CHAPTER 3

RESULTS

3.1 Results of the pilot study

3.1.1 Sample size calculation

After the pilot study the variance in population was calculated to be used in the sample size calculation. The variance was calculated from the formula below (Donald et al., 1996).

$$\sigma^2 = \frac{\sum x^2}{N} \qquad \text{Formula 3.1.1}$$

where

σ^2 = the variance

$\sum$ = the sum of x^2

x^2 = the deviation of each score from the mean $(X-\overline{X})$, otherwise known as the deviation score

N = the number of cases in the distribution

Sample size calculation for two groups of independent subjects is given below (Thinkhamrop, 2001).

$$\text{n/ group} = \frac{2\sigma^{2*}(Z_{\alpha/2} + Z_{\beta})^2}{\mu_d^2} \qquad \text{Formula 3.1.2}$$

n is number of sample size in the statistics

σ^2 is the variance of population

$Z_{\alpha/2}$ is standard score predicted by α

Z_β is standard score predicted by β

μ_d^2 is the size of the proposed effect

$\overset{*}{-}$ a small adaptation of the symbol

In calculating the level of significance α=0.05 (Z= 1.96), β=0.1 (Z=1.28), at the power of 90% and the effect size (change) of SBP of 10 mm Hg. Variance was calculated using Formula 3.1.1 with 20 patients and it was shown to be 453.

Independent sample size calculation using Formula 3.1.2

SBP:

$$\text{n/ group} = \frac{2\,(453)^2\,(1.96+1.28)^2}{(100)^2}$$

$$= 95.11$$

The number was increased by 30% to allow for patients dropping out.

$$= 123.64$$

DBP:

n/group = 38.63

The number was increased by 30% to allow for patients dropping out.

$$= 50.22$$

In conclusion, the number of patients which were required in this study to show the required statistically significant difference in SBP of 10 mm Hg was 124 patients per group.

3.1.2 Sphygmomanometer comparison with digital meter

The comparison in reading between sphygmomanometer and the digital meter in the hospital was performed in one day. This aimed to assess the difference in reading between the two instruments. Twenty persons who were aged over 18 years, with or without hypertension, were included in this test in the clinic of the hospital. Each patient had their BP measured with the digital meter and then after 5 minutes the research pharmacist performed two BP measurements with the sphygmomanometer. The results are shown in Table 3.1 and are analyzed by the paired t test. The measurement readings represented no significant difference in SBP, $p = 0.052$, but the readings of DBP and pulse rate were significantly different, $p < 0.05$. It is quite interesting that the readings from the sphygmomanometer were significantly higher than those from the digital meter.

Table 3.1 Results of blood pressure readings between the digital meter and sphygmomanometer in 20 patients (Ref. 1)

Measurement	Mean (SD) (N=20)		Mean difference	P value
	Digital	Sphygmomanometer		
Systolic BP	115.90 (19.53)	126.65 (29.05)	-10.75	0.052
Diastolic BP	71.10 (12.72)	83.05 (13.82)	-11.95	< 0.001
Pulse rate	87.05 (10.00)	82.75 (9.31)	4.30	0.007

3.1.3 Patient satisfaction

There were 16 patients whose data were analyzed. The age range of the study group was 40.8 to 86.0 years. The mean age was 63.2 $\pm$ 9.5 years.

Item development and selection

Items for the pilot study were developed to include the range of pharmacist provision in primary care settings. This provision was categorized into seven domains as shown in Table 3.2. A literature review and the judgement of seven experts were both used to develop the tool. Five of the experts were involved in the pharmacy field and two were involved in health sciences. Nearly equal numbers of positive and negative items were included to avoid response set bias. An attempt was made to make the items as simple and clear as possible in order to show a single idea in each statement.

Participants

There were 16 items which were included in the initial pro forma and these were trialed out. Participants were hypertensive patients who volunteered and who came to the hospital clinic visits on Fridays during July-September 2002.

Content Validity

The content validity of the first pro forma, 18 items, in seven domains was assessed as shown in Table 3.2. Four domains were shown to be in the level of 'very relevant and succinct', and the other three domains were in the level of 'relevant but needs minor alteration', general satisfaction, time spent and interpersonal relationship. The wording of each statement was also rated for readability and understandability. One expert recommended that the time taken in relation to the value which patients received should be indicated. Consequently the statements in the domain of 'time spent' were altered to include an estimate of the time spent in relation to the value the

patient received. This new statement was classified in the financial aspect domain. The 18 items were then reduced to 16 items in this pro forma as in Table 3.3.

Table 3.2 Content validity in domains of patient satisfaction pro forma (Ref. 2)

Domains Item [a]	sample[b] Mean [c] ± SD
General Satisfaction	3.28 ± 0.49
Time spent	3.07 ± 0.73
Accessibility and convenience	3.57 ± 0.53
Financial aspect	3.71 ± 0.49
Communication and management	3.54 ± 0.63
Interpersonal relationship	3.46 ± 0.70
Continuity of care	3.64 ± 0.50

[a] a 4 rating scale (1= not relevant, 2= unable to assess relevance without item revision, or item is in need of such revision that it would no longer be relevant, 3 = relevant but needs minor alteration, 4 = very relevant and succinct)
[b] seven experts rated the relevance to the objectives of the study.
[c] relevant level (1.00-1.50 = not relevant, 1.51-2.50 = unable to assess relevance without item revision, or item is in need of such revision that it would no longer be relevant, 2.51-3.50 = relevant but needs minor alteration , 3.50-4.00 = very relevant and succinct)

Reliability

The pro forma was tested for reliability by SPSS version 10. Cronbach's alpha was 0.66 in 16 respondents as shown in Table 3.3. The coefficient alpha when an item is deleted was quite high in items No 4, 11 and 15 and lowest in item Nos 9 and 13. This meant that item Nos 4, 11 and 15 might not measure the same thing as the other items because if this item was deleted, the Cronbach's alpha was higher. Item Nos 9 and 13 were quite highly correlated with other items because if they were deleted, the Cronbach's alphas were lower.

Table 3.3 Domains and items from the interview pro forma (N=16) (Ref. 3)

Satisfaction Scale Item [a]	Sample Mean [c] ± SD	Coefficient alpha when an item is Deleted
Communication and management		
1. You felt satisfied with pharmacist's explanation of using medications and life style modification. (+)	3.00 ± .49	0.64
2. You understood how to use medications and life style modification better after talking to a pharmacist. (+)	3.33 ± .49	0.63
3. Sometimes a pharmacist makes you wonder if her/his advice is correct.(-)	2.64 ± .50	0.68
4. A pharmacist did not pay attention to your complaining about disease problems. (-)	2.42 ± .74	0.70
5. You intend to follow the details of this pharmacist's advice. (+)	3.40 ± .51	0.61
Accessibility and convenience		
6. You have not received easy access to see a pharmacist. (-)	2.67 ± .82	0.66
Finance		
7. Although you have extra expense to see a pharmacist, you receive more benefits.(+)	3.20 ± .41	0.63
8. You felt the benefit received was not reasonable compared to the time spent. (-)	2.80 ± .77	0.64
Interpersonal relationship		
9. A pharmacist took care of you very much in medication use and life style modification. (+)	3.33 ± .62	0.59
10. You felt better after talking to a pharmacist about medication use and life style modification. (+)	3.46 ± .52	0.60
11. A pharmacist should smile, greet and talk more to a patient.(-)	2.06 ± .70	0.70
12. A pharmacist ignored what you told him/her.(-)	2.64 ± .75	0.65
13. A pharmacist was pleased to listen to your problems not only on hypertension. (+)	3.36 ± .50	0.57
Continuity of care		
14. You felt confident to see any pharmacist. (+)	3.20 ± .41	0.65
15. If it is possible, you would like to see the same pharmacist.(-)	2.00 ± .65	0.73
Overall satisfaction		
16. In conclusion, you felt satisfied with the pharmacy service of medication use and life style modification. (+)	3.40 ± .51	0.61
Alpha = 0.66		

[a] A 4-point scale (4 = strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree)
[c] Satisfaction level (1.00-1.50 = strongly dissatisfied, 1.51-.2.50 = dissatisfied, 2.51-3.50 = satisfied, 3.51-4.00 = strongly satisfied)
- negatively worded item
+ positively worded item.

3.1.4 Patient knowledge

Item development and selection

Items for the pilot test were developed to include the knowledge which patients should have in three areas, hypertension knowledge; Nos 1, 3, 5 and 8, risk modification; Nos 4, 6, 7, 11, and 12, and the proper use of medications; Nos 2, 9, 10, 13, and 14. A literature review and the judgement of the experts were used to help develop the tool.

The desirable level of coefficient alpha was set at a minimal of 0.50 (MacKeigan and Larson, 1989) although others have quoted higher values 0.800 (Edwards, 1970) and 0.637 (Risser, 1975).

Participants

There were 14 items which were included in the initial pro forma which were trialed out in two styles of responses, two answers and three answers. Participants were hypertensive patients who volunteered and who came to the hospital clinic visits on Fridays during July-September 2002.

Reliability

The two choices pro forma which was redesigned to use the three answer choices; yes, no and I don't know, was administered to 21 patients. The results are shown in Table 3.4. Item analyses were conducted on 14 items. Eight from 14 items' correlations were lower than 0.30, item Nos 2, 5, 6, 8, 10, 11, 13 and 14. Although the correlation between an item and the total correlation was quite low, it was decided not to delete them from the pro forma. Seven experts all agreed that they related to the

content which should be measured, and the coeffient alpha for the patient knowledge scale was 0.60, which was acceptable.

This pro forma was also evaluated under three subscales, 'hypertension knowledge', 'risk factor management' and 'proper use of medications', by item analyses. As results from Table 3.5, indicate items were more highly correlated with their own scale than other scales except in items No 1, 3 and 5. These three items had very low correlation with their own scale as well as other scales. In addition, item No 1 highly correlated with the proper use of medication scale. Nevertheless, these items were not revised as the experts all agreed that these items should be in the pro formas. The coefficient alphas in 'hypertension knowledge', 'risk factor management' and 'proper use of medications' were 0.11, 0.37 and 0.36 respectively.

Table 3.4 Item analysis and reliability test of patient knowledge (N= 21) (Ref. 4)

	Patient knowledge scales*	Mean (Variance) if item deleted	Corrected item-total correlation	Coefficient Alpha
1.	Hypertension is a curable disease	8.22 (4.42)	0.56	0.52
2.	Medications improve better symptoms but do not extend your life longer.	8.44 (5.56)	0.09	0.61
3.	Uncontrolled hypertension can cause stroke.	7.67 (4.94)	0.52	0.55
4.	High salt diet makes blood pressure uncontrolled.	7.83 (4.85)	0.36	0.56
5.	Uncontrolled blood pressure leads to kidney disease.	7.72 (5.51)	0.08	0.61
6.	High body weight is one risk factor of uncontrolled hypertension.	7.78 (5.36)	0.13	0.61
7.	Exercise in hypertensive patients should be avoided.	8.06 (4.64)	0.40	0.55
8.	Most uncontrolled hypertensive patients have headache and blurred vision.	8.44 (5.44)	0.16	0.60
9.	Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	7.83 (4.85)	0.36	0.56
10.	Hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses.	7.89 (5.05)	0.23	0.59
11.	Smoking and uncontrolled hypertension can cause heart disease.	7.78 (5.83)	-0.11	0.64
12.	Stress makes blood pressure harder to be controlled.	7.72 (4.80)	0.50	0.54
13.	All medications which are taken without prescription should have a pharmacist check to avoid drug interactions.	7.72 (5.86)	0.12	0.64
14.	If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	8.11 (4.93)	0.26	0.58
	Alpha = 0.60			

* three answer choices; yes, no and I don't know

Table 3.5 Correlations and coefficient alpha of each subscale item with its own scale (Bold) and with the other scales (Ref. 5)

Patient knowledge scales (∝ at pre test/after 6 mo)	Hypertension knowledge	Risk factor management	Proper use of medications
Hypertension knowledge (∝ = 0.11)			
1. Hypertension is a curable disease	**-0.12**	-0.23	0.46
3. Uncontrolled hypertension can cause stroke.	**-0.45**	-0.65	-0.24
5. Uncontrolled blood pressure leads to kidney disease.	**-0.55**	-0.16	0.00
8.Most uncontrolled hypertensive patients have headache and blurred vision.	**0.41**	0.16	-0.04
Risk factor management (∝ = 0.37)			
4. High salt diet makes blood pressure uncontrolled.	0.40	**0.65**	-0.03
6.High body weight is one risk factor of uncontrolled hypertension.	0.39	**0.63**	-0.33
7. Exercise in hypertensive patients should be avoided.	0.24	**0.40**	0.45
11. Smoking and uncontrolled hypertension can cause heart disease.	-0.03	**0.40**	-0.21
12. Stress makes blood pressure harder to be controlled.	0.41	**0.62**	0.30
Proper use of medications (∝ = 0.36)			
2. Medications improve better symptoms but do not extend your life longer.	-0.27	0.11	**0.51**
9. Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	0.18	0.18	**0.57**
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses.	0.17	0.07	**0.66**
13. All medications which be taken without prescription should have a pharmacist check to avoid drug interactions.	-0.06	-0.15	**0.30**
14. If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	0.37	0.01	**0.63**

3.1.5 Conclusion

The results from the pilot study showed the estimated samples should have 124 patients in each group in order to see the 10 mm Hg SBP difference between the control and treatment groups.

The comparison results between the digital meter and sphygmomanometer showed significant differences between the readings of the two meters in DBP and pulse rate but not in SBP readings. This should be taken into consideration in the clinical interpretation of the difference between the readings.

The patient satisfaction pro forma showed high agreement in the content of the questions from seven experts. The means of each subscale item were more than 3.00. Cronbach's alpha in a single construct was 0.66 which was also acceptable.

The patient knowledge pro forma also showed an acceptable coefficient alpha, 0.60, for a single construct of 14 items. In the multiple construct, each item in each construct mostly showed high correlation with its own scale, except in 'hypertension knowledge'. Cronbach's alphas in each subscale were quite low, <0.50. The follow-up test should be done both for the single and multiple constructs during the main study with higher samples.

The Digit Span test and SF-36 were not tested in the pilot study because the Digit Span test was a standard tool and SF-36 was already validated for validity and reliability (Leurmarnkul and Meetam, 2000).

3.2 Results of the main study

3.2.1 After the first six months

From the hospital database, 770 patients were identified as hypertensive patients in the Market area (Tumbon Talaad) on 14 March 2002. Of these there were only 137 eligible patients who signed the consent forms during July 2002-December 2002 and finally only 118 patients were left to enroll into the pre test period. Nineteen patients did not enter the study because two patients died during the pretest period, another patient had a stroke during this time, two patients planned to move away, one patient had an order to stop hypertensive medication and BP was in control, one patient chose to have hypertensive care in a private hospital, the remaining 12 could not be contacted after the first meeting.

Due to the small numbers of patients in the area of Tumbons Takhonyang and Kharmrieng, where there were only 46 patients and 48 patients respectively on the hospital database on 14 March 2002. Thus all patient medication profiles in both primary care units were examined by the research pharmacist to review every patient medication profile with the keywords of 'diagnosis of hypertension' or 'BP reading at least 140/90 mm Hg' at the last entry in each profile. There were 210 patients in total who met the above criteria, postcards were sent out to recall them in order to measure their BP and inform them about this study. One hundred and thirty two patients agreed to enroll into the study, but there were only 117 patients remaining during the pre test period. One patient died before the pre test period, one met the exclusion criteria, one was disabled, and the remaining 12 could not be contacted.

The patients, 118, in the Market area were randomly allocated into the treatment (59) and the control groups (59). And 117 patients in Tumbons Takhonyang and Kharmrieng were randomly assigned into the treatment (59) and the control groups (58).

3.2.1.1 Patient characteristics

From the total sample of 235 patients, 118 patients were allocated to the treatment group, that is the pharmacist involved group, and 117 patients to the no pharmacist involved group, that is the control group. The baseline patient characteristics at the beginning of the study are shown in Table 3.6. The results of randomization of hypertensive patients into groups showed no significant differences in demographic variables and baseline BP between groups. That is, the two groups were equal in all the variables.

Table 3.6 Homogeneity of demographic variables between groups at the baseline (N = 235) (Ref. 6)

	Treatment group (n =117)	Control group (n =118)	p value
Demographic variables			
Sex			0.224
Men, no. (%)	42	33	
Women, no. (%)	76	84	
Age, mean ± SD	63.20 ± 9.33	63.23 ± 9.25	0.982
Career			0.695
Business	21	19	
Gov employee	9	12	
Farmer	31	30	
Business employee	5	2	
Retired employee	9	0	
No career (house wife)	51	53	
Education			0.229
No education	1	2	
Primary school	83	81	
Secondary school	22	17	
Pre bachelor degree	4	2	
Bachelor degree	8	10	
Master degree	0	5	
Marital status			0.130
Widow	32	37	
Divorce	7	2	
Married	76	70	
Single	3	8	
Insurance			0.921
30 bath	15	13	
Free(gold card)	57	58	
Social insurance	2	1	
Refund	44	45	
Income range (bath)			0.934
<2,500	51	49	
2,500-5,000	30	27	
5,001-7,500	5	6	
7,501-10,000	6	5	
10,001-12,500	3	2	
> 12,500	23	28	
Disease			0.474
Hypertension	57	54	
Hypertension with diabetes	39	45	
Hypertension with target organ damage *	13	7	
Hypertension with diabetes and target organ damage	9	11	

*Target organ damage = previous stroke, myocardial infarction, left ventricular hypertrophy, angina pain, congestive heart failure, transient ischemic attack, renal failure

3.2.1.2 Pharmacist's intervention

Table 3.7 shows the response to the pharmacist's recommendations to modify the medication. As the result of the pharmacist's letters from the community pharmacy, 43 of 76 suggestions to change the patient's medication were accepted. In addition 45 of 130 recommendations made by the pharmacist in the patient's notes in the PCUs were accepted. Eleven recommendations were accepted for more investigations to be undertaken. Thus a total of 99 of 206 recommendations (48.06%) were accepted. Examples of the type of the pharmacist's interventions which were made are shown in Table 3.8 for the six months follow-up period.

