Effects of a pharmacist's medication review in nursing homes

Randomised controlled trial

LEE FURNISS, ALISTAIR BURNS, SARAH KATHRYN LLOYD CRAIG, SUSAN SCOBIE, JONATHAN COOKE and BRIAN FARAGHER

Background   Older people in nursing and residential homes often have complex disabilities and behavioural disturbances. Recent publicity has highlighted the dangers of medication in this group, and controls over prescribing have been suggested.

Aims   To investigate the effect of a review of medication by a pharmacist.

Method   An 8-month prospective trial of an active medication review by a pharmacist was carried out on 330 residents in nursing homes in Manchester.

Results   The intervention group experienced greater deterioration in cognitive function and behavioural disturbance than the control group, but the changes in depression and quality of life were similar for both groups. The number of drugs prescribed fell in the intervention group, but not in the control group, with a corresponding saving in drug costs. The number of deaths was significantly smaller in the intervention homes during the intervention period (4 v. 14) but not overall during the study period as a whole (26 v. 28).

Conclusion   This clinical intervention reduced the number of medicines prescribed to elderly people in nursing homes, with minimal impact on their morbidity and mortality.

In the past 15 years the number of people admitted to private nursing homes has increased six-fold (Royal College of Physicians, 1997), and increasing levels of physical and mental ill health in residents entering homes have resulted in raised dependency levels (Stern *et al*, 1993). Elderly nursing home residents receive up to four times as many prescription items as older people living in their own homes (Walley & Scott, 1995). There is evidence of inappropriate prescribing in nursing homes – about half of nursing home residents are on at least one inappropriate drug (Beers *et al*, 1991; Lunn *et al*, 1997). Studies have demonstrated the value of pharmacists in reducing medication in nursing homes (Obenchain, 1991; Hirshfield, 1993; Miller *et al*, 1993; Neel *et al*, 1993; Cole *et al*, 1996) and in the USA, pharmacists are legally required to carry out monthly medication reviews. In the UK, few studies have examined this issue (Lapsley, 1988; Corbett, 1997); none have been controlled trials or have included an economic analysis. The current study aimed to investigate the effect of a review of the medication of nursing home residents by a pharmacist.

METHOD

A 4-month observation phase was followed by a 4-month intervention; these periods were chosen to provide acceptably precise estimates of pharmacist activity.

Homes and residents

Fourteen homes took part in the study, matched into seven pairs equivalent in number of beds, registration status and resident mix. Each home in the pair came from different areas in South Manchester, to avoid a situation in which a general practitioner (GP) was looking after residents in both a control home and an intervention home. Using computer-generated pseudo-random numbers, one home in each pair was randomly allocated to receive a regular medication review by a pharmacist (intervention group) and the other to receive no pharmacist review ('normal' control group). Homes were randomised at the start of the observation phase. Written consent was obtained from each resident (from the next of kin if necessary) and the investigation was approved by the local ethics committee.

Intervention

The intervention consisted of a medication review by the study pharmacist for all consenting residents in homes in the intervention group. The review took place at the beginning of the intervention phase, in the GP's surgery, at the nursing home or (in exceptional circumstances) over the telephone. The pharmacist (L.F.) collected details of current medication for each resident from the Medicines Administration Record (MAR) chart in the home, together with a brief medical history and any current problems identified by the home staff. Three weeks after the medication review, the homes were revisited, to ascertain whether there had been any immediate problems with the changes in medication and to see if the suggested changes had been implemented.

Assessments

The following standardised tests were carried out on each resident in both groups at the beginning of the study (Time 0), after 4 months (Time 1, i.e. the beginning of the intervention) and 8 months (Time 2, i.e. the end of the intervention): Mini-Mental State Examination (MMSE; Folstein *et al*, 1975); Geriatric Depression Scale (GDS; Yesavage, 1988); Brief Assessment Schedule Depression Cards (BASDEC; Adshead *et al*, 1992); and Crichton-Royal Behaviour Rating Scale (CRBRS; Robinson, 1965; Wilkin *et al*, 1978).

Data were also collected on the types and numbers of drugs each resident was taking, and the reason for the use of any neuroleptic drugs was obtained from the nursing staff. The study pharmacist assessed whether the use of neuroleptics complied with the US Ombudsman Reconciliation Act (OBRA) guidelines (i.e., that the use of a neuroleptic is appropriate for psychotic disorders and organic mental syndromes associated with types of behaviour that present a danger to others or interfere with the abilities of staff to provide care

for the resident) (McGrath & Jackson, 1996). Information was collected on the use of primary and secondary care resources, and the number of accidents and deaths.

