JCN Journal of Clinical Nursing

Journal of
Clinical Nursing

CLINICAL ISSUES

The effect of patient education and home monitoring on medication compliance, hypertension management, healthy lifestyle behaviours and BMI in a primary health care setting

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Aim. The aim of this study was to determine the effect of anti-hypertensive patient-oriented education and in-home monitoring for medication adherence and management of hypertension in a primary care setting, by providing education on healthy lifestyle behaviours and medication adherence.

Background. Hypertension is the third most common cause of death worldwide. Prevalence of hypertension in Turkey is approximately 30% in the general population and 45–50% in population over 50.

Design. Randomised controlled study.

Methods. This study conducted in Turkey used a study group comprised of 120 subjects (40 Group A, 40 Group B, 40 controls), all previously diagnosed with hypertension and who started medication therapy at least one year prior to start of study. The study was conducted between February–November 2006 at public primary health care facilities and homes of the study participants. Participants in Group A and B received a total of six monthly education sessions, four times during clinic visits and two home visits. Medication adherence education for Groups A and B and education about healthy lifestyle behaviours for Group B were administered in a structured and individualised format. The control group was routinely monitored in health care facilities.

Results. Healthy lifestyle behaviours and perception of self-efficacy regarding medication adherence showed improvement after education sessions in Groups A and B. Systolic and diastolic blood pressures of subjects in Group A and B showed a significant decrease compared with those of the control group; the blood pressure decrease in Group B was greater than in Group A.

Conclusion. Nurses play an important role in uncontrolled hypertension detection and can improve medication adherence and healthy lifestyle behaviours.

Relevance to clinical practice. Patient education medication adherence alone and in combination with healthy lifestyle behaviour teaching is an effective tool for blood pressure reduction in the hypertensive population in primary health care settings.

Key words: blood pressure, healthy lifestyle behaviours, hypertension, in-home monitoring, medication adherence

Accepted for publication: 13 August 2010

Introduction

Previous reports state that hypertension is responsible for 6% of adult deaths worldwide (Cooper 2004), making it the third leading cause of worldwide (Bolli *et al.* 2005) and one of the most preventable cardiovascular risk factors (Lip 2004). Hypertension affects approximately 50 million people in the USA and 1 billion worldwide (JNC 7 Report 2003). In Turkey, the prevalence of hypertension in the adult population is approximately 30% and 45–50% in the population over 50 (Diagnosis and Treatment Guidelines for Primary Health Care, Turkish Ministry of Health 2003). It has been

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doi: 10.1111/j.1365-2702.2010.03534.x

reported that, unless extensive and efficacious precautions are undertaken, hypertension prevalence will increase even more as the global population ages (JNC 7 Report 2003). Hypertension is a major independent risk factor for cardiovascular and renal disease, increasing the risk of myocardial infarction, stroke, heart failure and renal disease (JNC 7 Report 2003, Kabakci 2006). The primary goal in the treatment of hypertension is the avoidance of hypertensive complications (Feldman *et al.* 1998) by regulating blood pressure to within normal limits (Casey 2004).

Despite the known benefits of lowering blood pressure in hypertensive patients, control of hypertension in all settings, including primary care, is still far from optimal (Banegas 2006) and continues to be a major public health problem (Düsing 2006). One of the most important factors affecting efficacy of blood pressure globally and in Turkey is the lack of patient adherence with prescribed antihypertensive therapies (Kabakci 2006). Similar to the Feldman and colleagues report, Kabakcı report that pharmacological non-adherence is prevalent and is an important factor in both poor blood pressure control as well as the incidence of hypertensive-related complications (Feldman *et al.* 1998, Kabakci 2006). Adherence is the level of conformity between the patient behaviour and clinical recommendations, such as using the medications properly, following prescribed diet and incorporating relevant lifestyle behaviour changes. Non-adherence may begin with the lack of adherence to medication therapy, such as failure to procure the prescribed medication or failure to self-administer medication according to prescribed schedules (Hill & Miller 2004). According to Coleman, reasons for non-compliance include: poor follow-up explanation or inadequate initial explanations (by health care providers) of medications; disbelief in the benefits of taking medications regardless of how the patient feels physically; forgetting to take medication; purposefully skipping medication (Coleman 2005). Other unhealthy habits that reduce the efficacy of anti-hypertensive therapy include: not attending follow-ups regularly; smoking; inadequate physical activity; and diets with excess of calories, fat or sodium (Hill & Miller 2004).

Obesity, excessive alcohol consumption, sedentary lifestyle, unhealthy diet and stress factors are contributing factors in high blood pressure (Campbell *et al.* 1999). Changes in lifestyle and adoption of a healthy lifestyle are crucially important in the prevention or amelioration of high blood pressure. Changes in lifestyle decrease blood pressure, increase the efficacy of antihypertensive drugs and decrease cardiovascular risk (The JNC 7 Report 2003).

Successfully managing hypertension requires that patients make a commitment to achieving and maintaining control of their blood pressure. They must keep follow-up appointments and adhere to non-pharmacologic treatment recommendations as well as pharmacotherapy regimens (Clark & Afflu 1995). Effective efforts to control blood pressure levels and improve the quality of life of hypertensive patients include appropriate combinations of health care services, information, counselling, reminders, self-monitoring, support and family therapy (Kaplan 2003).

Roy's adaptation theory and Pender's health promotion model were used to construct a framework for the hypothesis of this study. According to Roy, the individual and the environment are sources of stimuli that require modification to promote adherence (Chitty 1997). A subject's behaviour is affected by their abilities as well as internal and external stimuli (Velioğlu 1999). Thus, adherence education given by the nurse to get blood pressure under control contributes to adaptation of the patients to their disease and to the therapy as an external stimulus. To sustain integrity and homeostasis, hypertensive patients would become better informed through education and counselling provided by the nurse and then would adapt more easily to the changes brought about by hypertension.

