Original Research

Do family physicians need medical assistants to detect and manage hypertension?

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To test a new approach to detecting and managing hypertension, 34 family practices in southwestern Ontario that comprised 32 124 patients aged 20 to 65 years were randomly assigned in a 5-year study to either undertake a system of care in which a medical assistant oversaw screening and attended to education, compliance and follow-up (experimental group) or continue their usual practices (control group). The 17 physicians in the experimental practices (15 659 patients) were matched with the 17 in the control practices (16 465 patients) according to size of the community, sex, level of practice activity and length of time in practice. Hypertension was defined as at least two diastolic blood pressure readings over 90 mm Hg. More patients in the experimental group than in the control group were screened at least once (91% v. 80%); the former were more likely to have lower systolic blood pressure ($p < 0.02$), to be compliant ($p < 0.05$) and to be very satisfied with care ($p < 0.01$). There were no significant differences between the two groups in the rates of illness and death due to cardiovascular disease for all patients or for hypertensive patients. The unassisted family physician can provide effective care for hypertensive patients. However, minor modifications in the physician's practices can improve care.

Essai d'une manière nouvelle de dépister et de traiter l'hypertension artérielle. On recrute 34 clientèles de médecine générale du sud-ouest de l'Ontario. Dans certaines de celles-ci, désignées au hasard, on confie pendant 5 ans à une infirmière spécialement formée à cet effet le dépistage, l'instruction, la docilité et le suivi des personnes hypertendues: c'est le groupe expérimental (15 659 sujets). Les autres clientèles, qui continuent comme devant, forment le groupe témoin (16 465 sujets). Les sujets sont âgés de 20 à 65 ans. Les médecins de ces deux groupes, au nombre de 17 dans chacun, sont appariés quant à l'importance de l'agglomération, au sexe, au nombre de consultations par semaine et à la durée de leur exercice de la médecine. L'hypertension artérielle signifie ici une pression diastolique dépassant 90 mm Hg à au moins deux reprises. Les sujets du groupe expérimental viennent plus nombreux au dépistage (91%) que les témoins (80%) et tendent à montrer une pression systolique plus basse ($p < 0,02$), à être plus dociles à prendre les médicamants prescrits ($p < 0,05$) et à se dire très satisfaits du traitement ($p < 0,01$). Mais les deux groupes ne diffèrent pas significativement quant aux taux de morbidité et de mortalité par maladies cardio-vasculaires, ni pour l'ensemble des sujets, ni pour les sujets seuls hypertendus. Si le médecin généraliste est donc en mesure de bien traiter ceux-ci par ses propres moyens, il peut faire encore mieux grâce à certaines petites modifications de sa manière d'exercer.

A current critical issue for every health care system is how best to detect and care for the increasing number of hypertensive patients. Criticisms of the approaches existing in the 1970s were widespread in the United States, Canada and Great Britain.[1-3] In Canada, as elsewhere, the main criticisms were that physicians had no organized approach to detecting hypertension, often prescribed inadequate therapy, paid little attention to compliance and did not systematically follow up patients.

To test whether a strengthened family practice

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would be more effective, we designed a system that would respond to each of the main criticisms. The system included the following components.

- A case-finding strategy in which blood pressure was regularly measured in patients attending the office for any reason, with an outreach strategy for patients not attending the office.
- The encouraged use of a stepped-care protocol for all patients with diastolic blood pressure over 105 mm Hg.
- Attention to compliance-enhancing techniques.
- An organized follow-up strategy, with reminders to those defaulting.
- Use of specially trained medical assistants to help the physician carry out the preceding four strategies. The system combined screening and management strategies, each of which had been shown to be effective separately.[4,5] The system was evaluated by means of a randomized controlled trial.

We hypothesized that practices using our system, when compared over 5 years with control practices, would have higher rates of case finding, greater control of hypertension, a higher rate of compliance with treatment and lower rates of illness and death due to stroke, myocardial infarction, congestive heart failure and renal failure. The target for the screening strategy was to record blood pressure at least once for 95% of the practice population and twice for 75% of the practice population.