The initial assessments were made by the study pharmacist and the psychiatrist. The second and third assessments were carried out by six Registered Mental Nurses trained in the administration of the instruments, to ensure consistency and reliability.

Statistical analysis

The size of the study sample was determined from changes observed in behavioural characteristics (CRBRS) in a previous study (Wilkin *et al*, 1978). Assuming a within-homes variance of 50 and an intra-class correlation between 0.01 and 0.05, six to eight homes, each containing at least 20 residents, were required to detect differences of four points on the CRBRS scale as being statistically significant at the conventional 5% level with 90% power. To allow for drop-outs and refusals, homes with more than 20 residents were sought; the average number of residents per home who agreed to take part in the study was 23.6.

Changes over the study period were compared between the two study groups, using multivariate regression methods. To account properly for the cluster randomisation design used, 'nursing home' was forced into all regression models as a cluster variable (thus the unit of analysis was nursing home, not individual resident). In order to make full use of the study subjects remaining alive at each assessment time, separate analyses were carried out using the Time 1 and Time 2 observations; for both analyses, Time 0 observations were used as covariates to adjust appropriately for baseline differences between the study groups. All computations were done using the SPSS and STATA statistical computer packages.

RESULTS

Characteristics of the study sample (Table 1)

The 14 homes contained 424 residents, of whom 330 (78%) agreed to participate. On average, residents in the control homes were slightly younger, and there were proportionally fewer residents in these homes. The residents in the intervention group were served by 24 GPs, none of whom refused to

take part. Over the course of the study, 28 (16.3%) residents in the control homes and 26 (16.5%) in the intervention homes died.

Mental and physical state (Table 2)

Table 2 shows the mean differences in the rating scores between the two study groups;

those reported for Times 1 and 2 are covariate, adjusted for the differences observed between the groups at Time 0. In addition, the numbers of residents scoring above or below the accepted cut-off points are summarised for each scale.

The MMSE scores and the numbers of residents with scores below 23 did not

Table 1 Characteristics of study sample

	Control group	Intervention group
No. of residents at time 0	172	158
Age, years: mean (s.d.)	78.9 (13.7)	83.5 (9.2)
Females, *n* (%)	115 (67%)	125 (79%)
No. of deaths during observation phase	14	22
No. of residents at Time 1	158	136
No. of deaths during intervention phase	14	4
No. of residents at Time 2	144	132

Table 2 Mean rating scale scores

	Time 0	Time 1	Time 2
MMSE			
Control	15.6	15.5	17.1
(no. with score <23)	(120/172 (70%))	(103/149 (69%))	(72/116 (62%))
Intervention	13.8	13.5	12.5
(no. with score <23)	(120/158 (76%))	(99/132 (75%))	(93/118 (79%))
Difference (95% CI)	2.0 (−1.5 to 5.4)	0.6 (−1.0 to 2.3)[1]	1.6 (−0.1 to 3.3)[1]
		(*P*=0.46)	(*P*=0.07)
GDS			
Control	3.63	4.35	3.86
(no. with score >5)	(29/105 (28%))	(38/114 (33%))	(22/91 (24%))
Intervention	3.31	4.74	4.41
(no. with score >5)	(16/81 (20%))	(37/97 (38%))	(26/86 (30%))
Difference (95% CI)	0.09 (−0.96 to 1.14)	−0.41 (−1.42 to 0.61)[1]	−0.75 (−2.03 to 0.52)[1]
		(*P*=0.43)	(*P*=0.25)
BASDEC			
Control	3.79	3.83	3.26
(no. with score >6)	(25/107 (23%))	(5/112 (22%))	(11/87 (13%))
Intervention	4.38	4.72	3.77
(no. with score >6)	(18/82 (22%))	(25/93 (27%))	(15/81 (19%))
Difference (95% CI)	−0.64 (−1.66 to 0.38)	−0.37 (−1.47 to 0.73)[1]	−0.18 (−1.45 to 1.09)[1]
		(*P*=0.51)	(*P*=0.79)
CRBRS			
Control	14.9	15.1	14.5
(no. with score >8)	(119/172 (69%))	(112/154 (85%))	(86/127 (85%))
Intervention	17.4	18.8	19.4
(no. with score >8)	(128/158 (81%))	(116/136 (85%))	(109/118 (85%))
Difference (95% CI)	−2.5 (−5.9 to 0.9)	−1.5 (−3.5 to 0.4)[1]	−2.2 (−4.1 to −0.3)[1]
		(*P*=0.13)	(*P*=0.02)

