Longitudinal trends in prescribing for elderly patients: two surveys four years apart

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SUMMARY
Background. Elderly people are prescribed more drugs than younger people. The consequences of excessive or unwise prescribing, such as drug interactions, are well known.
Aim. A longitudinal study was undertaken to examine levels and patterns of prescribed drug use among a group of elderly people.
Method. Use of prescribed drugs by a sample of elderly people in Nottingham aged 65 years and over was assessed on two occasions four years apart, in 1985 and 1989.
Results. Complete drug data were available for 1003 respondents in 1985 and 662 respondents in 1989 (with attrition due mainly to mortality). Drug use increased significantly with age. Women took significantly more drugs than men. Approximately half of respondents were taking at least two drugs. The overall number of drugs per person being taken in 1989 was significantly greater than in 1985. This difference remained significant when age and mortality were controlled, suggesting that changes in drug use over time within this sample may reflect genuine changes in prescribing practice (rather than simply the effects of ageing). The most commonly prescribed drug classes on each occasion were drugs for the cardiovascular system, central nervous system, musculoskeletal system, gastrointestinal tract and respiratory system. The subgroups of drugs most commonly reported at each interview were diuretics, hypnotics and anxiolytics, analgesics and non-steroidal anti-inflammatory drugs. Drugs within the category 'hypnotics and anxiolytics' showed clear and differential trends over time, with the use of anxiolytics falling, while the use of hypnotics increased. Among those respondents admitted to residential care during the course of the study higher levels of psychotropic drug use, and an increase in antipsychotic medication, were observed.
Conclusion. It is important that the drug regimens of elderly people are frequently reviewed to ensure that only the minimum number of effective drugs, in the simplest regimen, are prescribed.

Keywords: prescribing rates; prescribing analysis; patient use of medication; longitudinal studies; elderly.

Introduction

IT is now widely recognized that elderly people (defined here as those aged 65 years or above) consume relatively more medication than younger people.[1-3] While higher levels of drug use are certainly related to the increased prevalence of chronic

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disease,[4] concern has also been expressed that part of the increase in medication use by elderly people may be a result of excessive or unwise prescribing.[2] Whatever the causes of high level prescribing, there is considerable agreement on its possible consequences. Adverse drug reactions, drug interactions, and decreased compliance have all been associated with increased drug use.[5-7] These concerns serve to focus detailed epidemiological attention on drug use, and particularly multiple drug use, among elderly people in primary care settings. Within this context detailed surveys of drug prescribing and usage not only identify outcome and risk, but also provide essential feedback to practitioners on trends and changes in prescribing practice.

Much of the available information on drug use among elderly patients living in the community has been obtained either through cross-sectional studies of this population[1,8-10] or from studies of particular sub-populations within it, such as heavy drug users[11] or psychotropic drug users.[12] While cross-sectional analyses provide useful information on levels of prescribing at a given point in time, procedural, methodological, geographical, and definitional differences among these studies limit the extent to which longitudinal changes and trends can accurately be inferred from them.[13] A rigorous evaluation of changing patterns of drug use within primary care settings, therefore, requires a longitudinal study in which a uniform method of data collection is applied within a representative sample of patients.

Longitudinal data from typical general practice populations of elderly people are rare. Stewart and colleagues examined prescribing practices in a retirement community in the United States of America over a 10 year period, but acknowledged that their study sample was highly selected and unrepresentative.[14] All participants had to be healthy enough to attend and participate in the study, and as participants became too ill to attend or became institutionalized they were omitted from the study and new participants recruited. In a longitudinal study of prescribing conducted by Landahl in Sweden, participants were all 70 years of age at the commencement of the study and not representative of the Swedish elderly population.[15]

A study was therefore undertaken to provide information on both overall levels and changing patterns of prescribed drug use, over a four-year period, in a sample of elderly people.

Method

The Nottingham longitudinal study of activity and ageing was set up in 1983 in order to assess the role of lifestyle and customary physical activity in promoting and maintaining health and well-being in later life. The first (baseline) survey was conducted in 1985, when a random sample of elderly people were interviewed in their own homes by trained lay interviewers.

The sample was selected as follows. Using electoral ward-level statistics from the 1981 census, three areas of greater Nottingham were combined to provide a study population, the demographic composition of which (as regards age, sex, social class, and the proportion of elderly people living alone) reflected the average national pattern for England and Wales.[16] The resulting area included a total population of 48 733 individuals served by 25 general practitioners. With the consent and cooperation of these general practitioners, Nottingham Family Practitioner Committee age–sex lists were used to identify all patients aged 65 years and over within the survey population. A total of 8409

elderly individuals were identified and served as the sampling frame for the study. From this frame a total of 1299 eligible individuals (those alive and still living at the address provided) were randomly selected. All subjects were non-institutionalized at the start of the study, and under the care of their own general practitioner.

