# Knowledge of drug costs: a comparison of general practitioners in Scotland and England

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*SUMMARY. The implementation of drug budgets will make it essential that general practitioners are aware of prescribing costs. A previous study of general practitioners in Scotland found that their knowledge of drug costs was often inaccurate. At the time of the Scottish study, doctors received very limited information on prescribing costs. By contrast, general practitioners in England have been receiving much more detailed information on their prescribing costs since the introduction of PACT (prescribing analyses and cost) in 1988/89. This study examines whether, as a result, doctors in England are more aware of drug costs.*

*The results suggest that they are not; indeed, doctors in Scotland had marginally better knowledge of drug costs. There is a continuing need to improve the cost information available to general practitioners.*

*Keywords: drug costs; prescribing costs; doctors knowledge; comparative studies.*

## Introduction

THE introduction of drug budgets[1] will make awareness of drug costs essential for general practitioners. An earlier study in Scotland in 1986 found that, while most general practitioners felt that costs should be taken into account when prescribing, their knowledge of drug costs was often inaccurate.[2] The same study highlighted a demand among general practitioners for better information about drug costs; over 70% of the doctors felt that providing more information on drug costs would lower the National Health Service drugs bill.

At the time of the earlier study, the information provided to general practitioners in Scotland was restricted to total numbers of prescriptions and costs for the doctors themselves, their practice and health board, and Scotland as a whole. However, general practitioners in England have been receiving much more detailed information since the introduction of PACT (prescribing analyses and cost) in 1988/89. This provides quarterly data on prescribing patterns and costs, allowing therapeutic groups and particular products to be identified, as well as comparisons with practice, family health services authority and national averages.[3] According to the working paper on indicative prescribing budgets,[4] 'the provision of PACT has increased awareness among general practitioners of the cost of their prescribing decisions.' This study examines whether, as might be expected, doctors in England have better knowledge of drug costs than their counterparts in Scotland.

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Submitted: 11 March 1991; accepted: 16 May 1991.



## Method

In April 1990, a randomly selected sample of 400 general practitioner principals in England from four randomly selected family health services authorities (North East Thames, Northern, Wessex and Yorkshire) was asked to estimate the net ingredient cost of 21 commonly prescribed drugs. The drugs chosen were identical to those used in the earlier Scottish survey,[2] and included products from different therapeutic groups (defined in accordance with the *British national formulary*[5]); cheap and expensive preparations; generic and proprietary drugs; and competing products. Doctors were urged not to estimate the cost of products they had never prescribed.

As in the previous study, cost estimates were classified as accurate if they were within 25% of the actual cost. Drug costs were obtained from the Prescription Pricing Bureau in Aberdeen for the Scottish survey, and the Prescription Pricing Authority in Newcastle for the English survey.

In the three and a half years between the Scottish and English studies, the costs of all but one of the drugs had changed. It would not, therefore, have been reasonable to compare in absolute terms estimates of drug costs for the two groups. Instead, the distribution of estimates around the true cost for each group was compared.

To assess doctors' knowledge of relative drug costs, estimated cost differences between the most and least expensive product in each therapeutic group were calculated by the authors. Doctors' ability to rank drugs in order of cost, even though they might be unaware of the size of the cost differences, was also calculated by the authors. Within each therapeutic group the number of errors in the ranking of drugs according to cost was counted. This could range from one (in groups with two drugs) to six (in groups with four drugs).

Chi square tests were used for comparisons involving discrete data. Estimated differences in drug costs for the two groups of doctors were compared using the Mann Whitney $U$ test. The $t$ test was also used where appropriate.

## Results

A total of 244 of the doctors in England (61%) completed the questionnaire, compared with 78% of those in Scotland. Table 1 summarizes the replies of the English sample. As in the Scottish survey, doctors tended to overestimate the cost of inexpensive preparations and underestimate the cost of expensive ones.

A comparison of the accuracy of doctors' estimates shows that 22% of doctors in England underestimated drug costs compared with 24% of the Scottish sample for the 21 drugs as a group. Overall the doctors in Scotland had slightly more accurate estimates than the doctors in England (within 25% of the actual cost) (29% versus 33%), and slightly fewer overestimates (43% versus 49%). The difference between the two was significant (chi square = 32.99, 2 df, $P<0.01$).