The effectiveness of the management strategy alone was assessed in patients identified as hypertensive before the study. We hypothesized that such patients in the experimental group would be more compliant with therapy and more likely to have their hypertension under control and, therefore, be less likely to suffer illness or death from hypertension-related disease than those in the control group.

Methods

In 1977 all 178 family physicians within a 65-km radius of London, Ont., were invited to participate in a 5-year study (1978–82) of a new approach to hypertension management; 87 expressed interest. Thirty-four physicians who could be pair-matched for location (population of community less than 10 000 or 10 000 or more), sex of physician, level of practice activity (less than 100 or 100 or more office patients per week) and length of time in practice (less than 5 years or 5 years or more) were chosen to participate.

One practice in each matched pair was randomly allocated by a flip of a coin to either the experimental or the control group. Physicians in the experimental group chose nurses to receive special training as medical assistants. Each assistant worked with the physician for approximately 11 hours per week implementing the management system and collecting data for the evaluation. In the control practices the physicians maintained their usual approach to hypertension detection and management, with no extra assistance. Evaluation data were collected by a research assistant. All physicians were in full-time community-based practices that accepted fee-for-service payments under the Ontario Health Insurance Plan.

The original estimates of sample size were calculated to ensure an adequate sample in the subgroup used to test the management strategy alone. We needed enough hypertensive patients to detect a decrease in the 5-year stroke rate from 3% to 1% with power of 80% (two-tailed $\alpha = 0.05$), while taking into account that randomization had been done by group.[6]

Medical assistants' activities

To detect new cases of hypertension, the medical assistant reviewed the charts of all patients attending the office, tagging them as either no recorded diastolic blood pressure in the previous 2 years or a previous blood pressure reading of more than 90 mm Hg. The tag served as a reminder to the physician and office staff that the patient should have his or her blood pressure measured during the visit. At the end of the day all charts with a newly recorded blood pressure were marked with a small dot, colour coded by year, to facilitate future identification. An outreach program was also implemented in the 17 experimental practices. In 1980 a postcard was sent to patients in the study who were over 40 years of age and who had not had their blood pressure recorded since Jan. 1, 1977; they were invited to "drop in" to the physician's office to have their blood pressure checked by the medical assistant at no charge. Of the 1678 patients contacted 520 (31%) visited the physician's office and had their blood pressure measured.

The management strategy was a collaborative effort by the physician and the medical assistant. It involved counselling sessions by the assistant with emphasis on patient education, discussion of patients' problems, regular follow-up visits and application of compliance-enhancing maneuvers such as tailoring and reminders. The assistant monitored whether follow-up appointments were made and kept, and ensured that second blood pressure measurements were done in patients with elevated blood pressure readings. On most return visits patients were seen by both the physician and the assistant, but some patients were monitored with extra visits to the assistant only.

For follow-up each physician and medical assistant worked out their own specific procedure. Most experimental practices set up a "tickler" file system. For each hypertensive patient an index card was filed by the month the next visit was due. As each patient attended, his or her card was advanced to the month of the next visit. At the end of the month the cards remaining were reviewed, and patients who had not visited or rebooked were

contacted. Several assistants performed a similar task using a loose-leaf booklet.

Data collection

The data were collected in the same manner for both the experimental and control practices. The medical assistants (experimental practices) and the research assistants (control practices) were the primary data collectors. Spot checks, formal interviews and regular refresher sessions throughout the study were used to ensure the precision and completeness of data collection.

To determine the cohort for the study and obtain baseline blood pressure data, all the charts of the study practices were reviewed. Patients who were considered to be eligible and who were 20 to 65 years of age in 1978 were assigned a unique identification number. Patients were considered eligible if they or their spouses had visited the physician's office in 1976 or 1977 and if there was no indication that they had moved or died before the start of the study. Data abstracted from each patient's chart included sex, year of birth, recent blood pressure readings, weight, whether a birth control pill had been prescribed, number of office visits in 1976 and whether hypertension had been diagnosed or hypotensive medications prescribed.