The numbers and the class of hypertensive medications were assessed as shown in Table 3.9. There was no significant change between the treatment and the control groups either in the medication class or the numbers of medications used at the pre test and after six months, $p < 0.05$.

Table 3.7 The response of physicians to the pharmacist's recommendations on modifications to patient medications

	Total No. of recommendations	No. of pharmacist recommendations accepted		No of pharmacist recommend-ations not accepted	No of recommend-ations not seen
		Drug modification	More investigations*		
Pharmacist's Letters	76	43	6	17	10
Pharmacist's Notes	130	45	5	69	11
Overall recommendations	206 (100%)	88 (42.72%)	11 (5.34%)	86 (41.75%)	21 (10.19%)

* These are pharmacist's recommendations which related to laboratory tests such as renal function or lipid profile. Patients' whose symptoms indicated they were at risk were also referred.

Table 3.8 Examples of the type of the pharmacist's interventions which were sent for the doctors' considerations

Examples	Categories	activities
1	A female patient who was on eltroxin 1x1 and HCTZ (50) 0.5x1 had a sudden right arm weakness after awaking one day. Lipid and thyroid function had not been screened or followed up.	Doc: FBS, lipid profile and off thyroid drug without seeing lab test
2	A female patient was found to have pitting edema of both legs via pharmacist review of system was sent back for more investigations of renal function test. She took HCTZ (50) 0.5x1 and Mestinon 1x3.	Doc: lipid, renal function, UA, Elyte
3	Cr 1.5 Clcr 33 ml/min, a female patient with DM+HT and renal insufficiency had never been screened for further lipid since Nov. 02 with LDL 164.6 mg/dl.	Doc: lipid profile
4	A male patient, HT with IHD, on simvastation Sep 02 for 1 month and stoped med without retest for seeing effectiveness. In March 03 a consultation was made.	Doc: start simvastatin and order lipid profile
5	Feb 03 Cr 1.8 Clcr =45.15 ml/min , a male patient, HT, always complained heavy legs and frequently diuresis even though HCTZ was stopped. Recommend for more investigation due to frequent diuresis and K monitoring is needed according to instruction on the use of Enaril(20) 1x1	Doc: order BUN, Cr, Elyte, UA, LFT
6	Screen FBS was impaired (110mg% ;December 02, 170mg%; March 03, 146mg%, March 03) without using DM meds. A female patient, HTN, was advised to control diet. She missed an appointment in April 03 and did not want to go so the pharmacist advised her to go and make herself ready to start medication.	Doc: order FBS for more follow -up
7	A male patient with mild HTN and DM who was taking Enaril (20) 0.5x2 and HCTZ(50) 0.5x1 complained of palpitation and easily producing much sweat with walking. Systemic review with recommendation was sent to a doctor.	Doc: The complaining symptoms might be caused from uncontrolled BP with sympathetic dominant. Atenolol (50) 0.5x1 might be beneficial to control BP and these symptoms. A doctor added Atenolol (50) 0.5x1
8	A male patient,64 years old, had DM with HT when on Enaril (5) 1x1. His blood pressures ranged mild to moderate, ~ 170-175/88-95 mm Hg within 4 months. He had pitting edema in both legs.	Doc: Recommend to increase the dose of Enaril to be 20 mg 1x1 to achive BP <140/90 mm Hg. A doctor increased Enaril to be 10 mg per day and also added HCTZ 0.5x1

Table 3.9 The assessment of hypertensive medications class and the number of hypertensive medications which were used at the pre test and after six months

Medication class	Treatment group	Control group	p value
Pretest			
Betablocker	26	24	0.750
CCB	20	23	0.490
Diuretics	57	55	0.794
ACEI	50	64	0.067
ACEII	2	1	0.561
Nitrates	8	8	1.000
Alphablocker	4	6	0.518
No of meds			
0	1	0	0.205
1	72	62	
2	39	48	
3	6	5	
4	0	2	
Total	118	117	
After 6 months			
Betablocker	35	28	0.318
CCB	24	28	0.503
Diuretics	60	57	0.740
ACEI	53	55	0.739
ACEII	4	1	0.178
Nitrates	8	9	0.786
Alphablocker	2	5	0.244
No of meds			
0	3	4	0.352
1	47	54	
2	57	43	
3	7	13	
4	1	1	
Total	115	115	

3.2.1.3 Visits

Numbers of visits during the six months follow-up is given in Table 3.10. The distribution was not normal. Mann-Whitney was used to evaluate the difference between groups. The numbers of visits was counted as missing data when their visits totalled less than 3 during these nine months, October 02 – June 03, because this calculation was planned to be related to the cost analysis. Five patients were missing from the total visits and non hypertensive visits calculation. Two patients went to other

hospitals, one patient stopped attending clinic visits after the first time of treatment and the other two patients attended the clinic less than three times. In the hypertension visit calculation, there were ten patients who dropped out. This included five patients from the total visits calculation. For the rest of the five patients, four patients did not receive hypertension medication after the beginning of the study and the other attended the clinic less than three times during this period.

The mean of total visits was higher in the treatment group than in the control group, 6.64 (range 3 to 9) and 6.19 (range 3 to 9), respectively. During the six months, most of the patients in the treatment group visited more frequently only in total visits, 8 times in the treatment and 7 times in the control group. Nevertheless, the Mann-Whitney U test indicated that the total visits and non hypertension visits were significantly higher in the treatment group than in the control group, $p < 0.05$ but there was no significant difference between the groups in the hypertension visits, $p > 0.05$

Table 3.10 Numbers of visits to receive medications in the treatment and control groups (Ref. 12)

	Treatment group Mean (SD) (min-max, mode, mean rank)	Control group Mean (SD) (min-max, mode, mean rank)	P value
Total visits (N=113 control, 117 treatment)	6.64 (1.62) (3-9,8, 124.71)	6.19 (1.57) (3-9, 7, 107.06)	0.031
Hypertension visit (N=110 control, 115 treatment)	5.75 (1.61) (3-9, 5, 115.44)	5.63 (1.63) (3-9, 5, 111.49)	0.561
Non hypertension visit (N=113 control, 117 treatment)	0.99 (1.26) (0-5,0, 125.20)	0.71 (1.23) (0-6, 0, 106.56)	0.022

Mann-Whitney was used to evaluate the difference between groups.

3.2.1.4 Clinical outcomes

3.2.1.4.1 Blood pressure Control

BP control was defined following JNC-6 (National high blood pressure education program, 1997). The controlled BP in hypertension without concomitant cardiovascular disease was defined as having a benchmark of $\leq$ 135/85 mm Hg because the conditions of BP measurement were similar to the conditions for self measurement at home as stated in JNC-6 and all other BP goals followed JNC-6 guidelines. Patients were counted as controlled when both SBP and DBP achieved those goals, otherwise they were considered to be uncontrolled.

A total of eight patients dropped out during the study, two in the treatment group at pre test and three at post test and a further three patients in the control group at the post test. The latest eight digital readings from the hospital database were used to replace the missing values for the intention to treat analysis.

BP control assessment compared between the treatment and the control groups:

From Table 3.11, at the beginning of the study in 235 samples, there was no significant difference between the number in the treatment and the control group who had their BP controlled ($p = 0.349$). After six months follow-up, the proportion of patients having their BP controlled was not significantly different between the treatment and the control groups ($p = 0.061$).

The data were also analyzed after excluding the patients whose BP was controlled at values lower than 140/90 mm Hg at the pre test. This left 158 patients

who had high BP at the pre test. Of these 76 were in the treatment group and 82 in the control group. At the end of the study 46 patients in the treatment group had both SBP and DBP controlled. This compared with 34 patients, in the control group. The difference between the two groups was significant ($p = 0.017$). That is 60.53% in the treatment group and 41.46% in the control group. This represented a 19.07% improvement in the treatment group which was a very marked improvement.

BP control assessment compared within each group:

In the 235 sample patients, Table 3.11, there were higher numbers of patients who had their BP controlled in both the treatment group and the control groups after six months. This represented a significant improvement in the BP control in both patient groups when compared with the pre test results ($p < 0.001$). The same results were obtained with the sample of 158 patients with high BP at the beginning of the study. The proportion of patients who achieved BP control was significantly higher in both groups after six months when compared with the pre test ($p < 0.001$).

Table 3.11 Blood pressures at the pre test and after six months in the treatment and the control groups (Ref. 7&8)

Number (Treatment gr. /Control gr.)	Treatment group		Control group		Exp (B)	95% CI	P value*
	BP controlled	BP uncontrolled	BP controlled	BP uncontrolled			
N_1=235 (118/117)							
Pre test	27[It]	91	21[Ic]	96	1.36	0.72-2.57	0.349
After 6 months	78[It]	40	67[Ic]	50	1.75	0.98-3.13	0.061
Interaction					0.10	0.01-0.98	0.048
N_2=158 (76/82)							
Pre test	0[It]	76	0[Ic]	82	-	-	-
After 6 months	46[It]	30	34[Ic]	48	2.17	1.15-4.09	0.017

N_1 means Total group of 235 patients
N_2 means patients who had BP ≥140/90 mm Hg at the pre test
*Multiple logistic regression was performed to evaluate a difference between groups which used pre test time as a covariate.
Interactions which did not show a significant difference were excluded from the model.
[It] Pairwise comparison showed p values <0.001 in the treatment group between after six months and the pre test.
[Ic] Pairwise comparison showed p values <0.001 in the control group between after six months and the pre test.
Dash line showed that the statistics could not be produced because of the constant at the pre test.

3.2.1.4.2 Blood pressure Difference

BP difference assessment compared between the treatment and the control groups:

Table 3.12, shows the results for the total number of 235 patients and for the 158 patients who had higher BPs of at least 140/90 mm Hg at the beginning of the study. The results for the SBPs of the 235 patients show that when the baseline SBP, the groups and the interaction between these two variables were controlled, the treatment group showed a significantly greater decrease in SBP at the six months follow-up than the control group (p = 0.037). When the baseline DBP was used as the covariate, the treatment group showed a significantly greater decrease in DBP than the control group (p = 0.027). In the study of 158 patients, the treatment group also

showed a more significant decrease in both SBP and DBP (p = 0.002 and 0.008). No significant interaction between baseline SBP or baseline DBP and patient group was found.

BP difference assessment compared within each group:

When comparing BPs at the six months follow-up with the baseline, the treatment group showed a significant decrease of 23.29 ± 19.10 mm Hg in SBP and 14.18 ± 11.20 mm Hg in DBP (p <0.001). The control group also showed a significant decrease of 18.64 ± 17.67 mm Hg in SBPs and 11.73 ± 10.08 mm Hg in DBPs (p <0.001). These results are given in Table 3.12.

Table 3.12 Mean blood pressures and paired differences for all patients (235) and for the group of patients (158) with existing high BP (≥140/90 mm Hg) at the pre test (Ref. 7&8)

Variable	Total group (N = 235)			Patients hypertensive at the pre test [a](N = 158)		
	Treatment group (N=118) Mean ± SD	Control group (N=117) Mean ± SD	p value	Treatment group (N=76) Mean ± SD	Control group (N=82) Mean ± SD	p value
Pre test between groups						
Systolic mm Hg	144.76 ± 19.69	142.41 ± 19.81	0.600	155.19 ± 15.51	152.19 ± 16.17	0.235
Diastolic mm Hg	85.72 ± 13.56	85.96 ± 12.94	0.889	90.47 ± 13.83	89.73 ± 12.96	0.731
Post test between groups						
Systolic mm Hg	121.47 ± 14.90	124.77 ± 17.97	0.037	124.16 ± 14.23	130.36 ± 16.83	0.002
Diastolic mm Hg	71.55 ± 10.80	74.23 ± 11.87	0.027	73.08 ± 10.68	76.52 ± 12.35	0.008
Paired differences within groups						
Systolic mm Hg	23.29 ± 19.10	18.64 ± 17.67	<0.001	26.26 ± 18.14	21.83 ± 17.84	<0.001
Diastolic mm Hg	14.18 ± 11.20	11.73 ± 10.08	<0.001	15.22 ± 10.95	13.22 ± 10.37	<0.001

[a]BP ≥140/90 mm Hg

3.2.1.4.3 Results of patient outcomes after six months

Table 3.13, after six months follow-up, the number of patients who were disabled was similar in both groups. Patients who died were a little bit different, no one in the control group and two in the treatment group. Total number of patients who were admitted to the hospital in the treatment group was a little bit higher than the control group, 11.02% and 8.55% respectively.

Table 3.13 Patient clinical outcomes during October 2002-June 2003 in the treatment and the control groups (file:pharmipd)

Patient clinical outcomes	Treatment group (N=118) Percent (No)	Control group (N=117) Percent (No)
Disabled	0.85 (1)	0.85 (1)
Died	1.69 (2)	0.00 (0)
Hospitalization (times)*		
1	9.32 (11)	6.84 (8)
2	0.85 (1)	0.85 (1)
3	0.85 (1)	0.00 (0)
8	0.00 (0)	0.85 (1)
total of hospitalization	11.02 (13)	8.55 (10)

*Hospitalization was recorded by the hospital. The causes of admission, disabling and death were not available.

3.2.1.4.4 Compliance rates

The number of patients at the pre test whose data were available in the treatment group was 112 patients and in the control group it was 109 patients. Fourteen patients dropped out from the study because one patient died, one patient refused to enroll in the study, three patients did not receive hypertensive medications, one patient went to another hospital and the remaining eight patients did not provide a pill count during the pre test. After six months, 11 patients from the pre test who had dropped out were still unavailable at this time and five more patients did not provide a

pill count. Three of these five patients had their medications stopped by a doctor. The other two did not provide a pill count.

Compliance rate assessment compared between the treatment and the control groups:

From Table 3.14, at the pre test in the treatment group 58 out of 112 patients, 51.33%, had good compliance and in the control group 61 out of 109 patients, 56.48%, likewise had good compliance. At the post test in the treatment group 70 out of 110 patients, 63.64%, had good compliance while in the control group there were 60 out of 108 patients, 55.56%. The results between the two groups were significantly better for the treatment group, around 3 times compared with the control group ($p = 0.014$). There was an interaction between patient group and compliance rate control at the pre test.

Compliance rate assessment compared within each group between the pre test and after six months:

It can be seen from Table 3.15 that after six months follow-up the proportion of patients who had a good compliance rate had increased in the treatment group, 58 of 112 at the pre test and 70 of 110 after six months, but it had not improved in the control group, 61 of 109 at the pre test and 60 of 108 after six months. However, there was no statistical difference in either group.

Table 3.14 Patient compliance rates of the treatment and the control groups at the pre test and after six months (Ref. 9)

Compliance	Good ≥80% compliance	Poor <80% compliance	Odds ratio	95% CI	p value
Pre test [a]					
Treatment group (N=112)	58 (51.33)	54 (48.21)	0.845	0.498-1.435	0.534
Control group (N=109)	61 (56.48)	48 (44.04)			
After 6 month [b]					
Treatment group (N=110)	70 (63.64)	40 (36.04)	2.585	1.136-5.883	0.014 [i]
Control group (N=108)	60 (55.56)	48 (44.86)			

[a] Fourteen patients were missing, 8 of whom dropped out and 6 of whom did not provide data. These were not included in this analysis at the pre test.
[b] By the end of the study a total of 17 patients were missing. The extra 3 missing patients, were not included in this analysis.
[i] Interaction was found between group and the pre test variable

Table 3.15 Patient compliance rates compared within each group between the pre test and after six months follow-up (Ref. 10)

Compliance	Good ≥80% compliance Number (%) (Pre test-After 6 months)	Poor <80% compliance Number (%) (Pre test-After 6 months)	p value*
Pre test –After 6 months			
Treatment group (N=112--110)	58 (51.33) --70 (63.64)	54 (48.21) – 40 (36.04)	0.142
Control group (N=109--108)	61 (56.48) -- 60 (55.56)	48 (44.04) – 48 (44.86)	1.000

* p values were calculated by McNemar test

3.2.1.4.5 Lifestyle Modification

The numbers of patients participating in each modification varied due to the information which was provided at each pharmacist visit.

After six months follow-up, participation in regular exercise showed a significant difference between the groups. The proportion of patients who participated in regular exercise was higher in the treatment group (65 of 114) than in the control

group (46 of 117, p=0.012). No interaction was found. The rest of the lifestyle factors did not show any significant difference between groups as shown in Table 3.16.

Within group comparison by the McNemar test showed significant improvement in stress avoidance only in the treatment group, p <0.05. The rest of the other lifestyle factors did not show any significant improvement in either groups (Table 3.16).

Table 3.16 The proportion of patients who had made lifestyle modifications after six months compared between the treatment and the control groups (Ref. 11)

Lifestyle modification	Treatment group		Control group		Odds ratio	95% CI	p value
	Pre test	After 6 mo	Pre test	After 6 mo			
Alcohol avoidance	108 (N=118)	103 (N=112)	106 (N=117)	105 (N=116)	0.64	0.16-2.48	0.514
Exercise	56 (N=115)	65 (N=114)	40 (N=98)	46 (N=117)	2.35	1.21-4.57	0.012
Stress avoidance	102[lt] (N=118)	107[lt] (N=112)	100 (N=117)	106 (N=116)	2.13	0.67-6.75	0.201
No smoking	110 (N=118)	108 (N=112)	110 (N=116)	110 (N=116)	0.17	0.01-2.09	0.165
Sodium avoidance	53 (N=115)	41 (N=114)	32 (N=87)	58 (N=114)	1.50	0.69-3.26	0.306

Pairwise comparisons showed significant difference by McNemar test, p <0.05, between the pre test and after 12 months[lt] within the treatment group.

