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Problems with Medication Use in the Elderly: An Australian Perspective

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ABSTRACT

Pharmacotherapy is an essential component of medical care for older patients, and around two-thirds of Australians over the age of 60 years use 4 or more drugs. Although polypharmacy is a well-known risk factor for adverse drug events, use of multiple drugs may be unavoidable in the elderly with multiple comorbidities. While there have been concerns about inappropriate prescribing, polypharmacy and non-adherence, it is now recognised that there are a broader range of drug-related problems that need to be addressed. These include suboptimal monitoring of drugs, poor medication management in patients' homes, under-prescribing and poor communication between health professionals. This is a review of the Australian literature on problems with medication use in the elderly, with guidelines for improving the quality of medicine use in this population.

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INTRODUCTION

The elderly make up a growing proportion of the Australian population. Currently those aged 65 years and over represent 12% of the population and in less than 50 years this will increase to 25%.¹ Given that both medication use and the incidence of adverse drug outcomes increase with advancing age, ensuring quality use of medicines (QUM) in older people is of paramount importance.²

To improve QUM in the elderly, we first need to understand how medications are used in this population and what problems exist. A vast body of research on medication use and related problems in the elderly has been published in the international literature. However, differences between the healthcare and pharmaceutical systems of different countries make it difficult to translate this research into the Australian setting.

This review describes medication use, drug-related problems and adverse drug outcomes among older Australians in community, residential care and hospital settings, and discusses some of the barriers to achieving QUM. The review is limited to Australian research cited in Medline, International Pharmaceutical Abstracts, and Australasian Medical Index from 1995 to 2005.

EXTENT OF MEDICATION USE

Community Setting

Most older Australians use at least one drug on a daily basis, and many use multiple drugs. In a randomly selected sample of 1611 Australians over the age of 60

years (mean 73 years) living independently in the community, at least one prescription drug was used daily by 87% of women and 83% of men, and at least one non-prescription drug by 44% and 35% respectively. At least four drugs (prescription and non-prescription) were used by 70% of women and 61% of men (mean 4.1 for women; 3.5 for men).³ This may be an under-estimation since this study relied on self-reported use which is often lower than actual use (on average one drug/patient).⁴

There is a significant group of older Australians who use an even greater number of drugs. Those referred to pharmacists for home medicines review or to community nursing services take an average of nine drugs.⁵⁻⁸ In a study of all drugs dispensed for Australian war veterans and war widows (n = 333 500) over a six-month period, 20% received more than 10 different drugs and 6.9% received more than 15.⁹ Factors associated with multiple drug use are increasing age, female gender, number of diagnoses, recent hospitalisation and depression.^{3,10}

Older patients are also significant users of complementary and alternative medicines (CAM). Although fewer Australians over the age of 65 years use CAMs compared with younger adults, among those with a chronic illness as many as 41% used at least one non-medically prescribed CAM and some used several.^{11,12} Vitamins and minerals are the most commonly used CAM (up to 35% of patients), while herbal or natural medicines were used by up to 14% of men and 23% of women.¹² CAM use may contribute to polypharmacy and increase the risk of adverse drug reactions (ADRs) and interactions.

Residential Care Facilities

Polypharmacy is the norm in Australian residential aged care facilities, with each resident prescribed an average of seven drugs (range 0-22).^{13,14} On average, two of these are prescribed on an as needed basis, most commonly analgesics, laxatives and psychotropics.^{14,15}

Hospital Setting

Medication use is even greater in hospitals. In a study of 1416 elderly inpatients (median age 81 years) on medical or aged care wards at nine hospitals in Victoria, the average number of drugs prescribed per patient was eight (range 0-22, six regular and two 'prn').¹⁶ Hospitalisation is also a time when many changes are made to medications, and often the number prescribed increases. Australian studies have reported that an average of five to seven changes are made during hospitalisation, including cessation of two to three drugs and initiation of three to four.¹⁷⁻¹⁹ This contributes to increased risk of drug-related problems during and immediately following hospitalisation.

