

Towards accurate prescribing analysis in general practice: accounting for the effects of practice demography

D J D SLEATOR

SUMMARY. *The object of this study was to develop a more accurate method of analysing prescribing patterns in general practice than is currently provided by prescribing analysis and cost (PACT) data. In particular it was hoped to be able to develop a system to predict accurately both the prescribing activity related to practice population age–sex distributions, and the related prescribing activity in the individual therapeutic groups used in PACT reports. Data from the Vamp research data bank were combined with mean prescription costs from the Prescription Pricing Authority and the patient age–sex profile of each practice. The estimated cost of prescribing for each practice in each therapeutic group was derived, and subsequently compared with the PACT data. Large variations were found between predicted patterns and PACT ‘averages’ for both overall costs, and within therapeutic groups. This was most noticeable where a practice’s age–sex profile varied markedly from the family health services authority mean age–sex distribution. Comparison of data for the different therapeutic groups showed the largest differential between the predicted patterns and PACT averages to be in the drugs for the cardiovascular system.*

Audit requires a baseline against which to measure, change and re-evaluate performance and this system of analysis provides a more accurate baseline against which to measure a practice’s prescribing habits. Subsequent evaluation will provide a judgement of the quality of that prescribing. A practice population’s age–sex structure is such a fundamental determinant of the practice’s prescribing patterns that some modification of the current PACT weighting system should be undertaken so as to reflect more accurately average prescribing in different age groups. This would assist prescribing audit.

Keywords: *prescribing patterns; prescribing analyses; demography.*

Introduction

WORKING paper 4 of *Working for patients*¹ and the subsequent *Improving prescribing*² both highlighted the need to refer to the age of a practice’s patient population when considering a practice’s prescribing patterns. The importance of age as a factor affecting prescribing patterns was subsequently endorsed in a paper by Forster and Frost.³

Surrey family health services authority was one of six family health services authorities to carry out pilot prescribing projects for the Department of Health in 1989–90. The need for a more accurate assessment of prescribing patterns at practice level was identified both in order to develop a system to set indicative

prescribing amounts which were responsive to expected need, and to facilitate discussions about prescribing between the family health services authority and general practitioners. It is likely that a practice’s historic prescribing pattern and the family health services authority overall costs will reflect local morbidity to some extent³ although the variation in prescribing cost between different practices may also be affected by other factors.⁴

Visits by the family health services authority medical adviser to general practitioners were seen as an important element of the indicative prescribing scheme.¹ Evidence from other studies suggests that personal contact influences the behaviour of general practitioners⁵ as does the opportunity to discuss prescribing habits.^{6,7} The provision of additional, more accurate information should help general practitioners to monitor their prescribing activity, and should allow improved assessment of the measures of rational prescribing which they need to judge their own performance.⁸

Prescribing analysis and cost (PACT) data provided by the Prescription Pricing Authority contain a weighting factor for patients on a general practitioner’s list who are over the age of 65 years. One prescribing unit is allocated to each patient under 65 years of age and three units to each patient aged 65 years and over. This is a useful, if limited, means of enabling a comparison of prescribing patterns to be made between a practice and the mean within the family health services authority when the practice has a considerably bigger or smaller elderly population than the family health services authority mean. However, the additional weighting given for elderly patients is evenly distributed among the therapeutic groups and is not weighted towards those therapeutic areas where more prescribing is likely to occur for an older than average population, or away from those same therapeutic areas where there is a younger than average population. The cost per prescribing unit used for the ‘family health services authority mean’ calculations is the family health services authority total cost for one quarter divided by the number of prescribing units. While the current system is remarkably simple and easy to calculate, it may not be accurate enough for current needs.

Despite the recognition of the effects of population age profiles on prescribing patterns^{1–3} there are little published data on how the different prescribing patterns relate to different age groups. The aims of this study were therefore to look at the variation in prescribing patterns, by age, sex and drug therapeutic group; to relate these variations to individual practices by deriving the ‘mean individual patient costs’ by age, sex and therapeutic group, and applying these to the practice population age–sex profile; and to compare these results with the practices’ PACT data.

Method

Vamp Research Limited has been routinely collecting computerized records since 1987 and by November 1991 the database had accumulated information on over four million patients. The data include information on a patient’s year of birth, sex, registration status, prescriptions (with the date of issue, name of drug, formulation, dose, total quantity, and whether a repeat prescription), and morbidity, as well as the district health

D J D Sleator, MB, medical adviser, Surrey Family Health Services Authority, Surbiton.

