24. Heesch KC, Byles JE, Brown WJ. Prospective association between physical activity and falls in community-dwelling older women. J Epidemiol Community Health 2008; 62: 421–6.
25. US Department of Health and Human Services. Physical Activity and Health: a Report of the Surgeon General. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion 1996.
26. Chasan-Taber L, Erickson JB, McBride JW *et al.* Reproducibility of a self-administered lifetime physical activity questionnaire among female college alumnae. Am J Epidemiol 2002; 155: 282–9.
27. Appleby PN, Allen NE, Roddam AW, Key TJ. Physical activity and fracture risk: a prospective study of 1898 incident fractures among 34,696 British men and women. J Bone Miner Metab 2008; 26: 191–8.
28. Shephard RJ, Shek PN. Cancer, immune function, and physical activity. Can J Appl Physiol 1995; 20: 1–25.
29. Department of Health. Saving Lives: Our Healthier Nation. 1999; 1–159.
30. National Osteoporosis Society. Healthy Bones. 2009; www.nos.org.uk.

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Medicine-taking practices in community-dwelling people aged ≥75 years in New Zealand

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Abstract

Background: older people experience more chronic medical conditions than younger people, take more prescription medicines and are more likely to suffer from cognitive or memory problems. Older people are more susceptible to the adverse effects of medicines, which may reduce their quality of life or lead to hospitalisation or death.
Objective: this study aims to identify medicine-taking practices amongst community-dwelling people aged ≥75 years in New Zealand.
Methods: this study was carried out in an urban setting in Dunedin (population 120,000), New Zealand. Interviews of a random sample of people from the electoral roll using a structured questionnaire were conducted. Subjects were community-dwelling people aged ≥75 years taking one or more prescription medicines. From a random sample of 810 people extracted from the electoral roll intended to recruit 300 participants, 524 people met the study criteria and were invited to participate. People living in a rest home or hospital, not contactable by telephone, or now deceased, were excluded. Responses were analysed, medicines categorised by the Anatomical Therapeutic Chemical classification and adherence classed as high, medium and low using a modified four-item Morisky Medication Adherence Scale. Univariate and multivariate linear and logistic regression was applied to combinations of variables.
Results: in total, 316 interviews were undertaken; a 61% response rate. Participants were 75–79 (35%), 80–84 (40%) and >85 years (25%); New Zealand European/European (84%), 'New Zealanders' (14%) or Maori (2%); and 141 (45%) lived alone. Almost half (49%) regularly saw a specialist and a third (34%) had been admitted to hospital in the past 12 months. Participants used a median of seven prescription medicines (range 1–19) and one non-prescription medicine (0–14). The majority (58%) believed medicines are effective and had systems/routines (92%) for remembering to take them. Doses tended to be missed following a change in routine, e.g. holiday. Men were more likely to report 'trouble remembering' than women (odds ratio = 1.86, 95% confidence interval 1.10–3.14; $P = 0.020$). Seventy-five percent of people had high or medium adherence scores and 25%, low scores. Common problems were reading and understanding labels (9 and 4%, respectively)

and leaflets (12%, 6%), and difficulty swallowing solid dose forms (14%). Only 6% had problems paying for their medicines. Around 17% wanted to know more about their medicines, and some people were confused about their medicines following hospital discharge.

Conclusion: overall, community-dwelling people aged ≥75 years in this study appeared to manage their medicines well and found them affordable. Nevertheless, there is a need to improve labelling, leaflets and education on medicines, particularly at hospital discharge.

Keywords: *aged, drug therapy, medication adherence, cost, elderly*

Introduction

Older people experience more chronic medical conditions than younger people, take more prescription medicines and are more likely to suffer from cognitive or memory problems [1–3]. They are more prone to practical difficulties with medicine-taking such as poor eyesight, trouble opening packaging or difficulty swallowing tablets. Older people are more susceptible to the adverse effects of medicines [4], which may reduce their quality of life or lead to hospitalisation or death [5].

Canadian and American studies suggest that cost may be a major factor in non-adherence to medicines amongst older people [6, 7]. This may be the case in New Zealand where all adults pay a prescription charge (NZ$3 per item for the first 20 items per calendar year per individual or family) and a surcharge for medicines not funded by the government. In addition, people pay a fee for visiting a general practitioner (GP) and for telephone requests for prescriptions. Medicine-related costs for older people in New Zealand may appear low compared to some countries, but the impact of such costs has not been examined.

