

# Effect of general practitioner education on adherence to antihypertensive drugs: cluster randomised controlled trial

Nudrat Noor Qureshi,<sup>1</sup> Juanita Hatcher,<sup>1</sup> Nish Chaturvedi,<sup>2</sup> Tazeen H Jafar<sup>1</sup>

**EDITORIAL** by Schroeder and Fahey

<sup>1</sup>Clinical Epidemiology Unit, Department of Community Health Sciences, Aga Khan University, P O Box 3500, Stadium Road, Karachi, 74800, Pakistan

<sup>2</sup>International Centre for Circulatory Health, National Heart and Lung Institute, Imperial College, London

Correspondence to: T H Jafar tazeen.jafar@aku.edu

BMJ 2007;335:1030-3

doi:10.1136/bmj.39360.617986.AE

## ABSTRACT

**Objective** To determine the impact of a simple educational package for general practitioners on adherence to antihypertensive drugs.

**Design** Cluster randomised controlled trial.

**Setting** Six randomly selected communities in Karachi, Pakistan.

**Participants** 200 patients with hypertension taking antihypertensive drugs; 78 general practitioners.

**Intervention** Care by general practitioners specially trained in management of hypertension compared with usual care.

**Main outcome measure** Correct dosing, defined as percentage of prescribed doses taken, measured with electronic medication event monitoring system (MEMS) bottle.

**Results** 200 patients were enrolled, and 178 (89%) successfully completed six weeks of follow-up. Adherence was significantly greater in the special care group than in the usual care group (unadjusted mean percentage days with correct dose 48.1%, 95% confidence interval 35.8% to 60.4%, versus 32.4%, 22.6% to 42.3%;  $P=0.048$ ). Adherence was also higher among patients who had higher levels of education ( $P<0.001$ ), were encouraged by family members ( $P<0.001$ ), believed in the effect of drugs ( $P<0.001$ ), and had the purpose of the drugs explained to them ( $P<0.001$ ).

**Conclusions** Special training of general practitioners in management of hypertension, emphasising good communication between doctors and patients, is more effective than usual care provided in the communities in Karachi. Such simple interventions should be adopted by other developing countries that are now facing an increasing burden of hypertension.

**Trial registration** Clinical trials NCT00330408.

## INTRODUCTION

Despite well established benefits of lowering blood pressure, and the existence of national and international guidelines on detection and management of hypertension, control remains poor.<sup>1</sup> Half of patients with hypertension in the United States reported receiving drugs for lowering blood pressure. However, only 30% had their blood pressure controlled to the conventionally recommended target of less than 140/90 mm Hg.<sup>2</sup> The situation is much worse in developing countries, where the prevalence of hypertension is high and blood pressure control rates are extremely low—about 6% in China and less than 3% in Pakistan.<sup>3,4</sup>

Suboptimal practice patterns by doctors, leading to inadequate adherence to antihypertensive drugs by patients, have been implicated as important contributors to poor blood pressure control.<sup>5-7</sup> Our

previous report on a national survey of general practitioners in Pakistan identified serious gaps in knowledge and practice regarding management of hypertension.<sup>8</sup> Similar findings have been reported from developed countries.<sup>9-11</sup> We did this study in Karachi, Pakistan, to assess the impact of special educational training of general practitioners in the management of hypertension on adherence to prescribed antihypertensive drugs and to determine the practice patterns of doctors that contribute to adherence to antihypertensive drugs.

## METHODS

This study was a substudy of a cluster randomised controlled trial to determine the impact of family based home health education and specially trained general practitioners on blood pressure. Using a multi-stage random sampling technique, we selected 12 out of 5000 geographical census based clusters in Karachi (250 households in each cluster). From these 12 clusters, we randomly assigned three clusters each to special care by a general practitioner and usual care by a general practitioner.

**Intervention**—We invited all general practitioners located in clusters randomised to special care to attend a one day intensive training session on hypertension. Components of the course included non-pharmacological and pharmacological interventions; prescribing low cost and appropriate generic drugs; preferential use of single dose drug regimens; scheduled follow-up visits; stepped care approach for titration of drugs to achieve target blood pressure levels; and satisfactory consultation sessions for patients, with explanations of treatment. The recommended target blood pressure was less than 140/90 mm Hg.

**Inclusion criteria**—Eligible participants were aged 40 years and above, had been identified as hypertensive, had visited their general practitioner within the previous month, and had been prescribed antihypertensive drugs.