Submitted: 20 December 1991; accepted: 23 April 1992.

© *British Journal of General Practice*, 1993, 43, 102–106.

authority area of the practice's main surgery address. The prescribing information collected by Vamp has been shown to be of high quality.⁹ This study is based on data from the last quarter of 1989. The prescribing rates for a sample of practices in Surrey which were providing data to Vamp Research were analysed. The aggregate population of the practices was known to total 30 608 patients and the number of patients in each age band was also provided. All data provided were in an aggregated, anonymous form and no individual practice details were known to the family health services authority.

The Vamp data collected from the practices were analysed to provide figures for the numbers of prescriptions issued to patients in seven age groups for both sexes. These rates can be used to derive a weighting factor to allow a more comprehensive prescribing unit system to be produced along the lines of the current PACT system. However, it was anticipated that the different age groups would have different rates of prescribing in the various therapeutic groups used in PACT (drugs for the cardiovascular system, gastrointestinal system, musculoskeletal system, respiratory system, and central nervous system, drugs used in infections, and all other drugs). For example, few children on a general practitioner's list would receive drugs for the cardiovascular system. Therefore the data were analysed to derive rates of prescribing in the different therapeutic groups for each age group in both sexes for one quarter. The prescribing rates within each therapeutic group thus produced were multiplied by the family health services authority mean cost for a prescription in that same therapeutic group for one quarter to produce a costed weighting factor. This is equivalent to the cost of prescribing to an 'average patient' in each age and sex group in each PACT therapeutic group for one quarter.

The age-sex distribution of each practice population was derived from the family health services authority patient register. The expected expenditure figures were produced for individual practices by multiplying the costed weighting factors by the number of patients in the relevant age groups in the practice. These figures are an estimate of the true mean prescribing cost, indicating the expenditure if the practice prescribed in an average way for all its patients.

In order to compare individual practices with the family health services authority mean the expected expenditure was calculated for a family health services authority average practice with the same number of patients (that is, one with a family health services authority mean age-sex profile, prescribing in an average way). These figures are not the same as the family health services authority mean figures shown on the practice's PACT data, which are already weighted by the prescribing unit system.

Analysis of the prescribing activity in practices in relation to their age-sex profiles was carried out for 139 practices in Surrey which were visited as part of the indicative prescribing scheme.

Results

Analysis of the overall rates of prescribing for all patients revealed a general pattern of increasing prescription rate with increasing age (Figure 1). However, the youngest age group (0-4 years) showed a variation from this pattern, with relatively high rates of prescribing. In all age groups, females received a higher mean number of prescriptions than males.

Analysis by therapeutic group demonstrated wide variation in prescribing costs for the different age groups in each of the therapeutic groups for both sexes and, in some instances, wide differences in prescribing costs between the sexes (Table 1). The largest cost differences between the age groups, for both males and females, occurred in drugs used in the cardiovascular system. Prescribing of drugs used in infections revealed a difference from

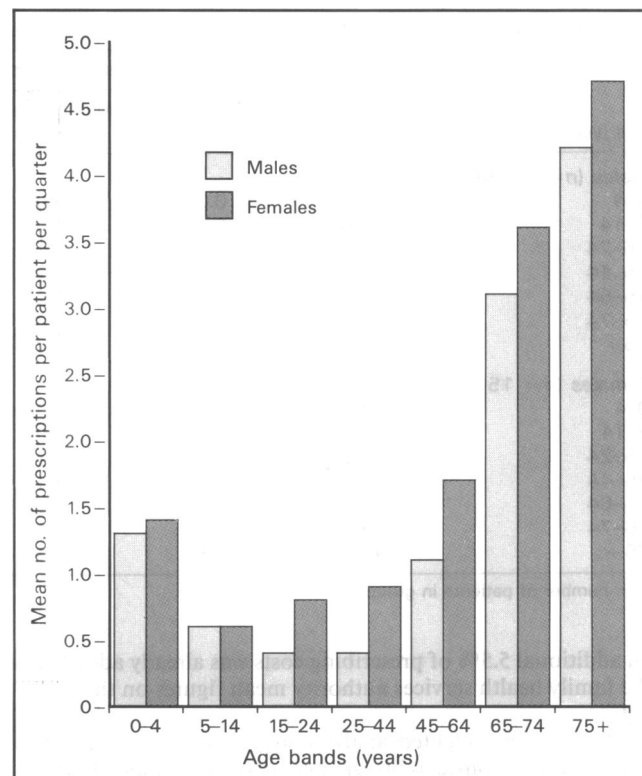


Figure 1. Mean number of prescriptions for patients in each age group over one quarter, by sex.

the general pattern with more prescribing occurring in the youngest age groups. Large differences in prescribing between the sexes were observed in the older age groups in drugs used for the central nervous system.