Medicine-taking problems have been identified in older people in the USA, Australia and Europe [3, 8, 9]. For example, Roth and Ivey in the USA interviewed 100 community-living people aged ≥65 years and found that they managed a considerable number of daily medicines (a mean of 9.1), and that inadequate health literacy, poor adherence and potentially inappropriate medication use were prevalent. Thompson and Stewart in Australia interviewed 204 community-living people aged ≥65 years and found that they sometimes took less medicine than prescribed for a variety of reasons, and that 45% of participants tended to hoard unused medicines. Granas and Bates in the UK interviewed 58 people (median age 68 years, range 28–88 years) and found that almost half worried about their illnesses (48%) and about a third (31%) had concerns about their medicines. In addition, participants wanted more information on the potential side effects and how to deal with long-term medication.

In New Zealand, in people aged ≥65 years, a recent pilot study examined some factors that might affect adherence to medicines [10], and an earlier study examined the range of prescription medicines used [11]. The pilot study found that the main factors affecting adherence were taking large quantities of medicines and a lack of knowledge about the purposes of their medicines. No studies have focused on people aged ≥75 years who may be more vulnerable to medicine-taking problems.

Aim

The present study was undertaken to examine medicine-taking practices in community-dwelling people aged ≥75 years in New Zealand to identify medicine-taking problems and to identify the range of prescription and non-prescription medicines used.

Methods

Using a purposely constructed questionnaire, people aged ≥75 years living in the community in Dunedin, New Zealand, randomly sampled from the electoral roll, were interviewed about their medicine-taking practices.

Two focus group meetings were held of people aged ≥75 years at community organisations in Dunedin to develop the questionnaire. The groups consisted of 5 and 10 people, respectively. Medicine-taking practices and problems were discussed. A structured questionnaire was drafted using the information gained, was piloted on four older people and modified in the light of their comments.

A precision for estimated proportions of ±10% using 95% confidence intervals (CIs) was felt to be sufficient, and differences of ~20% between groups were considered likely to have some practical implications. Based on these requirements, a sample size of 300 respondents was chosen, giving 95% CIs ±10% for the smallest group (each age group containing 100 respondents) as well as providing 80% power to detect differences of 17.1% between males (assuming 120) and females (assuming 180), or to detect differences of 20.6% between any two age groups (assuming 100 each) using a two-sided test with $P < 0.05$ considered statistically significant. A random sample of 810 people aged ≥75 years living within the city

boundaries was extracted from an electronic version of the electoral roll, taking equal numbers from each of the six strata defined by sex and age groups 75–79, 80–84 and ≥85 years. People with a rest home or nursing home address, PO Box number or not listed in the telephone directory were excluded from the study.

The 622 people remaining were mailed a letter and information sheet on the study and telephoned 1 week later by MB to ask if they wished to take part. Those not meeting the study criteria (due to recent nursing home or hospital admission, death or not taking any prescription medicines) were excluded. People agreeing to participate were visited by MB and interviewed using the purposely developed questionnaire. Participants showed MB their medicines, and details were recorded from the labels.

Medicines were listed by generic name (major ingredient) and categorised by the Anatomical Therapeutic Chemical (ATC) classification [12]. Participants' knowledge of each prescription medicine's purpose was categorised as 'correct' (any listed indication in the New Zealand data sheet [13] or near-correct answer, e.g. aspirin 'for the heart'), 'incorrect' (unlisted indication) or 'don't know'.

The proportions of participants with high, medium and low adherence were calculated using a modified version of a self-reported adherence measure, the four-item Morisky Medication Adherence Scale (MMAS-4) [14, 15]. Three of the original four questions were used. A fourth 'Do you ever have problems remembering to take your (name of health condition) medication' was changed to 'Do you have trouble remembering to take your medicine' as participants were likely to have several health conditions. Each affirmative answer scored one point; '0' denoted high adherence, '1–2' medium adherence and '3–4' low adherence. (Please see Box 1 Appendix 1 available as supplementary data in *Age and Ageing* online.)

