difficult to quantify. Clearly, if 90 per cent of poor compliance is due to under-adherence,²⁹ lack of expected medication efficacy may result. Data from the disposal component of the 1992 September Health and Pharmacy Education (Medication Awareness) program indicated that more than 50 per cent of medicines returned were virtually unused, suggesting a significant wastage problem. The majority of medication returns (60 per cent) were of prescription drugs and most of these came from the cardiovascular and central nervous system groups.⁴³ In another study,⁴⁴ hoarding and wastage of prescription drugs were NOT found to be significant problems in a cohort of 600 randomly selected pensioners. As a percentage of a year's supply of drugs at the average rate of being dispensed, wastage was found to be only 0.2 per cent. Clearly, more data on this potential problem need to be collected.

Direct correlation between non-compliance and poorer treatment outcomes has been shown for various chronic illnesses such as psychiatric illnesses, cardiovascular disorders, asthma, tuberculosis and epilepsy.⁴⁵

Prevention of medication problems

Polypharmacy and adverse drug reactions may be reduced by:

- Clearly defining the disease to be treated (for instance, a more precise diagnosis than rheumatic pain may prevent the inappropriate use of NSAIDs). Medications may have little or no useful effect on the disease.
- Appreciating the natural history of the disease; self-limiting diseases may not require medication treatment. For example, most upper respiratory tract infections are viral in origin and need no specific therapy.
- Determining the duration of the medication course, eg warfarin for set period only, and communicating this information clearly to the patient.
- Reducing doctors' and patients' expectations that a consultation ought to result in a medication prescription, and that medications are the most effective treatment for a disease.
- More clearly defining the role of medications in prevention of illness in older people (eg the role of lipid-lowering medications in older people).
- Regularly reviewing all the medications the patient is taking, including non-prescription and alternative medicines, and ceasing medications considered to be no longer required (see section on management of polypharmacy, below).
- Being aware of atypical presentations of both diseases and adverse drug reactions in the elderly. A new symptom or disease following the introduction of a new medication should be suspected of being due to that medication until demonstrated otherwise.
- Monitoring carefully for adverse drug reactions, including confusion, postural hypotension and metabolic disturbances such as electrolyte changes.
- Reporting all adverse drug reactions and developing appropriate post-marketing surveillance programs.
- Modifying the dosage to allow for age-related physiological changes, pathological processes and altered drug handling ('start low and go slow').
- The use of drug assays which may be of value in detecting adverse drug reactions, achieving therapeutic dosages, and occasionally in monitoring compliance.
- The use of academic detailing (using advisers knowledgeable about medications but not affiliated to any pharmaceutical company) may improve prescriber's knowledge of medications and increase their appropriate use.

- Developing quality assurance programs involving the whole prescribing team (doctor, pharmacist, community nurse and, where appropriate, the patient).
- Developing education programs for the doctor, pharmacist, patient and the whole society to raise awareness of the difficulties with medication use by older people.
- Developing peer-consensus guidelines concerning the appropriate treatment of common diseases.
- Developing specific education programs for older people about the nature of diseases and the appropriate use of medications.
- The use of a patient-held medication record, perhaps even a 'smart' card with a programmable metallic strip.
- Reducing the number of prescribing sources for an individual patient.

Management of polypharmacy

How the doctor can reduce the number of medications

Having agreed with the principle that the minimum number of medications should be prescribed for older people (and for all others, for that matter), a clear idea of what the patient is actually taking is needed. Therefore, the patient's medication list should be easily and clearly seen on their file. This is difficult with the card patient record system unless some form of summary card is held. It is easier with the Royal Australian College of General Practitioners record system and even easier with a good computerised medical records system that is regularly updated.

The medications, including non-prescribed ones, should be reviewed periodically with the patient or carer as, for a variety of reasons, the doctor's drug list may be different from that of the patient's (including patient-initiated alterations). Reviewing the repeat prescriptions and the actual tablet containers is also useful and, of course, much easier on home visits. The chore of writing up drug charts in nursing homes, and now hostels, could be viewed more positively as it provides the opportunity for critical medication review.