Insurance billing cards, specialist and hospital reports, and reports of hospital admissions and deaths from the physician's office served as sources for the medical and research assistants' data collection. Occasionally, additional data were discovered when hospital or autopsy files were reviewed by the study's medical director.

The office charts of all patients who died or were suspected of having hypertension-related illness (i.e., myocardial infarction, stroke, congestive heart failure or renal failure) or cancer were examined by the medical director. Hospital records, death certificates and autopsy reports (when available) were also reviewed to provide as complete a history as possible for each case. Following stringent criteria* developed by the project's medical subcommittee, the medical director evaluated each case and determined whether it was considered to be confirmed, possible or not confirmed. All cases of stroke and congestive heart failures and all deaths were independently reviewed by two of us (I.R.M. and M.J.B.), who were blind to the practice of origin. In addition, all equivocal episodes of myocardial infarction and renal failure were reviewed. In the event of disagreement, a consensus view was obtained; this occurred in less than 1% of the cases reviewed. All charts of patients identified as hypertensive were reviewed by the medical consultant to ensure that they had at least two recorded diastolic blood pressure readings over 90 mm Hg.

At the initial registration it became apparent that certain risk factors were not recorded in the charts. All patients in the study were therefore asked to complete a one-page questionnaire on alcohol consumption, smoking habits, weight (in kilograms), height (in metres) and occupation. Obesity was defined as a body mass index[7] ([weight] ÷ [height]^2) greater than 27 in men or greater than 25 in women. The questionnaire was initially completed during office visits; however, to maximize the response rate it was also done by telephone and mail.

The charts of the hypertensive patients were reviewed annually to note the last two blood pressure recordings, hypertensive medications prescribed and the number of visits to the physician's office in the preceding year. The charts of all patients were reviewed, either at the end of the study or when the patients moved or died.

Process measures

In the fourth year of the study, 45-minute interviews were conducted with a sample of hypertensive patients from the 34 practices. One of the main purposes of the interview was to independently document the blood pressure readings of identified hypertensive patients in the two groups. Our target was to interview about 25% of such patients.

A sample of 1135 patients was randomly drawn from computer-generated lists of all hypertensive patients. After excluding those who refused to participate (6.3%) and those who had moved or could not be contacted (5.5%), 1001 people, 80% of whom had been identified as having hypertension before the study began, were interviewed at home by trained interviewers blind to group assignment. During the interview three blood pressure readings were taken with a Hawksley random-zero sphygmomanometer (Hawksley and Sons Ltd., Lancing, Sussex, England).[8] Systolic blood pressure was deemed to be the mean of the second and third phase I readings, and diastolic blood pressure the mean of the second and third phase V readings. Compliance was measured by self-report of drug-taking, appointment-keeping and modification of life-style as well as by a compliance rating scale.[9] Satisfaction with medical care was measured with a variant of a scale developed by Zyzanski and colleagues.[10]

Testing of statistical significance

In our study the randomization of practices within a matched pair implied that analytic methods suitable to randomization of individuals could not be applied. Aside from taking into account the randomization by group, however, it was also considered important to adjust for the observed differences between the two groups with respect to age and smoking. The patients in the experimental

*Available from the authors on request.

group were somewhat older and more likely to smoke than those in the control group. We computed 5-year life-table probabilities (taking into account moves and, when applicable, deaths) for a given event within each of the following subgroups of patients: smokers aged 40 to 49 years, smokers aged 50 to 65 years, nonsmokers aged 40 to 49 years and nonsmokers aged 50 to 65 years; this was done separately for each of the 34 practices. The patients under 40 years of age were omitted from statistical testing because of extremely low event rates.