In Pender's health promotion model, cognitive perception factors effect the appearance of terminal behaviour change such as: the importance ascribed to health, health control, perception of self-efficacy, definition of health by the individual subject, perceived benefits of health-promoting behaviour, perceived supports or hindrances to health promotion behaviour. All of these factors are sensitive to change and can be improved by education (Galloway 2003, Toukola 2007). Perceived medication adherence self-efficacy is one of the cognitive perception factors in this model that can be improved by education. Through education, a nurse can teach the hypertensive patient appropriate behaviours to help control their hypertension. Education can improve patients' expectations regarding self-medication adherence, such as on time administration, regular medication use, procuring more medication before the previous prescription is completely consumed and continuing to use the medication even if there are some slight side effects. Education also enables the patient to understand hypertension better, its complications, effects of regular medication adherence on the control of blood pressure and the role of their own behaviours in blood pressure control. Such education further affects other cognitive factors in the model further enabling behavioural change.

There are many studies in the literature demonstrating that educational interventions, as part of anti-hypertensive therapy, increases medication adherence and improves healthy lifestyle behaviours and significantly decreases blood pressure levels (Garcia-Pena *et al.* 2001, Çakır 2003, Rudd *et al.* 2004, Bosworth *et al.* 2005, Reid *et al.* 2005, Svetkey *et al.* 2005). However, to date, there has been no study of the

effects of a combination of hypertension, medication adherence and healthy lifestyle behaviour education with health care facility follow-ups, home monitoring and phone interviews on hypertension and lifestyle behaviour changes. Neither has there been a study published to date that compares the efficacy of the medication adherence education vs. healthy lifestyle behaviour using two study groups and a control group subjects.

Aim

The aim of this study was to determine the effect of anti-hypertensive patient-oriented education and in-home monitoring for medication adherence and management of hypertension in a primary care setting, by providing education on healthy lifestyle behaviours and medication adherence.

Methods

This experimental study involved three groups, a test group A, a Group B and a control group C. Participants in Groups A and B received a total of six monthly education sessions, four times during clinic visits and two home visits. Medication adherence education for Groups A and B and education about healthy lifestyle behaviours for Group B were administered in a semi-structured and individualised format. The control group was routinely monitored in health care facilities.

Our hypotheses were as follows: (1) Education in medication adherence and healthy lifestyle behaviours will improve medication adherence in the study groups (Groups A and B). (2) Education in medication adherence and healthy lifestyle behaviours will result in lower average blood pressure values in study groups (Groups A and B). (3) Medication adherence levels in study Group B (education in both medication adherence and healthy lifestyle behaviours) will be higher than that of the patients in group A (who receive only medication adherence education). (4) The average blood pressures of patients in study Group B who have received education for both medication adherence and healthy lifestyle behaviours will be better than the patients in study group A who have received only medication adherence education.

Design

The study was performed as a pretest–post-test study.

Participants

The study group was comprised of 120 hypertensive patients residing in central Erzincan, Turkey, who were diagnosed at least one year prior to study entry, aged ≥35, had blood pressure ≥140/90 mmHg, were prescribed antihypertensive medication, literate, able to communicate easily and cooperate with researchers and who did not have any disease or condition (e.g. diabetes mellitus, heart failure, renal impairment) that would prevent them from participating in the study. The study was conducted between February–November 2006 at public primary health care facilities No. 1, 2 and 3 and homes of the study participants.

Data collection

Pretest data were collected through the administration of a descriptive questionnaire, medication adherence self-efficacy scale (MASES), health-promoting lifestyle profile (HPLP) to 130 hypertensive patients in the 1st, 2nd and 3rd primary health care facilities of Erzincan province and from personal data (blood pressure, height, weight available in the subjects' medical records). Hypertensive patients (average blood pressure is 140/90 mmHg or more after a rest period of 10–15 minutes following arrival at the primary health care facility and after two measurements within 5–10 minute intervals) were selected for the study.

Group A and B were composed of 43 randomly selected hypertensive patients, and the control group was composed of 44 patients. Randomisation was provided by enrolling the patients into Group A on Monday, into Group B on Tuesday and into Control group on Wednesday and so on. To prevent bias, following week days were changed. Allocation and outcomes data were not blind but statistician blinded. Three patients each in both Group A and B and four patients in the control group were excluded from the study because of reasons such as having frequent travel precluding regularly scheduled appointments, follow-up problems or discontinuing the education after study start. Thus, the study was completed with 120 patients, 40 patients in three groups. The total sample size was set at 120 with 40 subjects for each group based on power as 0·95, α as 0·05 and effect size as 0·70.

Final data were collected through re-administration of the pretest questionnaires and scales, blood pressure measurements and weight measurement. All data were obtained by face-to-face interview. The entire education intervention was comprised of six interviews, two during a home visit and four at the primary care facilities. Each intervention lasted 30 minutes for medication adherence education (Group A) and 45 minutes for the combination of healthy lifestyle behaviour and medication adherence education (Group B). For both home and clinic visits, a comfortable, quiet room was used for educational sessions. Furthermore,

monthly follow-up phone calls were conducted to provide Group A and Group B study subjects with general information about hypertension and to remind them about visit dates. Monthly visit was also conducted with the control group for the recording of blood pressures and weight. Control group was routinely monitored in health care facilities.

Physiological/physical measurements

After a 10–15 minutes rest period, systolic and diastolic blood pressures of patients were obtained from the patient's right arm with the patient in a seated position. Two successive measurements were performed at intervals of 5–10 minutes. Patients were requested not to smoke and to avoid caffeine (coffee, colas) intake 30 minutes prior to blood pressure measurement. A sphygmomanometer (ERKA) was used for the measurement. Systolic (SBP) and diastolic blood pressures (DBP) were recorded based on Korotkoff sounds.

