Organisational factors in relation to control of blood pressure:
an observational study

Melanie Inkster, Alan Montgomery, Peter Donnan, Tom MacDonald, Frank Sullivan and Tom Fahey

ABSTRACT

Background
Studies show that 60–75% of treated patients with hypertension in general practice, still do not reach the recommended blood pressure targets of <150/90 mmHg.

Aim
To investigate aspects of hypertension management in relation to sociodemographic variables, antihypertensive drug treatment, and organisational factors in primary care.

Design of study
Observational study over 3 years.

Setting
Eight general practices in Tayside, UK.

Method
Participants were 560 randomly selected patients aged 40–79 years receiving treatment for hypertension. The outcome measurement was blood pressure control, expressed in binary form based on the British Hypertension Society audit standard of <150/90 mmHg.

Results
Of 536 eligible patients, 261 (49%) were defined as having inadequate blood pressure control at the end of the study period. No significant associations were discovered with sex, age, deprivation score and comorbidity. In those patients with inadequate control, 30% had no modifications to their drug treatment during the study period. Blood pressure control at the end of the study period was not associated with number of antihypertensive drugs taken or number of antihypertensive drug modifications. The mean number of clinician contacts was 11 (standard deviation = 8), and mean continuity in primary care was high, although this was not associated with improved blood pressure control. A higher proportion of hypertension-related consultations were associated with increased odds of having inadequate blood pressure control.

Conclusion
Achieving adequate blood pressure control continues to represent a substantial health problem in a significant proportion of the hypertensive population. Patient, physician and organisational elements play a role in ensuring effective delivery of hypertension care in the community.

Keywords
continuity of care; hypertension; physician-patient relations.

INTRODUCTION

Inadequate control of blood pressure results in an increased incidence of coronary artery disease, congestive heart failure, peripheral vascular disease and stroke.[1] The management of hypertension takes place for the most part in primary care.[2] Studies show that 60–75% of treated hypertensive patients do not reach the recommended target blood pressure of <150/90 mmHg.[3,4]

Inadequate control of blood pressure is likely to be due to a combination of factors relating to the patient, health professional and the healthcare system. Patient-related factors that are implicated in poor control include inadequate adherence to antihypertensive treatment.[5] Physician and organisational issues have come under increasing scrutiny. It has been shown that patients with inadequate control have frequent contact with healthcare professionals who appear reluctant to intensify drug treatment when blood pressure goals are not being reached.[6,8] Potential explanations relate to poor knowledge, clinical uncertainty and inadequate adherence to clinical practice guidelines.[7] Such observations have led commentators to characterise the multifactorial issues relating to inadequate management by health professionals

***M Inkster**, MSc, PhD, CSO research fellow; **P Donnan**, MSc, PhD, senior lecturer; **F Sullivan**, PhD, FRCGP, head of division; **T Fahey**, MSc, MD, MFPH, FRCGP, professor of primary care medicine, Tayside Centre for General Practice; **T MacDonald**, MD, FRCP, professor, Medicines Monitoring Unit (MEMO), University of Dundee, Dundee.*
***A Montgomery**, MSc, PhD, senior lecturer, Division of Primary Health Care, University of Bristol, Bristol.*

Address for correspondence
Tom Fahey, Professor of Primary Care Medicine, Tayside Centre for General Practice, Division of Community Health Sciences, University of Dundee, Kirsty Semple Way, Dundee DD2 4AD. E-mail: t.p.fahey@chs.dundee.ac.uk

Submitted: 9 August 2004; **Editor's response:** 29 October 2004; **final acceptance:** 9 March 2005.