The finding that general practitioners in Scotland were better informed was generally confirmed for individual drug products (Table 2). The exceptions were ranitidine, ibuprofen and penicillin V, where doctors in England had significantly better knowledge. Only 55% of doctors in Scotland compared with 92% of doctors in England estimated the cost of enalapril maleate. At the time of the study in Scotland enalapril maleate had only recently been marketed, whereas at the time of the study in England,

**Table 1.** Costs of 21 different drugs as perceived by the doctors in England (proprietary names are given in italic type).

| Drug (dose; quantity) | No. of estimates | Actual price (£) | Range of estimates (£) | Mean estimate (£) | Standard deviation (£) | Median estimate (£) |
|---|---|---|---|---|---|---|
| $H_2$ receptor antagonists | | | | | | |
| *Zantac* (ranitidine) tablets 150 mg; 60 | 242 | 29.76 | 0.50–110.00 | 23.36 | 10.41 | 25.00 |
| *Tagamet* (cimetidine) tablets 400 mg; 60 | 241 | 18.61 | 0.60–90.00 | 17.38 | 8.60 | 16.60 |
| Antihistamines | | | | | | |
| *Piriton* (chlorpheniramine maleate) tablets 4 mg; 90 | 240 | 0.83 | 0.10–20.00 | 2.09 | 2.17 | 1.50 |
| *Triludan* (terfenadine) tablets 60 mg; 60 | 241 | 5.79 | 1.00–25.00 | 7.85 | 4.09 | 7.00 |
| Angina prophylactics | | | | | | |
| Glyceryl trinitrate tablets 0.5 mg; 100 | 241 | 0.44 | 0.01–10.00 | 1.02 | 1.41 | 0.50 |
| *Adalat* (nifedipine) tablets 10 mg; 100 | 239 | 11.45 | 0.70–50.00 | 12.19 | 6.79 | 10.00 |
| *Transiderm-Nitro* (glyceryl trinitrate) patches 5 mg; 30 | 220 | 15.95 | 3.00–60.00 | 16.09 | 8.67 | 15.00 |
| Analgesics | | | | | | |
| Paracetamol tablets 500 mg; 100 | 240 | 0.38 | 0.05–15.00 | 1.45 | 1.64 | 1.00 |
| Co-proxamol tablets; 100 | 242 | 1.42 | 0.60–20.00 | 3.90 | 2.74 | 3.00 |
| Co-dydramol tablets; 100 | 236 | 1.65 | 0.60–25.00 | 3.96 | 3.07 | 3.00 |
| Non-steroidal anti-inflammatory drugs | | | | | | |
| Ibuprofen tablets 400 mg; 100 | 241 | 2.55 | 0.45–26.00 | 4.89 | 3.53 | 4.00 |
| *Brufen* (ibuprofen) tablets 400 mg; 100 | 236 | 6.05 | 0.45–30.00 | 7.32 | 4.14 | 6.00 |
| *Ponstan* (mefenamic acid) capsules 250 mg; 100 | 234 | 7.55 | 1.00–80.00 | 8.94 | 7.00 | 8.00 |
| *Naprosyn* (naproxen) tablets 250 mg; 100 | 231 | 12.50 | 0.60–70.00 | 10.35 | 6.33 | 10.00 |
| Penicillins | | | | | | |
| Penicillin V tablets 250 mg; 28 | 242 | 0.46 | 0.10–10.00 | 1.40 | 1.43 | 1.00 |
| Ampicillin capsules 250 mg; 28 | 236 | 0.94 | 0.20–15.00 | 2.82 | 2.49 | 2.00 |
| *Penbritin* (ampicillin) capsules 250 mg; 28 | 224 | 1.99 | 0.30–25.00 | 4.18 | 3.30 | 3.00 |
| Amoxycillin capsules 250 mg; 21 | 241 | 2.92 | 0.30–15.00 | 3.92 | 2.61 | 3.00 |
| Others | | | | | | |
| *Innovace* (enalapril maleate) tablets 10 mg; 28 | 225 | 11.03 | 0.30–50.00 | 16.15 | 7.31 | 15.00 |
| Diazepam tablets 5mg; 90 | 241 | 0.11 | 0.10–16.00 | 2.37 | 2.45 | 1.80 |
| *Intal* (sodium cromoglycate) aerosol inhaler 5 mg; 1 | 238 | 14.52 | 1.00–30.00 | 8.48 | 4.74 | 8.00 |