Height measurement was obtained using a tape measure with the patient standing on a horizontal surface with the head, shoulder, hip and heel touching a vertical wall. Values were recorded in centimetres (cm). Weight measurement was obtained using a standard scales with patients wearing lightweight clothes. Values were recorded in kilograms (kg). Body weight (kg)/height $(m)^2$ was calculated as BMI according to the WHO standards. BMI values under 18·5 were considered to be thin, values between 18·5–24·9 were considered normal, 25–29·9 was considered to be overweight, between 30–39·9 as obese and 40 or more were considered morbidly obese (Report of the WHO Consultation on Obesity Geneva 2000). To reduce measurement error, end of the day sphygmomanometer and platform scale matched and controlled with another measurement instrument.

Interventions

Group A – education in medication adherence (Study A) (Fig. 1)
This group had six educational sessions in person directed at medication adherence following the pretest. Areas of discussion included the importance of regular medication adherence, efficacy of antihypertensive drugs, possible side effects and what to do in case of side effects, importance of follow-up visits). These subjects were given general information about healthy lifestyle behaviours (nutrition, weight reducing, exercise etc.) and hypertension (definition of hypertension, risk factors, complications). Educational methods included standard narration, question–answer and discussion. Also, follow-up phone call interviews were performed monthly to provide information about hypertension. A nursing education programme in hypertension care was planned, which involves unstructured non-pharmacological treatment and structured medication adherence treatment.

Group B – education in medication compliance in addition to education in healthy lifestyle behaviours (Study B) (Fig. 2)
This group received six monthly education sessions in person following the pretest and had individual education regarding medication adherence (importance of regular medication adherence, efficacy of drugs, possible side effects and what to do in case of side effects, importance of follow-up visits) and further received education in healthy lifestyle behaviours (nutrition, relevant diet, importance of reduced salt intake, how to deal with stress, weight control, exercise, risks of alcohol and smoking, etc.) as well as general information about hypertension (definition of hypertension, risk factors, complications). A nursing education treatment programme, which included hypertension care, consisted of structured non-pharmacological and medication adherence treatment. Similar to Group A, education methods included standard narration, question–answer and discussion. Also similar to Group A, phone call interviews were conducted once a month to give information about hypertension.

Control group
This group had six interviews after the pretest but only blood pressure and weight measurements were checked at each interview (i.e., no educational intervention). Phone calls were made to remind participants of upcoming appointments dates and times (Figs 1 and 2).

Ethical considerations

Institutional approval was obtained from Ataturk University Medical Sciences Ethical Committee and Erzincan District Health Board. Study aims, plans and benefits were explained to patients who met the study criteria. Patients were asked if they would voluntarily participate in the study and their written/oral consents were obtained. Confidentiality was maintained at all times. Education given to the study groups was also given to the control group after posttest administration. The effect of education given to the control group could not be evaluated because of the limited time. However, it is assumed that such education would be effective as it was with the experimental groups.

Outcome measures

Basic measurement outcomes were blood pressure, height and weight, medication compliance and lifestyle behaviours.

Interim measurement outcomes were blood pressure and weight at each study visit. Final measurement outcomes were blood pressure and weight, medication compliance and healthy lifestyle behaviours. A descriptive questionnaire, medication adherence/compliance self-efficacy scale (MASES) and HPLP were administered as pre- and post-test to all study subjects.

The descriptive questionnaire queried the socio-demographic characteristics of the patients. It was designed by the investigator based on similar studies and consisted of 12 questions, nine of which are related to patient's descriptive characteristics (age, sex, marital status, educational status, profession, income level (based on self-reporting; income higher than expenses, income equivalent to expenses, income less than expenses), family situation (lives with nuclear family, lives with extended family), smoking and alcohol consumption)and three related to the specifics of patient regarding hypertension (duration of therapy, comorbid diseases and whether prescribed medication is taken on a regular basis).

Medication adherence self-efficacy scale

MASES was developed by Ogedegbe *et al.* in 2003, to measure situation-specific efficacy beliefs regarding adherence to prescribed antihypertensive medications in a population at high risk for hypertension-related morbidity and mortality (Ogedegbe *et al.* 2003). The MASES is a 26-item, patient-derived, self-administered instrument. The participants were asked to rate their degree of confidence in taking their blood pressure medication in a variety of situations. The response to each item was formatted on a three-point Likert scale with 1 = not at all sure, 2 = somewhat sure and 3 = very sure. The lowest total score is 26 and the highest is 78. All responses were added to obtain a summary score with higher scores indicating greater self-efficacy. The MASES has a Cronbach's alpha coefficient of 0·92. Results of the Cronbach's alpha and test–retest reliability demonstrate that this MASES is internally consistent and yields stable scores over time. This scale is a brief instrument, which is easy for patients to use and to understand, taking on average, about five minutes to complete (Gözüm & Hacıhasanoğlu 2009). For this specific study, the internal reliability coefficient for the MASES was 0·92.

Health-promoting lifestyle profile scale

The Health Promotion Life-Style Profile Scale was developed in 1987 by Walker, Sechrist & Pender (Walker *et al.* 1987). Validity and reliability of the scale was tested in Turkey by Esin in 1997. Questions in this scale measure a subject's behaviours that can improve health. The α value of the scale was determined to be 0·91 (Esin 1997) and was calculated to be 0·90 for this specific study. The scale consists of 48 items, all positive behaviour categories and contains six subgroups. Subgroups are self realisation, health responsibility, exercise, nutrition, inter-personal support and stress management. The total score obtained from the scale indicates the level of healthy lifestyle behaviours. Scoring is performed on a four-point Likert Type Scale. One point is given to the answer 'never', 2 points are given to 'sometimes', 3 points to 'frequently' and 4 points to 'regularly'. The lowest total score is 48 and the highest is 192. A higher score indicates that the subject performs a higher level of the indicated behaviours (Esin 1997).

