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Improving cost-effectiveness of hypertension management at a community health centre

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Objectives. To describe the pattern of prescribing for hypertension at a community health centre (CHC) and to evaluate the impact of introducing treatment guidelines and restricting availability of less cost-effective antihypertensive drugs on prescribing patterns, costs of drug treatment and blood pressure (BP) control.

Design. Before/after intervention study.

Setting. Medium-sized CHC in the Cape Flats area of Cape Town.

Subjects. 1 084 hypertensive patients attending the CHC, who had at least two prescriptions for antihypertensive drugs during a 1-year period starting on 1 January 1992.

Interventions. 1. Implementation of stepped-care guidelines for hypertension, specifying treatment with more cost-effective drugs and minimising drug treatment. 2. Reducing availability for routine prescribing by CHC doctors of 10 less cost-effective antihypertensive drugs or drug combinations.

Outcome measures. 1. Mean number of drugs prescribed per patient. 2. Proportion of prescriptions for: each major class of antihypertensive drug; restricted availability and freely prescribable drugs; and more and less cost-effective drugs. 3. Mean monthly cost of drugs prescribed per patient. 4. Mean blood pressure and proportion of BP readings controlled (< 160/95 mmHg) or uncontrolled (≥ 160/95 mmHg).

Results. A mean of 1.7 active drugs was prescribed per patient per visit. The most frequently prescribed drugs were thiazide-like diuretics (44.8%), centrally acting agents (28.4%) and b-blockers (13.2%). Mean monthly drug costs per patient decreased significantly by R1.99 (24.2%) from R8.24 to R6.25 between the first and last prescription for each patient (exclusive of any reduction due to withdrawal of treatment). This was attributable to reduced prescribing of more expensive drugs withdrawn from routine use and a 51.1% increase in prescribing of the most cost-effective drugs. The overall annual cost-saving of the changes in prescribing for this CHC are estimated at R75 150. Blood pressure control did not change significantly.

Conclusion. The pattern of changes in prescribing and drug costs was consistent with a causal effect of the interventions. The study demonstrates the potential for improving cost-effectiveness of hypertension care in primary care in South Africa and the potential for research in this setting.

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The National Health Plan for South Africa announced that 'the primary health care approach is the underlying philosophy for the restructuring of the health system' and stressed the importance of the rational and appropriate use of resources. One mechanism suggested for addressing the growing problem of non-communicable disease in South Africa was to develop programmes for the cost-effective management of chronic diseases — for example, by promoting cost-effective therapy through peer and utilisation reviews, therapeutic guidelines and clinical audit.[1]

Hypertension is a major public health problem in South Africa. Community-based surveys have found age-adjusted prevalences of hypertension of 15 - 34%. Hypertension is common throughout South Africa and in all ethnic groups except perhaps blacks with traditional lifestyles in deep rural areas.[2,3]

Most patients with hypertension are treated in primary care settings. There are clear international[4,5] and South African[6] consensus guidelines describing best practice for the care of hypertensive patients. New guidelines from the Hypertension Society of Southern Africa for the management of hypertension in primary care have been published recently.[7]

These guidelines commonly encourage the use of well-established drugs like thiazide diuretics, reserpine and b-blockers as first-line treatment. There is more evidence from randomised trials of the efficacy of these drugs in reducing the occurrence of, and mortality from, stroke and heart disease,[8,9] compared with newer drugs like ACE inhibitors and calcium antagonists.

An estimated 60 - 90% of the treatment costs of hypertension are attributable to drugs.[10] Prices of antihypertensive drugs vary widely.[11] For example, in 1992 the costs to Cape Province day hospitals of hydrochlorothiazide and reserpine at typical doses were 12 and 6 cents per patient per month, respectively. ACE inhibitors and newer b-blockers cost up to R30 per patient per month, i.e. they are 250 - 500 times more expensive. A

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more recent comparison of tender, cost and dispensed retail prices confirms that these differentials persist in South Africa.[12]

Therefore, it is widely agreed that treatment with cheaper, well-established drugs is much more cost-effective.[10] Indeed, one proposal to increase the cost-effectiveness of hypertension treatment in South Africa argued for mass treatment using the cheapest drugs through low-cost outlets such as community health centres (CHCs), formerly called day hospitals.[13]