Before starting to reduce medication, it is important to develop a good rapport with the patient. It is probably a mistake to drastically alter a patient's drugs on their first visit to a new doctor. At this stage the patient and doctor do not know each other well whereas the patient's previous or other doctor usually may have known them and their history for many years and they have known and probably trusted that doctor.

Medication reduction/rationalisation should be carried out slowly; ideally over months rather than days or weeks. In this way rebound of symptoms is avoided especially for medications which are difficult to reduce such as sedatives, antidepressants and anti-inflammatories. If no rebound symptoms occur the patient may be encouraged to reduce the dose a little more. The exceptions to slow reduction would be when serious side-effects are likely or have already developed, for example, melaena in a patient taking an NSAID or when a patient is very confused and has minimal support. In this case, it is probably wise to discontinue as much medication as possible rapidly to avoid major compliance problems and adverse effects. Combination medications, eg hydrochlorothiazide and triamterene, may improve compliance. Dose boxes or similar compliance aids are not much help as it takes a certain amount of physical and mental dexterity to open a box of

different shaped and coloured pills on the right day and at the right time. It is very easy to drop them on the floor or to take the bulk of them all at once.

Psychoactive drugs can be safely discontinued in many older patients without worsening behaviour or recurrence of anxiety. In a randomised trial to decrease the use of psychoactive medications in nursing homes, a multidisciplinary educational program was directed at nursing assistants, nurses and physicians. This team approach included face-to-face educational sessions about the benefits and risks of psychoactive drug therapy with all disciplines, step-by-step suggestions for medication reduction, and instructions for specific behavioural techniques to use in place of medication, for example, reassurance, distraction and stimulation. Antipsychotic drugs were discontinued or less frequently prescribed. The decrease in antipsychotic drugs was not accompanied by any increase in disruptive behaviour or anxiety. In fact, subjects whose drugs were discontinued were less likely than controls to experience cognitive decline. Equally important, measures of staff stress did not increase.⁴⁶

A recent retrospective study of adverse drug events in nursing homes demonstrated that physician-pharmacist teams working together can successfully discontinue apparently unnecessary drugs without posing serious risk. Overall, 60 per cent of medication discontinuations were successful and did not require reinstitution. Histamine receptor blockers, such as ranitidine and cimetidine, NSAIDs and oral hypoglycaemics, were the least likely to require reinstitution while diuretics, anti-hypertensives and anti-anginals were often restarted. Most importantly, the risks of drug discontinuation were rarely life-threatening. Adverse events that followed drug discontinuation often required a physician's attention but none required hospitalisation and no deaths occurred.

Most older patients do not have multiple general practitioners, but if they do this should be strongly discouraged. Referrals to specialists should be coordinated and rationalised. The practice by some patients of visiting a number of hospital outpatient clinics can be considered a potential health hazard. Routine outpatient reviews of stable hypertension, osteoarthritis, non-insulin-dependent diabetes, etc, are often not warranted and could be discontinued by the general practitioner writing a letter to that effect to the clinic.

Which medications should be reduced?

The first step in the reduction of medications is to critically review the drug list. The following questions could be asked.

- Is the diagnosis for which the medication was prescribed correct?
- Does the original reason for prescribing the medication still exist? Perhaps a patient was prescribed a laxative for an episode of constipation that has resolved.
- Has the patient's condition changed, no longer warranting the medication? For instance, cholesterol-lowering medications are unlikely to be needed by a patient with severe dementia.

- Has medical thinking changed on how to best treat certain illnesses? For example, digoxin is no longer considered first or second line therapy for cardiac failure, unless the patient is in atrial fibrillation. Theophylline has been superseded by safer and more effective inhaled medications.
- Do any of the drugs have potentially serious side-effects, the risk of which outweighs their benefits? For example, the NSAIDs are not as safe as paracetamol which may be equally effective.⁴⁷
- Do any of the drugs interact with each other to cause potential adverse effects? For example, cimetidine and theophylline (cimetidine interferes with the clearance of drugs metabolised in the liver and the plasma concentration of theophylline may be increased), verapamil and beta-blockers (bradycardia and heart failure) and an NSAID and warfarin (bleeding, especially from peptic ulceration).
- Do any of the drugs prescribed adversely affect a coexisting disease? For example, NSAIDs and prednisolone may cause bleeding from a peptic ulcer.
- Are any of the drugs being used to treat the side-effect of another drug? For instance, a diuretic may have been prescribed to treat the salt and fluid retention side-effect of an NSAID. Ceasing the NSAID may allow the cessation of the diuretic.
- Can any of the drugs be reduced to once or twice daily administration? For example, verapamil 80mg three times daily may be able to be changed to slow release verapamil 240mg in the morning.
- Are any of the medication combinations irrational? For example, using more than one type of NSAID or multiple sedatives in the same patient.
- Is the patient actually taking the medication? A drug assay or pill count may help. If the medication is not being taken or is being taken very irregularly, prescriptions for it can be ceased.