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Prescribers' Awareness of Patients' Medications

Prescribers often have incomplete knowledge of the drugs being used by their patients and this is a major barrier to achieving QUM.² Older patients often receive prescriptions from multiple sources and they also self-medicate. Lack of awareness of a patient's complete drug regimen can result in problems such as duplication, drug interactions and failure to identify ADRs. In one Australian study, general practitioners (GPs) were not aware of a median of two drugs taken by each patient (range 0–10).²⁰ GPs may also be unaware of patients' CAM use. In a study of Australian war veterans, patients' use of herbal medicines and supplements was only recorded in their GP's records in 13% of cases.²¹

When patients move in and out of hospital there is potential for prescribing errors, and much of this is due to prescribers' lack of awareness of patients' drug use. This occurs because of poor transfer of information between healthcare settings. Australian studies have reported that only 38% of GPs provided medication information to the hospital when their patient was admitted, and an average of 0.5 to 1.0 drug per patient (range 0–5) was inadvertently omitted on admission.^{4,18,22} On discharge, GPs frequently fail to receive timely medication information from the hospital, and discharge summaries contain errors in 73% of cases.^{18,22}

PRESCRIBING PROBLEMS

Unnecessary and Inappropriate Prescribing

Inappropriate medications have been defined as those drugs that should generally be avoided in the elderly because they are either ineffective or pose unnecessarily high risk.²³ Twenty-five to forty per cent of community-dwelling older Australians are prescribed at least one potentially inappropriate drug (Table 1), and this is consistent with the international literature.^{1,9,24,25} The most commonly prescribed 'inappropriate' drugs are non-steroidal anti-inflammatory drugs (NSAIDs) (15% of patients) and benzodiazepines (18–30%). Benzodiazepines are prescribed even more frequently in institutional settings, with 36% of elderly patients at nine hospitals in Victoria and 43% at 20 residential care facilities in South Australia prescribed a benzodiazepine.^{16,26} High levels of use of these drugs are a concern because they are known to cause problems—benzodiazepines increase the risk of falls, fractures and cognitive impairment, and NSAID-induced gastrointestinal bleeding and congestive heart failure are among the most frequent causes of drug-related hospital admission in older people.^{9,27,28}

Although not all prescriptions for these drugs are inappropriate, there is evidence that they are over-used. A recent Australian study reported that up to 80% of cyclo-oxygenase-2 inhibitor usage may have been inappropriate, having been prescribed for osteoarthritis in the absence of inflammation, without prior trial of paracetamol and without regard for the cautions and contraindications of NSAID therapy.²⁹ Among hospitalised patients, 80% of benzodiazepine prescriptions were classified as inappropriate according to evidence-based criteria.¹⁶ Benzodiazepines are often inappropriately used long-term—a Sydney study assessed benzodiazepine use at three time-points over 4.5 years in 337 community-dwelling patients aged 75 years or older and found 17% were using a benzodiazepine at all three time-points.³⁰

A South Australian study that evaluated pharmacist and GP collaboration in medication review for 1000

community-dwelling elderly patients identified a range of drug-related problems. On average, 2.5 problems were identified per patient, and 50% of these related to prescribing.⁶ Inappropriate drug selection was noted for 27% of patients (most commonly cardiovascular drugs, analgesics, psychotropics) and use of an unnecessary drug (with no current valid indication) for 10%.³¹ There is evidence that similar prescribing problems exist in residential care.³² For example, a study at four nursing homes in Victoria identified an average of two drug-related problems per patient, of which one-third related to over-prescribing (unnecessary drug, duplication of therapy, inappropriate duration).¹⁴

Prescribing problems are also prevalent in Australian hospitals. Appropriateness of prescribing was assessed using evidence-based indicators in a study of 1416 elderly inpatients on medical or aged care wards at nine hospitals.¹⁶ Problems included over-prescribing (benzodiazepines, antipsychotics, acid suppressants) and inappropriate drug selection (metformin in renal impairment, long-acting oral hypoglycaemics).¹⁶

Dosing

Failure to adjust doses in the elderly is also common.^{9,14,16,31,33,34} One study found 45% of doses prescribed for patients with renal impairment were inappropriately high.³³ Another found that 81% of elderly patients prescribed allopurinol were receiving excessive doses.⁹ Prescription of inappropriately high doses was the most frequent problem of major significance detected by pharmacists in a major Australian hospital.³⁴ Under-dosing has also been reported in up to 21% of patients.³¹

Drug Interactions

Older patients are frequently exposed to potential drug interactions. One study found that two-thirds of patients who presented to a major teaching hospital in Perth had been exposed to at least one potential drug interaction—about 10% of interactions were considered to be of major clinical significance.³⁵ In 1017 patients discharged from a Melbourne teaching hospital on five or more drugs, 10% had at least one of a small number of potentially significant drug interactions.³⁶ Another study reported that about 7% of war veterans were exposed to a drug interaction of potentially major significance over a six-month period.⁹ The likelihood of an interaction and the number of interactions per patient is greatest in those prescribed more than six drugs.³⁵