How this fits in

Control of hypertension in the community is often inadequate, with a substantial proportion of patients failing to reach treatment goals. Inadequate control of blood pressure in the community seems to be related to patient, physician and organisational barriers. Half the patients in this study did not reach blood pressure treatment targets and a third of those patients had no drug modifications, evidence of 'clinical inertia'. Inadequate control is significantly associated with increased health professional contacts and hypertension-related consultations, although higher continuity of care is not associated with improved control.

associated with poor organisation of care as being due to 'clinical inertia'.[9]

Continuity of care is seen by many as a key element of modern general practice.[10] In the context of hypertension, continuity of care, which is a consistent and coherent approach to the management of hypertension that is responsive to a patient's changing needs, has been inadequately described.[11] The aim of this study was to investigate the relationship between the various patient, health professional and healthcare system factors, including continuity of care, that relate to the management of hypertension in a primary care setting.

METHOD

Eight general practices in Tayside participated in the study. Patients were identified as being hypertensive by means of a diagnostic code on the practices' computer records and if they were currently receiving treatment to lower their blood pressure. A random sample of 70 patients, stratifying by sex and age (40–79 years) in 10-year age bands, were obtained from each practice, giving a potential total of 560 patients. Sampling frequencies were related to a previous study on hypertension prevalence.[12]

Data concerning the process of care covering the period from 1 January 2000 to 31 July 2003 were collected.

Demographic variables including age, sex, and social deprivation on the Carstairs index and DepCat score were obtained.[13] Past medical history was collected along with pre-treatment blood pressure values and the time since diagnosis of hypertension.

The number and classes of antihypertensive drugs each patient was taking over the 3-year study period was recorded. Information on start and end dates of prescription drugs enabled us to calculate the number of drug modifications each patient had during the study period.

Drug modifications were subdivided into three categories:

- Changes: changing one class of drug for another or stopping a drug and replacing it with another from the same class;
- Intensifications: adding in a new drug or increasing a drug dosage;
- Diminutions: stopping a drug and not replacing it or decreasing a drug dosage.

Clinician contacts, both primary and secondary care, were recorded for each patient. For each consultation, the health professional seen, the reason for the consultation, and the location were noted. Any blood pressure readings and drug modifications were also collected.

Consultations in both primary and secondary care were further analysed to generate a continuity of care index, in relation to all conditions and hypertension alone. Continuity was measured using the usual provider continuity (UPC) index .[11] This represents the proportion of visits to the most often seen GP or practice nurse in primary care, and the proportion of visits to a consultant in secondary care. A value close to 1 would mean that a patient was seen by the same health professional for the majority of their consultations.

A hypertension case-mix index for both primary and secondary care consultations was generated by calculating the proportion of hypertension consultations a patient had in relation to all their consultations in primary and secondary care, respectively. This index is measured on a scale of 0–1; a value of 1 signifying that an individual was seen exclusively for hypertension rather than any other conditions.

Previous data indicates that 25% of hypertensive patients are prescribed three or more cardiovascular drugs.[14] Adequate blood pressure control (<150/90 mmHg) in this group of patients was 36% compared with 17% among patients prescribed fewer drugs.[14] With 80% power and 5% two-sided α, 224 patients would be required to detect a difference of this magnitude between those prescribed <3 and ≥3 cardiovascular drugs. As patients were sampled by practice, an inflation factor of 2.35, based on an intra-class correlation coefficient of 0.04 to allow for clustering,[15] meant that a total of 526 patients were required. To allow for excluded patients, we sampled 70 patients from eight practices, giving a potential total of 560.

The principal outcome was blood pressure control, calculated as a mean of one to three most recent blood pressure readings. Blood pressure control was expressed as a binary outcome, based on the Third Working Party British Hypertension Society audit standard of <150/90 mmHg.[16] Odds ratios (ORs) and 95% confidence intervals (CIs) were used to investigate the magnitude of the association

between each explanatory variable and the outcome of blood pressure control. Multivariable logistic regression models were then fitted to identify explanatory variables independently associated with blood pressure control. In all regression models adjustments were made for age category, number of comorbidities and clustering effects by practice. Data was managed and analysed using Stata 8.0 Statistical Software.

RESULTS

We collected data on 560 patients from eight practices across Tayside. Six (1%) of these patients had no recorded blood pressure readings, 16 (3%) were taking part in clinical trials, and two (0.4%) were on no medication during the study period, and were excluded from further analysis.