Once these questions have been asked, a decision about which drugs can be reduced or stopped can be made.

Patients should be reviewed regularly to pick up problems with dose changes. In addition, they and/or their relatives/carers should be informed of any potential problems and should notify the treating doctor if symptoms or problems recur.

Overcoming compliance barriers

Compliance barriers and ways to overcome them are outlined in Table 5.

Table 5 Overcoming compliance problems in older people

Compliance barriers	Resolution
Hearing impairment	Speak clearly and slowly Face the patient directly
Vision impairment	Labels and other written information should be clear and easy to read with bald face type, large letters
Dexterity problems	Provide non-child-resistant closures, explain procedure required to open containers, remove security seals Use specially shaped tops if possible, use medications that are easily held and, if necessary, broken
Memory difficulties	Repeat instructions Provide printed information to reinforce physician and pharmacist advice and to be home 'reference guides' Involve family/carer Evaluate patient's comprehension of drug instructions A self-medication training program prior to hospital discharge should be considered Recommend Webster-pak, Dosset box or similar Use Medi-List Consider formal compliance checks such as tablet counts or drug assays

continued ...

Table 5 continued

Compliance barriers	Resolution
Complexity of drug regimen	<p>Limit if possible, number of drugs and frequency of dose. Many drugs for older people require only once or twice-daily dosing</p> <p>Label medication with purpose as well as name</p> <p>Refer to other medications being taken</p> <p>Use Medi-List</p>
Multiple prescribing sources	<p>Adequate discharge planning of hospitalised older people, including communication with general practitioner</p> <p>Use single written record of medication (eg Medi-List)</p>
Lack of knowledge of condition	<p>Explain what treatment is for and how it works. Preferably printed as well as oral information should include name of medication, purpose, brand and generic name, dosage schedule, duration of therapy and whether drugs are to be taken continually or symptomatically</p>
Lack of knowledge of more likely adverse effects	<p>Explain these and provide printed information to back this up</p>
Social isolation	<p>Involve available family members/corers</p> <p>Arrange for community nurse or associated health professional visits if necessary</p>
Cost of drugs	<p>Consider non-drug alternatives</p> <p>Discourage the use of unnecessary non-prescription drugs</p> <p>Consider the substitution of generic drugs or less costly alternatives, but be aware that frequent changes in drug name or form may reduce compliance</p>
Drug hoarding	<p>Patients should be encouraged to correctly dispose of medications that are no longer required</p> <p>Avoid prescribing large quantities of medications at the one time</p> <p>Review all medications during home visits and identify those no longer needed</p>

Recommendations

Community care

1. In the general community, doctors and pharmacists are in the best position to assist older people with the management of their own medications. There will also be instances when community nurses and personal carers will take a pre-eminent role. Medication management can be improved in several ways as follows.
 - During a medical consultation, doctors should request details of prescription and non-prescription medications taken and reinforce the need to take each medication as prescribed. The extra time taken for medication review may prolong the consultation but may reduce the need for later consultations caused by medication problems.
 - The doctor or pharmacist should provide the patient with a written record of their medication regimen. A 'Medi-List' or similar record is useful. The information should include:
 - the name of the medication (generic and trade names)
 - what the medication has been prescribed for
 - when the medication is to be taken
 - the dose
 - duration of therapy
 - the possible, more common, adverse reactions
 - The pharmacist should provide the patient with clearly expressed, easily understood, printed drug information (consumer product information).
 - Use of other compliance aids should be considered (eg Dosett boxes). The pharmacist should offer advice on these.
 - The pharmacist should regularly advise on safe storage and disposal of medications.
2. If the patient has multiple prescribing sources, these should be better coordinated using one or more of the following options.
 - A written single patient-held record of current medications (eg Medi-List).
 - A computerised 'smart' card acting as an electronic record of current medications, adverse drug reactions and allergies would be a useful alternative.
 - Pharmacists could play a greater role in monitoring medications prescribed from several sources.