The interview questionnaire contained a total of 318 items and was designed to obtain comprehensive profiles of health, well-being, and sociodemographic status. Full details of the sampling and survey methodology have been described elsewhere.[17,18]

The first complete follow up of survivors, using identical methods and materials, was conducted in 1989. All respondents who had participated in 1985, and who were still living in Nottingham were invited to participate in the follow-up study.

On both occasions, respondents were asked for details of current consumption of prescribed drugs. Reported use was verified by the interviewer who asked for and examined evidence, such as containers and prescriptions. All reported medicines in both study periods were coded according to British national formulary 1984 category.

The statistical package for the social sciences, SPSSX-3 was used in data analysis. Appropriate non-parametric statistical techniques (Spearman rank correlations, Wilcoxon matched-pairs test, chi square, Mann-Whitney U test, and Kruskal-Wallis one-way analysis of variance) were used as tests of significance.

In the analyses of overall levels of drug use, all respondents interviewed in 1985 and 1989 were included (unless otherwise stated). However, in the analyses of change, only those respondents interviewed in both 1985 and 1989 were included. Drug use in 1985 and 1989 is presented both in terms of relative frequency of use (where use of a particular group of drugs is expressed as a percentage of all drugs used), and as the drug usage prevalence (the prevalence of use of a group of drugs per 100 respondents). While the relative frequency of use allows changing patterns in drug use to be observed,[14] this method of data presentation can obscure actual changes in the prevalence of usage. For example, relative frequency may suggest a decrease in the use of a group of drugs when there is an actual increase in the prevalence of use of those drugs. The drug usage prevalence provides a clearer indication of changes in prescribing trends with time. It is similar to the presentation of data as the percentage of respondents reporting use of particular drugs as used in other studies[10,15] but overcomes the problems that occur when a respondent reports the use of two or more drugs within the same subgroup.

Results

Of the 1299 individuals eligible to take part in 1985, 1042 (80.2%) were interviewed. In terms of age, sex, social class and the proportion living alone the sample closely resembled that for England and Wales as a whole.[16] A total of 753 individuals from the original sample were available for follow-up interviews in 1989 and of these, 690 (91.6%) agreed to be re-interviewed. Those lost to follow up between 1985 and 1989 included 261 people who had died, 63 who refused to take part, 25 who were untraceable and three who had emigrated. Drug data were classified as 'missing' (and respondents consequently omitted) if the interview was discontinued (usually because of cognitive impairment) before the questions concerning drugs were reached; if the respondent was unable to provide the information; or if reported drug use could not be verified. Drug data were missing for 39 cases from the 1985 dataset, and 28 from the 1989 dataset. Therefore, of those interviewed, complete drug information was available for 1003 individuals in 1985 and 662 in 1989. In 1985, all respondents were living at home, whereas in 1989, 23 respondents were living in residential or nursing homes (complete drug data were available for 17 of the latter group of respondents).

Drug use in 1985 and 1989

The percentage of respondents taking a given number of drugs in 1985 and 1989 is shown in Table 1. While 6.7% of respondents were taking more than four drugs in 1985, 10.6% of the respondents in 1989 were taking more than four drugs. Analysis of data from those interviewed in both 1985 and 1989 showed that the number of drugs per person being taken in 1989 was significantly greater than in 1985 (Wilcoxon $z = 8.641$, $n = 645$, $P<0.001$). Of 216 respondents who were taking no drugs in 1985, 129 were still taking no drugs at the time of the second interview. Among those interviewed twice and who were taking drugs the increase in the number of drugs per person between 1985 and 1989 remained significant (Wilcoxon $z = 6.76$, $n = 500$, $P<0.001$).

Drug use, by age and sex of respondents

Generally, there was a steady overall increase in the mean number of drugs used with increasing age, with modest but significant correlations between age and the mean number of drugs consumed in both 1985 (rho = 0.168, $n = 1003$, $P<0.001$) and 1989 (rho = 0.119, $n = 662$, $P<0.001$) (Table 2). Grouping respondents into four-year age groups (the age differential between the 1985 and 1989 assessments), the proportion of respondents taking medication increased from 57.3% of 164 people in the 65–68 years age group in 1985 up to 78.6% of 28 people aged 89 years and over in 1985 and 100% of 24 people in 1989 aged 89 years and older. Except for the 85–88 years age group, the mean number of drugs per person was greater in 1989 than in 1985 for all age groups (Table 2). Overall, the mean number of drugs being taken in 1985 was 1.8 and in 1989 it was 2.1.