3.2.1.5 Humanistic outcomes

At the pre test time, there were 235 patients who responded to the pro forma, but after six months, seven patients had dropped out because two of them had died, one patient was disabled due to a stroke, another had leg fractures, two patients refused to enroll in the study at the beginning of the study because of the inconvenience to see the pharmacist monthly and their preference to visit the hospital. The last patient did not want to respond to the pro forma because he was not satisfied

to do so. This left 228 patients, 116 patients in the treatment group and 112 patients in the control group.

3.2.1.5.1 Patient knowledge

Patient knowledge assessment compared between the treatment and the control groups:

At pre test there were two patients who did not respond to item No 9, thus N was indicated as 115. After six months, only 111 patients responded to items No 8, 10 and 13. This is because three patients did not respond in either of those items. Multiple logistic regression was used to compare the difference between groups by adjusting the pre test results. After six month, the results were similar to those obtained using the Mann-Whitney U test. Most of the items showed improvement after six months but there were no significant differences between the treatment and the control groups, except in item No 7, $p < 0.05$. This meant that patients in the treatment group knew significantly more than in the control group that exercise should not be avoided in hypertension. This is shown in Table 3.17.

Patient knowledge assessment compared within each group between the pre test and after six months:

When considering the improvement within a group by McNemar test, Table 3.18 shows that the treatment group significantly improved their scores in two items, these were Nos 7 and 10, this meant that the patients knew more after six months that exercise should not be avoided and may not stop medications due to adverse events

without telling doctors or pharmacists or nurses. The control group answered well in three items that is Nos 2, 9 and 10. This meant that the patients knew more about 'medications improve better symptoms but do not extend their life longer', 'hypertensive patients can adjust doses of hypertensive medication depending of each BP measurement' and 'hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses'. The Total scores showed significant improvements both in the treatment and the control groups.

The patient knowledge assessment compared between the treatment and the control groups in three subscales:

Table 3.19 shows the percent correct answers grouped into three domains. The Mann-Whitney U test was used for median rank comparison. These were 'hypertension knowledge' Nos 1, 3, 5 and 8, 'risk modification' Nos 4, 6, 7, 11 and 12 and the 'proper use of medications' items 2, 9, 10, 13 and 14. The comparison between groups after six months did not show any significant difference, $p > 0.05$, in all cases.

Patient knowledge assessment compared within each group between the pre test and after six months:

Table 3.20 shows that patient knowledge was represented in all three subscales, hypertension knowledge, risk modification and the proper use of medications. The Wilcoxon signed-rank test showed significant improvement in all three subscales in the treatment group, $p < 0.05$. That meant patients in the treatment group had significantly better knowledge in hypertension, risk modification and in the

proper use of medications. The control group showed a significant improvement in their knowledge only in the subscale concerned with the proper use of medications.

Table 3.17 Percent correct responses compared between the treatment and the control groups (Ref. 15)

Patient knowledge item	% correct response of within group				p value*	Odd	95% CI	p value**
	Treatment group		Control group					
	Pre test (N=118)	After 6 mo (N=112)	Pre test (N=117)	After 6 mo (N=116)				
1. Hypertension is a curable disease.	32.20	41.07	27.35	31.90	0.417	1.473	0.793-2.737	0.220
2. Medications improve better symptoms but do not extend your life longer.	5.93	14.29	5.98	17.24	0.987	0.789	0.381-1.637	0.525
3. Uncontrolled hypertension can cause stroke.	71.19	76.79	66.67	68.10	0.455	1.607	0.788-3.279	0.192
4. High salt diet makes blood pressure uncontrolled.	64.41	68.75	59.83	56.90	0.470	1.707	0.952-3.061	0.073
5. Uncontrolled blood pressure leads to kidney disease.	63.56	63.39	59.83	62.93	0.557	0.958	0.539-1.700	0.883
6. High body weight is one risk factor of uncontrolled hypertension.	62.71	67.86	61.54	56.90	0.853	1.663	0.935-2.956	0.083
7. Exercise in hypertensive patients should be avoided.	54.24	73.21	53.85	60.34	0.952	1.961	1.072-3.588	0.029
8. Most uncontrolled hypertensive patients have headache and blurred vision.	4.24	9.91 (N111)	8.55	6.03	0.178	2.002	0.718-5.581	0.184
9. Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	59.52 (N115)	66.07	51.28	68.97	0.424	0.861	0.485-1.527	0.608
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses.	59.32	73.87 (N111)	55.56	68.97	0.560	1.197	0.644-2.227	0.569
11. Smoking and uncontrolled hypertension can cause heart disease.	62.71	61.61	65.81	63.79	0.621	0.952	0.529-1.711	0.869
12. Stress makes blood pressure harder to be controlled.	72.88	76.79	72.65	80.17	0.968	0.802	0.412-1.561	0.515
13. All medications which are taken without prescriptions should have a pharmacist check to avoid drug interactions.	75.42	79.28 (N111)	73.50	76.72	0.736	1.177	0.588-2.355	0.645
14. If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	40.68	46.43	34.19	42.24	0.305	1.109	0.644-1.911	0.709
Total	51.96	58.40	49.76	54.37	0.479	-	-	0.185*

*p values were calculated by the Mann-Whitney U test in the pre test; **p values were calculated by multiple logistic regression using pre test as a covariate to adjust baseline

.Table 3.18 Percent correct responses compared between the pre test and after six months in each group (Ref. 16)

Patient knowledge item	% correct response (number)					
	Treatment group (N=112)			Control group (N=116)		
	Pre test	Post test	p value	Pre test	Post test	p value
1. Hypertension is a curable disease.	32.10 (36)	41.10 (46)	0.089	27.60 (32)	31.90 (37)	0.424
2. Medications improve better symptoms but do not extend your life longer.	6.30 (7)	14.30 (16)	0.078	6.00 (7)	17.20 (20)	0.002
3. Uncontrolled hypertension can cause stroke.	71.40 (80)	76.80 (86)	0.238	67.20 (78)	68.10 (79)	1.000
4. High salt diet makes blood pressure uncontrolled.	63.40 (71)	68.80 (77)	0.377	60.30 (70)	56.90 (66)	0.617
5. Uncontrolled blood pressure leads to kidney disease.	64.30 (72)	63.40 (71)	1.000	60.30 (70)	62.90 (73)	0.742
6. High body weight is one risk factor of uncontrolled hypertension.	63.40 (71)	67.90 (76)	0.500	62.10 (72)	56.90 (66)	0.405
7. Exercise in hypertensive patients should be avoided.	54.50 (61)	73.20 (82)	< 0.001	54.30 (63)	60.30 (70)	0.337
8. Most uncontrolled hypertensive patients have headache and blurred vision.	4.50 (5)	9.90 (11)	0.146	8.60 (10)	6.00 (7)	0.581
9. Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	57.80 (62)	67.00 (73)	0.144	51.70 (60)	69.00 (80)	0.007
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors or pharmacists or nurses.	60.40 (67)	73.90 (82)	0.012	55.20 (64)	69.00 (80)	0.015
11. Smoking and uncontrolled hypertension can cause heart disease.	63.40 (71)	61.60 (69)	0.850	66.40 (77)	63.80 (74)	0.735
12. Stress makes blood pressure harder to be controlled.	73.20 (82)	76.80 (86)	0.571	73.30 (85)	80.20 (93)	0.201
13. All medications which are taken without prescription should have a pharmacist check to avoid drug interactions.	74.80 (83)	79.30 (88)	0.359	74.10 (86)	76.70 (89)	0.710
14. If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	40.20 (45)	46.40 (52)	0.360	33.60 (39)	42.20 (49)	0.144
Total	51.96	55.45	< 0.001[a]	49.76	54.37	< 0.035[a]

p values were calculated by the McNemar test. [a] p values were calculated by the Wilcoxon signed rank test.

Table 3.19 Percent correct responses compared between groups in each domain of the patient knowledge constructed questions (Ref. 17)

Domains	Treatment group % of correct answers		Control Group % of correct answers		p value pre test*	p value after 6 months*
	Pre test (N=118)	After 6 months (N=112)	Pre test (N=117)	After 6 months (N=116)		
1. Hypertension knowledge	42.80	47.95	40.60	42.24	0.521	0.110
2. Risk factor management	63.39	69.64	62.74	63.62	0.884	0.128
3. Proper use of medications	47.61	55.45	44.10	54.83	0.303	0.850

*p values were calculated by the Mann-Whitney U test

Table 3.20 Percent of correct answers compared within groups after six months (Ref. 17)

Domains	Treatment group % of correct answers			Control Group % of correct answers		
	Pre test (N =118)	After 6 months (N=112)	p value	Pre test (N =117)	After 6 months (N=116)	p value
1. Hypertension knowledge	42.80	58.40	0.019	40.60	42.24	0.624
2. Risk factor management	63.39	47.95	0.025	62.74	63.62	0.669
3. Proper use of medications	47.61	69.64	0.001	44.10	54.83	< 0.001

*p values were calculated by the Wilcoxon signed-rank test

3.2.1.5.2 Patient satisfaction

Patient satisfaction assessments compared between the treatment and the control groups:

Table 3.21 shows the results in the terms of means and standard deviations (SD) in each subscale item. After six months follow-up, the results, of the Mann-Whitney U test showed that the treatment group had only a significantly higher score than the control group in item No 11, $p < 0.05$. This meant that patients in the treatment group were significantly satisfied with the pharmacist's smiling, greeting and talking when providing their service when compared with patients in the control group.

Patient satisfaction assessments compared within each group between the pre test and after six months:

Within group comparison is shown in Table 3.21. The Wilcoxon signed rank test was used to evaluate the difference within groups. After six months patients in the control group were more significantly satisfied than at the pre test in 12 items. That is Nos 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13 and 15. Patients in the treatment group were more satisfied than at the pre test in nine items, Nos. 1, 3, 4, 6, 7, 8, 11, 12 and 15.

Patient satisfaction assessments compared in six subscale items between the treatment and the control groups:

Table 3.22, median comparisons of the Mann-Whitney U test for between groups difference and the Wilcoxon signed rank test for within group difference were used. There was a significant difference between groups at the pre test in the subscale

item of 'interpersonal relationship', p <0.05. The mean scores showed higher satisfaction after six months in most of the subscales except 'continuity of care' in which the mean scores were lower, 2.65 at the pre test 2.52 after six months in the treatment group and 2.61 and 2.56 respectively in the control group. Nevertheless, they did not show any significant difference in patient satisfaction between groups after six months.

Patient satisfaction assessments compared in six subscale items within each group between the pre test and after six months:

Table 3.23 shows the difference within a group after six months follow-up. The patients in both groups showed more significant satisfaction in most of the subscale items, p <0.05. This indicated that patients in both groups tended to show significantly higher satisfaction in the pharmacist's communication and management, accessibility and convenience, finance and interpersonal relationship after six months. The patients in the both groups had less satisfaction in continuity of care, especially the patients in the treatment group who were significantly worse, p <0.05. In the subscale items of overall satisfaction neither group was significantly satisfied, p <0.05.

Table 3.21 Means of patient satisfaction at the pre test and after six months in the treatment and the control groups.

Satisfaction Scale Item [a]	Treatment group (N=112)					Control group (N=116)					p value**
	Pre test Mean(SD)	After 6 mo Mean(SD)	Mean rank (No)		p value*	Pre test Mean(SD)	After 6 mo Mean(SD)	Mean rank (No)		p value*	
			Negative	Positive				Negative	Positive		
Communication and management											
1. You felt satisfied with pharmacist's explanation of using medications and life style modification.	3.31 (0.55)	3.55 (0.50)	25.50 (37)	25.50 (13)	0.001	3.25 (0.52)	3.53 (0.55)	29.78 (46)	30.77 (13)	< 0.001	0.931
2. You understood how to use medications and life style modification better after talking to a pharmacist.	3.45 (0.50)	3.55 (0.53)	21.00 (28)	23.87 (15)	0.118	3.37 (0.48)	3.53 (0.55)	21.50 (32)	23.45 (11)	0.003	0.814
3. Sometimes a pharmacist makes you wonder if her/his advice is correct.	2.48 (0.78)	3.01 (0.75)	37.46 (57)	32.83 (15)	< 0.001	2.44 (0.71)	2.87 (0.88)	38.73 (53)	30.29 (19)	< 0.001	0.296
4. A pharmacist did not pay attention to your complaining about disease problems.	2.63 (0.79)	3.27 (0.78)	37.10 (62)	39.58 (12)	< 0.001	2.59 (0.82)	3.16 (0.82)	36.39 (59)	35.62 (13)	< 0.001	0.262
5. You intend to follow the details of this pharmacist's advice.	3.47 (0.50)	3.57 (0.50)	24.50 (29)	24.50 (19)	0.149	3.46 (0.50)	3.57 (0.55)	24.00 (31)	25.41 (17)	0.069	0.866
Accessibility and convenience											
6. You have not received easy access to see a pharmacist.	2.87 (0.77)	3.29 (0.69)	32.36 (51)	33.04 (13)	< 0.001	2.76 (0.83)	3.23 (0.70)	34.85 (51)	28.90 (15)	< 0.001	0.469
Finance											
7. Although you have extra expense to see a pharmacist, you receive more benefits.	3.23 (0.59)	3.46 (0.58)	22.83 (33)	21.50 (11)	0.001	3.24 (0.52)	3.46 (0.60)	28.92 (40)	30.78 (18)	0.009	0.943
8. You felt the benefit received was not reasonable compared to the time spent.	2.95 (0.71)	3.46 (0.60)	38.46 (59)	33.73 (15)	< 0.001	2.90 (0.71)	3.35 (0.62)	35.99 (53)	31.72 (16)	< 0.001	0.157
Interpersonal relationship											
9. A pharmacist took care of you very much in medication use and life style modification.	3.47 (0.50)	3.57 (0.51)	24.50 (30)	24.50 (18)	0.083	3.39 (0.56)	3.48 (0.57)	24.32 (30)	26.08 (19)	0.193	0.272
10. You felt better after talking to a pharmacist about medication use and life style modification.	3.47 (0.50)	3.57 (0.50)	25.00 (30)	25.00 (19)	0.116	3.34 (0.51)	3.58 (0.50)	30.00 (43)	30.00 (16)	< 0.001	0.925
11. A pharmacist should smile, greet and talk more to a patient.	2.40 (0.75)	2.79 (0.89)	40.68 (53)	33.48 (23)	< 0.001	2.21 (0.78)	2.50 (0.96)	40.90 (50)	38.45 (29)	0.019	0.019
12. A pharmacist ignored what you told him/her.	3.04 (0.65)	3.41 (0.64)	35.59 (52)	33.21 (17)	< 0.001	2.93 (0.72)	3.40 (0.51)	34.78 (51)	26.50 (14)	< 0.001	0.493
13. A pharmacist was pleased to listen to your problems not only on hypertension.	3.30 (0.59)	3.42 (0.61)	26.29 (33)	28.17 (20)	0.131	3.14 (0.64)	3.45 (0.61)	27.94 (43)	28.21 (12)	< 0.001	0.694
Continuity of care											
14. You felt warm to see any pharmacist.	3.46 (0.50)	3.51 (0.52)	25.50 (28)	25.50 (22)	0.396	3.32 (0.51)	3.45 (0.55)	29.50 (37)	30.84 (22)	0.075	0.437
15. If it is possible, you would like to see the same pharmacist.	1.83 (0.77)	1.54 (0.54)	18.50 (14)	26.33 (33)	0.001	1.89 (0.71)	1.66 (0.67)	29.00 (17)	29.00 (40)	0.004	0.230
Overall satisfaction											
16. In conclusion, you felt satisfied with the pharmacy service of medication use and life style modification.	3.51 (0.50)	3.57 (0.55)	20.50 (26)	21.87 (15)	0.132	3.44 (0.55)	3.51 (0.55)	26.84 (31)	27.23 (22)	0.244	0.343

* p values were calculated by the Wilcoxon signed rank test ** p values were analyzed by the Mann-Whitney U test

Table 3.22 The results between groups when patient satisfaction items grouped by each domain

Satisfaction Scale Item [a]	Treatment group Mean (SD)		Control group Mean (SD)		p value at pre test	p value after 6 months
	Pre test (N=118)	After 6 months (N=112)	Pre test (N=117)	After 6 months (N=116)		
Communication and management	3.07 (0.35)	3.39 (0.36)	3.02 (0.33)	3.33 (0.40)	0.386	0.280
Accessibility and convenience	2.87 (0.77)	3.29 (0.69)	2.76 (0.83)	3.23 (0.70)	0.262	0.469
Finance	3.09 (0.49)	3.46 (0.52)	3.09 (0.45)	3.41 (0.50)	0.873	0.334
Interpersonal relationship	3.14 (0.38)	3.35 (0.34)	3.00 (0.35)	3.28 (0.36)	0.034	0.179
Continuity of care	2.65 (0.40)	2.52 (0.32)	2.61 (0.39)	2.56 (0.37)	0.659	0.613
Overall satisfaction	3.51 (0.50)	3.57 (0.55)	3.44 (0.55)	3.51 (0.55)	0.438	0.343

p value was calculated by the Mann-Whitney U test

Table 3.23 The results of patient satisfaction when compared between the pre test and after six months shown by each domain.