The estimated costs of prescribing for the whole population of 1.1 million patients on the family health services authority patient registration database were calculated. The overall mean cost of prescribing for each patient was estimated to be £8.47. The mean prescribing cost for each patient over 65 years was 4.9 times that of a patient under 65 years. Using the mean number of prescriptions for each age band (Figure 1) and the mean prescription cost within the family health services authority to derive an alternative cost by age band reduced the differential in prescribing costs between those aged 65 years and over and under 65 years to 4.4. The analysis shows a cost differential between the 75 years and over age group and the 65-74 years age group of approximately 4:3 (mean cost for those aged 75 years and over was £29.21 while the mean cost for those aged 65-74 years was £22.27). The mean cost of prescribing for the 45-64 years age group was estimated to be £8.71, which is also higher than the overall mean.

Large variations were also seen in the expected costs derived from this age-sex weighted analysis system and the family health services authority mean costs from the PACT system. Some examples of how this method of calculating expected prescribing expenditure for individual practices would compare with the PACT system of weighting are detailed below:

Practice A

For practice A the PACT system allowed for an extra 5.5% of prescribing units because of the excess numbers of elderly people (those aged 65 years and over) in their population compared with the family health services authority mean. This meant that

Table 1. Mean prescribing costs over one quarter for each therapeutic group, by patients' age and by sex, for all patients.

Age (years)	Prescribing cost per patient in therapeutic group (£):						
	Cardiovascular system	Gastrointestinal system	Musculoskeletal system	Respiratory system	Central nervous system	Drugs used in infections	All others
<i>Males (n = 14 987)</i>							
0-4	0.00	0.35	0.00	1.39	0.09	2.67	2.15
5-14	0.00	0.12	0.02	1.14	0.06	1.08	0.85
15-24	0.03	0.13	0.14	0.58	0.09	0.53	0.72
25-44	0.15	0.30	0.32	0.38	0.20	0.31	0.80
45-64	2.21	0.74	0.87	0.78	0.40	0.40	1.84
65-74	7.04	2.55	2.61	1.91	1.25	0.70	4.95
75+	8.97	3.62	2.77	2.83	2.03	0.69	6.66
<i>Females (n = 15 621)</i>							
0-4	0.00	0.42	0.00	1.40	0.09	2.59	2.71
5-14	0.00	0.21	0.04	0.84	0.03	1.15	1.10
15-24	0.05	0.28	0.32	0.63	0.17	0.85	2.36
25-44	0.27	0.57	0.42	0.41	0.41	0.74	2.64
45-64	2.07	1.09	1.02	0.87	0.91	0.66	3.59
65-74	7.53	2.86	2.42	1.43	2.09	0.76	6.22
75+	9.44	3.80	3.44	1.42	3.07	0.82	8.12

n = number of patients in group.

an additional 5.5% of prescribing costs was already added into the family health services authority mean figures on the PACT data.

The age-sex weighted analysis suggested that the practice would need a considerably greater increase in expenditure to allow for their patient profile and could expect to be 13.1% above the spending of a practice with an average age-sex distribution. Thus, the practice would expect to be above the PACT family health services authority mean figure by 7.6% (that is 13.1% - 5.5%) if prescribing in an average way for all its patients.

Practice B

In practice B the PACT system reduced the number of prescribing units by 7.4% because of a smaller than average number of elderly patients, suggesting an expected cost of 92.6% of that of a practice with a family health services authority mean elderly population. The age-sex weighted analysis indicated that mean prescribing costs would be 12.2% below that of a practice with a family health services authority average age-sex distribution and that it could therefore expect to be 4.8% below the PACT mean figure. The practice, already above the PACT family health services authority mean cost, was thus shown to be even further above the prescribing of local colleagues. PACT estimate 92.6% of average; age-sex weighted estimate 87.8% of average (100% - 12.2%); practice already above PACT family health services authority mean figures, thus excess costs increased by 4.8% (92.6% - 87.8%).