Of the remaining 536 patients, 275 (51%) were defined as having blood pressure control at the end of the study period. Blood pressure control was based on the average of three blood pressure readings in 227 (42%), two readings in 149 (28%) and one reading in 160 (30%) patients.

A substantial proportion of patients, 212 (40%) were in the least affluent deprivation categories (5–6). Just over half, 286 (53%) did not have a concurrent comorbidity recorded, whereas 81 (15%) had two or more. The most prevalent comorbidities were angina (15.9%) and diabetes mellitus type 2 (20%). No significant associations were discovered between blood pressure control and sex, age, deprivation scores, length of time taking blood pressure treatment, or comorbidity (Table 1).

Over three-quarters of patients, 411 (77%) were prescribed more than one antihypertensive drug. Diuretics (*n* = 328 [61%]) were the most commonly prescribed followed by ACE inhibitors (*n* = 259 [48%]). In addition to antihypertensive medication, 168 (31%) patients were prescribed lipid-lowering treatment and 170 (32%) were prescribed aspirin. A substantial minority of patients (*n* = 45 [8%]) were prescribed other non-steroidal anti-inflammatory drugs.

In terms of the primary outcome measure, being prescribed three or more blood pressure lowering drugs was not associated with blood pressure control (adjusted OR = 1.31, 95% CI = 0.96 to 1.79). Just under one-third of patients (*n* = 163 [30%]) had no drug modifications during the 3-year study period (Table 2). There was no association between any drug modification and blood pressure control, (adjusted OR = 1.38, 95% CI = 0.92 to 2.07).

Approximately a quarter of patients had a drug change, (*n* = 152 [28%]) while 361 (67%) had at least one drug intensification. There was a significant association between a single intensification and worse blood pressure control (adjusted OR = 1.74, 95% CI = 1.04 to 2.90) (Table 2). Drug diminutions occurred in 162 (30%) individuals and were not associated with improved control.

Descriptive statistics for clinician contacts, continuity of care and hypertension case-mix index are presented in Table 3. Over the 3-year period, the average number of hypertension-related primary care contacts for patients was 11, (standard deviation [sd] = 8). Eight per cent (*n* = 41) of patients attended the secondary care hypertension clinic at least once during the 3-year study period and they were seen on average much less frequently (3 occasions [sd = 2]). Mean continuity, as measured by the UPC index, showed that two-thirds (0.65 [sd = 0.22]) of all hypertension-related primary care consultations were carried out by the same health professional. Continuity in secondary care was substantially lower (0.25 [sd = 0.34]) (Table 3). Lastly, as a proportion of all consultations during the 3-year study period, management of hypertension accounted for just under half the consultations in primary care (0.43 [sd = 0.24]) and secondary care (0.51 [sd = 0.32]).

Table 1. Blood pressure control and demographic characteristics.

Demographic	Blood pressure uncontrolled *n* (%)	Blood pressure controlled *n* (%)	Odds ratio	95% CI
Sex				
Male	120 (48)	131 (52)	1	
Female	141 (49)	144 (51)	1.06	0.76 to 1.50
Age in years				
40–49	18 (58)	13 (42)	1	
50–59	41 (51)	40 (49)	0.74	0.32 to 1.72
60–69	78 (41)	111 (59)	0.51	0.23 to 1.10
70–79	124 (53)	111 (47)	0.81	0.38 to 1.72
Deprivation category				
1	15 (47)	17 (53)	1	
2	39 (49)	41 (51)	1.07	0.47 to 2.46
3	43 (55)	35 (45)	1.39	0.61 to 3.20
4	67 (51)	65 (49)	1.17	0.54 to 2.54
5	12 (52)	11 (48)	1.24	0.42 to 3.66
6	84 (44)	105 (56)	0.91	0.43 to 1.93
Years since diagnosis				
0–4	44 (42)	60 (58)	1	
5–9	66 (47)	72 (53)	1.25	0.74 to 2.09
10–14	70 (55)	58 (45)	1.65	0.97 to 2.79
≥15	77 (48)	82 (52)	1.28	0.78 to 2.11
Number of comorbidities				
0	140 (49)	146 (51)	1	
1	91 (54)	78 (46)	1.22	0.83 to 1.78
≥2	30 (37)	51 (63)	0.61	0.37 to 1.02

Blood pressure control = <150/90 mmHg. CI = confidence interval. Odds ratio >1 = association with worse blood pressure control; <1 = association with improved blood pressure control.