**Screening visit (parent study)**—Trained community health workers paid visits to all homes in the selected cluster. They collected demographic, lifestyle, and medical information and measured blood pressure. People with hypertension were advised to consult a local general practitioner. Participants in the special care group were given a list of specially trained general practitioners within their cluster to choose from. Participants were blinded to intervention status.

**Recruitment visit (adherence study)**—Recruitment to the adherence study started six months after the screening visit. We collected information from the patients on their demographics and attitudes and on doctors'

practice patterns. Community health workers provided medication event monitoring system (MEMS) bottles, an electronic monitor that records the exact time and date of each cap opening sequence.<sup>12 13</sup>

**Follow-up visits**—Community health workers followed up all participants on three occasions for a total of six weeks, at the end of weeks one, three, and six after recruitment. At each follow-up visit, they downloaded data from the MEMS on to a computer. Participants were asked about any unintentional openings of the cap. Outcome assessors were blinded to the randomisation status of participants. At the final visit, community health workers measured blood pressure in a subset of 112 randomly selected patients.

**Statistical analysis**—The primary outcome was “correct dosing of drugs,” defined as percentage of prescribed doses taken during the monitored interval. We accounted for clustering at the level of the general practitioner within each cluster.<sup>14</sup> We tested for significance of the effect of special care versus usual care on the primary outcome.<sup>15</sup> We followed the intention to treat principle. We tested patient related and doctor related factors and retained them in the models if they were significantly associated with adherence. We developed two models—one including only the patient related factors and the second including both patient and doctor related factors to explore the components of the training that were significant. We did sensitivity analyses on participants who successfully completed the six week follow-up as per protocol (n=178) and on the entire dataset (n=200) after

substituting missing values. We also did a supplementary analysis on a subset of 112 patients to assess the effect of improved adherence (defined as those who took at least 50% of the prescribed drugs, based on the top third of patients for adherence) on blood pressure.

## RESULTS

Of the 1685 households in the six clusters included in this study, 1560 households agreed to participate in the parent study (response rate=92.5%). From these households, 1631 people were aged 40 and above, of whom 721 (44.2%) had hypertension. At the recruitment visit for the adherence study, 217 (30%) of these people with hypertension were eligible for enrolment; 200 (92.1%) of them consented to participate in the study. Of these, 178 participants (81 in special care group; 97 in usual care group) successfully completed six weeks of follow-up.

A total of 36 out of 55 invited general practitioners in the special care group received the training programme. The average time lag between training of doctors and referral of participants was six months; 98 (98%) of patients in the special care group sought care from the 36 trained general practitioners.

Patients' characteristics did not differ by randomisation group. Among the doctor related characteristics, the reported consultation time was more likely to be 10 minutes or more in the special care group than in the usual care group (65% v 51%; P=0.04). The general practitioner was more likely to explain the purpose of the drug to the patient in the special care group (37% v 17%; P=0.01). Notably, drug costs did not differ between the groups.

**Factors associated with adherence to antihypertensive drugs (n=200). Values are mean (95% confidence interval) percentage of days on which correct dose of drugs was taken**

Variables	Primary outcome: correct dosing*		
	Univariate	Multivariable model 1†	Multivariable model 2‡
Special care§:	(P=0.048)	(P=0.016)	(P=0.030)
Yes	48.1 (35.8 to 60.4)	42.3 (30.6 to 53.9)	42.8 (30.8 to 54.7)
No	32.4 (22.6 to 42.3)	25.6 (15.2 to 36.0)	27.9 (19.7 to 47.9)
Education status:	(P=0.001)	(P<0.001)	(P=0.001)
Illiterate	41.4 (35.1 to 47.6)	33.7 (27.9 to 39.6)	35.5 (29.6 to 41.4)
Primary school	35.2 (29.5 to 40.9)	26.8 (21.5 to 32.1)	29.8 (24.0 to 35.6)
Secondary school	41.5 (35.4 to 47.5)	27.6 (21.2 to 34.0)	29.2 (22.8 to 35.6)
Graduate and above	56.7 (47.0 to 66.4)	47.6 (39.1 to 56.0)	46.9 (38.6 to 55.2)
Encouraged by family:	(P<0.001)	(P<0.001)	(P<0.001)
Yes	44.5 (40.9 to 48.1)	41.1 (36.6 to 45.6)	42.1 (37.6 to 46.6)
No	26.7 (20.2 to 33.1)	26.7 (20.6 to 32.9)	28.6 (22.4 to 34.8)
Belief in taking drugs to treat illness:	(P<0.001)	(P<0.001)	(P<0.001)
Yes	44.5 (41.0 to 48.0)	43.6 (39.4 to 47.7)	44.9 (40.7 to 49.2)
No	21.5 (13.3 to 29.8)	24.3 (17.0 to 31.5)	25.8 (18.6 to 33.0)
Explaining purpose of drug(s) to patient:	(P<0.001)		(P=0.023)
Yes	50.1 (43.9 to 56.3)	–	31.7 (27.2 to 36.2)
No	36.7 (33.0 to 40.4)	–	34.7 (29.6 to 39.8)