Hospital care

3. In hospitals nurses have a special role in helping with the management of patients' medications.

Hospital staff should consider the following when altering an older person's medications.

- The older person (or their carer) should understand what the medication is for, the correct use of the medication and the importance of continuing the medication for the designated period.
- The older person should be capable of taking the medication as prescribed, or alternative safe arrangements should be instituted.
- Response to the medications, including timely detection of any adverse reactions should be monitored. This monitoring often needs to continue after discharge and should then involve the patient's general practitioner.
- The older person's general practitioner should be promptly informed of any hospitalisation and medication changes, especially at discharge. The patient should not leave hospital without a written record of their new medications, preferably as part of a discharge summary.
- Post-hospital care, including timely replacement of medications that need to be continued should be organised.

Institutional care

4. The following should be considered for older people living in institutions (such as hostels and nursing homes).
 - General practitioners should liaise with the local pharmacist and, where practical, assist supervisors and residents in planning drug administration.
 - The local pharmacist should advise on the safe storage and disposal of medications.
 - A responsible health professional (director of nursing, pharmacist or GP), appointed when appropriate by a patient care committee, should develop a pharmaceutical policy and, as a quality assurance measure, monitor documentation to ensure consistency and clarity.
 - Consideration should be given to a medication training program for supervisors, nurses or carers who have not previously experienced such training.

Education

5. Education emphasising the natural changes as well as the diseases of ageing and how these alter responses to medications should be a mandatory part of the training of doctors, pharmacists, nurses and other carers. Postgraduate update courses should be routinely made available.
6. Emphasis on communication skills should be explicit throughout all health care professional education and training.

7. Units demonstrating geriatric care should be established in teaching hospitals. Such units should include a pharmacist who could also have a role in community education.
8. The public and the pharmaceutical companies should be made more aware of the important issues in medication use by older people, including the undesirability of expecting a medication for every symptom experienced. Promoting positive images of ageing would assist this. High standards of prescribing practice should be publicised and demanded. At the same time care should be taken to avoid creating anxiety about appropriate medications.
9. Independent education programs should be supported so that doctors, pharmacists, nurses and relevant health workers are informed by impartial advisors of the latest advances in drug therapy for older people.

General

10. A national formulary of medications, including consensus guidelines on how to most effectively treat more common conditions, should be developed and widely distributed (by government or other impartial bodies). The formulary should pay particular attention to the unique needs of older people.
11. To reduce the possibility of drug misadventure, consideration should be given to the use of alternatives to drug treatment whenever possible and to avoiding the use of medications as a substitute for other health care resources.