Table 2. Crude and adjusted associations between blood pressure control and medication usage.

Variable	Blood pressure uncontrolled *n* (%)	Blood pressure controlled *n* (%)	Crude odds ratio	95% CI	Adjusted odds ratio[a]	95% CI
Medication total						
1	61 (49)	64 (51)	1			
2	106 (46)	123 (54)	0.90	0.58 to 1.40	0.94	0.57 to 1.55
≥3	94 (52)	88 (48)	1.12	0.71 to 1.77	1.26	0.78 to 2.03
Drug modifications						
0	71 (44)	92 (56)	1			
1	57 (55)	44 (45)	1.68	1.01 to 2.78	1.68	1.01 to 2.79
2	40 (47)	45 (53)	1.15	0.68 to 1.95	1.17	0.66 to 2.06
≥3	93 (50)	94 (50)	1.28	0.84 to 1.96	1.33	0.89 to 1.99
Drug changes						
0	180 (47)	204 (53)	1			
1	59 (54)	50 (46)	1.34	0.87 to 2.05	1.38	0.98 to 1.95
≥2	22 (51)	21 (49)	1.19	0.63 to 2.23	1.11	0.62 to 2.00
Drug intensifications						
0	77 (44)	98 (56)	1			
1	64 (54)	53 (46)	1.54	0.96 to 2.47	1.57	1.22 to 2.03
2	42 (48)	45 (52)	1.19	0.71 to 1.99	1.20	0.78 to 1.82
≥3	78 (50)	79 (50)	1.26	0.81 to 1.94	1.32	0.91 to 1.92
Drug diminutions						
0	180 (48)	194 (52)	1			
1	52 (47)	56 (53)	1.00	0.66 to 1.54	1.06	0.66 to 1.70
≥2	29 (54)	25 (46)	1.25	0.70 to 2.22	1.26	0.71 to 2.26

Blood pressure control = <150/90 mmHg. CI = confidence interval. Odds ratio >1 = association with worse blood pressure control; <1 = association with improved blood pressure control. [a]Adjusted for age band and number of comorbidities.

- *Drug modifications are classed as the total of drug changes and drug intensifications combined.*
- *Drug changes are classed as changing one class of drug for another or stopping a drug and replacing it with another from the same class.*
- *Drug intensifications are classed as adding in a new drug or increasing a drug dosage.*
- *Drug diminutions are classed as stopping a drug and not replacing it or decreasing a drug dosage.*

Table 3. Descriptive statistics for clinician contacts, continuity of care and hypertension case-mix index of care.

	Primary care				Secondary care			
	Blood pressure uncontrolled (*n* = 261; 49%)		Blood pressure controlled (*n* = 275; 51%)		Blood pressure uncontrolled (*n* = 21; 51%)		Blood pressure controlled (*n* = 20; 49%)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Clinician contacts	12	7.9	10	7.6	3	2.2	3	2.0
Continuity of care	0.65	0.21	0.66	0.23	0.27	0.39	0.23	0.29
Hypertension case-mix index	0.47	0.23	0.40	0.24	0.61	0.35	0.40	0.24

SD = standard deviation. Continuity was measured using the usual provider continuity index on a scale of 0–1. Values closer to 1 represent higher continuity. Hypertension case-mix index refers to the proportion of hypertension consultations in relation to all consultations, on a scale of 0–1. Values closer to 1 represent a patient being seen for increasing hypertension-related consultations.