\*Defined as percentage of prescribed doses taken during monitored interval.

†Includes patient related factors.

‡Includes patient related and training related factors.

§Care given by general practitioners intensively trained in management of hypertension.

P value for special care is based on MS<sub>(cluster)</sub> as error term; P values for all other variables are based on MS<sub>(error)</sub>.

The intraclass correlation coefficient for adherence to antihypertensive drugs for clustering at the general practitioner level was 0.06 (95% confidence interval 0.00 to 0.16). Patients randomised to special care took a greater percentage of the prescribed drugs than those randomised to usual care (48.1%, 95% confidence interval 35.8% to 60.4%, versus 32.4%, 22.6% to 42.3%;  $P=0.048$ ) (table). Key patient related factors that influenced correct dosing were the educational status of the patient, belief in taking drugs, and encouragement by the family to take the drug. The key doctor related practice was explaining the purpose of the drug(s) to the patient (table). In the multivariable model, these factors remained independent predictors of correct dosing. The  $R^2$  for the model was 73%.

Sensitivity analysis showed consistent results for per protocol analysis in the dataset restricted to participants with all follow-up data ( $n=178$ ) (adjusted mean percentage days correct dose 49.8%, 38.4% to 61.1% for special care; 25.4%, 24.3% to 46.5% for usual care;  $P=0.02$ ) and in the entire dataset ( $n=200$ ) when we used imputed adherence levels ranging from 100% to 6% for those who withdrew from the study in both groups. In the subgroup analysis, the falls in systolic blood pressure (8.3 mm Hg;  $P=0.04$ ) and diastolic blood pressure (3.8 mm Hg;  $P=0.1$ ) were greater among those with good adherence ( $\geq 50\%$  of drugs;  $n=29$ ) than those with poor adherence ( $< 50\%$  of drugs;  $n=83$ ).

## DISCUSSION

We found that relative adherence in people seeking care from specially trained general practitioners was 50% higher than in those consulting untrained general practitioners. Achieved blood pressure was lower in participants who adhered to their drugs than in those who did not. The main doctor related factor associated with increased adherence was explaining the purpose of the drug(s) to the patient. However, this factor alone did not account for the greater adherence to drugs in the special care group, and other factors need to be sought.

### Implications of the study

Studies on doctor targeted interventions on hypertension control worldwide have tested several different strategies, with heterogeneous results.<sup>16,17</sup> Benefits of training doctors on implementation of guidelines and prescription practices have been documented.<sup>16</sup> Our results support the value of such training programmes and show that even limited training of doctors leads to better adherence to antihypertensive drugs in a developing country setting. Inclusion of continuing medical education activities at a national level in programmes for prevention of chronic diseases in other developed and developing countries can be recommended.

We also found that significantly more general practitioners in the special care group than the usual care group were spending at least 10 minutes consulting with their patients. Although consultation

time was not independently associated with adherence, this strategy was part of the training package, which as a whole was found to be beneficial. The average consultation time with a general practitioner in the United Kingdom, where blood pressure control rates are less than 10%, is about 9.4 minutes—twice as long in the United States, where control rates are 30%.<sup>18-20</sup> In particular, our findings clearly underscore the importance of explaining the reasons for drugs in improving adherence.