Satisfaction Scale Item [a]	Treatment group Mean (SD)			Control group Mean (SD)		
	Pre test (N=118)	After 6 months (N=112)	p value	Pre test (N=117)	After 6 months (N=116)	p value
Communication and management	3.07 (0.35)	3.39 (0.36)	< 0.001	3.02 (0.33)	3.33 (0.40)	< 0.001
Accessibility and convenience	2.87 (0.77)	3.29 (0.69)	< 0.001	2.76 (0.83)	3.23 (0.70)	< 0.001
Finance	3.09 (0.49)	3.46 (0.52)	< 0.001	3.09 (0.45)	3.41 (0.50)	< 0.001
Interpersonal relationship	3.14 (0.38)	3.35 (0.34)	< 0.001	3.00 (0.35)	3.28 (0.36)	< 0.001
Continuity of care	2.65 (0.40)	2.52 (0.32)	0.016	2.61 (0.39)	2.56 (0.37)	0.245
Overall satisfaction	3.51 (0.50)	3.57 (0.55)	0.132	3.44 (0.55)	3.51 (0.55)	0.244

p value was calculated by the Wilcoxon signed rank test

3.2.1.5.3 Quality of life (SF-36)

The SF-36 contains eight muti-dimentional scales and a single item of health-reported transition. Raw scale scores which were recoded in the pro forma summed and transformed to a 1-100 scale. A zero score represented poor health and a score of 100 showed excellent health. After six months, there were seven patients who failed to respond to the SF-36. Two patients died, another two dropped out at the pre test time, two disabled patients dropped out after six months and another refused to respond to the pro forma.

Completeness of the data:

Missing values at the pre test were found in the physical functioning scale, general health, social functioning and bodily pain.

Table 3.24 and Table 3.25 give SF-36 scores and descriptive statistics at the pre test and after six months follow up in the treatment group and the control group respectively.

1) Physical functioning dimension

This dimension related to performance in all physical activities. Low scores meant that there were a lot of limitations in performing all physical activities such as running, lifting heavy objects, walking, climbing stairs, bending, kneeling. High scores meant that there were no limitations related to health in performing all types of physical activity including the most vigorous ones.

There was one patient who failed to answer in one item of this dimension at the pre test which was replaced by the mean from the items which left more than 50% of the items in the same domain. In the treatment group, Table 3.24, the overall mean after six months was slightly increased from the pre test, 66.92 to 63.35. The lowest score was 10.50 which was found in one patient in the pre test and two patients after six months. The highest score was 100 both at the pre test and after six months. There were three patients at the pre test and six patients after six months who reported no limitation in physical activities.

Table 3.25 shows the results in the control group. The overall mean in the pre test was 63.63 and 62.97 after six months, which was the second highest in eight dimensions. The lowest scores were ten at the pre test and five after six months which was lower than the mean minus the SD in one patient. The highest score at the pre test was found in three patients and in two patients after six months. These did not have any limitation of physical functioning with vigorous activities.

2) Role functioning-physical dimension

This dimension dealt with the following problems which resulted from the effect on physical health caused by their work or regular daily activities, including the working time which was lost or the effect on other activities. This resulted in accomplishing less than desired, a limitation in the kind of work or other activities undertaken and difficulties in performing their work or other activities.

In the treatment group, Table 3.24, the mean score after six months was slightly lower than at the pre test, 49.33 and 50.21 respectively. The lowest score was zero which was reported for 27 patients at the pre test and 30 patients after six months.

The maximum score was 100 for both groups. Twenty six patients at the pre test and 32 patients after six months did not have any problems due to their physical health which affected their work or regular daily activities.

Table 3.25 shows the results for the control group. The mean score after six months was slightly lower than at the pre test, 47.01 and 45.91 respectively. The lowest score was zero which was reported by 29 patients at the pre test and 38 patients after six months. There were 23 patients at the pre test and 31 patients after six months who reported no problems to do with their physical health which affected their work or regular daily activities.

3) Bodily pain dimension

This dimension shows the intensity of pain and the interference of pain with normal work including both outside and house work. There was one patient who missed one item at the pre test which was replaced with the mean from the items which left more than 50% of the items in the same domain.

In the treatment group, as shown in Table 3.24, the mean after six months was slightly higher than at the pre test, 56.03 and 52.24 respectively. The lowest score at the pre test was 10 and after six months was 22. These were lower than the mean minus the standard deviation. There were five patients in the pre test and four patients after six months who reported no bodily pain and no interference of pain on normal work and no expectation of getting worse.

In the control group, as shown in Table 3.25, the mean after six months was a little higher than at the pre test, 54.87 and 52.86 respectively. There was only one patient who reported a zero score at both the pre test and after six months. The

maximum score, 100, was reported by ten patients at the pre test and three patients after six months and they showed no bodily pain or interference from pain with their normal work.

4) general health perception dimension

The content of this dimension related to belief of personal health, including general health, current health compared with other people and expectation of health getting worse. There was one patient who failed to answer in one item of this dimension at the pre test which was replaced by the mean from the items which left more than 50% of the items in the same domain.

In the treatment group, as seen in Table 3.24, the mean after six months was a little higher than the mean at the pre test, 47.63 and 46.56, respectively. There were three patients at the pre test and one patient after six months who reported the lowest score, ten at the pre test and five after six months. The maximum scores were 87 at the pre test and 97.5 after six months. Only one patient at each time reported that they believed their personal health was excellent.

In the control group, as seen in Table 3.25, the mean after six months was lower than at the pre test, 45.03 and 47.67 respectively. The lowest score which showed their belief of personal health was poor or likely to get worse, was five at the pre test and 15 after six months. The maximum scores were 92 and 92.5, at the pre test and after six months respectively. There were three patients at the pre test and one patient after six months who believed that their health was excellent.

5) Vitality dimension

This dimension aims to differentiate in subjective well-being, including feeling full of life and lots of energy versus feeling worn out and tired.

It is seen in Table 3.24, that for the treatment group the mean after six months was higher than the mean at the pre test. One patient minimally scored zero and 15, at the pre test and after six months. One patient at the pre test and after six months rated themselves highly in their well-being, scoring 100.

Table 3.25 shows that in the control group the mean after six months was a bit higher than the mean at the pre test, 56.42 and 55.98 respectively. The lowest scores were five at the pre test and 15 after six months. One patient at each time scored the lowest, while the highest score was reported in one patient at the pre test and two patients after six months.

6) Social functioning dimension

This dimension assesses the interference with social activities due to physical and emotional problems. The mean score was the highest obtained both in the pre test and after six months of all eight dimensions. Only two patients failed to respond in one item at the pre test and the missing value was replaced by the mean from the items which left more than 50% of the items in the same domain.

In the treatment group, Table 3.24, the means at the pre test and after six months were also the highest rank in eight dimensions. The mean after six months was slightly lower than the mean at the pre test, that is, 72.54 and 74.77 respectively. One patient was rated lowest at the pre test and also after six months while 27 and 21 patients respectively were rated highest with scores of 100. This meant that during the

past four weeks they performed their normal activities without any interference from physical or emotional problems.

The control group in Table 3.25 showed that the mean after six months was slightly lower than the mean at the pre test, that is, 69.61 and 71.47 respectively. Three patients at the pre test and one patient after six months had the lowest scores of 25 and 12.5 respectively. There were 19 and 16 patients at the pre test and after six months who were rated highest with scores of 100, as they performed their normal social activities without interference from physical or emotional problems throughout the past four weeks. These highest scored numbers were of patients who were in the third rank of 'role-emotional' and 'role-physical'.

7) Role functioning-emotional dimension

This dimension evaluates whether the emotional problems related to the patient's work or regular daily activities.

The treatment group, results given in Table 3.24 show that the mean scores were also the lowest obtained of all eight dimensions. The mean after six months was a little higher than the mean obtained at the pre test, that is, 41.96 and 36.47 respectively. There were 58 patients at the pre test and 48 after six months who were rated with the lowest score of zero while 28 patients at the pre test and 34 patients at the six months assessment reported that they had no problems with their work or daily activities resulting from emotional problems.

In the control group for the role functioning-emotional dimension, the results in Table 3.25 show that the means were the lowest in eight dimensions. The mean after six months was a little lower than the mean at the pre test, that is, 39.94 and

42.17 respectively. Forty eight patients at the pre test and 52 patients after six months had minimal scores of zero while 33 and 27 patients respectively had the highest score of 100. The highest score meant that in the previous four weeks, they had no problems with work or daily activities which were due to emotional problems.

8) Mental health dimension

This dimension assesses mental health including nervousness and depression.

For the treatment group, it is seen in Table 3.24 that the means after six months were slightly lower than at the pre test, that is, 63.14 and 63.39 respectively. One patient at both times was rated with the lowest score of 28 while three patients at both times were rated with the highest score of 100, which showed that they felt peaceful, happy and calm all of the time.

The control group results given in Table 3.25 show that the means after six months were a little lower than the means at the pre test, that is, 62.52 and 63.11 respectively. One patient at both the pre test and after six months was rated with the lowest score, that is, 16. Similarly one patient was rated highest at 100 at both times. This meant that they felt peaceful, happy and calm all the time during the previous four weeks.

Quality of life (SF-36) assessments compared between the treatment and the control groups:

Table 3.26 gives the results of the two groups at the two periods of time in terms of mean scores and standard deviations. The lowest mean scores were recorded in the role limitation due to emotional problems in both groups and at both the pre test

and after six months. The social functioning scale scored highest in both groups and at both pre test and after six months. Overall the treatment group showed slightly higher scores after six months from the pre test except in the scales of 'role-physical', 'social functioning' and 'mental health' which showed slightly lower scores. The mean scores in two scales only in the control group improved slightly after six months, that is, in the scales of 'bodily pain' and 'vitality'. This left six scales which had a small decrease in mean scores. Mean scores in all domains were not significantly different between the groups at either the pre test or after six months follow-up, ($p > 0.05$).

Quality of life (SF-36) assessments compared within each group between the pre test and after six months:

From Table 3.27, the mean scores of the treatment group compared between the pre test and after six months showed a significant improvement in the bodily pain domain, $p < 0.05$. This meant that after six months patients in the treatment group tended to report less bodily pain and interference of pain with normal work both outside and house work. Most scales showed a slight increase in the mean scores except in the role limitation due to physical problems, social functioning and mental health. Conversely, the control group represented slight decreases in the mean scores in most scales after six months except in the role limitation due to bodily pain and vitality. Nevertheless, no significant improvement was found after six months follow - up.

Table 3.24 Descriptive statistics of SF-36 at the pre test and after six months for the treatment group (Ref. 23)

Scale*	Pre test (N=118)					After 6 months (N=112)				
	Mean	SD	Range	% Floor	% Ceiling	Mean	SD	Range	% Floor	% Ceiling
Physical Functioning (PF)	63.35	21.17	10.50-100	1 (0.85)	3 (2.54)	66.92	20.35	15-100	2 (1.79)	6 (5.36)
Role-physical (RP)	50.21	36.76	0-100	27 (22.88)	26 (22.03)	49.33	39.49	0-100	30 (26.79)	32 (28.57)
Bodily Pain (BP)	52.24	17.80	10-100	1 (0.85)	5 (4.24)	56.03	15.07	22-100	2 (1.79)	4 (3.57)
General Health (GH)	46.56	17.14	10-87	3 (2.54)	1 (0.85)	47.63	16.50	5-97.5	1 (0.89)	1 (0.89)
Vitality (VT)	56.44	16.40	0-100	1 (0.85)	1 (0.85)	58.97	17.02	15-100	1 (0.89)	1 (0.89)
Social Functioning (SF)	74.77	19.30	25-100	1 (0.85)	27 (22.88)	72.54	18.90	25-100	1 (0.89)	21 (18.75)
Role-emotional (RE)	36.47	41.75	0-100	58 (49.15)	28 (23.73)	41.96	43.09	0-100	48 (42.98)	34 (30.36)
Mental Health (MH)	63.39	16.81	28-100	1 (0.85)	3 (2.54)	63.14	16.16	28-100	1 (0.89)	3 (2.68)

Table 3.25 Descriptive statistics of SF-36 at the pre test and after six months for the control group (Ref. 23)

Scale	Pre test (N=117)					After 6 months (N=116)				
	Mean	SD	Range	% Floor	% Ceiling	Mean	SD	Range	% Floor	% Ceiling
Physical Functioning (PF)	63.63	22.42	10-100	1 (0.85)	3 (2.56)	62.97	24.17	5-100	3 (2.58)	2 (1.72)
Role-physical (RP)	47.01	36.28	0-100	29 (24.79)	23 (19.66)	45.91	40.24	0-100	38 (32.76)	31(26.72)
Bodily Pain (BP)	52.86	20.65	0-100	1 (0.85)	10 (8.55)	54.87	16.02	0-100	1 (0.86)	3 (2.58)
General Health (GH)	47.67	17.86	5-92	1 (0.85)	3 (2.56)	45.03	14.84	15-92.5	2 (1.72)	1 (0.86)
Vitality (VT)	55.98	15.05	5-95	1 (0.85)	1 (0.85)	56.42	16.74	15-95	1 (0.86)	2 (1.72)
Social Functioning (SF)	71.47	19.20	25-100	3 (2.56)	19 (16.24)	69.61	19.31	12.5-100	1 (0.86)	16 (13.79)
Role-emotional (RE)	42.17	42.07	0-100	48 (41.03)	33 (28.21)	39.94	41.29	0-100	52 (44.83)	27 (23.28)
Mental Health (MH)	63.11	16.91	16-100	1 (0.85)	1 (0.85)	62.52	15.23	16-100	1 (0.86)	1 (0.86)

Table 3.26 Mean SF-36 scores for the treatment and the control groups at the pre test and after six months (Ref. 24)

Scales*	Treatment group Mean (SD)		Control group Mean (SD)		p value at pre test	p value after 6 months
	Pre test (N=118)	After 6 months (N=112)	Pre test (N=117)	After 6 months (N=116)		
PF	63.36 (21.16)	66.92 (20.35)	63.63 (22.42)	62.97 (24.17)	0.877	0.288
RP	50.21 (36.76)	49.33 (39.49)	47.01 (36.28)	45.91 (40.24)	0.502	0.491
BP	52.29 (17.77)	56.03 (15.07)	52.86 (20.65)	54.87 (46.02)	0.924	0.803
GH	46.56 (17.14)	47.63 (16.50)	47.59 (17.76)	45.03 (14.84)	0.690	0.129
VT	56.44 (16.40)	58.97 (17.02)	55.98 (15.05)	56.42 (16.74)	0.867	0.259
SF	74.77 (19.20)	72.54 (18.90)	71.47 (19.20)	69.61 (19.31)	0.197	0.314
RE	36.49 (41.57)	41.96 (43.09)	42.17 (42.07)	39.94 (41.29)	0.264	0.665
MH	63.39 (16.81)	63.14 (16.16)	63.11 (16.91)	62.52 (15.23)	0.973	0.927

p values were calculated by Mann-Whitney U test
* codes of the SF-36 scales are shown in Table 3.24

Table 3.27 Comparison of mean scores within each group for the pre test and after six months (Ref. 24)

Scales*	Treatment group Mean (SD) (N=113)			Control group Mean (SD) (N=115)		
	Pre test	After 6 months	p value	Pre test	After 6 months	p value
PF	63.36 (21.16)	68.26 (24.97)	0.068	63.63 (22.42)	62.97 (24.17)	0.840
RF	50.21 (36.76)	49.33 (39.49)	0.657	47.01 (36.28)	45.91 (40.24)	0.658
BP	52.29 (17.77)	56.03 (15.07)	0.026	52.86 (20.65)	54.87 (46.02)	0.197
GH	46.56 (17.14)	47.63 (16.50)	0.619	47.59 (17.76)	45.03 (14.84)	0.082
VT	56.44 (16.40)	58.97 (17.02)	0.132	55.98 (15.05)	56.42 (16.74)	0.740
SF	74.77 (19.20)	72.54 (18.90)	0.376	71.47 (19.20)	69.61 (19.31)	0.612
RE	36.49 (41.57)	41.96 (43.09)	0.103	42.17 (42.07)	39.94 (41.29)	0.638
MH	63.39 (16.81)	63.14 (16.16)	0.735	63.11 (16.91)	62.52 (15.23)	0.831

p values were calculated by Wilcoxon signed-rank test
* codes of the SF-36 scales are shown in Table 3.24

Health reported transition scale

Health reported transition scale was not included in the eight scales. Patients rated this scale by comparing the amount of change of their health in general at the present time and in the previous year. The percentage responses are shown in Table

3.28. At the pre test most of the patients rated highest the item 'somewhat better now than one year ago' both in the control and treatment groups, 27.60% and 28.00% respectively. Figure 3.1 indicates the percentage responses were similar for both groups. After six months, patients in the control group rated highest the item 'somewhat worse now than one year ago', 27.60%, while in the treatment group the item 'somewhat better now than one year ago' was rated highest, 31.30 %. The responses were significantly higher in the treatment group when compared to the responses in the control group ($p < 0.05$) as also shown in Figure 3.2.