From a primary care perspective, poor blood pressure control is associated with an increasing number of clinician contacts during the 3-year study period ($\chi^2 = 5.39$, $P = 0.02$) (Table 4). Lastly, a higher hypertension case-mix index is significantly associated with poor control ($\chi^2 = 10.86$, $P = 0.001$) (Table 4). Adjusting for drug modifications made no difference to the magnitude and trend of the ORs for episodes, continuity and hypertension case-mix index. No clear pattern emerged in secondary care for these three explanatory variables, principally due to the smaller number of patients being seen.

DISCUSSION

Summary of main findings

This study shows that half the patients with

Table 4. Crude and adjusted associations between blood pressure control and clinician contacts, continuity of care and hypertension case-mix index.

Variable	Range	Blood pressure uncontrolled *n* (%)	Blood pressure controlled *n* (%)	Crude odds ratio	95% CI	Adjusted odds ratio[a]	95% CI
Clinician contacts							
Primary care	1–4	50 (43)	65 (57)	1			
	5–9	71 (46)	84 (54)	1.09	0.68 to 1.79	1.08	0.75 to 1.57
	10–19	91 (49)	95 (51)	1.25	0.78 to 1.99	1.20	0.89 to 1.62
	≥20	49 (61)	31 (39)	2.05	1.14 to 3.72	1.93	1.05 to 3.56
Secondary care	1–2	10 (53)	9 (47)	1			
	3–4	3 (38)	5 (62)	0.54	0.09 to 3.08	0.67	0.14 to 3.29
	≥5	8 (57)	6 (43)	1.20	0.29 to 4.93	2.28	0.39 to 13.19
Continuity of care							
Primary care	0–0.24	4 (31)	9 (69)	1			
	0.25–0.49	44 (51)	43 (49)	2.30	0.65 to 8.18	2.56	1.14 to 5.76
	0.5–0.74	130 (51)	123 (49)	2.38	0.71 to 7.98	2.51	0.82 to 7.68
	0.75–1.0	83 (45)	100 (55)	1.87	0.55 to 6.32	2.02	0.81 to 5.05
Secondary care	0	12 (55)	10 (45)	1			
	0.01–0.99	5 (36)	9 (64)	0.46	0.11 to 1.92	0.88	0.17 to 4.44
	1	4 (80)	1 (20)	3.33	0.29 to 38.29	2.24	0.07 to 73.95
Hypertension case-mix index							
Primary care	0–0.24	47 (36)	82 (64)	1			
	0.25–0.49	93 (50)	94 (50)	1.73	1.09 to 2.74	1.67	1.29 to 2.17
	0.5–0.74	88 (53)	77 (47)	1.99	1.24 to 3.22	1.91	1.26 to 2.92
	0.75–1.0	33 (60)	22 (40)	2.62	1.35 to 5.09	2.55	1.08 to 6.01
Secondary care	0–0.24	4 (40)	6 (60)	1			
	0.25–0.49	5 (45)	6 (55)	1.25	0.21 to 7.41	1.20	0.09 to 15.92
	0.5–0.74	2 (25)	6 (75)	0.50	0.06 to 4.19	0.12	0.01 to 2.13
	0.75–1.0	10 (83)	2 (17)	7.50	0.78 to 72.10	10.67	0.88 to 129.17

Continuity was measured using the usual provider continuity index on a scale of 0–1. Values closer to 1 represent higher continuity. Hypertension case-mix index refers to the proportion of hypertension consultations in relation to all consultations, on a scale of 0–1. Values closer to 1 represent a patient being seen for increasing hypertension-related consultations. CI = confidence interval. Odds ratio >1 = association with worse blood pressure control; <1 = association with improved blood pressure control. [a]Adjusted for age band and number of comorbidities.