We then computed an overall event rate adjusted for age and smoking from the four subgroup rates for each practice, using the direct method, with standard population figures given by the study population as a whole. The difference d_j in adjusted rates between the experimental and control groups in stratum j, $j = 1, j = 2, \ldots, j = 17$ was computed for each matched pair, and the Wilcoxon signed rank procedure used to test whether the median value of d_j was significantly different from zero.[11] We also performed Fisher's permutation test, which used the magnitudes of the differences as well as their ranks, to determine whether the experimental and control groups had different life-table rates.[11] The results from the two sets of analyses were very similar.

Results

The physicians selected to participate in the study had on average graduated more recently than all physicians in the area but were similar with respect to country of graduation and membership in the College of Family Physicians of Canada (Table I).

In the initial registration process we had intentionally used a broad definition of eligible patient. While this resulted in inclusion of many spouses who infrequently visited the office, spouses who were not part of the practice and many patients who had moved before the study began were also included. To correct the population base we excluded patients subsequently identified as having moved or died before 1978 (3505 patients) as well as those who could not be located or did not respond to the mailed or telephoned questionnaire and who had not visited the office during the study period (6180). Most of those excluded were under 35 years of age. Two patients refused to participate. There was therefore an active patient population of 32 124, 15 659 in the experimental group and 16 465 in the control group.

Data on age, sex and hypertension at the start of the study were available for all patients. Information on smoking, weight, height and alcohol consumption was drawn from the questionnaire, which had a completion rate of 84%. Patients in the experimental group were more likely than those in the control group to be smokers (43% v. 37%; Table II). The two groups were similar in terms of obesity, age, sex and alcohol consumption.

In the experimental group 90.8% of the patients had at least one blood pressure reading taken during the study, compared with 80.2% of the patients in the control group. Age-specific rates

Table II — Characteristics of experimental and control groups in 17 pairs of matched practices at time of entry to study

Characteristic	Result, % Experimental group (n = 15 659)	Control group (n = 16 465)
Age, yr		
20–29	31.9	31.6
30–39	23.7	27.0
40–49	18.3	18.4
50–59	18.4	15.8
60–65	7.7	7.2
Male	44.4	45.6
Hypertensive*	10.0	11.3
Smoker		
Yes	36.4	31.2
No	48.6	52.4
Unknown	15.0	16.4
Alcohol consumption		
None	14.4	15.3
< 1 drink per day	51.9	50.5
≥ 1 drink per day	18.5	17.2
Unknown	15.1	17.1
Obese		
Yes	26.0	26.0
No	58.3	56.4
Unknown	15.7	17.6

*At least two diastolic blood pressure readings greater than 90 mm Hg.

Table I — Representativeness of the study physicians

Group	Characteristics: Average no. of years since graduation as of 1978	Canadian graduate, %	Member of College of Family Physicians of Canada, %
Family physicians practising in area* (n = 178)	18.0	72.5	58.4
Interested in participating (n = 87)	14.4	72.4	66.7
Chosen for study (n = 34)	10.2	79.4	61.8

*Excludes full-time university faculty.

for men and women are shown in Table III. In the experimental group the target screening rate of 95% was attained for women over 39 years of age and for men over 49 years of age. These are the patients most at risk for hypertension. While the case-finding rates in the control group were lower than those in the experimental group for all ages, they exceeded 80% for patients over 39 years of age.

In the experimental group 70.3% of patients were screened at least twice during the study, compared with 57% of the patients in the control group. The target screening rate of 75% was attained in patients over 39 years of age in the experimental group.

The interviewed hypertensive patients in the experimental group were more likely than those in the control group to be advised to exercise, lose weight and modify their diet ($p < 0.001$) and to reduce stress ($p < 0.05$) (Table IV). The main changes in diet advised were to reduce salt intake, to increase the intake of potassium-containing foods and to eat less foods with high levels of cholesterol. Patients in the experimental group were more likely than those in the control group to report that they changed their diet ($p < 0.001$) and reduced stress ($p < 0.05$).