This background, together with the present context of severely limited resources for health care in South Africa, underlines the importance of research into interventions to improve the cost-effectiveness of prescribing. However, there has been relatively little such research worldwide, and almost none in South Africa. The only South African reference we found was an analysis of cost-savings and changes in blood pressure (BP) control following a change from nifedipine to other drugs in 30 hypertensive patients.[14]

We present a large prospective study of over 1 000 hypertensive patients from a Cape Town CHC. The aims were to describe the pattern of prescribing for hypertension and evaluate the impact of introducing treatment guidelines and reducing the availability of more expensive antihypertensives on: prescribing patterns, costs of drug treatment and BP control.

Methods

Subjects and setting

The setting, subjects, sampling technique and methods of data collection have been fully described in a previous paper.[15] Briefly, this was a before/after intervention study performed at Dr Abdurahman CHC in Athlone in the Cape Flats area of Cape Town. This is a medium-sized CHC, with a usual complement of four doctors, serving a largely coloured population.

The subjects were 1 098 of 3 147 hypertension patients attending the CHC during 1992. Fourteen of these patients who had collected fewer than two prescriptions during the study period were excluded from subsequent analysis.

Data collection

Hypertensive patients at this CHC were usually seen by clinic staff every 2 months, by a doctor once every 4 months (unless more frequent monitoring was clinically indicated, the patient asked for an appointment sooner or was referred by the primary care nurse), and by the primary care nurse in the interim. Changes in treatment occurred only during consultations with the doctor. Patients were given 4 weeks' supply of antihypertensive drugs at each visit, and collected repeat prescriptions between visits.

Drugs were dispensed from the hospital pharmacy. Hypertensive drugs prescribed were recorded by the second author (either during the consultation or retrospectively from pharmacy records) for the first 12 due (i.e. 4-weekly) prescriptions of selected patients starting from January 1992. Prescriptions were not always collected at exact 4-week intervals, and for a few patients the follow-up period extended into early 1993. Some patients were newly diagnosed as hypertensive during 1992. For these patients, data were collected on the number of due prescriptions left after subtraction of those that would have been written in the period prior to diagnosis. (For example, for a patient diagnosed in April, data were collected on their initial visit and the next 8 due prescriptions.)

The information used for analysis was as follows: (*i*) first and last recorded BP for each patient during the study period; (*ii*) name and dose of each antihypertensive drug from the first and last prescription collected by each patient during the study period; and (*iii*) total cost (in rand per month) of antihypertensive drugs for each prescription and for the first and last prescription collected by each patient during the study period.

BP was measured either by the primary care nurse or doctor. Costs of individual drugs were calculated by the CHC pharmacy and represented the mean costs of the drugs to the pharmacy in 1992.

Interventions

Treatment guidelines. In 1990, the Consultants' Committee at Groote Schuur Hospital (GSH) issued guidelines for the drug treatment of hypertension. These suggested a stepped-care approach in which the aim was to control BP with the least expensive treatments and the minimum number of drugs. The guidelines advised clinicians to try to reduce treatment (or withdraw it completely) in well-controlled patients. The recommended steps for responding to raised or poorly controlled BP were: (*i*) use a first-choice drug (amiloride co, hydrochlorothiazide, propranolol or reserpine); (*ii*) combine two first-choice drugs; (*iii*) add a vasodilator (hydralazine or verapamil); and (*iv*) add enalapril or captopril (in addition to the other drugs or in place of the vasodilator). Steps (*i*) - (*iii*) drugs were much cheaper than those in step (*iv*).

The guidelines were circulated to all CHCs in the Cape Town area early in 1991. In the middle of 1991, the second author issued doctors at Dr Abdurahman CHC with copies and asked them to implement the guidelines. The doctors agreed to change, whenever possible, to more cost-effective drugs when a change in medication was indicated as a result of poor control, patient preference or side-effects. Later in 1992, as confidence in the regimen increased, some patients with well-controlled BP and no other indications to alter therapy were changed to more cost-effective drugs. In all cases, treatment decisions were taken by the attending doctor, and treatment changed only where thought to be clinically justifiable.