Table 3.28 The percentage responses of Health Reported Transition compared between the treatment and the control groups and compared within each group (Ref. 25)

Items	Treatment group Number (percent)		Control group Number (percent)		p value at pre test	p value after 6 months
	Pre test (N=118)	After 6 mo (N=112)	Pre test (N=116)	After 6 mo (N=116)		
Much better now than one year ago	18 (15.30)	27 (24.10)	18 (15.50)	16 (13.80)	0.996	0.046
Somewhat better now than one year ago	33 (28.00)	35 (31.30)	32 (27.60)	25 (21.60)		
About the same as one year ago	20 (16.90)	19 (17.00)	22 (19.00)	26 (22.40)		
Somewhat worse now than one year ago	28 (23.70)	21 (18.80)	26 (22.40)	32 (27.60)		
Much worse now than one year ago	19 (16.10)	10 (8.90)	18 (15.50)	17 (14.70)		

p values were calculated by chi square

Figure 3.1 Percentage responses for Health Reported Transition between the treatment and the control groups at the pre test

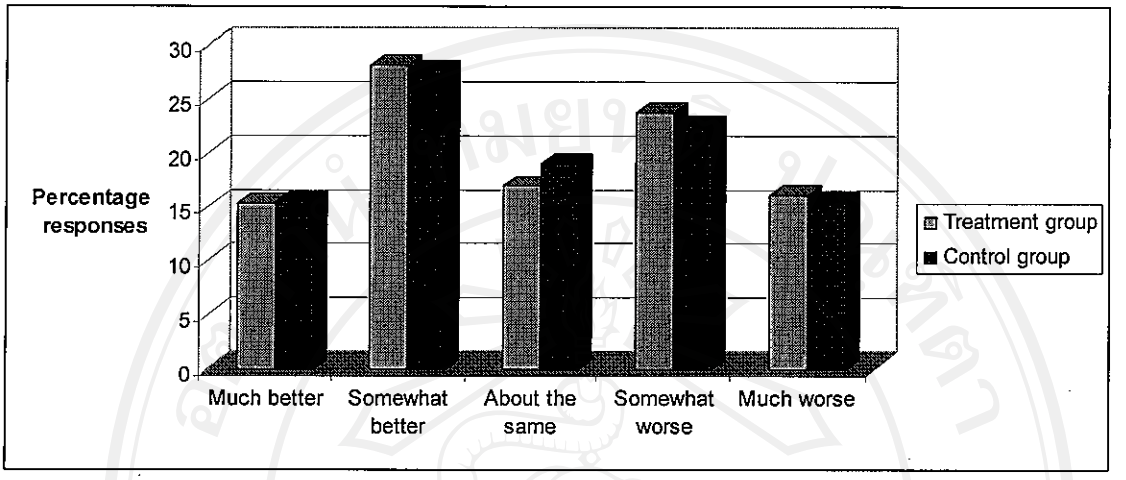
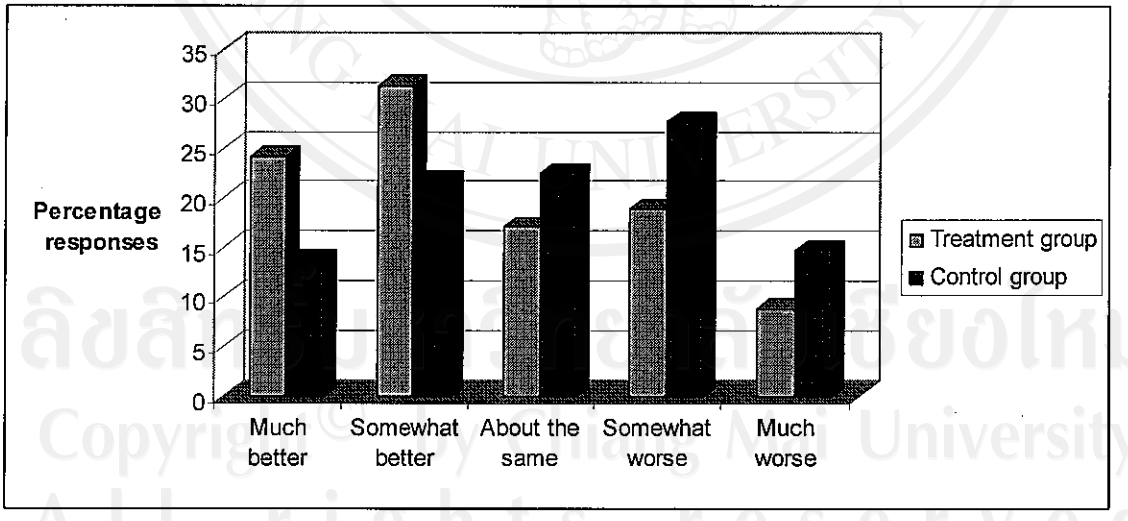


Figure 3.2 Percentage responses for Health Reported Transition between the treatment and the control groups after six months



3.2.1.5.4 Digit Span test

Digit Span test is the specific tool used to measure cognitive function in hypertensive patients' quality of life. There were two groups of different numbers which began with 2 digits and went up to 9 digits. A patient would say the first group of numbers by repeating what an interviewer said whereas a second group of numbers had to be said in reverse from what the interviewer had just said. The scores were zero, 2, 3, 4 up to 9. The normal rage is 7 ± 2 digits for the forward numbers and 5 ± 1 digits for the reverse numbers.

Table 3.29 gives the forward numbers for both groups, the means obtained were within the range of normal (5-9) but the means for the reverse digits were much lower than for the normal range in both groups (<4). There were no significant differences between groups with this test ($p > 0.05$). Only the mean scores of the forward numbers after six months were significantly reduced from the pre test in both groups ($p < 0.05$). Due to the possibility that the reduction in forward numbers in both groups might not be related to the pharmacist's involvement but rather to the anxiety of the procedure of interviewing or the misunderstanding of the procedure, these results were inconclusive.

Table 3.29 Mean scores of the Digit Span test compared between the treatment and the control groups and compared within each group between the pre test and after six months (Ref. 26)

groups outcomes (range of possible scores)[n]	Treatment group			Control group			p value at pre test**	p value after 6 mo**
	Pre test (N=118)	After 6 months (N=112)	p value*	Pre test (N=116)	After 6 months (N=116)	p value*		
Forward (0-9)	6.02 (1.31)	5.54 (1.24)	0.001	5.85 (1.40)	5.43 (1.50)	0.010	0.267	0.515
Reverse (0-9)	2.31 (1.01)	2.38 (1.26)	0.593	2.42 (1.28)	2.44 (1.12)	0.720	0.167	0.784

* p values were calculated for the difference within group by Wilcoxon signed-rank test.
** p values show >0.05 for the difference between groups by Mann-Whitney U test.
[n] normal: 7 ± 2 digits forward and 5 ± 1 digits in reverse

3.2.1.6 Economic outcome

Economic outcome was presented for 9 months from 1 October 2002 to 30 June 2003. The cost was not divided as pre and post test because some patients had one visit and received three months medications during the pre test and post test. This meant that some patients did not collect medications during these times. Thus, the analysis of medication cost over a longer time should provide a more accurate estimate. Costs were defined as costs for all medications, costs of medication for hypertension and costs of medication for non hypertension which were specifically recorded in databases at Mahasarakham Hospital and in Takornyang and Kharmrieng primary care units.

There are five patients who are missing from the calculation of total costs of all medications and total costs of non hypertension medication, four patients in the control group and one patient in the treatment group. This is because two patients received medical care at other provincial hospitals, one patient received care at a

clinic, one patient stopped their medications after the first visit and the other patient did not provide the necessary prescription data. In the analysis of medications for hypertension, there are ten patients who are missing from the analysis. These include the seven patients already described previously plus three additional patients who were all in the control group. Two patients did not get medication for hypertension right from the beginning of the study and the other patient was stopped from having the hypertension medication by a doctor.

3.2.1.6.1 Cost of medications

Costs of medications during October02-June03 compared between the treatment and the control groups:

Table 3.30 shows the results. Since the distribution of data was not normal the Man-Whitney U, nonparametric analysis, was performed to assess the difference between groups. The average costs of all medications in nine months were as high as 2537.30 bahts or 281.92 per month in the treatment group and 2171.04 bahts or 241.23 bahts per month in the control group. The hypertensive medication costs were 34.03% of the total costs in the treatment group, 863.34 baths or 95.93 bahts per month, and 45.78% of the total costs in the control group, 993.84 bahts or 110.43 bahts per month. The costs of non hypertensive medications were 66.56% of the total costs in the treatment group, 1688.71 bahts or 187.63 bahts per month, and 55.43% of the total costs in the control group, 1203.58 bahts or 133.73 bahts per month. Most of the costs were shown to be higher in the treatment group when compared with the control group but the cost of hypertension medications tended to be less in the treatment group than

the control group. However, the results of all the cost variables were similar for both the treatment group and the control group ($p > 0.05$).

Costs of medications assessment across nine months (October 02-June03) compared between the treatment and the control groups:

A 9x2 Factorial ANOVA was conducted to evaluate the effects of groups and times on costs. The means, standard deviations, minimum and maximum of costs are presented in Tables 3.31 to 3.33.

From Table 3.31, the total costs of all medications were transformed to validate Levene's test of homogeneity of variance. ANOVA indicated no significant interaction between groups and times, $F(8,2052) = 0.702$, $p > 0.05$, neither in the main effects of groups, $F(1,2052) = 3.681$, $p > 0.05$, nor in an effect of time across nine months in each group, $p > 0.05$. The groups main effect indicated that the control and the treatment groups spent the same amount of money for the total cost of medications over the period of nine months. This is also shown in Figure 3.3.

Table 3.32 shows the results with hypertension medications. The total costs of hypertension medications were also transformed. ANOVA indicated no significant interaction between groups and times, $F(8,2007) = 0.465$, $p > 0.05$. The groups main effect indicated that there was no significant difference between the control and the treatment groups, $p > 0.05$, neither was there an effect of time across nine months in each group, $p > 0.05$. This is also shown in Figure 3.4.

Table 3.33 shows the costs of non hypertension medications compared between groups and within groups over 9 months. This variable was transformed as before. ANOVA indicated no significant interaction between groups and times, F(8,

2052) = 0.623, p >0.05, neither an effect of time across nine months, F(8, 2052) = 0.822, p >0.05, but there was a significant main effect of groups, F(1, 2052) = 8.589, p <0.05. The groups main effect indicated that the treatment group tended to use more money in non hypertension medications than the control group. This is also shown in Figure 3.5.

3.2.1.6.2 Cost of medications on admission

Table 3.34 shows descriptive data of the costs and the number of admissions. After six months, patients in the control group were admitted to the hospital 20 times and patients in the treatment group were admitted 17 times. One patient in the control group was admitted the highest numbers of times. This was eight times within six months. The maximum number of admissions of one patient in the treatment group was three times. Average costs of medications during admission in the control group were higher than in the treatment group, 3439.13 compared with 1654.29 bahts respectively. Hypertensive medication costs were more in the control group when compared with the treatment group, 771.17 and 58.39 bahts respectively.

Table 3.30 Total cost of all medications and medications for hypertension compared between the treatment and the control groups over nine months follow-up (Ref. 27)

Measurement* (N of the treatment group, N of the control group)	Treatment group	Control group	Mann -Whitney U	p value
	Mean (SD) (Median, Mode, Min-Max, Mean rank)	Mean (SD) (Median, Mode, Min-Max, Mean rank)		
Total costs of all medications (N =117, 113)	2537.30 (3175.76) (1402.00, 451.00, 115.00-14670.00, 1117.78)	2171.04 (2568.60) (1213.50, 945.00, 127.50-15845.00, 113.14)	6343.50	0.597
Total costs of all medications per month per patient (N=117, 113)	281.92 (352.86) (155.78, 50.11, 12.78-1630.00, 1117.78)	241.23 (2878.86) (134.83, 105.00, 14.17-1760.56, 113.14)	6343.50	0.597
Total costs of hypertension medications (N=115, 110)	863.34 (1646.98) (322, 270, 42.5-12540.00, 111.12)	993.84 (2051.39) (296.50, 90.00, 53.00-14700.00, 111.83)	6196.50	0.792
Total costs for hypertension medications per month per patient (N=115, 110)	95.93 (183.00) (35.78, 30.00, 4.72-1393.33, 111.12)	110.43 (227.93) (32.94, 10.00, 5.89-1633.33, 111.83)	6196.50	0.792
Total costs of non hypertension medications (N=117, 113)	1688.71 (2565.55) (662.00, 180.00, 0.00-13897.00, 119.71)	1203.58 (1634.15) (688.00, 0.00, 0.00-9340.00, 111.14)	6118.00	0.329
Total costs of non hypertension medications per month per patient (N=117, 113)	187.63 (285.06) (73.56, 20.00, 0.00-1544.11, 119.71)	133.73 (181.57) (76.44, 0.00, 0.00-1037.78, 111.14)	6118.00	0.329

*Follow up period is during Oct02-June03. If patients had visits for less than 9 months but at least 3 months of cost data were available, costs were analyzed for that 9 month period.

** p values from Mann-Whitney tested for the difference between groups.

Table 3.31 Total costsof all medications compared within each group and between the treatment and the control groups (Ref. 28)

Months	Total cost of all medications (Bahts)					
	Treatment group (N=117) Mean (SD) (Min-Max)	Control group (N=113) Mean (SD) (Min-Max)	df1	df2	F	P value
Oct 02	296.98 (495.99) (0-2935.00)	269.08 (436.83) (0-3159.00)				
Nov02	258.14 (438.42) (0-2820.00)	192.43 (299.74) (0-1882.00)				
Dec 02	327.62 (550.14) (0-2843.00)	286.17 (478.99) (1-3145.00)				
Jan 03	194.56 (347.10) (0-2010.00)	202.22 (352.66) (0-2494.00)				
Feb 03	277.74 (477.88) (0-2520.00)	256.36 (433.85) (0-3100.00)				
Mar 03	269.19 (503.96) (0-3575.00)	229.08 (299.78) (0-1290.00)				
Apr 03	310.36 (486.96) (0-2520.00)	227.50 (429.62) (0-3125.00)				
May03	310.98 (675.42) (0-5790.00)	259.69 (428.57) (0-2530.00)				
Jun 03	291.73 (466.23) (0-2903.00)	248.51 (517.85) (0-3175.00)				
Total	281.92 (499.97) (0-5790.00)	241.23 (414.25) (0-3175.00)				
Total*	12.05 (11.70) (0-76.09)	11.10 (10.87) (0-56.35)	1	2052	3.681	0.055
Times: for 9 months						
Control group			8	1008	1.311	0.234
Treatment group			8	1044	1.445	0.173
Interaction: for group*time			8	2052	0.702	0.690

*The costs were transformed by square root to achieve Levene's test of homogeneity of variance assumption before using 9x2 Factorial ANOVA to compare between the control and treatment groups over 9 months.

Table 3.32 Total costs of hypertension medications, number of patients who received prescriptions in each month and total costs of medication per patient compared between groups (Ref. 29)

Months	Total cost of hypertension medications (Bahts)					
	Treatment group (N=115) Mean (SD) (Min-Max)	Control group (N=110) Mean (SD) (Min-Max)	df1	df2	F	P value
Oct 02	105.55 (216.77) (0-1320.00)	128.98 (344.34) (0-2940.00)				
Nov02	76.00 (174.66) (0-978.00)	88.53 (232.98) (0-1330.00)				
Dec 02	126.16 (300.71) (0-2520.00)	138.95 (374.67) (0-2940.00)				
Jan 03	61.03 (144.25) (0-968.00)	82.25 (212.97) (0-1290.00)				
Feb 03	115.95 (317.41) (0-2520.00)	129.49 (373.36) (0-2940.00)				
Mar 03	68.28 (130.69) (0-750.00)	99.55 (217.25) (0-1290.00)				
Apr 03	122.05 (302.93) (0-2520.00)	104.44 (339.39) (0-2940.00)				
May03	113.33 (390.76) (0-3660.00)	112.12 (311.88) (0-2060.00)				
Jun 03	74.98 (135.59) (0-750.00)	109.53 (365.52) (0-2940.00)				
Total	95.93 (251.71) (0-3660.00)	110.43 (313.93) (0-2940.00)				
Total*	6.21 (7.58) (0-60.50)	6.32 (8.40) (0.54.22)	1	2007	0.100	0.751
Times: for 9 months						
Control group			8	981	1.165	0.317
Treatment group			8	1026	1.817	0.070
Interaction: for group*time			8	2007	0.465	0.881

*The costs were transformed by square root to achieve Levene's test of homogeneity of variance assumption before using 9x2 Factorial ANOVA to compare between the control and treatment groups over 9 months.

Table 3.33 Total costs of non hypertension medications, number of patients who received prescriptions in each month and total costs of medication per patient compared between groups (Ref. 30)

Months	Total cost of non hypertension medications (Bahts)					
	Treatment group (N=117) Mean (SD) (Min-Max)	Control group (N=113) Mean (SD) (Min-Max)	df1	df2	F	P value
Oct 02	193.23 (426.84) (0-2860.00)	143.53 (286.62) (0-2337.00)				
Nov02	183.44 (359.68) (0-2340.00)	106.25 (165.03) (0-939.00)				
Dec 02	203.62 (444.98) (0-2798.00)	150.91 (293.80) (0-2350.00)				
Jan 03	134.57 (265.74) (0-1361.00)	122.15 (268.24) (0-2382.00)				
Feb 03	163.77 (330.96) (0-2280.00)	130.31 (223.38) (0-1280.00)				
Mar 03	202.07 (467.35) (0-3497.00)	132.17 (198.75) (0-1028.00)				
Apr 03	190.40 (317.11) (0-2404.00)	125.84 (252.11) (0-1634.00)				
May03	199.59 (427.42) (0-2265.00)	150.54 (250.64) (0-1410.00)				
Jun 03	218.03 (413.19) (0-2850.00)	141.89 (356.73) (0-2882.00)				
Total	187.63 (393.50) (0-3497.00)	133.73 (259.83) (0-2882.00)				
Total*	8.93 (10.39) (0-59.14)	7.69 (8.64) (0-53.68)	1	2052	8.589	0.003
Times: for 9 months						
Control group			8	1008	0.645	0.740
Treatment group			8	1044	0.785	0.616
Interaction: for group*time			8	2052	0.623	0.760

*The costs were transformed by square root to achieve Levene's test of homogeneity of variance assumption before using 9x2 Factorial ANOVA to compare between the control and treatment groups over 9 months.