Women took significantly more drugs than men in both 1985 (Mann-Whitney $z = 5.307$, $n = 1003$, $P<0.001$) and 1989 (Mann-Whitney $z = 4.663$, $n = 662$, $P<0.001$). In both years, the proportion of respondents taking no drugs was significantly greater for men (37.3% of 391 men in 1985 versus 23.9% of 612 women, $\chi^2 = 20.37$, 1 df, $P<0.01$; and 33.3% of 252 men in 1989 versus 19.5% of 410 women, $\chi^2 = 15.26$, 1 df, $P<0.001$). When only drug takers were studied at each assessment point, drug consumption remained significantly greater among women than men (1985: Mann-Whitney $z = 2.798$, $n = 711$, $P<0.01$; 1989: Mann-Whitney $z = 2.566$, $n = 498$, $P<0.01$).

Drug use, by therapeutic class

The relative frequency of use of drugs, by therapeutic class, is shown in Table 3. In 1989, the order of relative frequency of use of the therapeutic classes was the same as for 1985 except that drugs for the gastrointestinal system were used more frequently than drugs for the musculoskeletal system. There were few differences between men and women in the relative frequency of

Table 1. Levels of reported drug use in 1985 and 1989.

No. of drugs	% of patients prescribed no. of drugs in	
	1985 (n = 1003)	1989 (n = 662)
0	29.1	24.8
1	21.5	20.8
2	20.8	17.7
3	13.3	16.6
4	8.6	9.5
5	4.1	4.2
6	1.1	3.2
7	1.1	2.3
8+	0.4	0.9

n = number of respondents.

Table 2. Mean number of drugs prescribed for respondents in the four-year age groups in 1985 and 1989.

		Mean no. of drugs prescribed for respondents in each age group in	
Age group (years)		1985	1989
65–68	(n = 164/0)	1.3	–
69–72	(n = 225/133)	1.6	1.9
73–76	(n = 209/178)	1.8	1.9
77–80	(n = 200/140)	1.9	2.1
81–84	(n = 133/115)	2.2	2.3
85–88	(n = 44/72)	2.4	2.2
89+	(n = 28/24)	1.7	3.0

n = number of respondents in age group in 1985/1989.

use of the different major drug groups except that drugs for the respiratory system represented a greater proportion of the drugs prescribed for men than those prescribed for women.

The drug usage prevalence, expressed as the number of times drugs within a drug subcategory were reported per 100 respondents, for the major subcategories within the five most frequently prescribed therapeutic classes is shown in Table 4. The most commonly prescribed subcategories of drugs in both years were diuretics, hypnotics and anxiolytics, analgesics and non-steroidal anti-inflammatory drugs, representing 47% and 42% of the drugs taken in 1985 and 1989, respectively. Although the relative frequency of use of cardiovascular drugs and musculoskeletal drugs was lower in 1989 than 1985 (Table 3), the drug usage prevalence in 1989 of cardiovascular drugs had increased slightly and that of musculoskeletal drugs had shown a negligible decrease. The most notable changes within the cardiovascular group of drugs were the decline in drug use of cardiac glycosides, especially by women, and the 42% decrease in use of centrally acting antihypertensives.

There were several changes between the two points of measurement within the group of drugs for the central nervous system. The drug usage prevalence for hypnotics and anxiolytics fell by 4% between 1985 and 1989 but, when the components of this subgroup were examined there was a 13% increase in the use of hypnotics (from 13.1 to 14.8), accompanied by a 33% fall in

anxiolytics (from 8.1 to 5.4). To control for the effect of age between the two points of comparison, the drug usage prevalence for hypnotics by respondents aged 69 years or more in 1985 was compared with that for respondents interviewed in 1989. Hypnotic use in 1989 was still 10% greater than in 1985. There was a 72% increase in the prevalence of use of antidepressants and a 25% increase in the prevalence of use of analgesics, with the increase in analgesic use greater among the men than women. The greatest absolute change was a three-fold increase in the prevalence of use of drugs used in psychoses, although the numbers of drugs being used was small. Much of this change could be attributed to the high prevalence of use among the respondents who had moved to residential or nursing home care by 1989 (five/17), none of whom where taking any of this group of drugs in 1985.