Restrictions on drug availability. At various times during 1992, the local drugs committee withdrew ten relatively expensive antihypertensive drugs from routine use at the CHC. The drugs that were withdrawn were: (*i*) b-blockers (sotalol, metoprolol and nadolol); (*ii*) diuretic or diuretic combinations (indapamide, aldazide, chlortalidone and cyclopentathiazide/potassium chloride); (*iii*) centrally acting drugs, alone or in combination — clonidine, dehydroergocristine/clopamide/reserpine; and (*iv*) a calcium antagonist (diltiazem).

Analysis

Drugs were categorised in three different ways for analysis.

1. To describe prescribing patterns, individual drugs were assigned to eight different classes largely on the basis of the classification in the *South African Medicines Formulary*[16] (Table I).

2. Antihypertensive drugs were also categorised according to their availability to the CHC doctors: (*i*) 'CHC' drugs were freely prescribable by CHC doctors throughout the study period; (*ii*) 'consultant' drugs were three expensive antihypertensives (the ACE inhibitors, enalapril and captopril, and the calcium antagonist, nifedipine), which had been withdrawn from routine use by the local drug committee before the study began. Treatment with these drugs could only be initiated by consultants at secondary or tertiary levels of care. CHC doctors could continue to prescribe these drugs for patients transferred to their care for follow-up, and were free to change the dose or withdraw the treatment; and (*iii*) 'new consultant' drugs were ten antihypertensives (see above) withdrawn from routine use during the study period (prescriptions for these drugs were dispensed until supplies were exhausted and then other stepped-care drugs were substituted by the pharmacy after consultation with the doctor), and which became subject to the same prescribing restrictions as 'consultant' drugs.

Table I. Antihypertensive drug classes

1. ACE inhibitors, e.g. enalapril, captopril
2. b-blockers, e.g. propranolol, atenolol, metoprolol
3. Calcium antagonists, e.g. verapamil, nifedipine, diltiazem
4. Thiazide and thiazide-like diuretics, e.g. hydrochlorothiazide, hydroflumethazide, indapamide, cyclopenthiazide
5. Centrally acting drugs, e.g. reserpine, methyldopa
6. Vasodilators, e.g. hydralazine
7. a-blockers, e.g. prazosin
8. Other diuretics, e.g. spironolactone

The examples given are the drugs that were commonly prescribed during the study.

3. Finally, drugs from steps (*i*) to (*iii*) in the GSH guidelines were designated as cost-effective, compared with other drugs in step (*iv*) or others not included in the stepped-care protocol.

The mean number of drugs prescribed per visit and the proportions of different drug classes prescribed were determined by aggregating the prescriptions at the first and last visit for each patient during the study.

All costs were calculated as mean monthly cost of antihypertensive drugs per patient. Mean costs and the relative contribution of 'CHC', 'consultant' and 'new consultant' drugs were calculated for all patients collecting drugs at each of the 12 due prescriptions. The denominator was the number of patients collecting antihypertensive drugs at each due prescription. Patients on no hypertensive medication were excluded so that changes were independent of the withdrawal of treatment. Mean drug costs were also calculated for each patient's first and last prescription during the study period.

BP control was analysed by comparison of mean BP and proportion of patients controlled (< 160/95 mmHg) and uncontrolled (≥ 160/95 mmHg) from all patients' first and last BP measurements during the study period. Seventy-two patients who had had fewer than two BP measurements during the year were excluded.

Statistical analysis was performed using Epi-Info 6.0 database and statistical analysis software. The chi-squared test with Yates continuity correction was used to compare proportions. Paired *t*-tests were used to test for significant differences in the means of paired data.

Results

Prescribing patterns

A mean of 1.70 antihypertensive drugs was prescribed per visit (1.62 if patients on no treatment were included). Most prescriptions were for 1 (43.7%) or 2 (45%) drugs; 10.3% were for 3 drugs and 1% for 4 drugs. (For these analyses, each active antihypertensive agent within combination drugs has been counted as a separate drug.) There was no significant difference between the mean number of drugs prescribed per patient at the first (1.71) and last (1.70) prescription or in the proportions of patients on 1, 2, 3 or 4 drugs. There was a significant decrease from 1.67 to 1.57 drugs per patient between the first and last prescription if patients on no treatment were included (mean difference 0.10, 95% confidence interval 0.04 - 0.16 drugs per patient). This was due to an increase in the number of patients on no treatment between the first (6 patients, 0.6% of the total) and last prescription (77 patients, 7.1%).