**Table 2.** Comparison of the accuracy of drug cost estimates by general practitioners in England and Scotland.

| Drug | % responses in England | | | % responses in Scotland | | | Chi square |
|---|---|---|---|---|---|---|---|
| | Under-estimate | Accurate estimate[a] | Over-estimate | Under-estimate | Accurate estimate[a] | Over-estimate | |
| $H_2$ receptor antagonists | | | | | | | |
| Cimetidine ($n$ = 241/213) | *27* | *55* | *18* | *28* | *62* | *10* | 6.64* |
| Ranitidine ($n$ = 242/213) | *43* | *52* | *5* | *53* | *42* | *5* | 5.37* |
| Antihistamines | | | | | | | |
| Chlorpheniramine maleate ($n$ = 240/212) | *18* | *28* | *54* | *11* | *38* | *51* | 8.44* |
| Terfenadine ($n$ = 238/207) | *15* | *38* | *47* | *31* | *46* | *23* | 30.46** |
| Angina prophylactics | | | | | | | |
| Glyceryl trinitrate ($n$ = 241/213) | *22* | *32* | *46* | *16* | *30* | *54* | 3.61 |
| Nifedipine ($n$ = 239/211) | *32* | *37* | *31* | *37* | *51* | *12* | 24.65** |
| *Transiderm-Nitro* ($n$ = 220/196) | *35* | *30* | *35* | *52* | *38* | *10* | 36.01** |
| Analgesics | | | | | | | |
| Paracetamol ($n$ = 240/213) | *3* | *5* | *92* | *2* | *10* | *88* | 4.34 |
| Co-proxamol ($n$ = 242/205) | *8* | *8* | *84* | *8* | *23* | *69* | 20.18** |
| Co-dydramol ($n$ = 236/206) | *9* | *25* | *66* | *6* | *30* | *64* | 2.84 |
| Non-steroidal anti-inflammatory drugs | | | | | | | |
| Ibuprofen ($n$ = 241/204) | *10* | *33* | *57* | *16* | *22* | *62* | 8.27* |
| *Brufen* ($n$ = 236/207) | *26* | *35* | *39* | *22* | *43* | *35* | 2.86 |
| Mefenamic acid ($n$ = 234/213) | *29* | *34* | *37* | *17* | *47* | *36* | 12.37** |
| *Naprosyn* ($n$ = 231/213) | *48* | *41* | *11* | *50* | *39* | *11* | 0.13 |
| Penicillins | | | | | | | |
| Penicillin V ($n$ = 242/213) | *10* | *26* | *64* | *8* | *16* | *76* | 7.66* |
| Ampicillin ($n$ = 236/206) | *11* | *14* | *75* | *16* | *23* | *61* | 9.87** |
| *Penbritin* ($n$ = 224/201) | *8* | *19* | *73* | *9* | *27* | *64* | 4.45 |
| Amoxycillin ($n$ = 241/210) | *24* | *36* | *40* | *26* | *50* | *24* | 14.94** |
| Others | | | | | | | |
| Diazepam ($n$ = 241/212) | *0* | *1* | *99* | *0* | *0* | *100* | |
| Enalapril maleate ($n$ = 225/123) | *10* | *33* | *57* | *8* | *46* | *46* | 5.76 |
| Sodium cromoglycate ($n$ = 238/205) | *71* | *25* | *4* | *71* | *28* | *1* | 3.88 |

$n$ = total number of responses in England/Scotland. *$P$<0.05. **$P$<0.01. [a] Within 25% of the true cost.

it had become more established. The doctors were urged not to estimate the cost of products they had never prescribed. Table 3 examines doctors' knowledge of the differences in cost between competing products and between generic and proprietary equivalents. Doctors in England were significantly better informed about the difference in costs between the most and least expensive drug in the antihistamine, angina prophylactic, and penicillin categories.

Table 4 investigates general practitioners' abilities to rank competing drugs in order of cost. Most doctors were able to rank correctly the $H_2$ receptor antagonists and antihistamine drugs, and most made no or only one error in their ranking of angina prophylactics and analgesics. Doctors in England had significantly better knowledge of the relative costs of cimetidine and ranitidine, whereas doctors in Scotland were significantly better informed about the relative costs of the penicillins. Similar proportions of practitioners in England and Scotland, 27 (11%) and 30 (14%) respectively, were unaware that *Brufen* is more expensive than its generic equivalent (ibuprofen), while 50 doctors in England (22%), compared to 26 doctors in Scotland (13%), ranked incorrectly *Penbritin* and its generic equivalent (ampicillin) ($t=2.66$, $P<0.05$).

**Table 3.** Comparison of doctors' estimated differences in costs between competing products and between generic and proprietary preparations within therapeutic groups.

| Drug comparison | Doctors' estimated cost difference as % of actual cost difference (median) | | Mann Whitney *U* test Z score |
|---|---|---|---|
| | England | Scotland | |
| *Competing products* | | | |
| *Zantac* (ranitidine) versus *Tagamet* (cimetidine) | 55 | 58 | −0.67 |
| *Triludan* (terfenadine) versus *Piriton* (chlorpheniramine maleate) | −8 | 26 | −6.17** |
| *Transiderm-Nitro* (glyceryl trinitrate patches) versus glyceryl trinitrate | 8 | 37 | −4.90** |
| Codydramol versus paracetemol | −54 | −23 | −1.21 |
| *Naprosyn* (naproxen) versus *Brufen* (ibuprofen) | 50 | 48 | −0.31 |
| Amoxycillin versus penicillin V | 19 | 30 | −2.66** |
| *Generic and proprietary drugs* | | | |
| *Brufen* versus ibuprofen | 42 | 33 | −0.19 |
| *Penbritin* versus ampicillin | 5 | −23 | −1.49 |

* $P<0.05$, ** $P<0.01$.