Table 3.34 Costs of medications and number of hospitalizations during Oct02-June03 (Ref. 31)

	Treatment group Mean (SD), Min-Max, Sum N = 14	Control group Mean (SD), Min-Max, Sum N = 12
No of hospitalizations	1.21 (0.58), 1.00-3.00, 17.00	1.67 (2.02) 1.00-8.00, 20.00
Costs of medications	1554.29 (2560.70) 44.00-8231.00, 23160.00	3439.13 (8660.38) 49.50-30651.50, 41269.50
Costs of hypertension medications	58.39 (153.64) 0-541.00, 817.50	771.17 (2424.67) 0-8450.00, 9254.00

Figure 3.3 Total costs of medications in each group during the period 0ctober02-June03

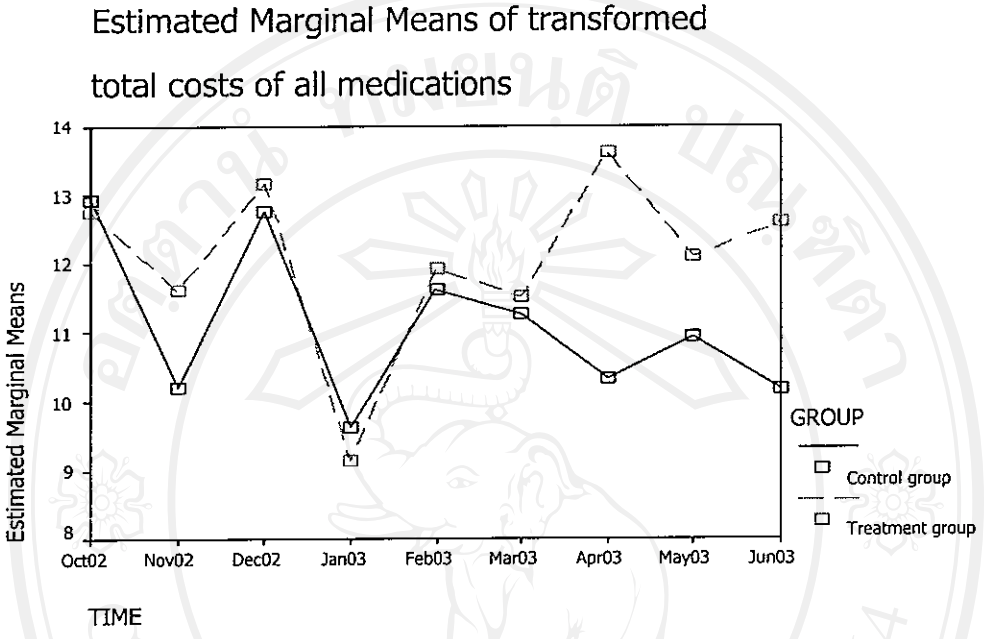


Figure 3.4 Hypertension costs in each group during the period Oct02-June03

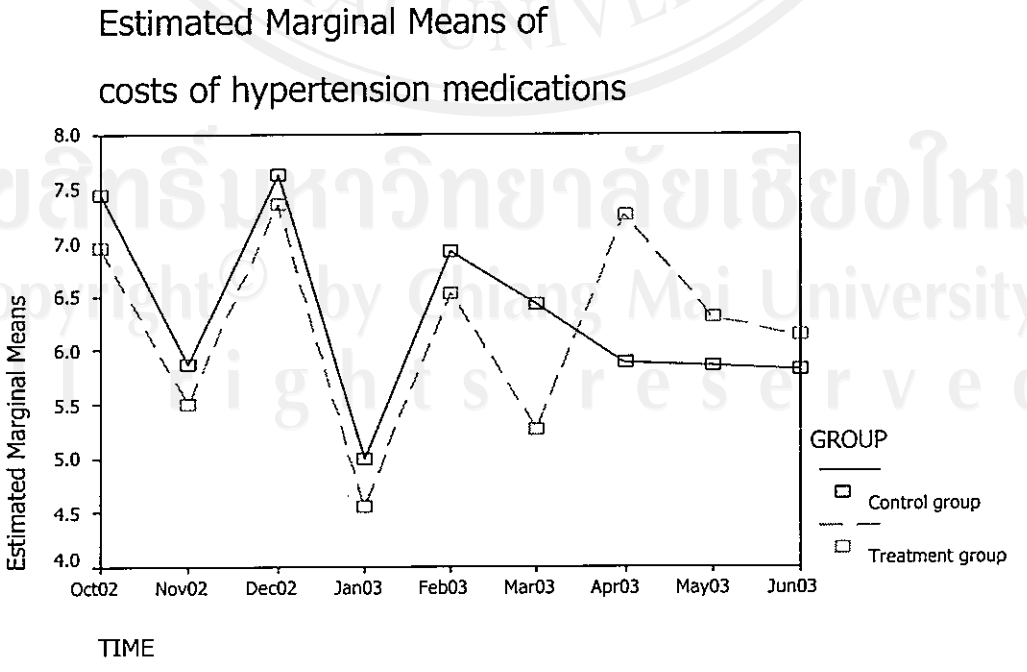
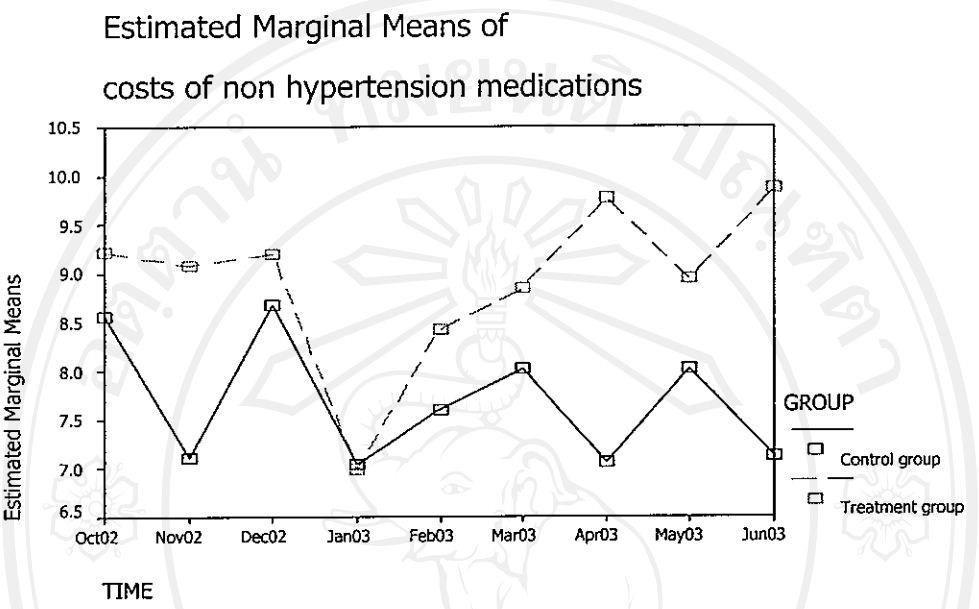


Figure 3.5 Non hypertension costs of medications in each group during the period Oct02-June03



3.2.1.7 Conclusions

The results after six months were shown in three dimensions: clinical, humanistic and economic outcomes.

Clinical outcomes:

After six months patients who received a pharmacist's involvement showed significantly more BP reductions and BP control when compared with patients who received the traditional service. Nevertheless, both groups showed significant improvement in BP control after six months. The BP improvement occurred due to the 48.06% pharmacist interventions which were accepted by doctors in changing medication and requesting more investigations. This also resulted from the pharmacist's intervention with patients who achieved a good compliance rate and changed their life-style at least in exercise performance. Nevertheless, those interventions did not cause any change either in the numbers or the class of hypertensive medications. Obviously, Patients who received a pharmacist's involvement visited the clinic significantly more often than patients who received the traditional service.

Humanistic outcomes:

1) Patient knowledge

. The comparison between groups showed that the patient knowledge was not different between the treatment and control groups. However, patients in the treatment group seemed to have better improvement in hypertension knowledge, risk factor

management and the proper use of medications than patients in the control group who tended to improve their knowledge only in the proper use of medications. The improvement found in the control group may result from finding the answers after the pre test, especially for item No 14, patients always asked after the interviews whether they should take or not take the medication if they forgot at the usual time.

2) Patient satisfaction

Most of the mean scores were higher after six months in both groups except in the continuity of care subscale. The satisfaction with pharmacist involvement was not different between the treatment and control groups. However, there was significantly greater satisfaction in most of the subscales except the overall satisfaction in both groups.

3) Quality of life

Patients who received the pharmacist's involvement during six months had similar quality of life as patients who did not receive it. Quality of life within six months did not change or improve significantly in either group. Nevertheless, health reported transition showed that the proportion of patients who rated highly in 'much better' and 'somewhat better' was greater in the treatment group, while the control group rated their condition highly in 'somewhat better', 'about the same' and 'somewhat worse'.

Cognitive function or attention test measured by the Digit Span test was inconclusive.

Economic outcome:

According to the Mann-Whitney test, a nonparametric test, all costs variables did not show any difference between groups. When comparing groups with times, multiple comparisons with a more reliable analysis using the ANOVA, parametric test. Costs of medications showed that patients in the treatment group spent more money on both all medications and non hypertensive medications over nine months when compared with the control group.

Costs of medications on admission and total admissions during six months were higher in the control group compared to the treatment group.

The summary of the procedure and the summary of the outcomes of the study are shown in Figures 3.6 and 3.7.

Figure 3.6 Summary of the process for the study during the first six months

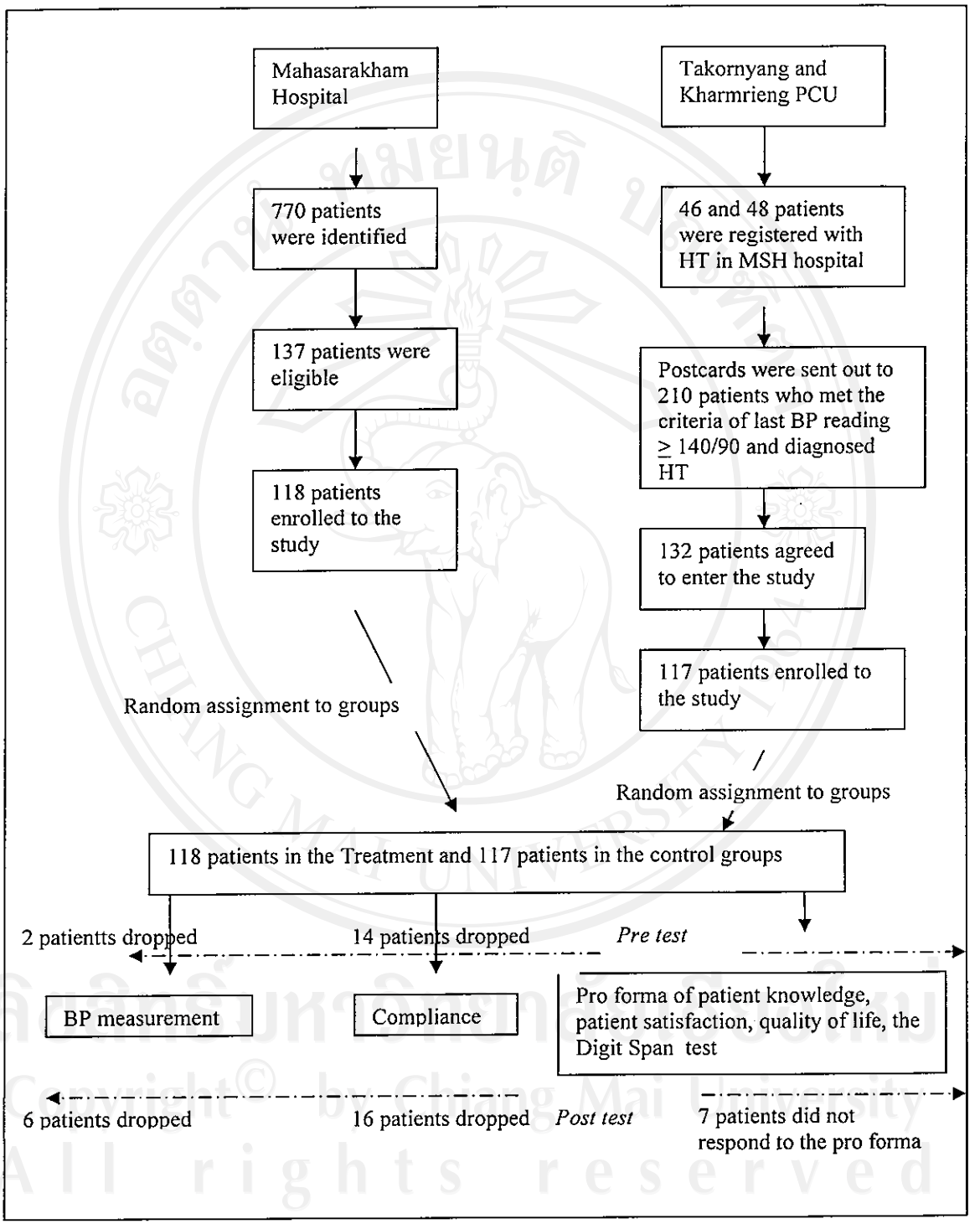
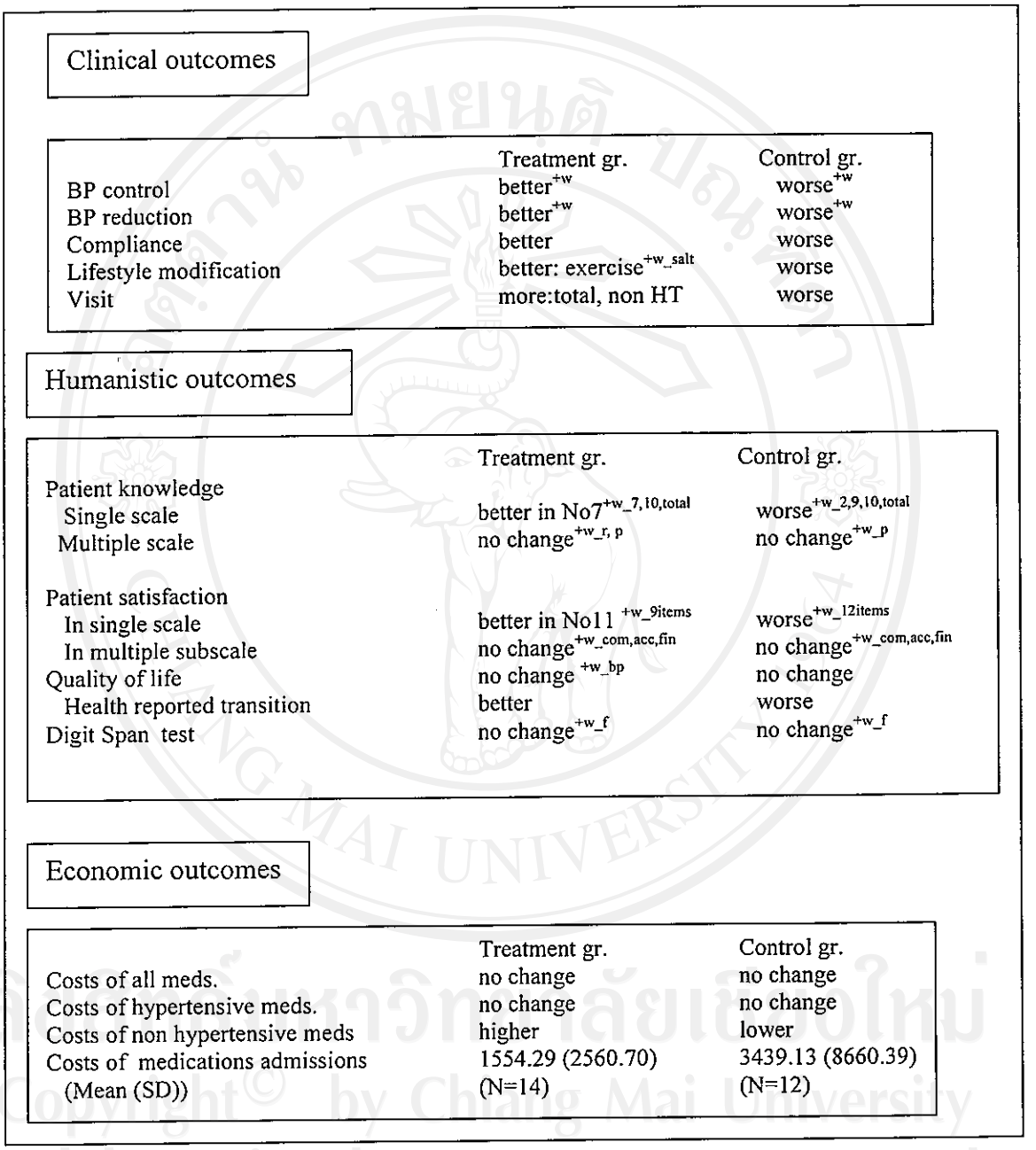


Figure 3.7 Summary of the significant outcome results after six months



Each superscript in the figure shows a significant difference; $^{+w}$ means a significant difference from the results of within group comparisons

In patient knowledge: h=hypertension knowledge, r=risk factor management, p=the proper use of medication; In patient satisfaction: com = communication and management, acc = accessibility and convenience, fin = finance, int = interpersonal relationship, con = continuity of care, ove = overall satisfaction; In quality of life: pf =physical function, re=role physical, bp=bodily pain, gh=general health, vt=vitality, sf=social functioning, re=role emotional, mh=mental health, f = forward numbers

Visit: total = total visit, non Ht= non hypertensive visit

3.2.2 Over 12 months (During July 2003-February 2004)

After 12 months follow-up, there were a total of 20 patients who had dropped out of the study. Eight patients had dropped out at the six months follow-up, of these only two patients could come back for the post test at the 12 months follow-up. There were 14 more patients who were missing in addition to those at the six months follow-up. Three patients died, two patients died of a related disease, the other committed suicide. Four patients were disabled, another patient moved to another province and six patients did not comply with the conditions of the study.