Practice C

The PACT system allowed practice C 6.7% extra prescribing units. The age-sex weighted analysis suggested the practice might need 11.7% higher costs than average, a difference of 5.0%. The PACT analysis showed the practice to be 12.0% above the PACT family health services authority mean for prescribing drugs in the cardiovascular system group. The age-sex weighted analysis suggested a need for 19.6% more expenditure on cardiovascular system drugs than a practice with an average age-sex profile. Allowing for the weighting in the PACT analysis (6.7%) the figures suggest that the practice was in fact prescribing more closely to the average of its peers when taking into account the age-sex distribution. PACT showed 12.0% for cardiovascular system drugs, to which must be added 6.7% for the PACT

weighting already included, thus 18.7% above a practice with average numbers of elderly patients. The age-sex weighted analysis suggests a requirement for an extra 19.6% for cardiovascular system drugs above a family health services authority mean age-sex profile practice. Therefore, the practice is below the age-sex weighted mean by 0.9% (19.6% - 18.7%).

Practice D

The PACT system allowed an extra 6.8% for the overall cost for practice D but the age-sex weighted analysis suggested a weighting of 12.8%, a difference of 6.0%. Prescribing costs for drugs in the musculoskeletal system group were raised and it was felt that this was likely to be a result of a larger than average elderly population. The age-sex weighted analysis suggested that even allowing for the elderly population, prescribing in this group was 21.8% higher than average.

In summary, when this age-sex weighted system was used to assess the prescribing needs of different practices' patient populations and was then compared with the PACT data it revealed areas of apparent 'underprescribing' and 'overprescribing' in individual therapeutic groups as well as overall. It also identified areas of 'average' prescribing where PACT data suggested an excess or low figure.

Attempts were made to check that the Vamp data were representative of prescribing in Surrey as a whole. Two tests were undertaken. A statistical analysis of the overall rate of prescribing in age groups for each sex as at Figure 1 (that is, rates of prescribing in Surrey) was carried out against Vamp's rates of comparable national prescribing figures. Surrey has a low prescribing frequency pattern, and this was reflected in all the age groups. The analysis confirmed a highly significant correlation between the prescribing in the family health services authority and prescribing on a national basis for both male and female patients using the product moment correlation coefficient (*r*) (male patients: *r* = 1.0; 95% confidence interval (CI) = 0.97 to 1.0, *P* < 0.001; female patients: *r* = 1.0; 95% CI = 0.98 to 1.0; *P* < 0.001).

Secondly, the costed weighting factors were run against the whole family health services authority age-sex profile (all patients living in Surrey who were registered with a general practitioner) and the figures compared with the actual PACT data (which relates to all the patients of Surrey general practitioners).

This showed an overall difference of 9.9%, the PACT figure being higher than the estimated figure. A large difference was found in central nervous system drugs where the PACT figure was 38.5% above the estimated figure. The difference in this therapeutic group alone, if added to the estimated total, would reduce the difference between the PACT total and estimated total to 6.9%, the PACT figure still being higher. Expenditure on drugs used in infections revealed the next largest difference at 15.3% greater than estimated. The other therapeutic groups gave figures of: cardiovascular system drugs 9.3%, gastrointestinal system 6.9%, musculoskeletal system 0.4%, respiratory system 10.7% and all others 5.7%. This suggests that this analytical method underestimated actual expenditure in cash terms. However, in calculating anticipated variations from the family health services authority mean for individual practices with this system it is the family health service authority mean derived from the same mean patient cost figures which is used, not the PACT data.

Discussion

The relative cost of prescribing to those aged 65 years or over is an important issue when analysing prescribing costs. This study indicates that the PACT weighting is usually inadequate for practices which have a considerably greater number of elderly patients than the family health services authority average, and overestimates the needs of those with considerably fewer elderly patients.

Using this method to calculate costs those patients under five years of age, while being individually more expensive than any of the next three age groups, are well below the average costs taken across all the age groups (£8.47), and close to the cost allocated to one prescribing unit. Additional weighting for those under five years within the current prescribing unit system does not seem to be necessary.