Data analysis

Data were analysed using SPSS statistics software, version 11.0 for Windows. To treat analysis, minimum and maximum values were controlled before the evaluation of the data. Chi-square and variance analysis (ANOVA) were used for the assessment of the experimental groups and the control group; paired *t*-test was used for intra-group assessment of significance of the difference between the average pretest–posttest scores of MASES, HPLP, BMI and SBP-DBP; variance analysis was used for inter-group assessment of significance of the difference between the average pretest–posttest scores of MASES, HPLP, BMI and SBP-DBP; Tukey test was used for advanced analysis; and McNemar test was used for assessment of significance of the difference between the pretest–posttest levels of regular and irregular using of medications in experimental groups and the control group. Internal consistencies of the MASES and HPLP scales were tested using Cronbach's alpha reliability coefficients. A significance level of $p = 0{\cdot}05$ was used for all comparisons.

Results

At pre-test, there were no statistically significant differences between any of the groups (both intervention and control groups) in terms of descriptive characteristics, SBP-DBP, MASES, HPLP scales or BMI pretest results (see Tables 1 and 2). When the effectiveness of interventions in the both control and intervention groups was compared using the SBP, DBP MASES, it was found out that the both interventions were effective, but combined education (Group B) more effective than medication adherence education alone (Group A) on blood pressure (Table 3). MASES scores of intervention groups were significantly increased. Significant differences were noted when comparing HPLP average scores between

Table 1 The comparison of descriptive features of intervention and controls groups

Descriptive features	Intervention Group A (n = 40)	Intervention Group B (n = 40)	Control group (n = 40)	Test value significance
Age	58·00 SD 8·9	56·92 SD 8·04	55·62 SD 8·46	F = 0·840 p = 0·434
Treatment duration in years	5·10 SD 4·32	7·10 SD 6·16	5·37 SD 5·17	F = 1·689 p = 0·189
	n (%)*	n (%)*	n (%)*	
Gender				
Female	20 (50·0)	20 (50·0)	22 (55·0)	χ^2 = 0·267
Male	20 (50·0)	20 (50·0)	18 (45·0)	SD = 2 p = 0·875
Marital status				
Married	36 (90·0)	33 (82·5)	35 (87·5)	χ^2 = 1·010
Widowed	4 (10·0)	7 (17·5)	5 (12·5)	SD = 2 p = 0·604
Education level				
Literate	3 (7·5)	6 (15·0)	2 (5·0)	χ^2 = 5·399
Primary school	24 (60·0)	21 (52·5)	26 (65·0)	SD = 8
Secondary school	3 (7·5)	6 (15·0)	3 (7·5)	p = 0·714
High school	6 (15·0)	3 (7·5)	5 (12·5)	
University	4 (10·0)	4 (10·0)	4 (10·0)	
Profession				
Officer-worker	1 (2·5)	3 (7·5)	2 (5·0)	χ^2 = 2·359
Housewife	17 (42·5)	20 (50·0)	19 (47·5)	SD = 6
Retired	20 (50·0)	15 (37·5)	16 (40·0)	p = 0·884
Farmer	2 (5·0)	2 (5·0)	3 (7·5)	
Economic status				
Income > expenditure	1 (2·5)	1 (2·5)	4 (10·0)	χ^2 = 3·292
Income = expenditure	35 (87·5)	34 (85·0)	32 (80·0)	SD = 4
Income < expenditure	4 (10·0)	5 (12·5)	4 (10·0)	p = 0·510
The type of family				
Nuclear family	35 (87·5)	37 (92·5)	35 (87·5)	χ^2 = 0·690
Extended family	5 (12·5)	3 (7·5)	5 (12·5)	SD = 2 p = 0·780
Tobacco use				
Smoking	3 (7·5)	8 (20·0)	5 (12·5)	χ^2 = 2·740
Non-smoking	37 (92·5)	32 (80·0)	35 (87·5)	SD = 2 p = 0·254
Alcohol use				
Drink	1 (2·5)	2 (5·0)	3 (7·5)	χ^2 = 1·053
Does not drink	39 (97·5)	38 (95·0)	37 (92·5)	SD = 2 p = 0·591
Comorbid illnesses				
Yes	18 (45·0)	20 (50·0)	16 (40·0)	χ^2 = 0·808
No	22 (55·0)	20 (50·0)	24 (60·0)	SD = 2 p = 0·668

*Per cent of column.

the two study groups and between study groups and the control groups (p < 0·001). For BMI, no difference was found between the study groups A and B, nor between Group A and the control group (p > 0·05); however, significant differences were observed between Group B and the control group (p < 0·05) (Table 3, Fig. 3).

The most significant reduction in systolic and diastolic blood pressure was seen in the intervention Group B (Fig. 4). The differences between systolic and diastolic blood pressures, MASES, HPLP and body mass index pre- to post-test total score averages study groups were statistically significant (p < 0·001) for both study groups, while there were not

Table 2 Comparison of pretest results regarding hypertensive control, blood pressure, MASES, HPLP scores and BMI values

Variable	Group A mean ± SD	Group B mean ± SD	Control group mean ± SD	Test and *p*-value
Before education	Pretest	Pretest	Pretest	
Systolic BP	159·25 ± 12·48	158·62 ± 12·85	158·50 ± 14·24	$F = 0·037$ $p = 0·964$
Diastolic BP	95·75 ± 5·00	95·50 ± 5·03	94·75 ± 5·05	$F = 0·427$ $p = 0·653$
MASES	55·30 ± 7·57	55·55 ± 7·67	55·12 ± 8·53	$F = 0·029$ $p = 0·971$
HPLP	87·20 ± 9·25	86·62 ± 10·43	86·52 ± 11·32	$F = 0·049$ $p = 0·952$
BMI	25·27 ± 2·87	25·62 ± 2·87	26·07 ± 4·09	$F = 0·581$ $p = 0·561$

MASES, medication adherence self-efficacy scale; HPLP, health-promoting lifestyle profile.