Complexity

A problem associated with drug use in the elderly that is often not considered by prescribers is complexity of medication regimens. Older people prescribed multiple drugs often have to take medications at several different times of the day, some before food, some after food, sometimes needing to halve tablets, often using multiple dose forms and multiple routes of administration. In a study of a community nursing intervention, patients were taking an average of 10.4 drugs, administered in an average of 16.6 doses per day, with an average of 8.1 special administration activities (e.g. before food, halve tablet, dissolve under tongue).³⁷

Under-Prescribing

Under-use of medications proven to decrease morbidity and mortality is also common in older Australians. Under-

Table 1. Drugs that should generally be avoided in elderly patients^{1,9,23}

Drug	Possible adverse effects	Prevalence of prescribing	Reference
<i>Psychotropic drugs</i>			
Benzodiazepines	Confusion, memory impairment, drowsiness, unsteady gait, falls and fractures, incontinence, dependence	18-30% (community) 31-43% (institution)	1, 9 16, 26, 83
Barbiturates	As above	0	24
Tricyclic antidepressants (amitriptyline, doxepin)	Confusion, drowsiness, urinary retention, constipation, postural hypotension	5-20%*	24, 83
Mianserin	Drowsiness, dry mouth, dizziness, vertigo	0.6-1.9%*	9, 83
Phenothiazine antipsychotics (chlorpromazine, thioridazine)	Confusion, drowsiness, extrapyramidal effects, tardive dyskinesia, urinary retention, constipation, postural hypotension	0.2% (community) 12%* (residential care)	1 83
<i>Analgesics</i>			
Non-steroidal anti-inflammatory drugs (especially indomethacin)	Gastrointestinal ulceration or bleeding, fluid retention, hypertension, dizziness, confusion	15% (indomethacin 5%)	9, 24
Dextropropoxyphene	Dizziness, confusion	0.7-3.3%	1, 9, 16, 24
<i>Antihistamines</i>			
Cyproheptadine	Sedation, confusion, urinary retention, constipation, postural hypotension	0	24
Promethazine	As above	0	24
<i>Antispasmodics</i>			
Dicyclomine	Confusion, urinary retention, constipation, postural hypotension	1.1%	24
Hyoscyamine	As above	1.1%	24
Propantheline	As above	2.2%	1, 24
<i>Antiparkinsonian drugs</i>			
Amantadine	Dizziness, postural hypotension, insomnia, depression	0.04%	1, 9
Benzhexol/benztropine	Confusion, urinary retention, constipation, postural hypotension	0.1%	1
<i>Antihypertensives</i>			
Methyldopa	Sedation, dizziness, dry mouth, postural hypotension, depression	0.5-0.7%	1, 9, 24
Prazosin	Postural hypotension, urinary urgency, dizziness	2%	9
<i>Miscellaneous</i>			
Cimetidine	Confusion, dizziness, drug interactions	1.7%	9
Co-trimoxazole	Skin reactions, hyperkalaemia (in renal impairment)	0.5-1.3%	1
Disopyramide	Dry mouth, constipation, blurred vision, urinary retention, confusion	2.2%	24
Hydrochlorothiazide+amiloride	Hyponatraemia	2.1-6.7%	1, 9
Long-acting hypoglycaemics (chlorpropamide/glibenclamide)	Hypoglycaemia	3.0-4.4%	9, 16, 24
Theophylline	Insomnia, irritability, anxiety, tremor	1.8%	1
Ticlopidine	Neutropenia	1.1%	24

*Data is from late 1990s; antidepressant and antipsychotic prescribing patterns likely to have changed due to availability of newer drugs.

prescribing has been observed in community, residential care and hospital settings, and may be a bigger problem than polypharmacy and inappropriate prescribing.^{38,39} In a study of 1000 elderly Australians undergoing multidisciplinary medication review, under-prescribing was noted for 25% and over-prescribing for 10%.³¹ Examples of drugs that are frequently under-prescribed for older Australians are listed in Table 2.⁴⁰⁻⁵¹

MONITORING

Recent studies from the US indicate that monitoring of drug therapy is often suboptimal, and may be a bigger problem than inappropriate prescribing.^{38,52-54} For example, baseline laboratory values were done in less than 50% of

elderly patients prescribed amiodarone, and potassium and creatinine levels were not performed at baseline, within one month, or annually in up to two-thirds prescribed diuretics, angiotensin converting enzyme inhibitors (ACEIs) or potassium supplements.^{38,52,53} The prevalence of this problem in Australia is not known, however, need for additional monitoring is one of the most common problems identified by pharmacists during medication reviews for community-dwelling and residential care patients.^{5,6,14} In a study of 1000 community-dwelling patients, suboptimal monitoring was noted for 33%.³¹ Cardiovascular drugs, especially digoxin and diuretics, were the most common medications requiring additional monitoring.³¹