During the questionnaire design, a number of associations between primary outcomes and descriptive variables were hypothesised (e.g. hospital admission in the past 12 months might be associated with increased medicine use). Data were examined for associations between variables using univariate and multivariate linear and logistic regression for continuous and binary outcomes, respectively, using Stata version 10. (Please see Box 2 Appendix 1 available as supplementary data in *Age and Ageing* online.) Multivariate regression was undertaken using all predictors with $P < 0.20$ from the univariate regression models. Multivariate logistic regression models were only examined where at least 10 cases and 10 non-cases were available for each predictor variable. Statistical significance was determined by $P < 0.05$. As this was considered an exploratory study, no adjustment for multiple comparisons was made. The University of Otago Ethics Committee gave ethical approval for the study, and written informed consent was obtained from each participant. This work was supported by a University of Otago Research Grant (grant number 0108-0309).

Results

In total, 524 people met the study criteria and 320 (61%) agreed to participate; 316 interviews were analysed, and four were practice interviews. Participants were 75–98 years; 172 men and 144 women (Table 1). About half of the participants (45%) lived alone, and half (55%) with a spouse or relative. Eighty-four percent were New Zealand European or European, 14% 'New Zealanders' (a term commonly

Table 1. Demographics and numbers of medicines

	All age groups $n=316$	75–79 years $n=110$	80–84 years $n=125$	≥85 years $n=81$
Male	172 (54%)	60 (55%)	64 (51%)	48 (59%)
Female	144 (46%)	50 (45%)	61 (49%)	33 (41%)
Educated to Secondary School level only	190 (60%)	63 (20%)	75 (24%)	52 (16%)
Tertiary education	63 (20%)	19 (6%)	28 (9%)	16 (5%)
Other further education	63 (20%)	28 (9%)	22 (7%)	13 (4%)
Sees a doctor other than at own GP practice, e.g. specialist	155 (49%)	47 (15%)	58 (18%)	50 (16%)
Been admitted to hospital in the past 12 months	107 (34%)	37 (12%)	36 (11%)	34 (11%)
All medicines[a]	2,735	915	1,077	743
$\beta=1.24$ (95% CI 0.38–2.1, $P=0.005$), >1 doctor				
$\beta=1.62$ (0.72–2.51, $P<0.001$), hospital admission in last 12 months				
Prescription medicines[a]	2,377	755	958	664
$\beta=1.08$ (0.25–1.91, $P=0.011$), >1 doctor				
$\beta=1.66$ (0.80–2.52, $P<0.001$), hospital admission in last 12 months				
Non-prescription medicines	358	160	119	79
$\beta=0.05$ (0.01–0.09, $P=0.020$), age (effect of each year older)				
Prescription medicines, all subjects, median (range)	7.0 (1–19)	6.0 (1–19)	7.0 (1–19)	8.0 (2–17)
Non-prescription medicines, all subjects, median (range)	1.0 (0–14)	1.0 (0–10)	1.0 (0–8)	1.0 (0–14)

[a]Multivariate linear regression including multiple doctors and admissions.

Table 2. Remembering and forgetting

Question	Yes	No
Do you have 'trouble' remembering to take your medicine?[a]	81 (26%)	235 (74%)
OR = 1.86 (95% CI 1.10–3.14, P = 0.020) males		
Do you have any 'way of remembering' what you should be taking and when?[b]	190 (60%)	126 (40%)
Do you 'ever forget' to take your medicines?[c]	147 (53%)	169 (47%)
OR = 0.93 (0.87–0.98, P = 0.011) age (each year older)		
OR = 1.17 (1.01–1.35, P = 0.041) members of community organisations		
OR = 1.72 (1.05–2.82, P = 0.031) males		
Are you 'ever unsure' if you have taken a medicine?	72 (23%)	244 (77%)
Can you think of a 'situation where it is more difficult' for you to take your medicine correctly?	91 (29%)	225 (71%)

[a]Univariate logistic regression.
[b]Analysis of comments found that 92% described a system/routine.
[c]Multivariate logistic regression including age, membership of organisations and sex.

used but that does not specify actual ethnicity) and 2% were Maori. Twenty percent were educated to tertiary level, 78% were involved in community organisations (median 1 organisation, range 1–9) and 22% were involved in earlier university-led research projects. Half of the participants (49%) regularly saw a specialist.