Table 3 Comparison of posttest results regarding hypertensive control blood pressure, MASES, HPLP and BMI

Variable	Group A mean ± SD	Group B mean ± SD	Control group mean ± SD	Test and *p*-value
After education	Posttest	Posttest	Posttest	
Systolic BP	139·75 ± 11·31^{a}	133·50 ± 12·25^{b}	156·00 ± 11·55^{c}	$F = 39·291$ $p = 0·000$
Diastolic BP	86·00 ± 4·69^{a}	83·50 ± 4·83^{b}	93·00 ± 4·35^{c}	$F = 45·215$ $p = 0·000$
MASES	71·10 ± 6·42^{a}	72·27 ± 5·27^{a}	56·85 ± 6·10^{b}	$F = 83·131$ $p = 0·000$
HPLP	97·80 ± 8·35^{a}	118·80 ± 13·88^{b}	87·65 ± 6·71^{c}	$F = 98·417$ $p = 0·000$
BMI	24·42 ± 2·81^{ab}	24·26 ± 2·76^{a}	26·04 ± 4·21^{b}	$F = 3·478$ $p = 0·034$

MASES, medication adherence self-efficacy scale; HPLP, health-promoting lifestyle profile.
Averages shown with different letters in the same line are different (from each other).

significant pre- to post-test differences in the control group ($p > 0·05$) (Table 4). In Groups A and B, the number of patients who regularly use medication was significantly increased after education ($p < 0·001$); there was no significant increase in medication compliance in the control group ($p > 0·05$) (Table 5).

Discussion

To the authors' knowledge, this study is the first nursing intervention study to improve both medication adherence and healthy lifestyle behaviours for hypertensive patients in Turkey. In this study, we shed light on professional educator roles of the nurse. Our results indicate the importance of receiving nursing intervention for controlled blood pressure, healthy lifestyle behaviours and medication adherence self-efficacy (Tables 3–5). The finding of study supported our hypothesis. Our results can be applicable to primary care facilities worldwide because uncontrolled blood pressure, non-adherence medications and unhealthy lifestyle behaviours are global problems.

Groups in the study were similar in terms of descriptive characteristics (Table 1). It has been shown in many descriptive studies that certain personal characteristics such as age, sex, being overweight, educational level, marital status, income level, smoking, alcohol consumption, comorbid diseases are associated with the prevalence of hypertension (Schutte *et al.* 2003, Esposti *et al.* 2004, Altun *et al.* 2005, Taşçı *et al.* 2005, Erem *et al.* 2008). Control of changeable characteristics is important for accurate testing of the efficacy of educational interventions.

Results of the pre-test, which was carried out before education and home monitoring started, showed that the averages of the two study groups and the control group were