Table 2. Drugs commonly under-prescribed for the elderly

Drug and indication	Patients not receiving drug*	Reference
ACE inhibitor/angiotension receptor antagonist in heart failure	19%†	40, 41
Beta-blocker in heart failure	48-60%	40, 41
Aspirin in ischaemic heart disease	10-20%	16, 42, 43, 47
ACE inhibitor post-myocardial infarction	31%	43
Beta-blocker post-myocardial infarction	19-21%	42, 43
Lipid-lowering drug post-myocardial infarction or cardiac artery bypass graft	22-36%	43, 47
Warfarin in atrial fibrillation (AF)	56-66%	41, 44-46, 84
Aspirin for stroke prophylaxis in previous stroke or transient ischaemic attack or with AF and not on warfarin	40-55%	26, 84
Anti-osteoporosis drugs following postmenopausal fracture	80%	48
Venous thromboembolism prophylaxis in high-risk hospitalised patients	29%	49
Analgesics for pain	16-22%	50
Pneumococcus vaccine	83%	51
Influenza vaccine	28%	51
Antihypertensive drugs	33%‡	85

*excluding patients with contraindications; †of 81% on ACE inhibitor, 53-61% receiving subtherapeutic dose; ‡of 67% on antihypertensives, 53% had blood pressure \geq 160/100 mmHg

ADHERENCE

Depending on the definition used, and the method for determining it, estimates of non-adherence (by subject) in the international literature range from 44 to 95%.⁵⁵ Local studies confirm that non-adherence is common in older Australians. In a South Australian study of patients visited at home one week post-discharge for a chronic respiratory or cardiac illness, 46% were non-adherent (taken less than 85% or more than 115% of prescribed drugs), and about one in five admitted to completely omitting one or more drugs.⁵⁶ Fourteen per cent of patients admitted to regularly forgetting to take medications despite an intention to do so, while 15% admitted to regularly altering dosages on the basis of symptom status and 21% admitted to reducing dosages to minimise cost.⁵⁶ Non-adherence may be unintentional or deliberate. In a study of 204 elderly community-dwelling patients, 47% indicated that they had at some time over the last few years used a lower dose than was prescribed, and 18% had used a higher dose.⁵⁷ Of those who reported altering a dose, about 40% said they had not informed their GP or pharmacist.⁵⁷

Sociodemographic variables such as age, gender, marital status, education or living arrangements have generally not been found to influence adherence.⁵⁵ There is also little evidence that a patient's knowledge of their medications affects adherence.^{55,56} However, some studies have found an association between non-adherence and increasing number of drugs prescribed (especially \geq 5), frequency of dosing or regimen complexity (\geq 12 doses/day), patient dissatisfaction with

prescriber, and number of prescribers and pharmacies.^{3,7,55} These factors are present for many elderly Australians and may partly explain the level of non-adherence.^{7,37} Reasons provided by older Australians for not adhering to prescribed drugs are listed in Table 3.⁵⁶⁻⁶⁰

Table 3. Reasons provided by the elderly for non-adherence⁵⁶⁻⁶⁰

<i>Intentional non-adherence</i>	
Side effects	
Lack of perceived need for the medication or dose prescribed	
Taking too many drugs	
Concerns about dependence	
Medication ineffective	
Stopped medication to see if it was still needed	
Going out for the day (especially diuretics)	
Cost	
<i>Unintentional non-adherence</i>	
Forgetfulness	
Running out	
Difficulty reading labels, opening containers, halving tablets or using medication devices	
Confusion about the medication regimen	
<i>Communication problems</i>	
Lack of explanation about medication and side effects from prescriber	
Failure to discuss non-drug treatment options	
Lack of explanation about the reasons for dosing regimen and special instructions	
Lack of time spent with health professionals	
Failure by health professionals to communicate instructions in a way patient understands	
Conflicting information from prescriber and pharmacist, and from different prescribers	
Antagonism between prescribers and pharmacists	

MEDICATION MANAGEMENT IN THE HOME

Studies that have assessed medication management by Australian patients in their own homes have reported a broad range of potentially serious problems.