hypertension do not meet blood pressure treatment goals. This finding is the same in all subgroups, irrespective of sex, age, deprivation status, years since diagnosis and number of comorbidities (Table 1). These results are similar to previous studies that show a substantial proportion of patients with hypertension do not meet treatment goals, although different blood pressure levels have been used so direct comparison is difficult.[4,17,18] Greater numbers of individuals were taking two or more blood pressure lowering agents when compared to a recent study in the UK (Table 2).[14] Nevertheless, increasing number of drugs was not associated with improved control. A third of patients with inadequate control did not have any drug modification during 3 years of monitoring (Table 2). This is consistent with evidence of clinical inertia — where no therapeutic changes are made in a patient with inadequately controlled hypertension.[8,9,19] However, increasing modifications and intensifications were not associated with improved blood pressure control, illustrating that inadequate control is likely to be multifactorial, with other factors such as inaccurate measurement, poor adherence to antihypertensive drugs and variable individual response to treatment, likely to exert an important influence.[1,20]

Monitoring and follow up of patients with hypertension has important implications in terms of health service provision and chronic disease management. Monitoring of patients is time-consuming, with on average 11 visits over a 3-year period. Inadequate control is significantly associated with a higher number of clinician contacts and an increasing proportion of hypertension-related visits (Table 4); this is likely to be a marker of inadequate control whereby a patient is being monitored and

treated but treatment goals are not being reached. Lastly, provider continuity, although higher in primary care when compared to secondary care, was not associated with better control of blood pressure in patients (Table 4).

Comparison with existing literature

These findings show that inadequate control of hypertension is not attributable to a single identifiable cause. Clinical inertia remains an important issue, and has been associated with different health professional-related factors: overestimation of care provided; use of 'soft' reasons to avoid intensification of therapy; and lack of education, training, and practice organisation aimed at achieving therapeutic goals.[9] Other studies have confirmed that substantial physician-related barriers to the effective management of hypertension remain, principally not treating to target and not intensifying drug treatments while continuing to recall patients when they have not reached treatment goals.[6–8,21] Furthermore, patient-related factors, such as poor adherence to therapy and inadequate practice organisation, are likely to interact with physician inertia. There is some evidence that poor healthcare system organisation, inadequate adherence and physician-related barriers occur in tandem.[5,8]

Continuity is a distinguishing feature of primary care.[10] Continuity has three separate elements: information, management, and relationship with patients.[11] Despite its apparent importance, only one previous study (46 patients in one healthcare centre) has examined the impact of continuity on the control of hypertension.[22] Higher continuity was associated with a non-significant trend in terms of increased healthcare contacts and improved blood pressure control.[22] The findings of the current study are discordant with these findings. In terms of hypertension management, although continuity was high, inadequate control persisted, suggesting that providers of care were failing to respond to the changing needs and requirements of patients.[11] Recent studies in diabetes care also found no association between continuity and diabetes monitoring.[23] It seems that further evidence is needed to demonstrate the added value of continuity in the context of chronic disease management in general and hypertension control in particular.

Limitations of the study

There are several limitations with this study. Data collection was retrospective while follow up was prospective, potentially producing information bias. Medical practices were invited to participate, so those that agreed may represent practices that have a prior interest in hypertension and its management. Measurement and definition of continuity is complex, relating to several dimensions of care — informational, longitudinal and interpersonal. The UPC index relates primarily to the longitudinal aspect of care and does not reflect the informational and interpersonal aspects of care.[11] Lastly, 'office' measurement of blood pressure by doctors produces systematically higher readings than self-measurement or measurement by nurses.[24] We adopted recorded blood pressure measurement as the most practical measurement; it also is the measurement on which most treatment decisions are based.