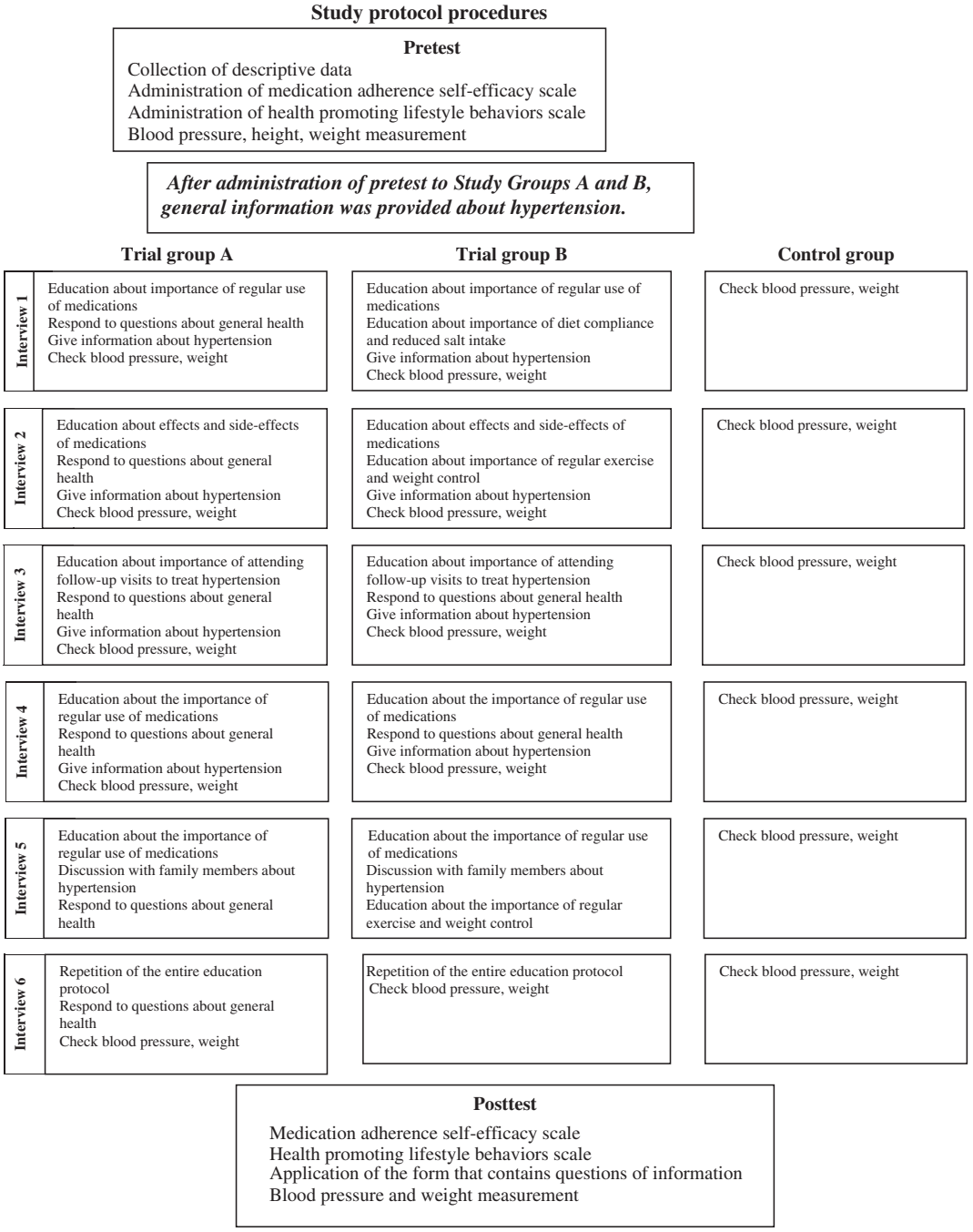

Figure 1 Education plan for each of the six study visit.

similar in terms of systolic, diastolic blood pressures, MASES, perceived self-efficacy, HPLP and BMI (Table 2). The average blood pressure levels were classified as Grade 1 and 2 hypertension; antihypertensive medication adherence/compliance and self-efficacy perception were above average; healthy lifestyle behaviours were at a medium level; and average BMI was slightly high. Although there are several studies evaluating the medication adherence of hypertensive patients in Turkey (Çetinkaya *et al.* 1996, Eryonucu *et al.* 1999, Karakurt 2004), reliability and comparability of their results are limited because of the lack of standardised instruments used in the surveys. In a study by Ogedegbe *et al.* (2003), the developer of the MASES, carried out on an Afro-American study group, it was found that medication adherence self-efficacy levels were higher compared to the results of the study carried out by Gözüm and Hacıhasanoğlu (2009).

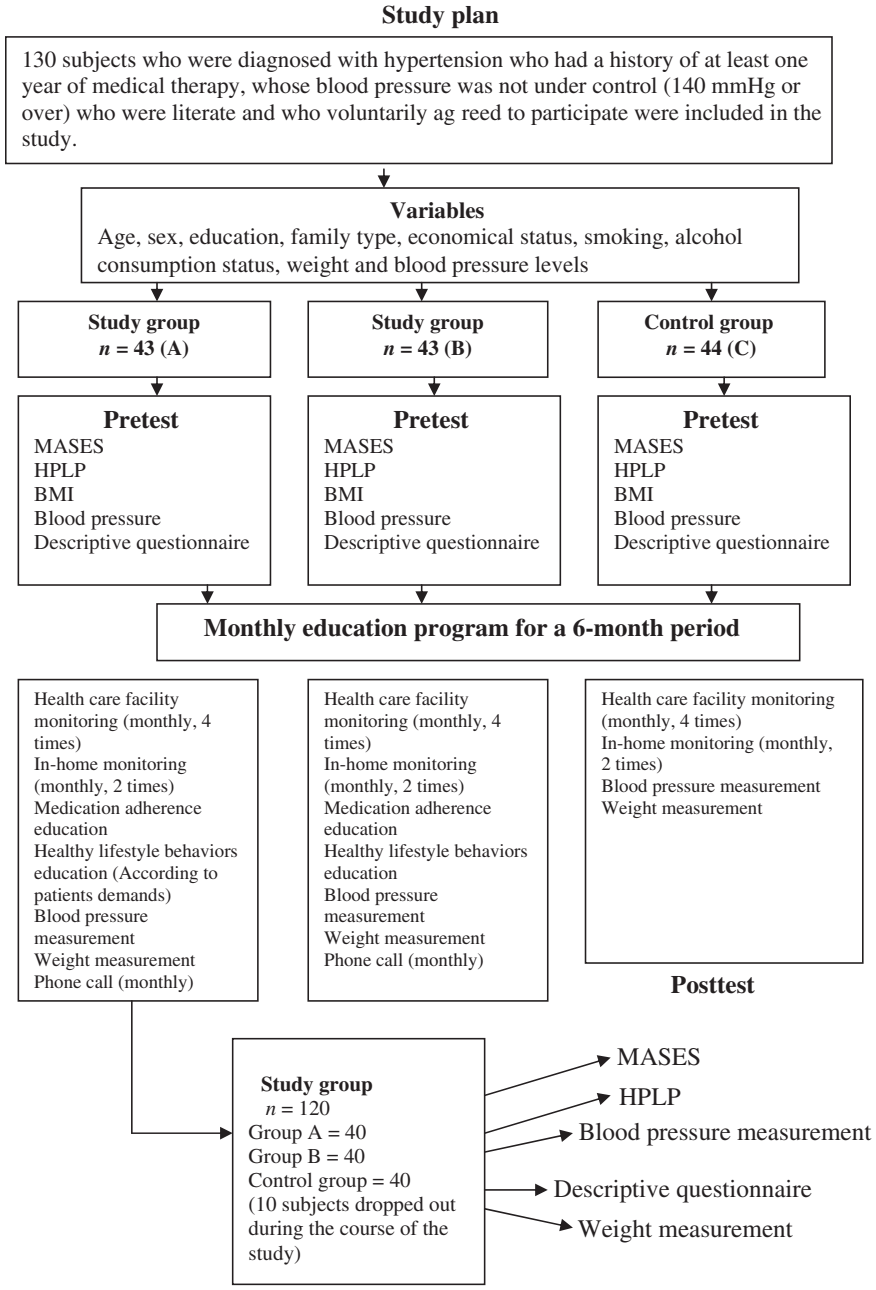

Figure 2 Study plan.