Participants used 2,377 prescription medicines in total (median 7, range 0–19) and 358 non-prescription medicines (1, 0–14) (Table 1). Increased use was associated with (i) seeing a specialist (number of prescription medicines 1.08 higher, 95% CI 0.25–1.91, P = 0.011) and (ii) having a hospital admission in the past 12 months (number of prescription medicines 1.66 higher, 0.80–2.52, P < 0.001). Use of non-prescription medicines significantly decreased with age (0.05 lower per year older, 0.01–0.09, P = 0.020).

Almost 80% of prescription medicines were for the cardiovascular system (32%), nervous system (22%) or the alimentary tract (18%). The top five prescription medicines were aspirin (60%), paracetamol (41%), simvastatin (35%), metoprolol (31%) and cilazapril ± hydrochlorothiazide (31%). Over 40% of participants took simvastatin (35%) or atorvastatin (7%). The top five non-prescription medicines were paracetamol (17%), glucosamine ± chondroitin (14%), fish oils (11%), multivitamins ± minerals (7%) and aspirin (5%).

Most participants (58%) thought 'taking medicines improved their health', but some were unsure (38%) or disagreed (4%). Many were positive: 'medicines keep me alive'; 'are necessary'; 'help my symptoms'. Some were accepting: 'I don't mind taking medicines; I am resigned to it'; 'medicines are part of my life'. Others were more negative: 'I would prefer not to take medicines'; 'I don't like taking them'; 'I hate taking them'.

A fifth of participants had worries about side effects; 93% would ask their doctor about medicine-related worries, 32% their pharmacist and 1–6% a hospital specialist/nurse/family member. For more information, 8% used the internet and 4% a patient support group or family health book. Almost a fifth of participants (17%) wanted to know more about their medicines, their purpose (5%) and side effects (4%). Fifty-seven percent knew the purpose of all their medicines, 75% knew 75–100%, 20% knew 25–74%, 3% knew 1–25% and 2% knew none.

Almost all participants (98%) claimed to take their medicines as instructed. The majority thought their doctor (61%) or pharmacist (67%) always/often/sometimes made it easier for them to understand how to take them. Forty-three percent of participants reported taking prescription medicines differently from instructions, and 16% without discussing this with their doctor. The changes that were not discussed with the doctor were not considered detrimental to health as they were mainly dose decreases (ointments, creams, vitamins, laxatives, antacids) or timing (but not dose) changes, mainly in relation to food. Ten percent of participants reported they sometimes felt worse when taking medicines. Six percent of participants would stop taking the medicine if they felt worse, but most would discuss this with their doctor. People with worries about side effects were more likely to stop taking medicines because they felt better (OR = 3.16, 1.05–9.45, P = 0.040).

A quarter (26%) of participants had 'trouble' remembering to take medicines and half (53%) sometimes 'forgot' (Table 2). Men were more likely to forget (OR trouble remembering 1.86, P = 0.020; OR forgetting 1.72, P = 0.031). People were less likely to report 'forgetting' as age increased (OR = 0.93, P = 0.011). A quarter (23%) of the participants were sometimes unsure whether they had taken their medicines. Missed doses tended to be at lunch time or evenings, or after changes in routine (holidays, meals out, being busy). Almost everyone (92%) reported using a system/routine to remind them to take their medicines, such as putting medicines in a prominent place or preparing them the night before. Some participants used a compliance aid filled by themselves (20%) or a pharmacy (10%). Three quarters of the participants were found to have a high or medium adherence score (38% high, 37% medium), and a quarter (25%) had a low score [14, 15].

A few people had physical problems taking medicines (Table 3). Fourteen percent had trouble swallowing, particularly large solid tablets, and 12% had problems opening packets or bottles. Seventeen of the 115 participants who needed to break tablets in half found this a problem. Nine percent of participants had problems reading labels (increased with age, OR = 1.11 per year, P = 0.044). Sixteen percent had problems understanding labels. Nine percent had problems reading leaflets (more likely in people worried about side effects, OR = 3.01, P = 0.004).