Table II. Proportion of drug classes prescribed

Class of antihypertensive treatment	First and last prescription		First prescription		Last prescription	
	No. of prescriptions	%	No. of prescriptions	%	No. of prescriptions	%
ACE inhibitors	198	5.6	95	5.3	103	6.0
b-blockers	465	13.2	251	13.9	214	12.5
Calcium antagonists	169	4,8	81	4.5	88	5.2
Thiazide and thiazide-like diuretics	1 571	44.8	831	46.0	740	43.4
Centrally acting drugs	997	28.4	492	27.2	505	29.6
Vasodilators	70	2.0	22	1.2	48	2.8*
Other diuretics	29	0.8	12	0.7	2	0.1*
a-blockers	14	0.4	22	1.2	7	0.4*
Total	3 513	100.0	1 806	100.0	1 707	100.0

* Significant differences in proportions prescribed between first and last prescriptions (χ^2 test, $P < 0.05$).

The proportion of prescriptions for each of the main antihypertensive drug classes is shown in Table II. The commonest were thiazide and thiazide-like diuretics (44.8%), centrally acting drugs (28.4%) and b-blockers (13.2%).

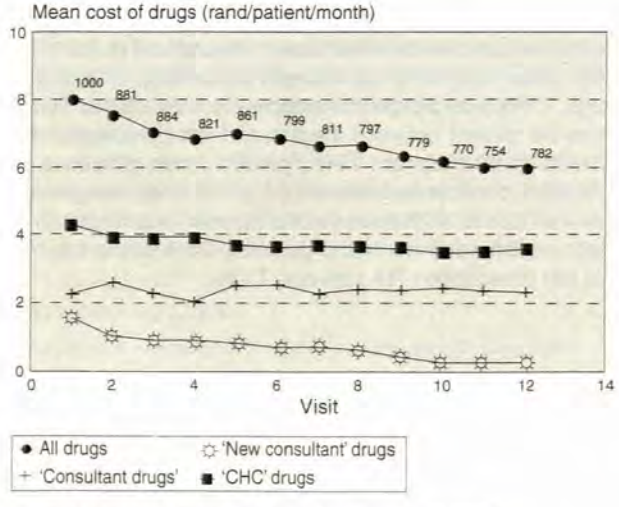
For patients on monotherapy the distribution was similar. The commonest agents were thiazide and thiazide-like diuretics (55.4%), followed by centrally acting drugs (17.8%), b-blockers (11.5%), ACE inhibitors (10.9%) and calcium antagonists (3.5%). Other drugs accounted for less than 1% of monotherapy prescriptions.

For patients on two different drugs nearly all (88.5%) were on a combination of a thiazide or thiazide-like diuretic and another drug. In 60.4% of cases the second drug was a centrally acting antihypertensive, in 19.5% a b-blocker, in 5.4% a calcium antagonist and in 3.2% an ACE inhibitor. The remaining patients (11.5%) were on other drug combinations.

There was no significant change in the proportion of prescriptions for the five most commonly prescribed classes of antihypertensive drug between the first and last prescription (Table II). Significant changes were confined to the most infrequently prescribed drugs.

Drug costs

The mean cost per patient at each due prescription is shown in Fig. 1, together with the contribution from 'CHC', 'consultant' and 'new consultant' drugs. The figures exclude patients who failed to collect medication at each visit, and also those who had been taken off hypertensive treatment. (The number of hypertensive patients on no treatment increased steadily from 6 at the first visit to 63 at the twelfth.)



Patients on no hypertensive treatment or defaulting at each visit have been excluded.
Numbers collecting prescriptions per visit are on the all drug costs line.

Fig. 1. Changes in drug costs by visit at Dr Abdurahman CHC.

The graph shows that mean drug costs per prescription steadily decreased due to a dramatic reduction in the proportion of costs attributable to 'new consultant' drugs and a smaller decrease for 'CHC' drugs. There was no change in the mean cost per prescription of 'consultant' drugs.