### Limitations and strengths

Our study had some potential limitations. Firstly, we did the study six months after the general practitioners were trained. This shows the persistence of a single education session in the medium term but does not test the long term beneficial effects. Secondly, opening of the MEMS bottle does not necessarily ensure that the patient takes a pill, and the bottles are subject to potential manipulation. Similarly, knowing that adherence is being assessed may inflate actual adherence. Thirdly, inclusion of only participants who attended the general practice clinic within the previous month (30% of hypertensive patients) introduces a selection bias against those who do not seek medical assistance. However, given that, on average, adults in Pakistan visit a general practitioner frequently, and that the characteristics of our study population are comparable to people with hypertension from the general population of Pakistan, we believe that our findings would be generalisable to the population at large.<sup>4</sup>

Strengths of our study include the use of a population based setting, random selection and randomisation of study groups, blinding of patients to treatment assignment, use of electronic MEMS bottles for measuring adherence, and measurement of adherence over a cumulative period of six weeks. We saw high response rates. Uptake of our training programme by general practitioners was high, which may result from several factors. Continuing medical education courses are lacking in Pakistan, and opportunities for further education seem to be welcome.<sup>8</sup>

### Conclusion

Our study showed that simple training of general practitioners in management of hypertension has a positive impact on adherence to antihypertensive drugs at a population level in a developing country. This in turn improved blood pressure control. A key determinant was an explanation provided by the general practitioner of the purpose of drugs. Our findings provide strong support for continuing medical education in the management of hypertension, which should include simple yet important messages such as better communication between doctor and patient.

Other members of the Hypertension Research Group: S Badruddin, A Hameed, F Jafary, A Khan, M Karim, A Gilani, S Hashmi, S Jessani, R Bux, Z Qadri, M Saleem, P Cosgrove, and A Khan (Aga Khan University, Karachi, Pakistan); N Poulter (Imperial College, London).

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

Hypertension is a major public health problem globally  
 Doctors in Pakistan have been shown to have serious gaps in knowledge of and approach to treatment of patients with hypertension  
 Lack of adherence to antihypertensive drugs contributes to poor rates of blood pressure control

**WHAT THIS STUDY ADDS**

Special training of general practitioners with a simple educational package on management of hypertension led to significantly improved adherence among communities in Pakistan  
 Simple interventions emphasising good communication between doctors and patients should be adopted by other developing countries

**Contributors:** See bmj.com.

**Funding:** Wellcome Trust, UK (THJ, NC, JH) and Aga Khan University Research Council (NNQ). MEMS bottles were provided by Aardex, Switzerland.

**Competing interests:** None declared.

**Ethical approval:** Aga Khan University Ethics Review Committee.

- Hypertension Detection and Follow-up Program Cooperative Group. Five-year findings of the hypertension detection and follow-up program: I. Reduction in mortality of persons with high blood pressure, including mild hypertension. *JAMA* 1997;277:157-66.
- Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *JAMA* 2003;290:199-206.
- Wang Z, Wu Y, Zhao L, Li Y, Yang J, Zhou B. Trends in prevalence, awareness, treatment and control of hypertension in the middle-aged population of China, 1992-1998. *Hypertens Res* 2004;27:703-9.
- Jafar TH, Levey AS, Jafary FH, White F, Gul A, Rahbar MH, et al. Ethnic subgroup differences in hypertension in Pakistan. *J Hypertens* 2003;21:905-12.
- Degli Esposti E, Di Martino M, Sturani A, Russo P, Dradi C, Falcinelli S, et al. Risk factors for uncontrolled hypertension in Italy. *J Hum Hypertens* 2004;18:207-13.
- Dusing R. Overcoming barriers to effective blood pressure control in patients with hypertension. *Curr Med Res Opin* 2006;22:1545-53.