1. Covariate adjusted for differences at baseline (Time 0).
MMSE, Mini-Mental State Examination; GDS, Geriatric Depression Scale; BASDEC, Brief Assessment Schedule Depression Cards; CRBRS, Crichton-Royal Behaviour Rating Scale.

change significantly over the study period, although there was a decline in the total MMSE scores for the intervention group. No statistically significant changes were observed in the depression scores during the study. Mean CRBRS scores tended to increase in the intervention group relative to the control group, and the difference between the groups became significant at Time 2. However, these changes could not be attributed to the intervention, as the increase in impairment occurred before this.

The number of accidents and falls (recorded in the nursing home reports) in each group did not differ significantly throughout the study. Over the intervention phase, there were 14 deaths in the control homes (one death in each of three homes; two in each of two homes; three in one home; four in one home) compared with just four deaths in the intervention group homes (two deaths in each of two homes). This difference was statistically significant (Mann–Whitney U-test: $P=0.028$).

Drug use and pharmacist recommendations

The mean number of drugs prescribed for all residents at admission to the study was 4.91, with a range of 0–17 (see Table 3). In 54% of cases, prescribing of neuroleptics was inappropriate according to the US OBRA guidelines. Residents in both groups of homes experienced a decrease in the mean number of drugs prescribed during the intervention phase (Table 4). After adjustment for baseline differences, the reduction in the homes where medication was reviewed was greater than that in control homes, but this difference was not statistically significant ($P=0.070$).

A total of 261 recommendations were made by the pharmacist, of which 239 (91.6%) were accepted by the GP and resulted in 144 actual treatment changes. Thirty residents received no modification to their drug treatment and the mean number of recommendations per resident for the other residents was 2.46, with a range of 0–7. Recommendations were classified according to the reasons given in Table 5.

Economic data

Numbers and associated costs of all contacts with primary and secondary care services were calculated for each resident alive at the end of each phase of the study, using contemporaneous local figures for comparative costing. It is likely that costs per resident do overlap between the intervention and control homes: the degree of overlap might not be great, but sufficient to prevent statistical significance being established. Costs vary very considerably between residents, making average costs per home very variable also. Costs relating to the use of primary and secondary care resources could not always be determined for individual home residents. For example, a GP or physiotherapist might attend more than one resident on a single visit to a home. Costs were thus computed for each home overall for each study period and divided by the number of individual residents in that period, to provide average costs per resident. These are summarised in Table 6. Because only 14 nursing homes in total could be included in the study, no formal statistical comparison of these average costs between the control and the intervention groups was possible. However, there was a clear trend for reduction in costs in the intervention group.

DISCUSSION

The main findings of this study are: that a simple and low-cost intervention using existing skills can reduce the number of drugs

Table 3 Medications being prescribed at baseline

(a) Number of medications per subject	No. (%) of subjects	No. of medications	No. (%) of subjects
0	8 (2%)	6	33 (10%)
1	23 (7%)	7	29 (9%)
2	34 (10%)	8	22 (7%)
3	51 (16%)	9	11 (3%)
4	47 (14%)	10	17 (5%)
5	47 (14%)	11–17	8 (2%)

(b) Common types of medication prescribed	British National Formulary class	% of residents
Laxatives	1.6	49
Diuretics	2.2	44
Antipsychotics	4.2	30
Hypnotics/anxiolytics	4.1	28
Anti-platelet drugs	2.9	28
Analgesics	4.7	27
Antidepressants	4.3	25
Ulcer-healing drugs	1.3	21
Musculoskeletal	10	16
Nitrates/Ca antagonists	2.6	15
Anti-Parkinsonian	4.9	12
Anti-epileptics	4.8	10

Table 4 Mean numbers of prescribed drugs

	Time 0	Time 1	Time 2
Control	4.9	4.5	4.4
Intervention	5.1	5.1	4.2
Difference (95% CI)	−0.02 (−1.2 to 1.2)	−0.3 (−0.06 to −0.04)[1] ($P=0.03$)	0.5 (−0.04 to 1.0)[1] ($P=0.07$)