Of the 401 interviewed hypertensive patients in the experimental group who were receiving medication 75% reported that they missed no more than one pill per week, compared with 67% of the 407 such patients in the control group ($p < 0.05$). Thus, significantly more patients in the experimental group than in the control group were compliant.

The mean systolic blood pressure was significantly lower for the hypertensive patients in the experimental group (137.2 mm Hg) than for those in the control group (140.1 mm Hg) ($p = 0.012$). The mean diastolic blood pressure was also lower, although not significantly so, for the former patients (81.9 mm Hg) than for the latter (83.0 mm Hg). Because there were small differences between the two groups in sex, social class, history of smoking and duration of hypertension, multiple logistic regression was performed, with the dependent variable being diastolic blood pressure less than 90 mm Hg; this analysis confirmed the lack of a statistically significant difference between the two groups with respect to control of elevated diastolic blood pressure.

There was concern that interposing the medical assistant between the doctor and the patient would adversely affect the doctor–patient relationship and thus be a source of dissatisfaction in the experimental group. The physician–medical assistant team generated heightened satisfaction rather than dissatisfaction (Table V). At the same time, there were no differences between the two groups in their attitude to doctors in general.

Illness and death

The rates of the selected illnesses and death and of various combinations of events among all the patients in the study are shown in Table VI.

Table III — Proportion of patients who had at least one blood pressure reading recorded during the study period

	% of patients			
	Men		Women	
Age at entry, yr	Experimental group	Control group	Experimental group	Control group
20–29	80.7	62.2	89.8	82.4
30–39	90.0	70.5	91.7	80.9
40–49	90.9	81.9	94.8	87.2
50–59	94.2	87.2	94.5	90.3
60–65	96.1	91.4	96.3	94.8

Table IV — Proportion of hypertensive patients for whom changes in life style were advised and undertaken

	% of patients			
	Change advised		Change undertaken	
Change	Experimental group (n = 489)	Control group (n = 512)	Experimental group	Control group
Smoking reduction	18.2	16.8	17.6	15.8
Exercise	34.8	21.9†	51.1	46.2
Stress reduction	31.8	24.8*	52.9	46.5*
Weight reduction	48.4	38.7†	62.4	57.6
Dietary changes	24.4	16.5†	27.8	20.0†

*$p < 0.05$.
†$p < 0.001$.

There was no significant difference between the two groups in any event or combination of events.

The lack of difference in death rates raises the question whether the medical assistants (experimental practices) might have been more aggressive than the research assistants (control practices) in ascertaining data on death. Since the rates of cancer were not expected to differ between the two groups, cancer was used as a control condition. As can be seen in Table VI, the rates were similar for the two groups, which ruled out a possible ascertainment bias.

The characteristics of patients identified as hypertensive before the study began are shown in Table VII. Hypertensive patients in the experimental group were older and more likely to smoke than those in the control group.

Hypertensive patients in the experimental group had a mean of 4.9 visits per year during the study, compared with 4.5 visits per year for those in the control group. Blood pressure readings were recorded in 3 of the 5 study years for 86.6% of the former patients, compared with 79.1% of the latter. While the rates in the experimental groups are higher, those in the control group also reflect good follow-up.

The rates of the selected illnesses and death and of various combinations of events for patients identified as hypertensive before the study began are shown in Table VIII. There was no difference between the two groups in any event or combination of events. The rates of cancer were similar in the two groups, which again ruled out a possible bias.

The lack of difference between the experimental and control groups in rates of events may have been due to reduction of uncontrolled hypertension in both groups. At the start of the study 4.7% of hypertensive patients had recorded diastolic blood pressure readings over 105 mm Hg, only 46% of whom were taking hypotensive drugs.[12] By the end of the study the last recorded blood pressure reading was greater than 105 mm Hg for only 23 (1.5%) of the patients identified as hypertensive before the study began in the experimental group and 27 (1.5%) of those in the control group; the proportions receiving hypotensive drugs were 83% and 81% respectively. Thus, those at greatest risk for cardiovascular disease were being closely monitored in both groups.