Six percent of participants had problems paying for medicines in the past 12 months (more likely in those born

Table 3. Problems when taking medicines

Problems	Yes	No	Not applicable
Swallowing tablets/capsules	43 (14%)	273 (86%)	0
Opening packets or bottles	37 (12%)	272 (87%)	7 (2%)
OR=2.35 (95% CI 1.12–5.92, P=0.024), worried about side effects[a]			
OR=2.66 (1.17–6.02, P=0.019), using a compliance aid[a]			
OR=0.42 (0.20–0.85, P=0.016), male[a]			
Breaking tablets (n=115)	17 (5%)	98 (31%)	201 (64%)
OR=4.20 (1.37–12.86, P=0.012), born outside NZ[a]			
OR=5.24 (1.78–15.42, P=0.003), worried about side effects[a]			
OR=0.28 (0.09–0.84, P=0.023), members of community organisations[a]			
Crushing tablets (n=2)	1 (0.3%)	1 (0.3%)	314 (99%)
Measuring liquids (n=22)	1 (0.3%)	21 (7%)	294 (93%)
Using inhalers (n=49)	1 (0.3%)	48 (15%)	267 (85%)
Giving own injection (n=13)	0	13 (4%)	303 (96%)
Reading labels	38 (12%)	202 (64%)	76 (24%)
OR=1.11 (1.00–1.22, P=0.044), age (effect of each year older)[a]			
OR=0.40 (0.17–0.91, P=0.029), members of community organisations[a]			
OR=0.43 (0.19–0.95, P=0.037), believe medicines are effective[a]			
Understanding labels	19 (6%)	221 (70%)	76 (24%)
OR=3.78 (1.08–13.24, P=0.038), hospital admission in past 12 months[a]			
OR=8.41 (1.06–66.6, P=0.044), male[a]			
Reading leaflets	28 (9%)	261 (83%)	27 (9%)
OR=3.01 (1.43–6.33, P=0.004), worried about side effects[a]			
Understanding leaflets	11 (4%)	278 (88%)	27 (9%)

[a]Univariate logistic regression.

outside New Zealand, or believing medicines are effective; or OR>2, P<0.05). Medicines considered expensive were those not government funded and hospital outpatient medicines. Participants disposed of unwanted medicines via their pharmacy (30%), the lavatory (19%) or the household rubbish (9%). Some retained medicines for re-use (12%) and some rarely had surplus medicines (33%).

Some unsolicited comments were made about taking medicines following hospital discharge. One participant was pleased his new medicines were explained to him before discharge, but others were more negative: a man's discharge medicines did not match his medication card; another was given a lot of new medicines without any explanation; a woman had to phone her community pharmacist to find out the one tablet in a bottle was a monthly dose; and another woman felt worse when combining her own tablets and ones from the hospital, and discovered later she should not have taken this combination.

Discussion

Overall, the people in the present study appeared to manage their medicines well. Almost all had systems/routines to remind them to take them, and a third used a compliance aid to assist. Only 6% had problems paying for their medicines. Only a quarter of participants appeared to have low adherence. Fewer than 10% of medicines were taken differently from instructions and only 3% without the doctor knowing. Some problems reported were trouble swallowing, difficulty reading, or understanding labels or leaflets; and some people were confused about medicines following hospital discharge. These issues are challenges for health professionals.

Almost all participants claimed to be taking medicines as instructed, yet around 40% were actually taking them differently. Nevertheless, these changes had mostly been agreed with a doctor but had not yet resulted in labelling changes. For the changes not yet discussed with a doctor, these were not thought detrimental as they were mainly timing changes or dose decreases for medicines that can be appropriately taken/used 'as required'.

Participants took a similar number of prescription medicines (n=7) to those in a UK care home study (mean=6.9, ≥65 years) and a New Zealand pilot study (mean=7.0, ≥65 years) [10, 16]. Common prescription medicines (aspirin, paracetamol and simvastatin) were similar to those in the New Zealand pilot study (aspirin, omeprazole and simvastatin) [10]. We found a higher use of statins (42%, simvastatin plus atorvastatin) than in a recent US study (21%), but the latter included people taking no medicines [17]. The proportion of participants reporting difficulty paying for medicines (6%) was similar to that reporting cost-related non-adherence to medicines (5 and 9%) in Canada and the USA, respectively [7].

Consistent with an Australian study, the present study found that older people sought medicine information more often from GPs than pharmacists, but had a similar level of satisfaction [18]. After GPs and pharmacists, the internet (used by 8% of participants) was the most common source of medicine information, more commonly than in a Finnish study (used by 4% of participants 50–64 years) [19]. The present study, like others, found that participants wanted to know more about their medicines (purpose, side effects and details) [20, 21]. A small minority of people in the present study found reading and understanding leaflets difficult. This was consistent with findings for all age groups in a systematic review by Raynor *et al.* [22]. The latter identified peoples' concerns about the complex language used and found that leaflets do not necessarily increase knowledge.