The use of gastrointestinal drugs among this sample increased been 1985 and 1989 with the greatest increases occurring in the use of ulcer healing agents, mainly H_2-antagonists, and laxatives. Drugs for the treatment of respiratory conditions were also used more frequently in 1989 than in 1985 with increased use of the beta-adrenoceptor stimulants and a marked increase in the use of corticosteroids.

Fifty one drugs were reported for the residential and nursing home respondents, the most common being diuretics (10), cardiac glycosides (three), hypnotics and anxiolytics (eight), analgesics (four), drugs used in psychoses (six), and laxatives (four). Central nervous system drugs constituted 47% of the drugs taken by this small group.

Discussion

Over the four-year period, the mean number of drugs being used increased by 18% in this representative sample of elderly people. Part of this increase can be attributed to a number of respondents who were not taking drugs in 1985 but were taking drugs by 1989. However, even among drug takers, there was an increase in drug use over the time between the interviews. It is reasonable to conclude that some of these changes were influenced by ageing (and consequent increased pathology) within the sample, a factor closely associated with levels of prescribing.[3,15,19-21] However, there also appears to be an increase in drug prescribing and use over time independent of ageing. The number of drugs per respondent was greater in 1989 than in 1985 for all age

Table 3. Frequency of use of those drugs reported by men and women in 1985 and 1989, by therapeutic class.

	% of all drugs recorded in					
	1985			1989		
Therapeutic class[a]	Men (n = 585)	Women (n = 1224)	Total (n = 1809)	Men (n = 435)	Women (n = 974)	Total (n = 1409)
Body system:						
Cardiovascular	33.9	34.2	34.1	30.8	30.2	30.4
Central nervous	26.0	30.1	28.8	26.4	30.3	29.1
Musculoskeletal	11.3	11.2	11.2	9.2	9.3	9.3
Gastrointestinal	7.7	6.5	6.9	9.2	9.5	9.4
Respiratory	10.1	5.2	6.8	11.3	5.9	7.5
Endocrine	3.4	4.6	4.2	3.2	4.6	4.2
Blood and nutrition	3.1	3.8	3.5	3.0	3.5	3.3
Infection	2.7	1.1	1.7	3.2	2.4	2.6
Skin	1.2	0.8	0.9	0.9	1.2	1.1
Eye	0.2	1.1	0.8	1.8	1.8	1.8
Genito-urinary tract	0.2	0.7	0.3	0.5	1.0	0.9
Malignant disase	0.2	0.4	0.3	0.2	0.2	0.2
Ear, nose and throat	0	0.3	0.2	0.2	0	0.1
Unidentified	0.2	0.1	0.1	0	0	0

n = total number of drugs reported by group. [a]According to British national formulary.

Table 4. Prevalence of drug use of the most common subgroups of the five most frequently used major drug groups.

	No. of drugs reported per 100 respondents in					
	1985			1989		
Major drug group and subgroups[a]	Men (n = 391)	Women (n = 612)	Total (n = 1003)	Men (n = 252)	Women (n = 410)	Total (n = 662)
Cardiovascular	50.6	68.3	61.4	53.2	71.7	64.7
Diuretic	19.2	32.8	27.5	21.8	35.4	30.2
Vasodilator	14.1	9.8	11.5	13.5	13.4	13.4
Beta-adrenoceptor blocker	8.4	7.5	7.9	7.1	8.0	7.7
Cardiac glycoside	4.1	8.7	6.9	4.0	6.8	5.7
Centrally acting antihypertensive	3.8	7.7	6.2	2.8	4.1	3.6
Central nervous system	38.9	60.1	51.8	45.6	72.0	61.9
Hypnotic and anxiolytic	14.8	25.2	21.1	12.7	24.9	20.2
Analgesic	14.1	21.6	18.6	21.4	24.2	23.3
Antidepressant	2.8	6.9	5.3	3.2	12.7	9.1
Drugs used in nausea and vertigo	3.8	3.3	3.5	3.2	3.7	3.5
Drugs used in psychoses	0.8	0.7	0.7	1.2	2.9	2.3
Musculoskeletal	16.9	22.3	20.2	15.9	22.2	19.8
NSAID	13.6	20.1	17.5	12.7	16.8	15.3
Gastrointestinal	11.5	13.1	12.5	15.9	23.2	20.4
Laxative	3.3	4.7	4.2	4.4	7.8	6.5
Antacid	3.3	4.2	3.9	3.6	5.4	4.7
Ulcer healing drugs	3.8	1.5	2.4	6.3	6.3	6.3
Respiratory	15.1	10.3	12.2	19.4	13.9	16.0
Beta-adrenoceptor stimulant	5.9	3.6	4.5	7.9	4.6	5.9
Corticosteroid	1.5	1.5	1.5	4.0	2.7	3.2

n = number of respondents. [a]According to British national formulary. NSAID = non-steroidal anti-inflammatory drug.