References

1. Williamson J, Chopin JM. Adverse reactions to prescribed drugs in the elderly: a multicentre investigation. *Age Ageing* 1980; 9: 73-80.
2. Divoll M, Ameer B, Abernethy DR, Greenblatt D. Age does not alter acetaminophen absorption. *J Am Geriatr Soc* 1982; 30: 240-4.
3. Rubin PC, Scott PJ, Reid JL. Prazosin disposition in young and elderly subjects. *Br J Clin Pharmacol* 1981; 12: 401-4.
4. Cusack B, Kelly J, O'Malley K, Noel J, Lavan J, Morgan J. Digoxin in the elderly: pharmacokinetic consequences of old age. *Clin Pharmacol Ther* 1979; 25: 772-6.
5. Greenblatt DJ, Sellers EM, Shader RL. Drug disposition in old age. *N Engl J Med* 1982; 306: 1081-8.
6. Tregaskis BF, Stevenson IH. Pharmacokinetics in old age. *Br Med Bull* 1990; 46: 9-21.
7. Greenblatt DJ, Shader RI, Divoll M, Harmatz JS. Benzodiazepines: a summary of pharmacokinetic properties. *Br J Clin Pharmacol* 1981; 11: 11S-16S.
8. Greenblatt DJ. Reduced serum albumin concentrations in the elderly: a report from the Boston Collaborative Drug Surveillance Program. *J Am Geriatr Soc* 1979; 27: 20-2.
9. MacLennan WJ, Martin P, Mason BJ. Protein intake and serum albumin levels in the elderly. *Gerontology* 1977; 23: 360-7.
10. Birkitt DJ. The importance of unbound drugs. *Agents Actions [suppl.]* 1985; 17: 79-84.
11. Swift GC, Homeida M, Halliwell, M Roberts CJC. Antipyrine disposition and liver size in the elderly. *Eur J Clin Pharmacol* 1978; 14: 149-152.
12. Woodhouse KW, James OFW. Hepatic drug metabolism and ageing. *Br Med Bull* 1990; 46: 22-35.
13. Woodhouse KW, Wynne H, Baillie S, James OFW, Rawlins MD. Who are the frail elderly. *Quart J Med* 1988; 68: 505-506.
14. Rowe JW, Andrew J, Tobin JD, Norris AH, Shock NW. Age-adjusted standards for creatinine clearance. *Ann Intern Med* 1976; 84: 567-9.
15. Reidenberg MM, Levy M, Warner M, Coutinho CB, Schwartz MA, Yu G, Cherpipko J. Relationship between diazepam dose, plasma level, age, and central nervous system depression. *Clin Pharmacol Ther* 1978; 118: 513-14.

16. Castledon CM, George CF, Marcer D, Hallet C. Increased sensitivity to nitrazepam in old age. *Br Med J* 1977; 1: 10-12.
17. Swift CG. Pharmacodynamics: changes in homeostatic mechanisms, receptor and target organ sensitivity in the elderly. *Br Med Bull* 1990; 46: 36-52.
18. Vestal RE, Wood AJJ, Shand DG. Reduced beta-adrenoreceptor sensitivity in the elderly. *Clin Pharmacol Ther* 1979; 26: 181-6.
19. Shepherd AMM, Hewick DS, Moreland TA, Stevenson IH. Age as a determinant of sensitivity to warfarin. *Br J Clin Pharmacol* 1977; 4: 315-20.
20. Kurowski W. Polypharmacy and older people. Background paper. Melbourne: Australian Council on the Ageing, 1989.
21. McAuley I. Policy issues paper on pharmaceutical benefits pricing authority. Canberra: Consumers' Health Forum, 1988.
22. Australian Bureau of Statistics. 1989-90 National Health Survey. Use of medications, Australia, Cat No 4377.0. Canberra: ABS, 1992.
23. Simons LA, Tett S, Simons J et al. Multiple medication use in the elderly. Use of prescription and non-prescription drugs in an Australian community setting. *Med J Aust* 1992; 157: 246-6.
24. Adamson L, Kwok YS, Smith I'. Too much of a good thing. Older consumers and their medications. Australian Consumers' Association and Combined Pensioners' Association, Sydney, 1988.
25. Mant A, Kehoe L, Eglant A et al. Use of medications by the elderly. *Australian Family Physician* 1990; 19: 1405-11.
26. Nolan L, O'Malley K. Prescribing for the elderly: Part II. Prescribing patterns: differences due to age. *J Am Geriatr Soc* 1988; 36: 245-54.
27. Smithurst BA. Consumption of drugs in eight private nursing homes in a provincial Australian city. *Public Health* 1982; 96: 292.
28. Morrow D, Leiner V, Sheikh J. Adherence and medication instructions: review and recommendations. *J Am Geriatr Soc* 1988; 36: 1147-60.
29. Cooper JK, Love DW, Raffoul PR. Intentional prescription nonadherence (noncompliance) by the elderly. *J Am Geriatr Soc* 1992; 30: 329.
30. MacDonald ET, MacDonald JB, Phoenix M. Improving drug compliance after hospital discharge. *B Med J* 1977; 1: 618-21.
31. Montamat SC, Cusack BJ, Vestal RE. Management of drug therapy in the elderly. *N Engl J Med* 1989; 321: 303-8.
32. Burns J, Sneddon I, Lovell M et al. Elderly persons and their medication: a post-discharge follow-up study. *Age Ageing* 1992; 21: 178-81.
33. Colt MG, Shapiro AI'. Drug-induced illness as a cause for admission to a community hospital. *J Am Geriatr Soc* 1989; 37: 323-6.
34. Popplewell PY, Henschke PJ. Acute admissions to a geriatric assessment unit. *Med J Aust* 1982 ; 1: 343.