Knowledge

Patients' knowledge about their medications is often poor, especially when it comes to adverse effects. In a study, one week after hospital discharge patients were able to correctly state the purpose and dosage for around 90% of drugs, but only 9% of relevant major adverse effects.⁵⁶ Patients were able to state special instructions for their drugs (e.g. dosing in relation to food) in only 20% of cases.⁵⁶ Although knowledge may not impact significantly on adherence, an awareness of relevant adverse effects may be important to enable patients to recognise and report problems. Awareness of special instructions is important to maximise effectiveness and minimise adverse effects. Elderly patients are also commonly confused about generic and brand names, resulting in inadvertent duplication of medications.⁶¹

Storage and Repacking

Most older Australians keep their medicines in the kitchen, around 4% store them in the bathroom (unsuitable due to

the high humidity and temperature fluctuations) and 8.3% store them in multiple locations.^{57,61} In an in-home assessment of 204 elderly Australians' medications, apart from those who used dose administration aids, 14% kept prescription drugs in containers other than that in which they had originally been dispensed.⁵⁷ In most cases the alternative containers had not been marked with details of their contents. The reasons for doing this included the need to halve tablets that were originally dispensed in blister packs, a dislike of blister packs, for portability, and difficulty in opening the original container. More disturbing is the fact that 9% of patients mixed more than one prescription drug in the same container.⁵⁷

Stockpiling and Hoarding

Stockpiling and retention of drugs no longer needed (hoarding) are potentially dangerous practices that can lead to wastage and errors. In the same in-home assessment, 25% of patients had at least two extra packs of the same drug on hand.⁵⁷ Forty-two per cent had at least one medication that they no longer used, almost 30% had three or more, and one patient had 31.⁵⁷ Almost one in five patients were found to have expired drugs.

In a South Australian study of 342 patients visited at home one week post-discharge, 35% had hoarded and used previously prescribed drugs.⁵⁶ In a study of 204 elderly patients undergoing a multidisciplinary home medicines review, an average of 4.8 additional drugs, over and above those currently being taken, were found in their homes.⁶¹ One in five patients had also retained discontinued repeat prescriptions.⁶¹ A disturbing finding was that one in ten patients were actually using multiple brands or types of the same drug.⁶¹

Sharing

Surveys of older Australians reveal that 13 to 20% have shared their medications with another person.^{57,62} In most cases the drug was either one that could be purchased over-the-counter or one that the patient had been prescribed but had run out. However, 2% reported having borrowed a prescription drug that had never been prescribed for them.⁵⁷

Self-Administration Ability

There is little data on the physical ability of older Australians to manage their medications. A study of 24 patients referred to a community nursing service found that two (8%) could not remove tablets from a vial, three (13%) were unable to manipulate a blister pack, and seven (29%) could not use a child-proof bottle cap.³⁷ Two (8%) patients could not manipulate a multi-compartment dose administration container, and eight (33%) could not read a medication label.³⁷ In a larger study of patients in their own homes, 34% reported difficulty in opening medication containers.⁶³ Dose administration containers are commonly used in an attempt to simplify medication management and enhance compliance, but their use is not without problems. Errors associated with both the filling and use of these devices have been reported, along with other problems such as inadvertent duplication.⁶⁴

Many of these problems are difficult or even impossible to identify without a home visit, suggesting that, at least for high-risk individuals, a home visit may be an important component of patient care.⁶⁵ The potential importance of a home visit is reinforced by the fact that

the number of medications recorded in GPs' medical records or ascertained through patient interview is often an underestimate of the actual number used by the patient.⁴ The number of drugs taken according to the patient is also less likely to predict the presence of medication management problems compared with the actual number of drugs found in the patient's home.⁶¹

ADVERSE OUTCOMES

Adverse outcomes associated with drug use (ADRs, hospital admissions, death) occur more commonly in the elderly, and the rate of ADRs in older Australians has been on the increase over the last two decades.^{2,66,67} A study of 1000 Australians (median age 75 years) who had been referred by their GP to a pharmacist for home medicines review found that 19% had an ADR.³¹

A review of Australian studies published up to 1996 found that medications were implicated in 15 to 22% of unplanned hospital admissions involving older people.⁶⁶ A more recent study in Tasmania found that 18% of unplanned hospital admissions in patients aged 75 years and over were definitely or probably drug-related, while another 12% were possibly drug-related.⁶⁸ Unplanned readmission to hospital following discharge is also a major problem in the elderly, with 29 to 35% of unplanned readmissions drug-related.^{68,69}