1. Covariate adjusted for differences at baseline (Time 0).

Table 5 Reasons for recommendations suggested by pharmacist

Reasons for recommendation	No. of recommendations
Indication for medication no longer present	85
Safer or more efficacious use of drug used	77
Safer or more efficacious drug available	22
Review of treatment − individual drugs	22
Economy	17
Indication present, no medication prescribed	14
Review whole treatment	13
Side-effect/adverse drug reaction	5
Contra-indication	3
Therapeutic duplication	2
Drug interaction	1
Total	261

Table 6 Use and costs per resident of primary and secondary care resources

Control group

Item	Observation phase		Intervention phase	
	Frequency	Cost (£)	Frequency	Cost (£)
Drugs	4.41	142.53	4.37	141.24
Non-drug				
General practitioner visits	2.15	65.99	1.60	46.31
In-patient days	1.51	249.13	1.26	256.54
Out-patient visits	0.58	30.16	0.53	27.27
Domiciliary visits	0.08	4.36	0.09	4.70
Primary care visits	1.13	16.66	1.26	16.91
Totals		508.83		492.98

Intervention group

Item	Observation phase		Intervention phase	
	Frequency	Cost (£)	Frequency	Cost (£)
Drugs	4.92	159.01	4.07	131.54
Non-drug				
General practitioner visits	2.81	82.19	2.85	75.41
In-patient days	1.44	197.60	0.55	55.67
Out-patient visits	0.38	23.70	0.30	19.77
Domiciliary visits	0.24	13.32	0.32	13.72
Primary care visits	1.26	16.88	1.16	13.41
Pharmacist hours			0.41	5.36
Totals		492.69		314.89

prescribed to elderly people in nursing homes; that the intervention may reduce costs; and that it can be instituted without detriment to the mental or physical health of residents. The average number of medicines taken by nursing home residents in the UK is between six and seven, with a proportion taking up to 19 (Corbett, 1997; Lunn *et al*, 1997). These figures are similar in the USA (Beers *et al*, 1992). Half the residents take five or more drugs (Nolan & O'Malley, 1989) and 19% of admissions to hospital may be due to inappropriate drug therapy (Cannon & Hughes, 1997; Cunningham *et al*, 1997) with half being preventable (Lindley *et al*, 1992).

Previous reports that nursing home residents are prescribed medication which can be changed (Beers *et al*, 1991; Lunn *et al*, 1997) is substantiated by this study, in which one-third of all the recommendations made by the pharmacist was that medications no longer indicated should be reviewed. The prescription of neuroleptics was higher than in previous studies (24% in the Glasgow study by McGrath & Jackson, 1996) but their inappropriate prescription, as judged against the US OBRA guidelines, was far less than the comparative figure of 88% in the Glasgow study. Not all the changes suggested by the pharmacist were implemented; the reasons for this were not specifically recorded. The study showed positive benefits nonetheless.

It appears that medication review by a pharmacist with GPs can reduce the number of inappropriate drugs prescribed for residents. Such a review may be cost-effective for the National Health Service, and could potentially have positive benefits for residents. The number of older people entering nursing and residential homes in the future is likely to increase (Melzer *et al*, 1997). This study is the first controlled trial in the UK of the effects of a medication review by a pharmacist, and should be of interest to purchasers of health and social care.

REFERENCES

Adshead, F., Cody, D. D. & Pitt, B. (1992) BASDEC: a novel screening instrument for depression in elderly medical in-patients. *British Medical Journal*, **305**, 397.

Beers, M. H., Ouslander, J. G., Rollinger, I., et al (1991) Explicit criteria for determining inappropriate medication use in nursing home residents. *Archives of Internal Medicine*, **151**, 1825–1832.

—, —, Fingold S. F., et al (1992) Inappropriate medication prescribing in skilled-nursing facilities. *Annals of Internal Medicine*, **117**, 684–689.

Cannon, J. & Hughes, C. M. (1997) An assessment of the incidence and factors leading to drug-related hospital admissions in the elderly. *European Journal of Hospital Pharmacy*, **3**, 14–18.

Cole, M. R., Jacobs, M. & Silver, B. (1996) Unnecessary medications: cost savings resulting from

interdisciplinary assessment of medication regimens. *Consultant Pharmacist*, **11**, 933–936.