The mean cost per patient of prescribing to the 45–64 years age group (£8.71) is higher than the overall mean cost per patient. As such this should be an important group to consider for additional weighting both because of the individual cost and because it is a large group. This is not, however, a group which is routinely identified within a practice's total patient population, unlike the 65–74 years and 75 years and over age groups which are already identified for other purposes. If a differential weighting for the 75 years and over age group and the 65–74 years age group is incorporated into the current PACT system, as has been proposed,¹⁰ a ratio close to 4:3 would seem appropriate.

This study supports the suggestion that a new system is needed¹⁰ which is more flexible than that currently used. Three options seem possible: first, the basic system could be kept but the weighting increased for those aged 65 years and over. From this study the best figure would probably be 4.5 or 5 units, but a full assessment similar to this study using comparable national figures would be necessary. A small refinement would be to give different weightings to the 65–74 years age group and the 75 years and over age group. Secondly, a new system could be developed based on the current structure but providing a more sensitive assessment of expected need. A possible system would be one that allocates new units to five groups: 0–4 years two units; 5–44 years one unit; 45–64 years 2.5 units; 65–74 years six units and 75 years and over eight units. Thirdly, a system could be developed based on a more comprehensive age–sex weighted analysis of prescribing patterns as in this study. This has the advantage of enabling a more comprehensive assessment of prescribing need in individual therapeutic groups.

It became apparent during the study that a number of factors needed further consideration as they may influence the accuracy of the model or the interpretation of the results. These

included: the different rates of prescribing to be expected in different family health services authorities (resulting in different ratios between the various age groupings); matching the time when the prescribing rate information was derived with the time that the mean prescribing cost and age–sex profile data were produced, because of seasonal variations in prescribing activity;¹¹ and practices with large numbers of patients in other family health services authorities, who were thus not on the family health services authority database, as the age–sex profile of these 'out of area' patients was not known.

The development of a method to equate practice population profiles with prescribing cost patterns more accurately is potentially a major advance towards the objective assessment of practice prescribing habits. The information provided by PACT reports is a basis for doctors to ask themselves questions about prescribing activity. The age–sex weighted system provides more accurate information, allowing more relevant questions to be asked. The system does not identify 'good' or 'bad' prescribing, it provides a different baseline against which to judge prescribing activity. A judgement of what is appropriate prescribing must be made following the analysis.

This system shows large variations in prescribing costs between the age groups studied and between the sexes. This suggests that a sophisticated method of analysis will be needed if it is proposed to develop a truly accurate model for assessing expected costs for indicative prescribing amounts, or a capitation based formula for the hospital and prescribing elements of the funds of fundholding practices. Not only does each practice have a unique population age–sex profile, but other local factors, such as the number of temporary residents, nursing home residents, patients requiring high cost medications and local hospital prescribing policies, need to be considered.

The basis of this article is prescribing patterns in Surrey, and as such it is possible that the conclusions may not be directly applied to another family health services authority area. However, the significant correlation between overall prescribing rates in Surrey and national rates suggests that similar patterns could emerge nationally.

An age–sex weighted system could not currently replace historic prescribing patterns as the main factor for the setting of indicative prescribing amounts. However, there appear sufficient grounds to recommend its further development, with a view to its general application in conjunction with historic data, as variations from the PACT mean figures, both overall and in specific groups, have been shown. The ability to make more accurate comparisons of prescribing rates, especially in individual therapeutic groups, should help provide a more sensitive measure when monitoring prescribing activity.

References

1. Secretaries of State for Health, Wales, Northern Ireland and Scotland. *Working for patients. Indicative prescribing budgets for general medical practitioners. Working paper 4*. London: HMSO, 1989.
2. Department of Health. *Improving prescribing*. London: DoH, 1990.
3. Forster DP, Frost CEB. Use of regression analysis to explain the variation in prescribing rates and costs between family practitioner committees. *Br J Gen Pract* 1991; **41**: 67-71.
4. McGavock H. Some patterns of prescribing by urban general practitioners. *BMJ* 1988; **296**: 900-902.
5. Horder J, Bosanquet N, Stocking B. Ways of influencing the behaviour of general practitioners. *J R Coll Gen Pract* 1986; **36**: 517-521.
6. Harris CM, Jarman B, Woodman E, et al. *Prescribing — a suitable case for treatment. Occasional paper 24*. London: Royal College of General Practitioners, 1984.
7. Harris CM, Fry J, Jarman B, Woodman E. Prescribing — a case for prolonged treatment. *J R Coll Gen Pract* 1985; **35**: 284-287.