It can be argued that dichotomising blood pressure goals into 'success' or 'failure' does not adequately describe the complexity of treating patients with hypertension. For instance, if a person is taking several antihypertensive drugs, there may be a stage when the additional benefits of blood pressure lowering are offset by problems with side effects. In some of the patients who have not met treatment goals in this study, this issue may have arisen. Furthermore, even in randomised trials of antihypertensive drugs where monitoring and intensification of treatment is substantial and strongly protocol-driven, blood pressure goals, particularly in terms of systolic blood pressure, are frequently not met. For example, in antihypertensive drug trials 90% of patients meet a diastolic blood pressure target of <90 mmHg but only 50% of patients meet a systolic blood pressure target of <140 mmHg.[25] More appropriate targets may relate to lowering blood pressure by 10–12/5–7 mmHg below initial blood pressure reading. However, it should be noted that initial blood pressure reading was adjusted for in all analyses and that adequacy of control of blood pressure did not differ across the different strata of initial blood pressure readings (data not shown but available from authors). Lastly, there may be a tension for GPs in trying to align public health priorities — meeting quality indicator standards for hypertension treatment goals, with individual priorities — the trade-off concerning intensification of treatment to meet treatment goals with increasing probability of suffering side effects.

Implications for further research

Medical practice variation, particularly in terms of delivery of care, remains a pressing issue.[26] This study shows that more work is needed to unravel the relationship between the process of hypertension care in terms of patient, physician and organisation-related factors and the subsequent clinical outcome of blood pressure control. Until this is done, the continuing situation of inadequate control and speculation concerning causes — improper

measurement, poor adherence to therapy, concurrent use of antagonising drugs, failure to implement non-pharmacological therapies or inadequate control — will continue.[27] With increasing recognition that hypertension, like many other chronic medical conditions, requires attention in terms of organisation and delivery of care, new models have been proposed.[28] The chronic care model characterised by an organised system of care, supporting self-management, and an effective delivery system is consistent with evidence from randomised trials showing that a system of registration, recall and regular review is likely to promote improved blood pressure control.[29] More evidence is needed to evaluate newer forms of hypertension care, including decision support systems, patient self-monitoring and treatment and educational systems. One thing is certain, clinical practice guidelines, are going to continue to fail to influence clinical practice, unless their recommendations are augmented with systems of care addressing issues of organisation, delivery, self-management, decision support and information systems.[29]

Achieving adequate blood pressure control continues to represent a major public health problem in a significant proportion of the hypertensive population. Although clinical inertia remains an important barrier to control, no single factor is likely to provide an adequate explanation. Improvement in blood pressure control will require a multifactorial solution incorporating patient, physician and organisational elements to ensure effective delivery of hypertension care in the community.

Funding body

This study was funded through an MRC HSRC Research Initiation Award (02/BA1005) and by an EastRen research bursary award (532-01)

Ethics committee

The study was approved by the Tayside Regional Ethics Committee (152/02)

Competing interests

Tom M MacDonald has received honorariums for lectures and advisory boards in the last year from Pfizer, Roche, Speedel, Medeus, Novartis and Sankyo. All other authors have no conflict of interest to declare

Acknowledgements

We would like to thank the eight participating Tayside general practices for their help in carrying out this study.