- Krousel-Wood M, Thomas S, Muntner P, Morisky D. Medication adherence: a key factor in achieving blood pressure control and good clinical outcomes in hypertensive patients. *Curr Opin Cardiol* 2004;19:357-62.
- Jafar TH, Jessani S, Jafary FH, Ishaq M, Orakzai R, Orakzai S, et al. General practitioners' approach to hypertension in urban Pakistan: disturbing trends in practice. *Circulation* 2005;111:1278-83.
- Hyman DJ, Pavlik VN, Vallbona C. Physician role in lack of awareness and control of hypertension. *J Clin Hypertens (Greenwich)* 2000;2:324-330.
- Sisson SD, Rastegar D, Rice TN, Prokopowicz G, Hughes MT. Physician familiarity with diagnosis and management of hypertension according to JNC 7 guidelines. *J Clin Hypertens (Greenwich)* 2006;8:344-50.
- Hagemeister J, Schneider CA, Barabas S, Schadt R, Wassmer G, Mager G, et al. Hypertension guidelines and their limitations—the impact of physicians' compliance as evaluated by guideline awareness. *J Hypertens* 2001;19:2079-86.
- Hamilton GA. Measuring adherence in a hypertension clinical trial. *Eur J Cardiovasc Nurs* 2003;2:219-28.
- Lee JY, Kusek JW, Greene PG, Bernhard S, Norris K, Smith D, et al. Assessing medication adherence by pill count and electronic monitoring in the African American study of kidney disease and hypertension (AASK) pilot study. *Am J Hypertens* 1996;9:719-25.
- Eldridge SM, Ashby D, Feder GS, Rudnicka AR, Ukoumunne OC. Lessons for cluster randomized trials in the twenty-first century: a systematic review of trials in primary care. *Clin Trials* 2004;1:80-90.
- Cochran GW, Snedecor W. *Statistical methods*. 7th ed. Ames, IA: Iowa State University Press, 1980.
- Fahey T, Schroeder K, Ebrahim S. Interventions used to improve control of blood pressure in patients with hypertension. *Cochrane Database Syst Rev* 2006;(4):CD005182.
- Aucott JN, Pelecanos E, Dombrowski R, Fuehrer SM, Laich J, Aron DC. Implementation of local guidelines for cost-effective management of hypertension: a trial of the firm system. *J Gen Intern Med* 1996;11:139-46.
- Mechanic D. How should hamsters run? Some observations about sufficient patient time in primary care. *BMJ* 2001;323:266-8.
- Lane DA, Lip GY. Ethnic differences in hypertension and blood pressure control in the UK. *QJM* 2001;94:391-6.
- Wolf-Maier K, Cooper RS, Kramer H, Banegas JR, Giampaoli S, Joffres MR, et al. Hypertension treatment and control in five European countries, Canada, and the United States. *Hypertension* 2004;43:10-7.

**Accepted:** 20 September 2007

## Mortality in patients with and without colectomy admitted to hospital for ulcerative colitis and Crohn's disease: record linkage studies

Stephen E Roberts,<sup>1</sup> John G Williams,<sup>1</sup> David Yeates,<sup>2</sup> Michael J Goldacre<sup>2</sup>

**EDITORIAL** by Sanderson and Parkes

<sup>1</sup>School of Medicine, Swansea University, Swansea SA2 8PP

<sup>2</sup>Department of Public Health, University of Oxford

Correspondence to: S E Roberts  
 stephen.e.roberts@swansea.ac.uk

**BMJ** 2007;335:1033-6  
 doi:10.1136/bmj.39345.714039.55

This article is an abridged version of a paper that was published on [bmj.com](http://bmj.com) on 30 October 2007. Cite this version as: *BMJ* 30 October 2007, doi: 10.1136/bmj.39345.714039.55 (abridged text, in print: *BMJ* 2007;335:1033-6).

**ABSTRACT**

**Objective** To compare mortality outcomes in the three years after elective colectomy, no colectomy, and emergency colectomy among people admitted to hospital for inflammatory bowel disease, to inform whether the threshold for elective colectomy in clinical practice is appropriate.

**Design** Record linkage studies.

**Setting** Oxford region (1968-99) and England (1998-2003).

**Participants** 23 464 people with hospital stay for more than three days for inflammatory bowel disease, including 5480 who had colectomy.

**Main outcome measures** Case fatality, relative survival, and standardised mortality ratios.

**Results** In the Oxford region, three year mortality was lower after elective colectomy than after either no

colectomy or emergency colectomy, although this was not significant. For England, mortality three years after elective colectomy for ulcerative colitis (3.7%) and Crohn's disease (3.3%) was significantly lower than that after either admission without colectomy (13.6% and 10.1%; both  $P < 0.001$ ) or emergency colectomy (13.2% and 9.9%;  $P < 0.001$  for colitis and  $P < 0.01$  for Crohn's disease). Three or more months after elective colectomy, mortality was similar to that in the general population. Adjustment for comorbidity did not affect the findings.

**Conclusions** In England, the clinical threshold for elective colectomy in people with inflammatory bowel disease may be too high. Further research is now required to establish the threshold criteria and optimal timing of elective surgery for people with poorly controlled inflammatory bowel disease.