3.2.2.1 Pharmacist's intervention

Table 3.35 shows the response to the pharmacist's recommendations to modify the medication. During July03-Febuary04, a total of 83 letters were sent off from the community pharmacy, more than half of them (49) were accepted to modify medication and to have more laboratory investigations. In primary care units, 89 recommendations were made in the patient's notes, 42 notes were accepted. Overall, over half, 52.91%, of the recommendations were accepted in all settings, although 40.70% of recommendations were not accepted. There were also 6.40 % of recommendations which were not seen by a doctor. The examples of pharmacist's consultations are shown in Table 3.36.

The numbers and the class of hypertensive medications used during July03-February03 are shown in Table 3.37. Neither results showed any significant difference between groups.

Table 3.35 The response of physicians to the pharmacist's recommendations on modification of patient medications during July 03 – February 04.

	Total No. of recommenda-tions	No. of pharmacist recommendations accepted		No of pharmacist recommend-ations not accepted	No of recommend-ations not seen
		Drug modification	More investigations*		
Pharmacist's Letters	83	35	14	27	7
Pharmacist's Notes	89	38	4	43	4
Overall recommendations	172 (100%)	73 (42.44%)	18 (10.47%)	70 (40.70%)	11 (6.40%)

* These are pharmacist's recommendations which related to laboratory tests such as renal function or lipid profile. Patients' whose symptoms indicated they were at risk were also referred.

Table 3.36 Examples of pharmacist's interventions sent for doctors' consideration

Case via letter	Categories	activities
1	An old man who had a pitting edema both legs while on nifedipine (10) 1x3 was sent back with a recommendation to investigate relevance to nifedipine.	Doc: UA, BUN, Cr, LFT, e'lyte
2	A female patient with DM and HT had symptoms like hypoglycemia with chest pain and fell down one day. She did not know what happened to her and though it was from DM. A recommendation for further investigation of possible heart complication.	Doc: EKG and other tests and started Isosorbidinitrate (10) 1x3 and ASA grI 1x1
3	An old female patient with HT and renal impairment came to follow up to see the pharmacist with stage 3 hypertension and bleeding in her eyes. Immediately sent to a doctor.	Doc: She was hospitalized that day.
4	An old man with K 5.7 was taking Enaril (20) 1x1, a recommendation was made to change med or close monitoring.	Doc: renal function test
5	A male patient with DM and HT always had a high pulse rate (> 90times/sec). Since diagnosed DM in 1999, he had never been screened for Dyslipidemia and he had a chest pain which might be related to IHD. A recommendation for lipid profile was sent.	Doc: lipid profile
6	A 75 year man who had HTN complained of dizziness, feeling cold very often. He nearly fell during driving a motorcycle. He was on Atenolol (50) 2x1. Systematic review found that symptoms might be from Atenolol high dose.	Doc: Recommend to decrease Atenolol to be 1x1 and add a diuretic e.g. HCTZ 0.5x1 or Natrilix 1x1. A doctor accepted to decrease Atenolol to be 1x1 and add Natrilix 1x1
7	An old female patients was taking propranolol (10) 4x2, HCTZ 0.5x1, Enaril (20) 1x1 with good BP control, <140/90. After 4 months follow-up, skin rash was found and diagnosed as first experience of psoriasis. A medication review had been done and showed a relation with propranolol long term might cause psoriasis.	Doc: Mention of the possible side effect of propranolol causing first experience of psoriasis. Propranolol should be reconsidered since other medications might be more suitable, CCB e.g. manidipine (10) 1x1. A doctor accepted and changed to manidipine (10) 1x1 with HCT 0.5x1 and Enaril (20) 1x1.

Table 3.37 Assessment of hypertensive medications class and the number of hypertensive medications which were used after 12 months

Medication class	Treatment group	Control group	p value
Pretest			
Betablocker	37	33	0.597
CCB	24	23	0.480
Diuretics	55	55	0.951
ACEI	54	60	0.397
ACEII	2	3	0.644
Nitrates	6	8	0.570
Alphablocker	4	6	0.509
No of meds			
0	3	6	0.231
1	43	46	
2	56	48	
3	8	13	
4	-	2	
Total	110	115	

3.2.2.2 Visits

Table 3.38 shows the number of visits in each group. When the number of visits fell below three times that patient was reckoned as failing to keep the relationship with the cost analysis in economic outcomes. This left 110 patients in the control group and 112 patients in the treatment group who had the required number of visits and non hypertension visits. Thirteen patients were excluded due to three patients having died and the remaining 10 patients had less than three visits during July 03-Febuary 04. For the hypertension visits there were 101 patients left in the control group and 108 patients in the treatment group. There were a total of 26 patients who were excluded from the analysis because four patients died, another five did not receive hypertension medication after the beginning of the study, another patient went to a different hospital, and the remaining 16 patients had less than three visits during this time. The Mann-Whitney U test was used to evaluate the difference between

groups due to the data not being normally distributed. A significant difference was shown for the total visits, $p < 0.05$. This indicated that patients in the treatment group tended to have more overall visits than the patients in the control group.

Table 3.38 Numbers of visits to receive medications in the treatment and the control groups (Ref. 36)

	Treatment group Mean (SD) (min-max, Mean rank)	Control group Mean (SD) (min-max, Mean rank)	Mann-Whitney U	P value
Total visits (N=110 control, 112 treatment)	6.07 (1.50) (3-8, 123.70)	5.47 (1.55) (3-8, 99.08)	4794.00	0.004
Hypertension visit (N=101 control, 108 treatment)	5.35 (1.43) (3-8, 112.41)	5.02 (1.48) (3-8, 97.08)	4654.00	0.061
Non hypertension visit (N=110 control, 112 treatment)	0.91 (1.26) (0-7, 115.33)	0.85 (1.42) (0-8, 107.60)	5731.50	0.325

Mann-Whitney was used to evaluate the difference between groups.

3.2.2.3 Clinical outcomes

BP control was defined in accordance with the Sixth Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure guidelines, JNC-6 (National high blood pressure education program, 1997). The controlled BP in hypertension without concomitant cardiovascular disease was defined as having a benchmark of $\leq$135/85 mm Hg because the conditions of BP measurement were similar to the conditions for self measurement at home as state in JNC-6 and all other BP goals followed JNC-6 guidelines. The patient was counted as controlled when both their systolic and diastolic BPs achieved the stated goals, otherwise they were recorded as uncontrolled.

3.2.2.3.1 Blood pressure control

BP control assessment compared between the treatment and the control groups after 12 months:

Table 3.39 shows the results of BP control after 12 months by multiple logistic regression which used the pre test as a covariate. In the group of 235 the proportion of patients which had their BP controlled in the treatment group was significantly higher than in the control group, 92 of 118 compared with 76 of 117, $p < 0.05$. In the group of 158 patients whose BP was at least 140/90 mm Hg at the start of the study the results were similar and the proportion with controlled BP was significantly higher in the treatment group, $p < 0.05$.

BP control assessment compared within each group between the pre test and after 12 months:

When compared within each group after 12 months, 235 patients in both groups had significant improvement in controlling their BP, $p < 0.05$. In addition, the proportion of 158 patients with controlled BP was significantly higher in both groups after 12 months follow-up, $p < 0.05$, as shown in Table 3.39.

Table 3.39 BPs at pre test and after 12 months in the treatment and the control group (Ref. 32)

Number (Treatment gr./ Control gr.)	Treatment group		Control group		Exp (B)	95% CI	P value*
	BP controlled	BP uncontrolled	BP controlled	BP uncontrolled			
N_1=235 (118/117)							
Pre test	27	91	21	96	1.36	0.72-2.57	0.349
After 12 months	92[It]	26	76[Ic]	41	1.85	1.03-3.34	0.040
N_2=158 (76/82)							
Pre test	0	76	0	82	-	-	-
After 12 months	56[It]	20	48[Ic]	34	1.98	1.01-3.89	0.046

N_1 means Total group of 235 patients
N_2 means patients who had BP ≥140/90 mm Hg at the pre test
*Multiple logistic regression was performed to evaluate a difference between groups which used pre test time as a covariate. [It] Pairwise comparison showed p values <0.001 in the treatment group between after 12 months and the pre test. [Ic] Pairwise comparison showed p values <0.001 in the control group between after 12 months and the pre test; Dash line showed that the statistics could not be produced because of the constant at the pre test. Interactions which did not show significant difference were excluded from the model.

3.2.2.3.2 Blood pressure difference

BP difference assessment compared between the treatment and the control groups after 12 months:

The outcomes showed similar results to those after six months follow-up. Table 3.40 shows the results after 12 months follow-up in the 235 patient group. The decrease in BP in the treatment group, SBP/DBP 26.72/13.53 mm Hg, was significantly greater than in the control group, SBP/DBP 12.32/9.75 mm Hg, p <0.05. Similar results were also obtained with the 158 patient group who had BPs of at least 140/90 mm Hg at the beginning of the study. The BP difference was significantly greater in the treatment group, SBP/DBP 33.66/16.61 mm Hg, when compared with the control group, SBP/DBP 17.30/11.99 mm Hg, p <0.05.

BP difference assessment compared within each group between the pre test and after 12 months:

When compared within each group after 12 months in 235 patients, Table 3.40, both the control and treatment groups had a significant decrease in both SBP and DBP, $p < 0.05$. This was similar to the group of 158 patients in which both groups had significant decreases of BP over 12 months follow-up, $p < 0.05$.

Table 3.40 Mean BPs and paired differences for all patients (235) and for the group of patients (158) with existing high BP (≥140/90 mm Hg) at the pre test, compared between the pre test and after 12 months (Ref. 33)

Variable	Total group (N = 235)			Patients hypertensive at the pre test [a] (N = 158)		
	Treatment group (n=118) Mean ± SD	Control group (n=117) Mean ± SD	p value	Treatment group (n=76) Mean ± SD	Control group (n=82) Mean ± SD	p value
Pre test between groups						
Systolic mm Hg	144.76 ± 19.69	142.41 ± 19.81	0.600	155.19 ± 15.51	152.19 ±16.17	0.235
Diastolic mm Hg	85.72 ± 13.56	85.96 ± 12.94	0.889	90.47 ± 13.83	89.73 ±12.96	0.731
After 12 months between groups						
Systolic mm Hg	118.03 ± 13.67	130.08 ± 20.63	< 0.001	124.16 ± 14.23	130.36 ± 16.83	<0.001
Diastolic mm Hg	72.19 ± 10.68	76.22 ± 10.61	0.001	73.08 ± 10.68	76.52 ± 12.35	0.002
Paired differences within groups						
Systolic mm Hg	26.72 ± 19.36	12.32 ± 21.55	<0.001	33.66 ± 18.22	17.30 ± 21.03	<0.001
Diastolic mm Hg	13.53 ± 11.21	9.75 ± 11.23	<0.001	16.61 ± 10.90	11.99 ±11.04	<0.001

[a] BP ≥140/90 mm Hg

3.2.2.3.3 Results of patient outcomes after 12 months follow-up

Table 3.41, during follow-up July 03-February 04, the number of patients who were disabled in the control group was higher than in the treatment group, 2.56% and 0.85% respectively. Two patients died in each group. The total number of patients who were admitted to hospital in the control group was noticeably higher than the treatment group, 8.55% and 7.63 % respectively.

Table 3.41 Patient clinical outcomes during July03-February 04 in the treatment and the control groups

Patient clinical outcomes	Treatment group (N=118) Percent (No)	Control group (N=117) Percent (No)
Disabled	0.85 (1)	2.56 (3)
Died	1.69 (2)	1.71 (2)
Hospitalization (times)*		
1	6.78 (8)	6.84 (8)
2	0.85 (1)	1.71 (2)
3	0.00 (0)	0.85 (1)
6	0.00 (0)	0.85 (1)
Total of hospitalization	7.63 (9)	10.26 (10.26)

*Hospitalization was recorded by the hospital. The cause of disabling, death and admission were not available.

3.2.2.3.4 Compliance rates

Compliance rate was analyzed by Multiple logistic regression using the pre test as a covariate. A total of 30 patients dropped out from the analysis due to disabling (three), death (five), moving to another province (one), no hypertensive medication (nine), no data of pill count provided (nine) and receiving treatment from other hospitals (three).

Compliance rate assessment compared between the treatment and the control groups:

Table 3.42 indicates that the proportion of patients in the treatment group who had good compliance, 68 of 103, was significantly higher than the proportion in the control group, 47 of 102. These results show a significant difference between groups, $p < 0.05$. Multiple logistic regression indicated that twice as many patients in the treatment group had 'good compliance' compared with the patients in the control group, odds ratio = 2.398.

Compliance rate assessment compared within each group between the pre test and after 12 months follow-up:

Table 3.43, indicates that within each group comparison, a greater proportion of patients in the treatment group showed significantly higher compliance after 12 months follow-up. That is 61 of 112 at the pre test and 68 of 103 after 12 months follow-up, $p < 0.05$. Conversely, the proportion of the patients in the control group with improved compliance did not show a significant increase. That is 58 of 109 at the pre test and 47 of 102 after 12 months, $p > 0.05$. In fact compliance deteriorated.

Table 3.42 Patient compliance rates of the treatment group and the control groups (Ref. 34)

Compliance	Good ≥80% compliance	Poor <80% compliance	Odd ratio	95% CI	p value
Pre test					
Treatment group (N=112)	58 (51.33%)	54 (48.21%)	0.845	0.498-1.435	0.534
Control group (N=109)	61 (56.48%)	48 (44.04%)			
After 12 months					
Treatment group (N = 103)	68 (66.00%)	35 (34.00%)	2.398	1.349-4.265	0.003
Control group (N=102)	47 (46.10%)	55 (53.90%)			

Table 3.43 Patient compliance rates compared within each group between the pre test and after 12 months follow-up (Ref. 34)

Compliance	Good ≥80% compliance (Pre test-After 12 months)	Poor <80% compliance (Pre test-After 12 months)	p value
Pre test – After 12 months			
Treatment group (N=112--103)	58 (51.33)-68 (66.00)	54 (48.21)-35 (34.00)	0.029
Control group (N=109--102)	61 (56.48)-47 (46.10)	48 (44.04)-55 (53.90)	0.112

3.2.2.3.5 Lifestyle modification

Table 3.44, after 12 months follow-up, participation in regular exercise and avoidance of a high salty diet showed a significant difference between the groups. The proportion of patients who participated in regular exercise was higher in the treatment group (82 of 108) than in the control group (65 of 112, odds ratio=2.08, p=0.023).The proportion of patients who avoided a salty diet was higher in the treatment group (61 of 105) than in the control group (39 in 103, odds ratio = 2.38, p = 0.006). No interaction was found. The rest of the lifestyle factors did not show any significant difference between groups.

Within group comparison by the McNemar test showed two significant improvements involved with exercise and stress avoidance, p <0.05. The rest of the lifestyle factors did not show any significant difference in each group.

Table 3.44 The proportion of patients who had made lifestyle modifications after 12 months compared between the treatment and the control groups (Ref.35)

Lifestyle modification	Treatment group		Control group		Odds ratio	95%CI	p value
	Pre test	After 12 mo	Pre test	After 12 mo			
Alcohol avoidance	108 (N=118)	98 (N=109)	106 (N=117)	103 (N=113)	1.20	0.39-3.69	0.749
Exercise	56 (N=115)	82[2t] (N=108)	40 (N=98)	65[2t] (N=112)	2.08	1.11-3.92	0.023
Stress avoidance	102 (N=118)	105[2t] (N=109)	100 (N=117)	106[2t] (N=113)	1.74	0.49-6.19	0.392
No smoking	110 (N=118)	104 (N=109)	110 (N=116)	107 (N=113)	0.28	0.02-3.58	0.326
Sodium avoidance	53 (N=115)	61 (N=105)	32 (N=87)	39 (N=103)	2.38	1.29-4.39	0.006

Pairwise comparisons showed significant difference by McNemar test, p <0.05, between the pre test and after 12 months[2t] within the treatment group and [2c] within the control group

3.2.2.4 Humanistic outcomes

Patient recruitment

Patient knowledge was measured after 12 months. There were 109 patients left in the treatment group and 113 patients in the control group. In total, 13 patients were lost from the study. In addition to seven patients who had dropped out after six months follow up, there were six patients who were omitted from the study because three of them died, one patient was disabled and the other two did not enroll until the end of the study.

3.2.2.4.1 Patient knowledge

Patient knowledge assessment compared between the treatment and the control groups:

Table 3.45 shows that the results of patient knowledge at the time of the pre test and after 12 months follow up. After 12 months, significant differences between groups were found in items Nos 1, 13 and Total score, $p < 0.05$. This meant that patients in the treatment group knew more than patients in the control group that 'hypertension is not a curable disease', 'all medications which are taken without prescriptions should have a pharmacist check to avoid drug interactions' and overall knowledge in 14 items.

Patient knowledge assessment compared within each group between the pre test and after 12 months:

Table 3.46 shows comparisons within each group between pre test and after 12 month follow-up. Percentages in most items in the control group seemed to be increased except item Nos 8, 11 and 13. In the treatment group, the percentages increased in all items except item No 8. Nevertheless, the percentages of correct responses were significantly higher in most of the scale items except in items No 3, 5, 8 and 12 in the treatment group. On the other hand, the control group showed significant improvements in only five of 14 items, Nos 2, 7, 9, 10 and 12. However, the Total score showed significant improvement in both groups, $p < 0.05$. This meant that patients in the treatment group tended to have greater knowledge after 12 months than at the time of the pre test in 11 items and total score. The results also showed that patients in the control group had an improvement in their knowledge after 12 months but only in five items and Total score.