REFERENCES

1. Mulrow CD. *Evidence-based hypertension.* London: BMJ Books, 2001.
2. McCormick A, Fleming D, Charlton J. *Morbidity statistics from general practice. Fourth national study, 1991–1992.* London: HMSO, 1995. http://www.statistics.gov.uk/downloads/theme_health/MB5No3.pdf (accessed 3 Nov 2005).
3. Hyman DJ, Pavlik VN. Characteristics of patients with uncontrolled hypertension in the United States [see comments]. *N Engl J Med* 2001; **345:** 479–486.
4. Wolf-Maier K, Cooper RS, Kramer H, *et al.* Hypertension treatment and control in five European countries, Canada, and the United States. *Hypertension* 2004; **43:** 10–17.
5. Shea S, Misra D, Ehrlich M, *et al.* Predisposing factors for severe, uncontrolled hypertension in an inner-city minority population. *N Engl J Med* 1992; **327:** 776–781.
6. Berlowitz D, Ash A, Hickey E, *et al.* Inadequate management of blood pressure in a hypertensive population. *N Engl J Med* 1998; **339:** 1957–1963.
7. Frijling B, Spies T, Lobo C, *et al.* Blood pressure control in treated hypertensive patients: clinical performance of general practitioners. *Br J Gen Pract* 2001; **51:** 9–14.
8. Oliveria SA, Lapuerta P, McCarthy BD. Physician-related barriers to the effective management of uncontrolled hypertension. *Arch Intern Med* 2002; **162:** 413–420.
9. Phillips L, Branch W, Cook C, *et al.* Clinical inertia. *Ann Intern Med* 2001; **135:** 825–834.
10. Freeman GK, Olesen F, Hjortdahl P. Continuity of care: an essential element of modern general practice? *Fam Pract* 2003; **20:** 623–637.
11. Haggerty JL, Reid RJ, Freeman GK, *et al.* Continuity of care: a multidisciplinary review. *BMJ* 2003; **327:** 1219–1221.
12. Colhoun HM, Dong W, Poulter NR. Blood pressure screening, management and control in England: results from the health survey for England 1994. *J Hypertens* 1998; **16(6):** 747–752.
13. Carstairs V, Morris R. *Deprivation and health in Scotland.* Aberdeen: Aberdeen University Press, 1991.
14. Montgomery AA, Fahey T, Peters TJ, *et al.* Evaluation of a computer-based clinical decision support system and chart guidelines in the management of hypertension in primary care: a randomised controlled trial. *BMJ* 2000; **320:** 686–690.
15. Montgomery AA, Fahey T, Peters TJ. A factorial randomised controlled trial of decision analysis and an information video plus leaflet for newly diagnosed hypertensive patients. *Br J Gen Pract* 2003; **53:** 446–453.
16. Ramsay LE, Williams B, Johnston G, *et al.* Guidelines for the management of hypertension: report of the third working party of the British Hypertension Society. *J Hum Hypertens* 1999; **13:** 569–592.
17. Prencipe M, Casini A, Santini M, *et al.* Prevalence, awareness, treatment and control of hypertension in the elderly: results from a population survey. *J Hum Hypertension* 2000; **14:** 825–830.
18. Kearney P, Whelton M, Reynolds K, *et al.* Worldwide prevalance of hypertension: a systematic review. *J Hypertension* 2004; **22:** 11–19.
19. O'Connor P. Overcome clinical inertia to control systolic blood pressure. *Arch Intern Med* 2003; **163:** 2677–2678.
20. Deary AJ, Schumann AL, Murfet H, *et al.* Double-blind, placebo-controlled crossover comparison of five classes of antihypertensive drugs. *J Hypertension* 2002; **20:** 771–777.
21. Asch S, Kerr E, Lapuerta P, *et al.* A new approach for measuring quality of care for women with hypertension. *Arch Intern Med* 2001; **161:** 1329–1335.
22. Phillips D, Shear C. Provider continuity and control of hypertension. *J Fam Pract* 1984; **19:** 793–797.
23. Gill JM, Mainous AG III, Diamond JJ, Lenhard MJ. Impact of provider continuity on quality of care for persons with diabetes mellitus. *Ann Fam Med* 2003; **1:** 162–170.
24. Little P, Barnett J, Barnsley L, *et al.* Comparison of agreement between different measures of blood pressure in primary care and daytime ambulatory blood pressure. *BMJ* 2002; **325:** 254–259.
25. Mancia G, Grassi G. Systolic and diastolic blood pressure control in antihypertensive drug trials. *J Hypertens* 2002; **20:** 1461–1464.
26. Wennberg JE. Unwarranted variations in healthcare delivery: implications for academic medical centres. *BMJ* 2002; **325:** 961–964.
27. Burnier M. Blood pressure control and the implementation of guidelines in clinical practice: can we fill the gap? *J Hypertens* 2002; **20:** 1251–1253.
28. Lewis R, Dixon J. Rethinking management of chronic diseases. *BMJ* 2004; **328:** 220–222.
29. Fahey T, Schroeder K, Ebrahim S. Educational and organisational inventerventions used to improve the management of hypertension in primary care: a systematic review. *Br J Gen Pract* 2005; **55:** 875–882.