35. Lamour I, Dolphin RG, Baxter H. A prospective study of hospital admissions due to drug reactions. *Aust J Hosp Pharm* 1991; 21: 90-5.
36. Col N, Fanale JE, Kronholm P. The role of medication noncompliance and adverse drug reactions in hospitalisations of the elderly. *Arch Int Med* 1991; 150: 841-5.
37. Harvey, R. Issues in pharmaceutical drug use in Australia. National Health Strategy Issues Paper No 4, Canberra, 1992.
38. Hutchinson TA, Flegel KM, Kramer MS, et al. Frequency, severity and risk factors for adverse reactions in adult outpatients: a prospective study. *J Chron Dis* 1986; 39: 533.
39. Gurwitz JH, Avorn J. The ambiguous relation between ageing and adverse drug reactions. *Annals Int Med* 1991; 114: 956-66.
40. Wang RI, Terry LC. Adverse drug reactions in a Veterans Administration hospital. *J Clin Pharmacol* 1971; 11: 14.
41. Lumley LE, Walker SR, Hall CG et al. The underreporting of adverse drug reactions seen in general practice. *Pharmaceut Med* 1986; 1: 205.
42. Lindley CM, Tully MP, Paramsothy V et al. Inappropriate medication is a major cause of adverse drug reactions in elderly patients. *Age Ageing* 1992; 21: 294-300.
43. Be wise with medicines month. Commonwealth Government's September Health and Pharmaceutical Education Campaign, September 1992.
44. Harvey R. Hoarding and wastage of prescription drugs. Paper presented to the 1987 Public Health Association Conference, Sydney, 1987.
45. Burrell CP et al. Therapeutic consequences of noncompliance. National Pharmaceutical Council, Washington DC, 1984.
46. Avom J, Soumerai SB, Everitt DE et al. A randomised trial of a program to reduce the use of psychoactive drugs in nursing homes. *N Engl J Med* 1992; 327: 168-73.
47. Bradley JD, Brandt KD, Katz BP, Kalasinski LA, Ryan SI. Comparison of an anti-inflammatory dose of ibuprofen, an analgesic dose of ibuprofen, and acetaminophen in the treatment of patients with osteoarthritis of the knee. *New Engl J Med* 1991; 325: 87-91.

The National Health and Medical Research Council

The National Health and Medical Research Council (NHMRC) is a statutory body within the portfolio of the Commonwealth Minister for Human Services and Health, established by the **National Health and Medical Research Council Act 1992**. The NHMRC advises the Australian community and Commonwealth, State and Territory Governments on standards of individual and public health, and supports research to improve those standards.

The NHMRC advises the Commonwealth Government on the funding of medical and public health research and training in Australia and supports many of the medical advances made by Australians.

The Council comprises nominees of Commonwealth, State and Territory health authorities, professional and scientific colleges and associations, unions, universities, business, consumer groups, welfare organisations, conservation groups and the Aboriginal and Torres Strait Islander Commission.

The Council meets twice a year to consider and make decisions on reports prepared by committees and working parties following wide consultation on the issue under consideration.

A regular publishing program ensures that Council's recommendations are widely available to governments, the community, scientific, industrial and educational groups.

The Council publishes extensively in the following areas:

- Child Health
- Clinical Practice
- Communicable Diseases
- Dentistry
- Drugs and Poisons
- Drug and Substance Abuse
- Environmental Health
- Health Ethics
- Infection Control
- Mental Health
- Nutrition
- Public Health
- Radiation
- Women's Health

A List of Current Publications is available from:

NHMRC
GPO Box 9848
Canberra ACT 2601

Telephone (06) 289 7646 (24-hour answering machine)
Facsimile (06) 289 7802