Most people had positive beliefs about medicines improving their health or accepted the need to take them regularly; a fifth had concerns about side effects. These findings were consistent with Moen *et al.* in people aged ≥65 years who found gratitude for medicines co-existing with problems [23]. Positive beliefs about medicines have been associated with improved adherence [24].

Consistent with a meta-analysis by Di Matteo (569 studies), only a quarter of our study participants appeared to have poor adherence [25]. Systematic reviews by Haynes *et al.* and George *et al.* have tried to identify effective interventions that improve adherence but have found short-term or inconsistent effects [26] and no single effective intervention [27]. Combined educational and behavioural strategies are recommended until further evidence from single intervention strategies emerges [27]. In addition, and consistent with earlier reviews [28], George *et al.* recommended a tailored approach for individuals.

Difficulty in swallowing was the most common practical problem in our study with a prevalence similar (14%) to that in a UK study (11%, ≥75 years) [29]. A qualitative study by Kelly *et al.* concluded that problems are often due to a lack of inter-professional communication, and this needs to be improved [30]. They found that several people may be assisting the patients manage their medicines (doctor, nurse, pharmacist, dietician), and that each professional assumes another is taking responsibility. We also found some inappropriate disposal of medicines: via the household rubbish. As problems were suspected prior to our study [31], MB advised people to return unwanted medicines to a pharmacy for safe disposal.

Despite a random sample being used, some selection bias may have occurred as people could decide whether they wished to participate in the study. It is possible that some people with medicine-taking or cognitive problems declined, fearing being identified as 'not coping'. This was an exploratory study, and as such, a number of different models were examined. Findings should be considered tentative until they have been confirmed in other studies. Another limitation might be the use of the Morisky tool to estimate adherence, as participants may have overestimated their adherence to give a socially acceptable response. Indeed, other responses may have been similarly enhanced or perhaps subject to recall bias. In addition, there may have been an underestimate of problems with medicines; for example, inhaler technique may have been poorer than reported. Direct observation of these techniques would have been a more useful measure. The study may not be generalisable to other countries because of differences in health systems and the cost of medicines, and not generalisable to all urban areas in New Zealand because of Dunedin's low Maori and Pacific Island population. Nevertheless, the study provides a comprehensive overview of medicine-taking practices in this age group and setting in New Zealand.

Conclusions

Overall, the community-dwelling people aged ≥75 years in this study appeared to manage their medicines well. They believed medicines are effective, found them affordable and had systems/routines to help remember to take them. Only a quarter of participants appeared to have poor adherence. Common problems were reading and understanding labels and leaflets, and difficulty swallowing solid dose forms. A fifth of participants wanted to know more about their medicines, and a few were confused about their medicines following hospital discharge. The challenges that remain are to improve labelling, leaflets and education on medicines, particularly at hospital discharge, and to identify and address any practical problems.

Key points

- Community-dwelling people aged ≥75 years in New Zealand used a median (range) of 7 (1–19) prescription medicines and 1 (0–14) non-prescription medicines.
- They appeared to manage their medicines well and found them affordable, and only a quarter appeared to have poor adherence.
- Their main practical problems were reading and understanding labels and leaflets, and swallowing solid dose forms.
- Some people wanted more information on medicines, particularly on hospital discharge.
- Health professionals should aim to provide appropriate medicines education and help solve practical problems.

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Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

References

1. Fortin M, Bravo G, Hudon C, Vanasse A, Lapointe L. Prevalence of multimorbidity among adults seen in family practice. Ann Fam Med 2005; 3: 223–8.
2. Royal College of Physicians. *Medication for older people*. second edition. *A report of a working party of the Royal College* of Physicians. London: Royal College of Physicians, 1997.
3. Roth MT, Ivey JL. Self-reported medication use in community-residing older adults: a pilot study. Am J Geriatr Pharmacother 2005; 3: 196–204.