A search for other, unanticipated confounding variables was unsuccessful. Publication of the results of the Multiple Risk Factor Intervention Trial[13] led us to explore the possibility of an increase in sudden death associated with hydrochlorothiazide use. However, the results were not altered when we controlled for the use of hypotensive drugs. Furthermore, we found no specific effect of hydrochlorothiazides.

Table V — Proportion of hypertensive patients who were very satisfied with the care provided

Area of care	% of patients: Experimental group (n = 489)	% of patients: Control group (n = 512)
Doctor's and staff's concern	43.8	34.9*
Doctor's/staff's explanations	34.2	31.8
Doctor's availability	44.2	37.8†
Waiting time	28.9	16.4*
Overall care	59.5	47.6*

*$p < 0.01$.
†$p < 0.05$.

Table VI — Incidences of selected illnesses and death during the study period

Event	Rate, %: Experimental group (n = 15 659)	Rate, %: Control group (n = 16 465)
Stroke	0.54	0.39
Myocardial infarction	1.18	0.89
Congestive heart failure	0.48	0.45
Renal failure	0.04	0.04
Death	1.50	1.63
Death due to cardiovascular disease	0.66	0.67
Death or cardiovascular disease	3.01	2.65
Death due to cardiovascular disease, or cardiovascular disease	1.96	1.52
Cancer	1.80	1.81

Table VII — Characteristics of patients with hypertension identified before the study

Characteristic	% of patients: Experimental group (n = 1560)	% of patients: Control group (n = 1856)
Age, yr		
20–29	4.2	5.1
30–39	9.0	12.2
40–49	20.5	21.9
50–59	40.3	37.1
60–65	26.0	23.7
Male	43.6	41.4
Smoker		
Yes	30.3	27.3
No	60.6	61.5
Unknown	9.2	11.2
Alcohol consumption		
None	24.0	23.9
< 1 drink per day	44.7	45.5
≥ 1 drink per day	20.5	17.9
Unknown	10.8	12.7
Obese		
Yes	46.8	48.1
No	41.9	39.0
Unknown	11.3	13.0

Approach to hypertension

The experimental effect may have been too weak to make a major difference in outcome, or the physicians in the control group may have significantly changed their practices during the study. The advantage of using concurrent controls rather than historical controls is that the former are subject to the same external pressures that change over time. To determine whether the physicians in the control group had modified their practices more than would have been expected, we surveyed, at the end of the study, the two groups of physicians and a sample of community physicians who had not been involved in the study. Questionnaires were sent to 68 full-time physicians matched (two to one) with the physicians in the study by location (rural or urban). The sampling frame was the 1980 *Canadian Medical Directory*.[14] One reminder/thank-you notice was sent. Forty-six questionnaires were returned anonymously, a response rate of 68%.

The initial investigation of hypertension and advice given to hypertensive patients were similar for all the physicians (Table IX). A smaller proportion of physicians in the experimental group prescribed thiazides as the drug of first choice. In the study the choice of drug therapy had been left to the physician, although both groups received material on stepped-care therapy.

Another question was whether the study physicians, especially those in the control group, were more aggressive than the nonstudy physicians in their approach to drug therapy. The similarities in reported treatment approaches were striking. All three groups of physicians favoured treating men with borderline hypertension under 40 years of age but saw less value in prescribing drugs to such men over 59 years of age.

Table VIII — Incidences of selected illnesses and death during the study period in patients with hypertension identified before the study

Event	Rate, %	
	Experimental group (n = 1560)	Control group (n = 1856)
Stroke	2.6	1.7
Myocardial infarction	3.6	3.1
Congestive heart failure	1.8	1.7
Renal failure	0.4	0.2
Death	4.6	5.0
Death due to cardiovascular disease	2.5	2.8
Death or cardiovascular disease	9.7	8.6
Death due to cardiovascular disease, or cardiovascular disease	7.2	5.7
Cancer	3.7	4.6

Discussion

Our hypothesis that augmented family practice would be more effective than usual family practice was not proven. The experimental practices were successful in increasing screening rates, compliance and satisfaction and in slightly lowering blood pressure. If we had confined our investigation to the process measures alone, we might have made a convincing case for instituting medical assistants in family practice. This would have had strong implications for the cost of health care. But because there were no differences in the rates of illness and death between the two groups, the extra costs would not increase the effectiveness of care.