groups except the 85–88 years age group. Two other studies reported an increase in drug use with time even when the contribution of ageing was controlled.[14,15] Interactions between practice and policy which may account for such an increase have been suggested by Stewart who pointed out that, even given constant levels of pathology, improved diagnoses, new treatments and demand for preventive drug therapies will lead to increased pressure to prescribe.[4]

Sex differences in the present study were particularly striking. Not only did women use more drugs than men, but more women took one or more drugs than men, a difference which held for both 1985 and 1989. Similar patterns have been reported elsewhere.[1,14,15] However, distribution of these differences across drug categories was far from uniform, with cardiovascular drugs (particularly diuretics) and central nervous system drugs (particularly hypnotics and anxiolytics) showing the largest sex differences.

The most commonly prescribed groups in both 1985 and 1989 were drugs for the cardiovascular, central nervous, musculoskeletal, gastrointestinal and respiratory systems, with the cardiovascular and central nervous system groups accounting for approximately 60% of all drugs being taken at the time of both interviews. Other studies have also found these to be the most commonly prescribed drug groups for non-institutionalized elderly people.[9,21] The subgroups of diuretics, hypnotics and anxiolytics, analgesics and non-steroidal anti-inflammatory drugs accounted for over 40% of all drugs recorded at the time of each interview.

The number of drugs reported per 100 respondents for the central nervous system increased from 52 in 1985 to 62 in 1989. Use of the drug subgroup of hypnotics and anxiolytics showed a small decline between 1985 and 1989 but there was a 13%

increase in use of the hypnotic component of this subgroup. Other studies have found that the prevalence of hypnotic use increases with age[22,23] and in the present study this may partly explain the change in use with time. However, when the effect of age was controlled, hypnotic use in 1989 was still found to be greater than in 1985. The decrease in use of anxiolytics is more than offset by the increase in use of antidepressants and antipsychotics. Much of the increase in antipsychotic use was among the 17 respondents who were nursing home or residential home residents by 1989, as none of these respondents was taking antipsychotic drugs in 1985.

Both the overall level of prescribing, and the changing patterns in prescribing shown for some drug groups in the present study, closely follow trends reported in national dispensing statistics. Reduced anxiolytic prescribing, the increasing use of ulcer healing agents, such as the H_2-antagonists, and inhaled corticosteroids, are clearly evident in trends summarized in England by the Department of Health.[24] Similarly, the increasing use of prescription drugs over a four-year period shown by the present sample is consistent with the steady increase in the total number of drugs dispensed for this age group throughout the same period for England as a whole.[24] Other features of the present findings seem consistent with changes in clinical practice. The decrease in prevalence of use of the cardiac glycosides between 1985 and 1989, accompanied by an increase in diuretic and vasodilator use, probably reflects the more rational use of these drugs following reports that, for patients with heart failure and in sinus rhythm, cardiac glycosides could be discontinued safely.[25,26]

This study has found that the majority of elderly patients take at least one drug and 49% to 54% take two or more drugs. Multiple drug use by elderly people has raised considerable concern. The report by the Royal College of Physicians of London

stated that elderly people suffered adverse drug reactions more commonly than younger people because elderly people take more medication and have a greater susceptibility to adverse effects through altered pharmacokinetics and pharmacodynamics.[2] More recently, several authors have reported that age itself is not a significant predictor of adverse drug effects, instead, taking more than four drugs and clinical status were better predictors.[5,7,27] At each point of assessment in the present study, approximately 7% of respondents reported taking more than four drugs.

The Royal College of Physicians report also suggested that inadequate supervision and excessive prescribing for elderly people are responsible for some of the adverse drug reactions that occur.[2] This statement is supported by the findings of Adams and colleagues that considerable, inappropriate prescribing for elderly patients occurs.[28] These analyses show that the number of drugs per person increased with time. Improved diagnosis and knowledge of how to prevent diseases, as well as the development of new products, may well contribute to this trend. It remains important that the drug regimens of this vulnerable group are frequently reviewed to ensure that only the minimum number of effective drugs, in the simplest regimen, are prescribed.

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