Gozum & Hacihasanoglu translated the MASES into Turkish and conducted the study in a similar group in Erzincan province. Differences between the Gözüm and Hacıhasanoğlu (2009) study and Ogedegbe *et al.* (2003) study may result from the inclusion of patients whose blood pressures levels are already taken under control in Ogedegbe *et al.* (2003) study. Compared with a previous study (Çakır 2003) performed in Turkey on hypertensive patients, healthy lifestyle behaviour level of the patients in the present study before education was lower, a result that may be because of the lower average blood pressure level of the patients in the study of Çakır (2003).

Taken together, Tables 3 and 4 and Figs 3 and 4, it is of interest that the two different educational protocols were effective in both study groups; however, the change in Group B is more prominent, probably attributable to the combination of the medication adherence education and healthy lifestyle behaviours education for that group. Systolic and

Table 4 Comparison of pre- and posttests according BP, MASES, HPLP and BMI

Before and after education	Systolic X ± SD	Diastolic X ± SD	MASES X ± SD	HPLP X ± SD	BMI X ± SD
Group A					
Before education	159·25 ± 12·48	95·75 ± 5·00	55·30 ± 7·57	87·20 ± 9·25	25·27 ± 2·87
After education	139·75 ± 11·31	86·00 ± 4·69	71·10 ± 6·42	97·80 ± 8·35	24·42 ± 2·81
Significance	t = 19·953	t = 12·854	t = −15·688	t = −17·450	t = 12·302
	p = 0·000	p = 0·000	p = 0·000	p = 0·000	p = 0·000
Group B					
Before education	158·62 ± 12·85	95·50 ± 5·03	55·55 ± 7·67	86·62 ± 10·43	25·62 ± 2·87
After education	133·50 ± 12·25	83·50 ± 4·83	72·27 ± 5·27	118·80 ± 13·88	24·26 ± 2·76
Significance	t = 20·154	t = 17·423	t = −14·320	t = −14·099	t = 20·222
	p = 0·000	p = 0·000	p = 0·000	p = 0·000	p = 0·000
Control group					
Before education	158·50 ± 14·24	94·75 ± 5·05	55·12 ± 8·53	86·52 ± 11·32	26·07 ± 4·09
After education	156·00 ± 11·55	93·00 ± 4·35	56·85 ± 6·10	87·65 ± 6·71	26·04 ± 4·21
Significance	t = 1·803	t = 1·934	t = −1·487	t = −1·027	t = 0·274
	p = 0·079	p = 0·060	p = 0·145	p = 0·311	p = 0·786

MASES, medication adherence self-efficacy scale; HPLP, health-promoting lifestyle profile.

Table 5 Comparison of medication usage status before and after training

	Group A		Group B		Control group	
Drug use status	Before education S (%)*	After education S (%)*	Before education S (%)*	After education S (%)*	Before education S (%)*	After education S (%)*
Regularly use	10 (25·0)	32 (80·0)	9 (22·5)	34 (85·0)	11 (27·5)	17 (42·5)
No regularly use	30 (75·0)	8 (20·0)	31 (77·5)	6 (15·0)	29 (72·5)	23 (57·5)
Significance**	p = 0·000		p = 0·000		p = 0·238	

*Per cent of column.
**Test of McNemar.

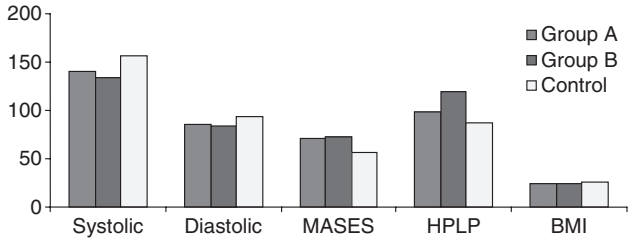

Figure 3 Posttest comparison between groups' for BP, MASES, HPLP and BMI index.

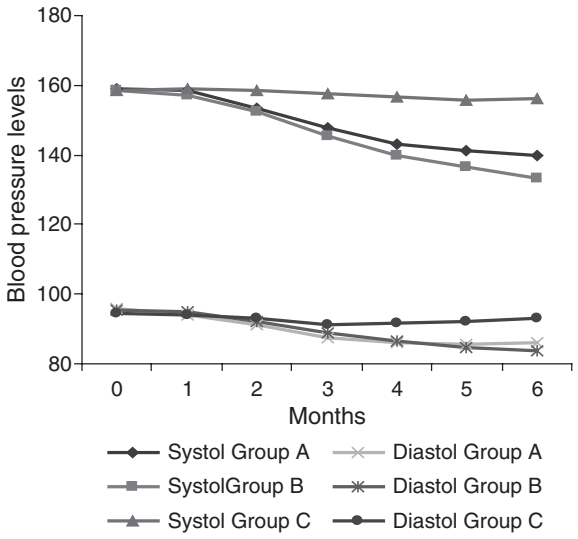

Figure 4 Blood pressure distribution of groups analysed by month.