The dissociation of process measures and outcomes is a common occurrence in medicine.[15] The chosen process measures may have no association with the outcome (e.g., the execution of intravenous pyelography has little effect on whether hypertension is controlled), or there may be more important direct mediators. In our study the pa-

Table IX — Study and nonstudy family physicians' approach to hypertension in 1983

Approach	% of physicians		
	Experimental group (n = 17)	Control group (n = 17)	Nonstudy group (n = 46)
Included in initial routine investigation of hypertension			
Urinalysis	94.1	94.1	89.1
Electrolyte studies	76.5	82.4	75.6
Intravenous pyelography	17.7	17.6	13.0
Prescribed thiazide as drug of first choice	64.7	94.1	78.3
Advised hypertensive patients to			
Lose weight if overweight	94.1	94.1	100.0
Reduce salt intake	76.5	70.6	71.7
Reduce stress	70.6	64.7	68.9
Believed drug therapy to be of moderate value for men with borderline hypertension aged			
< 40 yr	88.2	82.4	84.4
≥ 60 yr	35.3	29.4	33.3

tients who were most at risk for cardiovascular disease (i.e., those with diastolic blood pressure readings greater than 105 mm Hg) were closely monitored in both groups. Similarly, patients with a high likelihood of hypertension (i.e., those over 45 years of age) were well screened in both groups. This reflects the increased awareness of hypertension in the community, which in the Multiple Risk Factor Intervention Trial[13] was considered a major factor in the lack of difference between experimental and control groups.[16]

Differences in case-finding rates were most apparent in the patients under 30 years of age, in whom the prevalence of hypertension is very low; thus the potential for improved outcome is similarly low. Our primary conclusion is that the family physician can effectively detect and manage hypertension with minor modifications in his or her practice. Using existing resources appears to be a more satisfactory way of caring for hypertensive patients than setting up hypertension clinics or training new personnel as add-ons to the health care system.

Although the higher screening rates, compliance and satisfaction in the experimental practices resulted in no difference in outcome in the 5 years of the study, a longer follow-up period may have allowed their impact to be felt. Minor inexpensive adjustments to existing practices could improve performance in these three areas. The approach used in the experimental practices can easily be modified for any general practice. The first modification is adopting the policy that every adult have his or her blood pressure measured at least once every 2 years when a visit is made to the office for any reason. We refer to this as continuous practice population screening. To carry out this policy a reminder system that can be managed by a nonmedical member of the office is needed. It could consist of the coloured dots used in our study or notation with a coloured marker when the day's charts are refiled that a blood pressure reading has been taken in the calendar year.

The second modification is instituting a follow-up system. The simple "tickler" file with 12 monthly divisions worked well in our study and identified hypertensive patients who had missed their return appointments.

The third modification is paying greater attention to compliance for hypertensive patients who are receiving treatment. Techniques to enhance compliance have been critically evaluated only in the last 10 years.[17] As with other medical innovations, there is a time lag before these types of techniques become widely accepted or rejected. Family physicians, by increasing their use of compliance-enhancing techniques, will see more effective results in the treatment of patients who have elevated blood pressure.

The fourth modification, suggested by our study, relates to factors that affect satisfaction with care. Unexpectedly, patient satisfaction, especially satisfaction with waiting time, was enhanced by the physician–medical assistant team in the experimental practices. The assistant was often available to attend to the patient, even if the doctor was delayed. If a patient is attending for a brief blood pressure reading, it is inconvenient to have a long stay in the waiting room. Since blood pressure readings in hypertensive patients can for the most part be anticipated, it should be possible to alleviate the waiting problem.