To explore the causes of this fall in drug costs further, prescribing patterns and costs of drugs were analysed at the first and last visit of 1 002 patients who were prescribed antihypertensive treatment at both visits. This revealed a statistically significant ($P < 0.001$) R1.99 (24.2%) decrease in mean costs per patient of all antihypertensive drugs prescribed, from R8.24 to R6.25 per patient per month. This was due to significant ($P < 0.001$) decreases in the mean costs per patient of R1.11 (76.0%) for 'new consultant' and R0.98 (22.8%) for 'CHC' drugs. The cost attributable to 'consultant' drugs increased non-significantly.

The reduction in costs attributable to 'new consultant' drugs was due to a reduced number of prescriptions from 296 to 107 between the first and last visits and a 43.8% reduction in the mean monthly cost of individual drugs prescribed from R4.95 to R2.78 per patient per month. The reduction in costs associated with 'CHC' drugs was due to a 32.8% fall in the mean cost of the individual drugs prescribed from R3.28 to R2.22 per patient per month, and occurred in spite of an increase in the number of prescriptions of these drugs from 1 314 to 1 480 between the first and last visits. The total number of prescriptions did not change significantly, though the mean cost per drug prescribed fell from R4.83 to R3.63 per patient per month. The number of prescriptions and mean costs per prescription of 'consultant' drugs did not change significantly.

The cause of the fall in the mean cost of individual 'CHC' drugs prescribed is shown in Table III. There was a significant increase in the prescribing of most of the more cost-effective drugs between the first and last visits. The proportion of all prescriptions for drugs from steps (*i*) to (*iii*) of the GSH guidelines increased by 51.1% from 40.3% to 60.9% of the total.

Table III. Prescribing of more and less cost-effective drugs at first and last prescription

	First visit		Last visit	
	No.	%	No.	%
'Step (*i*) drugs'				
Hydrochlorothiazide/ moduretic†	478	26.5	584	34.2*
Propranolol	13	0.7	24	1.4
Reserpine‡	158	8.7	309	18.1*
Total	649	35.9	917	53.7*
'Step (*iii*) drugs'				
Verapamil	57	3.2	74	4.3
Hydralazine	22	1.2	48	2.8*
Total	79	4.4	122	7.1*
All drugs				
Step (*i*) and (*iii*) drugs	728	40.3	1 039	60.9*
Other drugs	1 078	59.7	668	39.1*
Total active drugs prescribed	1 806		1 707	

* Significant difference in proportions of drugs prescribed between first and last prescriptions (c2 test; $P < 0.01$).
† Dyazide, a similar combination of hydrochlorothiazide and a potassium-sparing diuretic, was also commonly prescribed. However, it was more expensive than moduretic and was not included in the GSH guidelines, so has been excluded from this total.
‡ This total does not include reserpine where it was prescribed as the combination product 'rautrax' (reserpine + rauwolfia + KCl), as this is more expensive and is not included in the GSH guidelines.
Excludes 82 patients receiving no hypertensive drugs at their first or last prescription.

Blood pressure control

The mean systolic pressure at the first measurement was slightly lower (155.0 mmHg) than at the last measurement (156.2 mmHg). The pattern was reversed for diastolic pressure (88.8 v. 87.9 mmHg). None of these differences was statistically significant. There were also no significant differences between the proportion of patients controlled and uncontrolled at the first and last measurements.

Discussion

The study was based on a large sample of hypertensive patients followed prospectively. It provides more complete information on prescribing behaviour than has previously been reported in South Africa.

The most commonly prescribed drug classes at Dr Abdurahman CHC were similar to those found in previous studies.[17,18] The overall pattern of prescribing at this CHC accords well with recommendations for cost-effective prescribing, with over 85% of prescriptions being for thiazide or thiazide-like diuretics, centrally acting drugs and b-blockers.

There was a steady reduction in the mean cost per prescription for antihypertensive drugs during the study period and a statistically significant difference of R1.99 in the mean cost per patient of antihypertensive drugs at the first and last prescription. This was achieved without any apparent deterioration in BP control. The mean cost-savings per patient, demonstrated between the first and last prescription, would result in a saving of about R23.88 per patient per year if maintained over 12 months. If applied to all the hypertensive patients at Dr Abdurahman, this would save this CHC R75 150 per annum on drug costs for hypertensive treatment.