## Discussion

Our results indicate that general practitioners in England in 1990 were no better informed about the cost of commonly prescribed drugs than were their counterparts in Scotland in 1986. This is perhaps surprising given the introduction of the PACT system in England in 1988/89, and the recent government emphasis on efficient prescribing. However, it would be wrong to conclude that these developments have had no effect without evidence about doctors' knowledge prior to these changes in England.

The study of cost awareness by Rowe and MacVicar[6] in 1986 included four of the drugs covered in our questionnaire. Their sample comprised 50 doctors in England, including 30 principals and trainees in general practice. Estimates which were greater than 50% and less than twice the actual cost were defined as 'accurate'. The number of doctors able to estimate drug costs accurately was: diazepam one doctor (2%), ibuprofen 44 doctors (88%), ampicillin 40 doctors (80%), and amoxycillin 36 doctors (72%). Using Rowe and MacVicars' definition of accuracy, the corresponding figures for our English study were: diazepam six doctors (3%), ibuprofen 150 doctors (62%), ampicillin 88 doctors (37%), and amoxycillin 176 doctors (73%). This comparison, albeit limited, provides no evidence of an improvement in knowledge since 1986. Indeed, the proportion of accurate estimates appears to have deteriorated significantly for ibuprofen ($t=-3.79$, $P<0.01$) and ampicillin ($t=-5.56$, $P<0.01$).

**Table 4.** Comparison of the number of errors in ranking of drug costs by doctors in England and Scotland.

| Drug therapeutic group | No. of errors | No. (%) of doctors in: England | | Scotland | | Chi square |
|---|---|---|---|---|---|---|
| $H_2$ receptor antagonists | 0 | 214 | *(89)* | 170 | *(80)* | 6.33* |
| | 1 | 27 | *(11)* | 43 | *(20)* | |
| Antihistamines | 0 | 237 | *(99)* | 201 | *(97)* | N/A |
| | 1 | 2 | *(1)* | 6 | *(3)* | |
| Angina prophylactics | 0 | 134 | *(62)* | 136 | *(70)* | 2.81 |
| | 1 | 82 | *(38)* | 58 | *(30)* | |
| | 2 | 0 | *(0)* | 0 | *(0)* | |
| | 3 | 1 | *(1)* | 0 | *(0)* | |
| Analgesics | 0 | 52 | *(22)* | 67 | *(34)* | 7.26 |
| | 1 | 169 | *(72)* | 121 | *(61)* | |
| | 2 | 5 | *(2)* | 2 | *(1)* | |
| | 3 | 8 | *(3)* | 10 | *(5)* | |
| Non-steroidal anti-inflammatory drugs | 0 | 38 | *(17)* | 18 | *(9)* | 8.58 |
| | 1 | 100 | *(45)* | 103 | *(52)* | |
| | 2 | 50 | *(23)* | 39 | *(20)* | |
| | 3 | 23 | *(10)* | 21 | *(11)* | |
| | 4-6 | 11 | *(5)* | 17 | *(9)* | |
| Penicillins | 0 | 56 | *(25)* | 72 | *(36)* | 9.76* |
| | 1 | 99 | *(45)* | 86 | *(43)* | |
| | 2 | 36 | *(16)* | 27 | *(14)* | |
| | 3 | 19 | *(9)* | 10 | *(5)* | |
| | 4-6 | 12 | *(5)* | 4 | *(2)* | |

* $P<0.05$. N/A = not applicable.

Our findings reiterate the need for improvements in the cost information available to general practitioners. The PACT system in England and the recently introduced Scottish Prescribing Analysis (SPA)[7] provide a starting point, but they are unlikely to meet fully the information requirements for drug budgets. PACT level 1 information, which is supplied to all doctors, provides information about overall prescribing costs, but does not identify individual products. Levels 2 and 3, obtainable on request or issued automatically to doctors with above-average prescribing costs, contain much more detailed information. However, these printouts of past prescribing are too cumbersome to be used during consultations. In addition, they may not highlight areas where less costly but equally effective drugs could be substituted for current prescriptions. Drug formularies which incorporate information on comparative costs may help to do this.[8] For the future, desktop computer systems represent the most promising means of providing up-to-date information on drug costs, safety and efficacy.

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**Acknowledgements**

We are greatly indebted to the general practitioners who provided the information for this study and to Doreen Adams for data preparation. Financial support from the Scottish Home and Health Department is acknowledged.

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