ADRs are the most common cause of drug-related hospital admission (60–70%), but under-treatment (omission or cessation of indicated treatment, non-adherence) is also a significant contributor, accounting for 26% of drug-related admissions in one study.^{66,68} Drug interactions and inadvertent consumption of too much of the correct medication have also been associated with admissions.^{35,68,69} The commonest drug-related presentations to hospital in the elderly are falls and postural hypotension (24%), heart failure (17%) and delirium (15%).⁶⁸ Other drug-related presentations include gastrointestinal bleeds, diabetes, angina, arrhythmias, and seizures.²⁸

Drug-related deaths have also been reported. In the Tasmanian study, of the 219 unplanned hospital admissions in patients over 75 years old, there were six deaths attributable to drug-related problems, of which four were judged preventable.⁶⁸ These included: two as a result of embolic strokes secondary to chronic atrial fibrillation in patients not receiving thromboprophylaxis; one as a result of digoxin toxicity leading to bradycardia and cardiac failure; and one deliberate drug overdose.

In Australia in 2001–02, at least 45 000 hospital admissions of patients aged 65 years or over were associated with an adverse drug event (either caused the admission or occurred during the admission).⁷⁰ It has been estimated that for a 60-year-old Australian the 25-year risk of a significant ADR causing hospital admission or occurring during a hospital stay is around 35%.⁶⁷

The drugs most frequently implicated in adverse outcomes in the elderly are cardiovascular drugs (especially ACEIs, diuretics) and psychotropic drugs.^{2,68} However, the frequency of adverse outcomes with these drugs is not significantly out of proportion with their frequency of use, as these are the most commonly prescribed drugs for older Australians (Table 4).^{1-3,9,13,31} Other drugs implicated in ADRs are anticoagulants, NSAIDs, steroids and antibiotics.^{28,67} These findings are consistent with data from other countries.⁵⁴

Table 4. Drugs frequently implicated in adverse outcomes

Drug	Usage*	Adverse outcomes†
Cardiovascular	27%	48%
ACE inhibitors		14%
Diuretics		11%
Beta-blockers		7.4%
Calcium blockers		6.6%
Digoxin		4.9%
Nitrates		4.9%
Central nervous system	17%	21%
Antidepressants (SSRI and TCA)		7.4%
Benzodiazepines		4.9%
Antipsychotics (especially phenothiazines)		4.9%
Anti-parkinsonian		2.5%
Antithrombotics	9%	5.7%
Aspirin (low-dose)		4.1%
Warfarin		1.6%
Corticosteroids	NA	5.7%
NSAIDs	5%	4.9%

*all drugs prescribed;^{1,31} †all drugs implicated in hospital admission;⁶⁸ SSRI = selective serotonin re-uptake inhibitor, TCA = tricyclic antidepressant; NA = Data not available

Risk Factors

Advanced age itself is not a risk factor for an ADR, so the fact that ADRs are more common in the elderly is likely to be due to age increasing the probability of acquiring other risk factors.² Probably the greatest predictor of ADR risk is the number of drugs consumed.² It is likely that the increase in incidence of ADRs reported in older Australians over the last two decades is at least partially due to an increase in the intensity of medical care and drug therapy over this period, for example in cardiovascular disease and diabetes management.^{67,71} In the Tasmanian study of hospital admissions, multiple medications were implicated in 25% of drug-related admissions.⁶⁸ In the South Australian study that followed elderly patients post-discharge from hospital, there was a correlation between number of drugs prescribed on discharge and subsequent unplanned readmission within six months.⁷² Polypharmacy is a risk factor for some of the major geriatric syndromes including falls and delirium.

In addition to the number of medications taken, prescription of 'inappropriate' drugs (Table 1) or inappropriate doses increases the risk of ADRs, hospitalisation and death.^{54,73} Suboptimal monitoring of drug therapy has also been associated with adverse outcomes, as has inappropriate under-prescribing.^{54,68}

It is difficult to know to what extent suboptimal medication management in patients' homes contributes to adverse outcomes, and the risk is likely to vary depending on the stability and severity of the individual's disease state(s) and the relative safety of their drug regimen.⁵⁶ An Australian study reported an association between some of these problems and poorer health outcomes, however, due to the cross-sectional design, it was not able to establish a causal relationship.⁶¹

Other factors that predispose the elderly to ADRs include altered pharmacodynamics and pharmacokinetics, multiple comorbidities, and diminished physiological reserve.² Additional risk factors include female gender, low bodyweight, renal or hepatic insufficiency and a previous ADR. However, it is unclear whether these are independent risk factors or indicators of another cause of ADRs, such as failure to individualise dosages.²

Although not all adverse outcomes are avoidable, many are. In one study a home medicines review involving a pharmacist and GP resulted in resolution or amelioration of identified ADRs in 60% of cases.⁷⁴ At least one in three, and as many as one in two, drug-related hospital admissions in the elderly are considered preventable.^{66,68}