Corbett, J. (1997) Provision of prescribing advice for nursing and residential home patients. *Pharmaceutical Journal*, **259**, 422–424.

Cunningham G., Dodd, T. R. P., Grant, D. J., *et al* (1997) Drug related problems in elderly patients admitted to Tayside hospitals, methods for prevention and subsequent reassessment. *Age and Ageing*, **26**, 375–382.

Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975) "Mini-Mental State". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, **12**, 189–198.

Hirshfield, J. S. (1993) Positive patient outcomes from interdisciplinary assessments of psychoactive drug use. *Consultant Pharmacist*, **8**, 532–534.

Lapsley, R. (1988) Prescription monitoring in a nursing home. *Pharmaceutical Journal*, **240**, 688–690.

Lindley, C. M., Tully, M. P., Paramsothy, V., *et al* (1992) Inappropriate medication is a major cause of adverse drug reactions in elderly patients. *Age and Ageing*, **21**, 294–300.

Lunn, J., Chan, K., Donoghue, J., *et al* (1997) A study of the appropriateness of prescribing in nursing homes. *International Journal of Pharmaceutical Practice*, **5**, 6–10.

McGrath, A. M. & Jackson, G. A. (1996) Survey of neuroleptic prescribing in residents of nursing homes in Glasgow. *British Medical Journal*, **316**, 611–612.

Melzer, D., Ely, M. & Brayne, C. (1997) Cognitive impairment in elderly people: population based estimate of the future in England, Scotland and Wales. *British Medical Journal*, **315**, 462.

Miller, S. W., Warnock, R., Marshall, L. L., *et al* (1993) Cost savings and reduction of medication-related problems as a result of consultant pharmacy intervention. *Consultant Pharmacist*, **8**, 1265–1272.

Neel, A. B., Pittman, J. C., Marasco, R. A., *et al* (1993) Psychoactive drug use in Georgia nursing homes: effects of aggressive intervention. *Consultant Pharmacist*, **8**, 245–248.

Nolan, L. & O'Malley, K. O. (1989) The need for a more rational approach to drug prescribing for elderly people in nursing homes. *Annals of Internal Medicine*, **18**, 52–56.

Obenchain, L. A. (1991) Effectiveness of drug-regimen review in eliminating unnecessary drugs. *Consultant Pharmacist*, **6**, 845–847.

Robinson, R. A. (1965) The organisation of a diagnostic and treatment unit for the aged in a mental hospital. In *Psychiatric Disorders in the Aged*, pp. 186–193. Manchester: Geigy UK for the World Psychiatric Association.

Royal College of Physicians (1997) *Medication for Older People*. London: Royal College of Physicians of London.

Stern, M. C., Jagger, C., Clark, M., *et al* (1993) Residential care for elderly people: a decade of change. *British Medical Journal*, **306**, 827–830.

Walley, T. & Scott, A. K. (1995) Prescribing in the elderly. *Postgraduate Medical Journal*, **71**, 466–471.

Wilkin, D., Mashiah, T. & Jolley, D. J. (1978) Changes in behavioural characteristics of elderly populations of local authority homes and long-stay hospital wards, 1976–77. *British Medical Journal*, **ii**, 1274–1276.

Yesavage, J. A. (1988) Geriatric Depression Scale. *Psychopharmacology Bulletin*, **24**, 709–710.

CLINICAL IMPLICATIONS

■ An assessment by a multi-disciplinary team can reduce the number of drugs prescribed to elderly people in nursing and residential homes.

■ This reduction can be achieved with minimal impact on residents' physical and mental health.

■ The introduction of such an assessment should be considered as a marker of good practice.

LIMITATIONS

■ The specific nature of the intervention needs further study.

■ Not all the recommendations were followed by the general practitioners.

■ The study took place in one area and so the generalisability of the results cannot be assumed.

LEE FURNISS, MRPharmS, ALISTAIR BURNS, FRCPsych, SARAH KATHRYN LLOYD CRAIG, MRCPsych, SUSAN SCOBIE, MRPharmS, JONATHAN COOKE, PhD, BRIAN FARAGHER, PhD, Withington Hospital, Manchester

Correspondence: Alistair Burns, Professor of Old Age Psychiatry, Department of Psychiatry, University of Manchester, Withington Hospital, Manchester M20 8LR. Tel: 0161 291 4831; Fax: 0161 445 5305; e-mail: A_Burns@fsl.with.man.ac.uk