diastolic blood pressures decreased to normal levels in both study groups. Systolic (57·5%) and diastolic (65%) blood pressures of more than half of the patients in Group A decreased to below hypertension limits (140/90 mmHg). The decrease in Group B was higher (67·5% in systolic, 75% in diastolic) (Table 3, Figs 3 and 4), thus confirming our fourth hypothesis. A higher decrease in blood pressure levels in Group B may be explained by the administration of both education programmes as opposed to just the medication adherence protocol. Further, there was more improvement in healthy lifestyle behaviours in the Group B than in Group A or the control group, which supports our consideration. The current results are in agreement with many studies showing that educational initiatives in hypertensive patients increase

medication adherence and healthy lifestyle behaviours and decrease blood pressure levels (Bosworth *et al.* 2005, Clark *et al.* 2000, Rudd *et al.* 2004, Çakır 2003, Garcia-Pena *et al.* 2001, Svetkey *et al.* 2005). Similarly, Canzanello *et al.* (2005) reported significant decreases in blood pressures of hypertensive individuals following an education programme taught by physicians and nurses promoting medication adherence and health lifestyle behaviours. In a study by Stergio *et al.* (2003), control was achieved in SBP of 51% and diastolic blood pressure of 84% of hypertensive patients through implementation of individual treatment strategies by general practitioners for improving medication adherence during a six-month monitoring period. The present study showed that a six-month education programme taught by the investigator, who is a nurse, along with in-home monitoring had a significant impact on blood pressure control. This finding supports the literature and verifies our second hypothesis.

The greatest improvement in healthy lifestyle behaviours occurred in study Group B (Tables 3 and 4, Fig. 3). Of note, however, during educational interviews, hypertensive patients in Group A who had only medication adherence education asked questions about the role of nutrition and exercise on hypertension. These questions were usually about salt intake limitations, questions about nutrition and weight control. Information given to hypertensive patients in Group A about healthy lifestyle behaviours was limited to the extent of their questions. However, the average HPLP post-test score of this group (Group A) was higher than pre-test for this same group and higher than as those of the control group.

Although medication adherence average score increased most in Group B, no significant difference was found between Group A and B and further, the medication adherence average scores of Groups A and B were significantly higher than that of the control group (Tables 3 and 4, Fig. 3). These results confirm our first and third hypothesis and emphasise the importance of patient education in the treatment and care of hypertensive patients. Even if long-term education is not possible, the act of answering relevant questions alone in hypertensive patients could potentially help in blood pressure control (Table 3 and 4).

Following education, we found a statistically significant decrease in the BMI averages of patients in both study groups and no BMI decrease in the control group (Tables 3 and 4). Many studies in the literature (Çakır 2003, Grandi *et al.* 2006, Drevenhorn *et al.* 2007) have shown that hypertensive patients lose weight after education, monitoring and counselling. A meta-analyses by Neter *et al.* (2003) have clearly demonstrated decreases in weight, which also resulted in decreased blood pressure in hypertensive patients after educational interventions including suggestions for decreased caloric intake, increased physical activity and a combination of both.

In the present study, the gradual decrease in blood pressure in the two study groups was associated with the education provided on medication adherence and the resultant higher compliance rates for regular medication use (Table 3, Fig. 4). In the medication adherence education, we emphasised the importance of regular use including the importance of trying not to miss even one dose and continuation of medication even after a slight and anticipated side effects; patients were referred to a specialist whenever a serious or potentially side effect was noted. At study completion, the regular medication adherence was significantly improved in Groups A and B (regular medication use ratios were 25% and 22·5% before education, respectively, and increased to 80% and 85% after education) (Table 5). The self-efficacy perception of patients in this study was responsive to the education; in fact, MASES scored improved such that scores were near maximal at post-test in Groups A and B (Table 4). Similar to the current results, Çakır (2003) found that regular medication use increased from 73·3–100% after education. Lee *et al.* (2006) reported in their experimental study with controls that six months after the educational intervention, the medication adherence ratio that included knowledge of medication name, side effects, usage types and indications increased from 62·1–96·9%.

Overall, the present study, as well as those previously published, have shown that education positively impacts hypertension, knowledge of side effects, regular medication use and medication adherence. Education administered by nurses about hypertension and life-long antihypertensive medication therapy will inevitably provide increased success in blood pressure control. Health professionals, even if they do not have the opportunity to give a long-term education, must be aware of the fact that responding to questions of hypertensive patients is influential in incrementing compliance to medication and enabling them to choose a healthy life style. Individual patient education has positive effects on hypertension; however, we advise for future studies that group education may be more appropriate in some settings because it saves time and is more cost-effective.

In this study, standardisation of physical measurement tools was not compared by an accredited institution. Use of other robust tools for end might be considered as an important limitation for this study. Therefore, further research is required to establish this.

Conclusion

Educational interventions in hypertensive patients are efficacious in hypertension management and can make a major contribution to improvement in the patients' healthy lifestyle behaviours, medication adherence, blood pressure and BMI. Considering the results of the present study, nurses working in primary health care facilities may confidently use both educational and counselling services to improve patient adherence and to lower blood pressure. Nurses play a significant role in patient compliance and blood pressure control in Turkey where hypertension is important problem. It is important that primary health care nurses be educated in proper methodologies for teaching patients about hypertension, medication adherence and healthy lifestyle behaviours.

Finally, it must be acknowledged that some patients with hypertension will always be inclined to non-adherence medication and unhealthy lifestyle behaviours. Therefore, future efforts should be made to encourage nurses to educate their hypertensive patients. This study results may have implications for both Turk and other nurses who have given care to hypertensive patients because non-adherence medication is important problem in other countries. So, the results of this study may have implications for nurses working in other countries too.

Relevance to clinical practice

Patient education medication adherence alone and in combination and healthy lifestyle behaviour teaching is an effective tool for blood pressure reduction in the hypertensive population in primary health care settings.

Acknowledgements

This study was performed as part of a doctoral thesis under the supervision of the second author. We thank all study subjects for their willing participation. This study was presented as an oral presentation in the XIIth National Public Health Congress, Turkey (21st–25th October, 2008) and received the award for third best presentation.

Contributions

Study design: SG, RH; data collection and analysis: RH, SG and manuscript preparation: RH, SG.

Conflict of interest

The authors declare that they have no conflict of interest.

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