DISCUSSION

Despite increasing awareness of the problems associated with medication use in the elderly and the introduction in recent years of strategies to address them, it appears that, at least up until the early 2000s, the incidence of drug-related problems and adverse drug outcomes has been on the increase.^{67,71} The largest increases have occurred in those aged over 80 years and this is a concern with the expected doubling of the population aged over 80 years over the next 20 years.⁷¹ These increases have occurred despite research suggesting up to 50% of adverse outcomes are preventable. Reasons for this continuing high incidence in older Australians are probably multiple, and include increasing intensity of medical care and drug therapy, slow implementation and uptake of strategies to improve QUM, and possibly a failure on the part of health professionals to recognise and focus on the key problems related to medication use in the elderly.

Considerable research and commentary over the last 10 to 15 years has focused on the need to avoid prescribing drugs that are classified as 'inappropriate' in older people (Table 1).^{23,25,39} However, apart from NSAIDs and benzodiazepines, the drugs implicated in preventable adverse events (Table 4) are not classified as 'inappropriate'. For example, ACEIs and warfarin have proven benefits in the elderly and are not classified 'inappropriate', yet these are commonly associated with adverse outcomes. When these drugs cause problems, it is often because they are prescribed, dosed, taken or monitored inappropriately.³⁹ In a study at 10 Australian hospitals, 9.2% of patients receiving warfarin had an INR above 5 either on admission or during their hospital stay.⁷⁵

There has also been a major focus on the need to avoid polypharmacy and improve adherence, while a number of other issues have, until recently, been under-recognised.^{76,77} These include poor home medication management, suboptimal monitoring of the effects of prescribed drugs, and under-prescribing.

Achieving QUM in the elderly is not easy. Since the number of drugs prescribed is an independent risk factor for an ADR, non-compliance and hospital admission, the number of drugs needs to be minimised. However, there is increasing evidence for the benefits of many drugs in the diseases that are common in this population, so inappropriate under-prescribing also needs to be avoided. Regimens that include the use of two or more drugs to treat one condition are increasingly being recommended for the optimum management of diseases such as hypertension, heart failure, obstructive airways disease, osteoporosis and diabetes, so multiple medications are often indicated in the elderly with multiple comorbidities.

Under-prescribing in the elderly population is well documented, and in the Tasmanian study of hospital admissions, one of the categories of unplanned drug-related admission most frequently classified as severe and preventable, was omission of indicated treatment.⁶⁸ A range of explanations and barriers to the prescription of indicated drugs in the elderly have been proposed:⁷⁸

- lack of high quality evidence from clinical trials with relevance to treating older patients with multiple chronic medical conditions;
- failure of clinical practice guidelines to adequately address treatment of older patients with multiple comorbidities;⁷⁹
- prescribers' non-specific fear of polypharmacy and its associated risks, based on many years of teaching that avoidance of polypharmacy is the key to QUM in the elderly;³⁸
- concerns about patients' capacity to self-administer with complex medication regimens;
- patients' and prescribers' reluctance to use preventive drugs for chronic illnesses (preference for therapies that have immediate benefit on quality of life); and
- financial barriers due to the cost of multiple, chronic medications.

The need to keep the number of drugs as low as possible while avoiding under-treatment of the elderly with multiple comorbidities creates a difficult balancing act. This challenge was illustrated in a recent study that assessed the impact of clinical practice guidelines in the elderly with multiple comorbidities.⁷⁹ The authors created a hypothetical 79-year-old with osteoarthritis, type 2

diabetes, hypertension, osteoporosis, and chronic obstructive airways disease, and applied the recommendations from published clinical practice guidelines, taking care to develop a regimen that was as simple as possible. They determined that the patient would need to take 12 drugs, with 19 doses per day, taken at five different times of the day.⁷⁹ Such a regimen would be difficult for any patient to manage, and carry substantial risk of an adverse event.

Research has confirmed that patients' management of their medications is often suboptimal. This, along with the fact that polypharmacy is largely unavoidable in many elderly patients, indicates that there is a need for reliable systems of care to improve drug safety and enhance medication management and adherence in the elderly. Such systems require a multidisciplinary, multifaceted and multi-sector approach.⁷⁸ Health professionals in primary through to tertiary care need to work together to develop and apply effective systems which optimise inter-professional communication and include regular medication review along with home visits for high-risk patients (Table 5).