Several difficult methodologic issues had to be dealt with during the study. To identify the population at risk, a two-stage procedure was used. Because of limited resources, the second exclusion stage was done by continuous monitoring of the population base. It would have been preferable to have contacted the patients by mail or telephone at the start of the study to verify each patient's status.

Ensuring the validity and reliability of the target events was challenging given the many sources of data. Strict definitions, as used in many tightly controlled trials, would have eliminated many of the patients suffering from the selected diseases. We modified definitional requirements to allow inclusion of less exact office recording; for example, we accepted as a partial criterion for congestive heart failure the description "typical signs of congestive heart failure". A second approach was to classify events into "confirmed" and "possible" subgroups. The analyses in the results section were based only on confirmed cases. Similar analyses that included possible cases yielded identical results.

The unit of randomization in our study was the practice rather than the patient. Sample-size calculations and statistical analyses appropriate to this design must take into account the intracluster correlation ρ induced by group randomization.[6] Using a measure of intracluster correlation for dichotomous variables proposed by Fleiss,[18] we estimated the value of ρ for the 5-year incidence of stroke (the main outcome of interest in the study) to be 0.002. Incorporating this estimate into appropriate modification of standard sample-size formulae[6] with $\alpha = 0.05$ (two-tailed) and $\beta = 0.20$ showed that the sample of 3400 hypertensive patients identified before the study began was large enough to demonstrate a reduction in the stroke rate from 3% to 1%, the smallest reduction thought to be clinically meaningful.

Analysis of the data on illness and death also took into account the within-cluster correlation. In addition to the methods described in the section on testing of statistical significance, we applied new methods recently proposed by Liang[19] for the analysis of odds ratios with dependent data. These analyses further confirmed the lack of statistically significant differences in the rates of events between the experimental and control groups.

Were the physicians in this study representative of Ontario physicians? Of the family physicians contacted 49% expressed interest in participating. Not unexpectedly, fewer older physicians were willing to commit themselves to a 5-year

study. The physicians chosen were similar to all physicians in the area with respect to country of graduation and membership in the College of Family Physicians of Canada, the only comparative data available from the 1980 *Canadian Medical Directory*.[14] At the end of the study the attitudes and approaches to hypertension of the study and nonstudy physicians were similar. In a survey of family physicians on the value of treating borderline hypertension, Dunn and colleagues[20] found similar attitudes to those expressed by the physicians in our study. We have no reason to believe that our conclusions could not be extended to other similar settings.

Clearly, family physicians do not need medical assistants to detect and manage hypertension effectively. Assistants help but are not essential. None of the physicians in the experimental practices kept the assistants in that role after the study was completed. The lack of funding of primary care nursing services was probably a prime consideration in that decision.[21] However, there are benefits of the use of medical assistants. When funding arrangements allow (as in community health centres and health service organizations), assistants working in conjunction with physicians can provide care for hypertensive patients that enhances satisfaction, compliance and follow-up.

Can family physicians detect and care for all the hypertensive patients in the population? Our study has shown that people who visit the physician's office can be screened and managed effectively without extra resources. Is there a sizeable number of people who are missed with this approach? In London, Ont., over 90% of patients in two studies conducted 10 years apart reported that they had a regular family physician.[22,23] The number of family physicians and other primary care physicians has steadily increased in London and elsewhere. With fewer patients per doctor, more time will be available for the type of preventive care required for detecting and managing hypertension.

The two groups least likely to visit a family doctor are transients, who frequently use emergency departments, and working men. For transients, emergency department staff might best detect elevated blood pressure, but whether those detected will make adequate arrangements for ongoing care is an open question. For working men, detection at work and combined follow-up with the family doctor may be a feasible approach that will involve the public health care system.

Conclusion

Application of expensive modifications in detecting and managing hypertension in family practice is not likely to lead to a reduction in rates of illness and death. Family physicians in southwestern Ontario are carrying out procedures necessary to detect and adequately treat most of the hypertensive patients in their practices.

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