Further analysis suggested that the decrease was attributable mainly to the prescribing of cheaper drugs within drug classes, rather than switching between classes or a reduction in the number of drugs prescribed. The most marked changes occurred in costs attributable to drugs that were withdrawn from routine use during the study ('new consultant' drugs) and drugs that were wholly under the control of CHC doctors ('CHC' drugs). There was no decrease in costs attributable to existing consultant-only drugs.

Some of the weaknesses of the study have been commented on in more detail in the accompanying paper.[15] Lack of monitoring of the method of BP measurement has been acknowledged. However, we believe that the conclusion that the overall level of BP control was constant is justifiable, since there was no change in the method of measurement during the year and no reason to believe that there was selective bias operating between the first and last measurements. Follow-up was limited to a year, so the possibility of a delayed deterioration of BP control consequent on the changes in drug treatment cannot be excluded, though we think it is unlikely.

The study clearly has some limitations as an investigation of the cost-effectiveness of introducing treatment guidelines and restrictions on the availability of more expensive drugs. For example, data collection was limited to drug costs and level of BP control, and no data were collected on side-effect profiles, quality of life or costs of investigations associated with drug treatments. However, to investigate this properly requires randomised controlled trials, and was beyond the capabilities of our study design. There is also conflicting published evidence from randomised controlled trials about the side-effect profile and effect on quality of life of different antihypertensive drug classes, and the choice of drug treatment is therefore the subject of much debate.[19,20] Furthermore, during the study, changes in drug therapy were only maintained if clinically justified and side-effects following changes in drug treatment were actively sought by doctors at the CHC. Any occurrence of side-effects, even if unnoticed by the patient or limited to the patient's dislike of the new medication (with no symptoms or signs of known side-effects), was sufficient grounds to change medication. We therefore believe it is justifiable to evaluate these interventions in terms of their effect on drug costs and BP control.

It is not possible to infer causality from an uncontrolled study. However, the size of the cost-savings and the pattern of the changes in prescribing are highly suggestive of an effect of the guidelines and changed availability of drugs. The interventions were probably complementary and it is difficult to ascertain from the data which intervention had the greatest impact. However, the reduction in aggregated costs and mean costs per drug prescribed for the 'CHC' drugs must represent changes in prescribing behaviour independent of drug availability (since this was unchanged for these drugs).

The savings demonstrated in this study may be an underestimate for two reasons. Firstly patients who had had hypertensive treatment withdrawn were excluded from the analysis. Their number increased steadily through the year, so their inclusion would increase estimated cost-savings. However, in the absence of a control group, it is unclear to what extent withdrawal of treatment resulted from implementation of the GSH guidelines.

Secondly, the GSH guidelines were introduced in the middle of 1991, before monitoring of prescribing and drug costs began — although they were not fully implemented until January 1992 (D W R Lunt — personal observation). Any resulting reduction in prescribing costs in 1991 would not have been recorded in our study, and would have decreased the apparent effect of the guidelines measured during the study period.

In conclusion, this study suggests that significant savings in antihypertensive drug costs could be achieved in primary care in South Africa through the introduction of treatment guidelines and restriction of the availability of the most expensive drug treatments, while free access to a range of cheaper, but still effective, antihypertensive drugs was maintained. This evidence is especially welcome given the current debate about the effectiveness of guidelines and the difficulties of implementation.[21,22]

Further work is needed to evaluate the effectiveness of similar interventions for hypertension and for other common chronic conditions in other primary and secondary care settings in the public and private sectors.

The success of these interventions — the clinical guidelines were introduced voluntarily by the CHC doctors — illustrates the potential for family physicians to act as resource managers, one of the principles of family practice.[23]

Whether this sort of activity will become widespread in South Africa is questionable, given the lack of incentives. The CHC and the community it serves received no financial benefit from the more economical prescribing during this study. Perhaps one way to encourage more cost-effective prescribing is to learn from the UK experience with fundholding GPs[24] and to allow all or a proportion of savings from drug costs to be used to fund improvements in services and facilities of the institution making the savings.

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