The need to develop strategies to improve QUM in older Australians has been recognised by both health professionals and Australian Governments (State and Commonwealth) over the past 10 years. This has resulted in a range of strategies directed at improving medication management (Table 6). This is a positive step and hopefully will result in a decrease in preventable adverse outcomes over time. To date, the uptake of these strategies has been limited, so that only a minority of at-

Table 5. Guidelines for quality use of medicines in the elderly

Ensure accurate record of all medications in use	Ask patient to bring all medications to clinic or pharmacy for review. Consider home visit. Directly ask patient about use of over-the-counter and complementary medicines.
Carefully manage the number of medications (prescribed and non-prescribed)	Balance the need to avoid polypharmacy with minimising under-use of vital drugs. Use non-drug treatments where possible (e.g. insomnia). Avoid prescribing to manage adverse effects of other drugs; be aware of atypical presentations of adverse drug reactions (ADRs) in older people. Regularly review medications to eliminate those no longer required or with unacceptable risk of toxicity. ⁸⁶ Review use of complementary medicines. ⁸⁷
Individualise doses	Reduce doses where appropriate, to allow for age-related physiological changes and pathological processes (e.g. renal impairment). As a general rule, 'start low and go slow' with medications known to cause problems (e.g. drugs affecting the central nervous system). Avoid under-dosing (e.g. ACE inhibitors in heart failure, analgesics)
Keep regimen as simple as possible	Minimise number of doses and dose-times per day. Minimise number of different dose forms. Minimise number of special administration procedures (e.g. halving of tablets). Choose preparations suitable for the patient (size of tablet, colour, packaging)
Ensure patient is capable of safely managing their medications	Involve patient in decisions on their therapy to enhance autonomy and adherence. Consider patient's functional and cognitive abilities when prescribing. Check patient understands the regimen and importance of adhering to it. Educate patient about important side effects and what to do if they occur. Check patient is able to open containers and use dose forms prescribed. Ensure patient has a medication routine to facilitate adherence. Provide compliance aids when appropriate. Minimise hoarding of previously used and expired drugs. Periodically check patient compliance (direct questioning, inspection of medications, or review of prescribing and dispensing frequency). Provide contact details for additional information support
Monitor drug effects and relevant laboratory tests	Discontinue drug if monitoring reveals inadequate response (after non-adherence ruled out) or ADR. Consider an ADR as a possible cause for any new problem
Utilise available strategies and inter-disciplinary collaboration to enhance quality use of medicines	See Table 6

risk patients are receiving these services. For example, in 2003–04, 26 000 home medicines reviews were undertaken, which represents 10% of the population likely to benefit.⁸⁰ Only 13 000 case conferences were funded under Medicare's Enhanced Primary Care packages.⁸⁰ Although clinical pharmacy services have existed in Australian hospitals for many years, a comprehensive service is still not provided to all inpatients.⁸¹ National guidelines for continuity of medication management between hospital and community settings have not been widely implemented.⁸²

Table 6. Strategies implemented in Australia to improve quality use of medicines in the elderly

Clinical pharmacy services
Hospital inpatient pharmacy services
Hospital outreach medication management reviews (post discharge)
Domiciliary medication management reviews (Home Medicines Review)
Residential care medication management reviews
Enhanced primary care services
Health assessments
Chronic disease management
Care planning
Multidisciplinary case conferences
Disease state management programs
Clinical audit
Prescriber feedback programs (e.g. NPS, Department of Veterans' Affairs)
Hospital drug use evaluation programs
Education of health professionals
Educational outreach services (academic detailing)
NPS newsletters and case studies
Australian Medicines Handbook (and Aged Care Companion)
Telephone advisory services
NPS Therapeutic Advise and Information Service (for health professionals)
NPS Medicines Line (for consumers)
Medication management practice guidelines
APAC Guidelines for Medication Management in Residential Aged Care Facilities
APAC Guidelines for Achieving Continuity of Medication Management

NPS = National Prescribing Service, APAC = Australian Pharmaceutical Advisory Council

Since most of the data presented in this review predates the implementation of these strategies, it will be interesting to see how the situation changes over the next decade. There is some evidence that benzodiazepine usage is slowly decreasing and there appears to have been some improvement in prescribing of those drugs that have been the focus of the National Prescribing Service's programs (analgesics, antibiotics, antihypertensives), but educational programs alone are unlikely to be the solution.^{80,83} The application and uptake of multidisciplinary strategies such as home medicines review, case conferencing and post-discharge medication management services will need to increase, accompanied by improved training for professionals providing these services. A major impact on adverse medication outcomes can only be expected when these strategies are fully implemented.

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