4. Hilmer SN, McLachlan AJ, Le Couteur DG. Clinical pharmacology in the geriatric patient. Fundam Clin Pharmacol 2007; 21: 217–30.
5. Chan M, Nicklason F, Vial JH. Adverse drug events as a cause of hospital admission in the elderly. Intern Med J 2001; 31: 199–205.
6. Tamblyn R, Laprise R, Hanley JA *et al*. Adverse events associated with prescription drug cost-sharing among poor and elderly persons. JAMA. 2001; 285: 421–9.
7. Kennedy J, Morgan S. Cost-related prescription nonadherence in the United States and Canada: a system-level comparison using the 2007 International Health Policy Survey in Seven Countries. Clin Ther 2009; 31: 213–9.
8. Thompson ST, Stewart K. Prescription medication use practices among non-institutionalised older persons. Int J Pharm Pract 2001; 9: 141–51.
9. Granas AG, Bates I. Patients' understanding and management of their illnesses and prescribed medicines—a descriptive study. Pharm World Sci 2005; 27: 321–8.
10. Kairuz T, Bye L, Birdsall R *et al*. Identifying compliance issues with prescription medicines among older people: a pilot study. Drugs Aging 2008; 25: 153–62.
11. Martin I, Hall J, Gardner T. Prescribing for patients aged 65 years and over in New Zealand general practice. N Z Med J 2002; 115: U221.
12. WHO Collaborating Centre for Drug Statistics Methodology. ATC Index, 2009 [cited 25/6/09]. Available at http://www.whocc.no/atcddd/.
13. New Zealand Medicines and Medical Devices Safety Authority. Information for health professionals. Medicine data sheets, 2009. 24/3/2009. http://www.medsafe.govt.nz/profs/Datasheet/dsform.asp.
14. Morisky DE, Malotte CK, Choi P *et al*. A patient education program to improve adherence rates with antituberculosis drug regimens. Health Educ Q 1990; 17: 253–67.
15. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. Med Care 1986; 24: 67–74.
16. Zermansky AG, Alldred DP, Petty DR *et al*. Clinical medication review by a pharmacist of elderly people living in care homes—randomised controlled trial. Age Ageing 2006; 35: 586–91.
17. Qato DM, Alexander GC, Conti RM, Johnson M, Schumm P, Lindau ST. Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. JAMA 2008; 300: 2867–78.
18. Thompson ST, Stewart K. Older persons' opinions about and sources of prescription drug information. Int J Pharm Pract 2001; 9: 153–62.
19. Närhi U, Helakorpi S. Sources of medicine information in Finland. Health Policy 2007; 84: 51–7.
20. Nair K, Dolovich L, Cassels A *et al*. What patients want to know about their medications. Focus group study of patient and clinician perspectives. Can Fam Physician 2002; 48: 104–10.
21. Raynor DK, Knapp SJ, Edmonson H. How do patients use medicines information leaflets in the UK? Int J Pharm Pract 2007; 15: 209–18.
22. Raynor DK, Blenkinsopp A, Knapp P *et al*. A systematic review of quantitative and qualitative research on the role and effectiveness of written information available to patients about individual medicines. Health Technol Assess 2007; 11: 1–160.
23. Moen J, Bohm A, Tillenius T, Antonov K, Nilsson JL, Ring L. "I don't know how many of these [medicines] are necessary."—a focus group study among elderly users of multiple medicines. Patient Educ Couns 2009; 74: 135–41.
24. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. J Psychosom Res 1999; 476: 555–67.
25. DiMatteo MR. Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. Med Care 2004; 42: 200–9.
26. Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. Cochrane Database Syst Rev 2008; 16CD000011.
27. George J, Elliott RA, Stewart DC. A systematic review of interventions to improve medication taking in elderly patients prescribed multiple medications. Drugs Aging 2008; 25: 307–24.
28. Ryan AA. Medication compliance and older people: a review of the literature. Int J Nurs Stud 1999; 36: 153–62.
29. Preston M, Morris H. Dysphagia, the impact on dispensing doctors. Dispensing Doctor J 2005; 21: 11–5.
30. Kelly J, D'Cruz G, Wright D. A qualitative study of the problems surrounding medicine administration to patients with dysphagia. Dysphagia 2009; 24: 49–56.
31. Braund R, Peake BM, Shieffelbien L. Disposal practices for unused medicines in New Zealand. Env Int 2009: 10.1016/j.envint.2009.04.003.

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