Patient knowledge assessment in three subscales compared between the treatment and the control groups and within each group:

Table 3.47 shows the results of patient knowledge in three subscales. After 12 months there were more significant improvements in the treatment group than the control group in hypertension knowledge and in the proper use of medications, $p < 0.05$. Nevertheless, Table 3.48 shows that both the control and treatment groups had a significant improvement in all three subscales, $p < 0.05$. This meant that the knowledge in both groups had improved after 12 months and this was significantly

higher in the treatment group than in the control group, especially in hypertension knowledge and the proper use of medications.

Table 3.45 Percent correct response compared between the treatment and control groups between pre test and after 12 months (Ref. 39)

Patient knowledge item	% correct response of within group				Odd	95% CI	p value*
	Treatment group		Control group				
	Pre test (N=118)	After 12 months (N=109)	Pre test (N=117)	After 12 months (N=113)			
1. Hypertension is a curable disease.	32.20	55.96	27.35	36.28	2.239	1.268-3.853	0.005
2. Medications improve better symptoms but do not extend your life longer.	5.93	26.61	5.98	23.01	1.220	0.651-2.288	0.534
3. Uncontrolled hypertension can cause stroke.	71.19	78.90	66.67	73.45	1.319	0.670-2.595	0.423
4. High salt diet makes blood pressure uncontrolled.	64.41	77.98	59.83	69.91	1.504	0.814-2.779	0.192
5. Uncontrolled blood pressure leads to kidney disease.	63.56	75.23	59.83	68.14	1.383	0.748-2.555	0.301
6. High body weight is one risk factor of uncontrolled hypertension.	62.71	74.31	61.54	70.80	1.189	0.642-2.202	0.581
7. Exercise in hypertensive patients should be avoided.	54.24	80.73	53.85	73.45	1.571	0.810-3.047	0.181
8. Most uncontrolled hypertensive patients have headache and blurred vision.	4.24	3.70 (N108)	8.55	7.08	0.585	0.159-2.150	0.420
9. Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	59.52 (N115)	69.72	51.28	66.37	1.127	0.612-2.075	0.701
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses.	59.32	79.82	55.56	69.91	1.644	0.859-3.148	0.134
11. Smoking and uncontrolled hypertension can cause heart disease.	62.71	71.56	65.81	65.49	1.693	0.857-3.344	0.129
12. Stress makes blood pressure harder to be controlled.	72.88	80.73	72.65	84.07	0.757	0.363-1.581	0.459
13. All medications which are taken without prescription should be let a pharmacist check to avoid drug interactions.	75.42	86.24	73.50	69.03	3.274	1.566-6.846	0.002
14 If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	40.68	56.88	34.19	43.36	1.659	0.960-2.865	0.070
Total	51.96	65.55	49.76	58.60	-	-	0.014[a]

*p values were calculated by multiple logistic regression used pre test as a covariate to adjust baseline; [a] p value was calculated by Mann-Whitney U test for total scores after 12 months.

Table 3.46 Percent correct response compared between the pre test and after 12 months in each group (Ref. 40)

Patient knowledge item	% correct response (number) within group					
	Treatment group			Control group		
	Pre test (N=109)	Post test (N=109)	p value	Pre test (N=113)	Post test (N=113)	p value
1. Hypertension is a curable disease.	33.00 (36)	56.00 (61)	< 0.001	27.40 (31)	36.30 (41)	0.112
2. Medications improve better symptoms but do not extend your life longer.	6.40 (7)	26.60 (29)	< 0.001	6.20 (7)	23.00 (26)	< 0.001
3. Uncontrolled hypertension can cause stroke.	70.60 (77)	78.90 (86)	0.108	37.30 (76)	73.50 (83)	0.265
4. High salt diet makes blood pressure uncontrolled.	63.30 (69)	78.00 (85)	0.024	60.20 (68)	69.90 (79)	0.109
5. Uncontrolled blood pressure leads to kidney disease.	64.20 (70)	75.20 (82)	0.067	60.20 (68)	68.10 (77)	0.176
6. High body weight is one risk factor of uncontrolled hypertension.	62.40 (68)	74.30 (81)	0.049	61.10 (69)	70.80 (80)	0.091
7. Exercise in hypertensive patients should be avoided.	54.10 (59)	80.70 (88)	< 0.001	54.00 (61)	73.50 (83)	0.001
8. Most uncontrolled hypertensive patients have headache and blurred vision.	4.60 (5)	3.70 (4)	1.000	8.00 (9)	7.10 (8)	1.000
9. Hypertensive patients can adjust doses of hypertensive medication depending on each BP measurement.	56.60 (60)	69.80 (74)	0.026	53.10 (60)	66.40 (75)	0.018
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors, pharmacists or nurses.	60.60 (66)	79.80 (87)	< 0.001	54.9 (62)	69.90 (79)	0.010
11. Smoking and uncontrolled hypertension can cause heart disease.	63.30 (69)	71.60 (78)	0.049	67.3 (76)	65.50 (74)	0.855
12. Stress makes blood pressure harder to be controlled.	73.40 (80)	80.70 (88)	0.152	72.6 (82)	84.10 (95)	0.026
13. All medications which are taken without prescriptions should have a pharmacist check to avoid drug interactions.	74.30 (81)	86.20 (94)	0.007	73.50 (83)	69.00 (78)	0.472
14. If you recognize that you miss a dose, for example you are taking a daily dose, you do not need to take this dose at the time you recognize you missed it because the time has gone by.	40.40 (44)	56.90 (62)	0.016	33.60 (38)	43.40 (49)	0.091
Total	51.96	65.44	< 0.001 [a]	49.76	58.60	0.014[a]

p values were calculated by McNemar test. [a] p values were calculated by Wilcoxon signed rank test.

Table 3.47 Percent correct response compared between groups in each domain of patient knowledge constructed questions (Ref. 41)

Scale	Treatment group % of correct answers		Control Group % of correct answers		p value pre test*	p value after 12 months*
	Pre test (N=118)	After 12 months (N=109)	Pre test (N=117)	After 12 months (N=113)		
1. Hypertension knowledge	42.80	53.44	40.60	46.24	0.521	0.028
2. Risk factor management	63.39	77.06	62.74	72.74	0.884	0.212
3. Proper use of medications	47.61	63.85	44.10	54.34	0.306	0.019

*p value was calculated by Mann-Whitney U test

Table 3.48 Percent of correct answers compared within groups after 12 months (Ref. 41)

Scale	Treatment group % of correct answers			Control Group % of correct answers		
	Pre test (N =118)	After 12 months (N=109)	p value	Pre test (N =117)	After 12 months (N=113)	p value
1. Hypertension knowledge	42.80	53.44	< 0.001	40.60	46.24	0.034
2. Risk factor management	63.39	77.06	< 0.001	62.74	72.74	0.004
3. Proper use of medications	47.61	63.85	< 0.001	44.10	54.34	0.001

p value was calculated by Wilcoxon signed-rank test

3.2.2.4.2 Patient satisfaction

Patient satisfaction assessments compared between the treatment and the control groups:

In Table 3.49, patient satisfaction was measured after 12 months follow up, Mann-Whitney U test was used to analyze the mean ranks of patient satisfaction because the data distribution was not normal. Twelve items showed significantly higher scores in the treatment group when compared with the control groups, $p < 0.05$, except scale item Nos 2, 5, 7 and 14. Predominantly, most of the mean scores were higher in the treatment group than in the control group except for item No 15. That is the score in item No 15 in the treatment group was significantly lower than the score in the control group, $p < 0.05$. This meant that patients in the treatment group tend to be more satisfied with the research pharmacist compared with the patients in the control group. While patients in the control group who rated in lower score meant that they were satisfied with any pharmacist.

These results indicated that patients in the treatment group tended to be more satisfied with the pharmacist's involvement than were patients in the control group, in 12 items. And after 12 months follow-up, the patients in both groups tended to be more satisfied than at the pre test time.

Patient satisfaction assessments compared within each group between pre test and after 12 months:

Table 3.49 shows that the patients in both groups were significantly more satisfied after 12 months than at the pre test in most of the items except item No 15 for

which both groups had reduced scores. Only the treatment group showed a significantly lower score in item No 15. This lower score meant that patients in the treatment group were more satisfied with the research pharmacist after 12 months than at the pre test time.

Patient satisfaction assessments in six subscale items compared between the treatment and the control groups:

In Table 3.50, the results are shown in six subscale items. At the pre test, there was a significant difference between groups in the scale 'interpersonal relationship', $p < 0.05$. After 12 months follow-up, most of the mean scores were significantly higher in the treatment group than in the control group, $p < 0.05$, except in 'Finance' and 'Continuity of care'. There was no significant difference between groups. The treatment group had significantly lower mean scores than the control group in the scale of 'continuity of care', $p < 0.05$. This meant that patients in the control group were more satisfied with pharmacists' communication and management more than patients in the treatment group. This meant that patients in the treatment group were more satisfied with the pharmacist's communication and management, accessibility and convenience, interpersonal relationship, and overall satisfaction.

Patient satisfaction assessments compared within each group in six subscales between the pre test and after 12 months:

Table 3.51 shows that the patients in both groups had more significant satisfaction after 12 months follow up compared to the pre test, $p < 0.05$. But, only the mean score in 'continuity of care' in the control group did not show any improvement.

This meant that patients in both groups had significantly more satisfaction after 12 months when compared with the pre test in most scales except in the continuity of care in the control group.

Table 3.49 Means and mean ranks of patient satisfaction compared between groups and between the pre test and after 12 months in the treatment and the control groups (Ref. 43)

Satisfaction Scale Item [a]	Treatment group (N=109)					Control group (N=113)					p value**
	Pre test Mean(SD)	After 12mo Mean(SD)	Mean rank (No) Negative	Mean rank (No) positive	p value*	Pre test Mean(SD)	After 12mo Mean(SD)	Mean rank (No) Negative	Mean rank (No) Positive	p value*	
Communication and management											
1. You felt satisfied with pharmacist's explanation of using medications and life style modification.	3.31 (0.55)	3.85 (0.38)	32.00 (4)	32.00 (59)	< 0.001	3.25 (0.52)	3.73 (0.46)	29.00 (3)	30.05 (56)	< 0.001	0.028
2. You understood how to use medications and life style modification better after talking to a pharmacist.	3.45 (0.50)	3.84 (0.39)	29.00 (8)	29.00 (49)	< 0.001	3.37 (0.48)	3.74 (0.51)	34.65 (10)	31.50 (53)	< 0.001	0.112
3. Sometimes a pharmacist makes you wonder if her/his advice is correct.	2.48 (0.78)	3.61 (0.65)	28.75 (4)	42.67 (79)	< 0.001	2.44 (0.71)	3.36 (0.73)	25.00 (10)	44.33 (73)	< 0.001	0.004
4. A pharmacist did not pay attention to your complaining about disease problems.	2.63 (0.79)	3.77 (0.60)	43.50 (4)	45.07 (85)	< 0.001	2.59 (0.82)	3.50 (0.80)	43.67 (9)	42.92 (76)	< 0.001	0.001
5. You intend to follow the details of this pharmacist's advice.	3.47 (0.50)	3.83 (0.38)	27.50 (9)	27.50 (45)	< 0.001	3.46 (0.50)	3.83 (0.44)	31.80 (5)	26.50 (48)	< 0.001	0.653
Accessibility and convenience											
6. You have not received easy access to see a pharmacist.	2.87 (0.77)	3.72 (0.54)	33.25 (6)	39.49 (71)	< 0.001	2.76 (0.83)	3.30 (0.94)	38.79 (12)	36.04 (60)	< 0.001	< 0.001
Finance											
7. Although you have extra expense to see a pharmacist, you receive more benefits.	3.23 (0.59)	3.77 (0.46)	31.50 (6)	33.15 (59)	< 0.001	3.24 (0.52)	3.65 (0.65)	36.40 (10)	31.17 (53)	< 0.001	0.188
8. You felt the benefit received was not reasonable compared to the time spent.	2.95 (0.71)	3.77 (0.46)	31.00 (3)	38.81 (73)	< 0.001	2.90 (0.71)	3.60 (0.65)	44.00 (4)	35.52 (67)	< 0.001	0.042
Interpersonal relationship											
9. A pharmacist took care of you very much in medication use and life style modification.	3.47 (0.50)	3.91 (0.29)	28.00 (4)	28.00 (51)	< 0.001	3.39 (0.56)	3.71 (0.53)	27.50 (6)	24.07 (42)	< 0.001	0.001
10. You felt better after talking to a pharmacist about medication use and life style modification.	3.47 (0.50)	3.87 (0.36)	26.50 (5)	26.50 (47)	< 0.001	3.34 (0.51)	3.73 (0.47)	32.00 (11)	32.60 (53)	< 0.001	0.007
11. A pharmacist should smile, greet and talk more to a patient.	2.40 (0.75)	3.57 (0.76)	27.13 (8)	47.82 (83)	< 0.001	2.21 (0.78)	3.28 (0.92)	32.38 (12)	48.62 (80)	< 0.001	0.007
12. A pharmacist ignored what you told him/her.	3.04 (0.65)	3.78 (0.48)	40.63 (4)	37.85 (71)	< 0.001	2.93 (0.72)	3.52 (0.60)	27.75 (8)	33.18 (56)	< 0.001	< 0.001
13. A pharmacist was pleased to listen to your problems not only on hypertension.	3.30 (0.59)	3.78 (0.48)	34.69 (8)	32.19 (56)	< 0.001	3.14 (0.64)	3.55 (0.61)	31.79 (14)	33.96 (52)	< 0.001	0.001
Continuity of care											
14. You felt warm to see any pharmacist.	3.46 (0.50)	3.76 (0.47)	31.23 (13)	29.00 (45)	< 0.001	3.32 (0.51)	3.65 (0.56)	29.75 (6)	25.50 (45)	< 0.001	0.132
15. If it is possible, you would like to see the same pharmacist.	1.83 (0.77)	1.26 (0.61)	31.96 (55)	32.25 (8)	< 0.001	1.89 (0.71)	1.69 (0.95)	31.04 (46)	40.48 (21)	0.056	< 0.001
Overall satisfaction											
16. In conclusion, you felt satisfied with the pharmacy service of medication use and life style modification.	3.51 (0.50)	3.88 (0.33)	24.00 (3)	24.00 (44)	< 0.001	3.44 (0.55)	3.75 (0.49)	25.00 (7)	25.00 (42)	< 0.001	0.029

* p values were calculated by Wilcoxon signed rank test ** p values were analyzed by Mann-Whitney U test

Table 3.50 The results between groups showing which patient satisfaction items were grouped by each domain (Ref. 44)

Satisfaction Scale Item [a]	Treatment group Mean (SD)		Control group Mean (SD)		p value at pre test	p value after 12 months
	Pre test (N=118)	After 12 months (N=109)	Pre test (N=117)	After 12 months (N=113)		
Communication and management	3.07 (0.35)	3.78 (0.30)	3.02 (0.33)	3.63 (0.37)	0.386	0.001
Accessibility and convenience	2.87 (0.77)	3.72 (0.54)	2.76 (0.83)	3.30 (0.94)	0.262	< 0.001
Finance	3.09 (0.49)	3.77 (0.40)	3.09 (0.45)	3.62 (0.55)	0.873	0.063
Interpersonal relationship	3.14 (0.38)	3.78 (0.30)	3.00 (0.35)	3.56 (0.43)	0.034	< 0.001
Continuity of care	2.65 (0.40)	2.51 (0.35)	2.61 (0.39)	2.67 (0.54)	0.659	0.012
Overall satisfaction	3.51 (0.50)	3.88 (0.33)	3.44 (0.55)	3.75 (0.49)	0.438	0.029

p value was calculated by Mann-Whitney U test

Table 3.51 The results of patient satisfaction compared between the pre test and after 12 months as shown by each domain. (Ref. 44)

Satisfaction Scale Item [a]	Treatment group Mean (SD)			Control group Mean (SD)		
	Pre test (N=118)	After 12 months (N=109)	p value	Pre test (N=117)	After 12 months (N=113)	p value
Communication and management	3.07 (0.35)	3.37 (0.30)	< 0.001	3.02 (0.33)	3.63 (0.37)	< 0.001
Accessibility and convenience	2.87 (0.77)	3.72 (0.54)	< 0.001	2.76 (0.83)	3.30 (0.94)	< 0.001
Finance	3.09 (0.49)	3.77 (0.40)	< 0.001	3.09 (0.45)	3.62 (0.55)	< 0.001
Interpersonal relationship	3.14 (0.38)	3.78 (0.30)	< 0.001	3.00 (0.35)	3.56 (0.43)	< 0.001
Continuity of care	2.65 (0.40)	2.51 (0.35)	0.011	2.61 (0.39)	2.67 (0.54)	0.190
Overall satisfaction	3.51 (0.50)	3.88 (0.33)	< 0.001	3.44 (0.55)	3.75 (0.49)	< 0.001

p value was calculated by Wilcoxon signed rank test

3.2.2.4.3 Quality of life (SF-36)

Patient quality of life was measured after 12 months. There were 109 patients left in the treatment group and 113 patients in the control group. Thirteen patients who dropped out from the study were explained in the section of patient knowledge after 12 months follow up.

Missing values were found only in the physical functioning scale. There were three patients who missed one item after 12 months which was replaced with the mean from the items which left more than 50% of the items in the same domain.

SF-36 scores and descriptive statistics at the pre test and after 12 months follow up are presented in Table 3.52 for the treatment group and 3.53 for the control group. A zero score represents poor health and a score of 100 shows excellent health. The role limitation due to emotional problems had lowest mean scores in both groups which ranged from 35.40 to 49.54 at the pre test and after 12 months. The highest mean scores were shown in the role limitation due to social functioning which ranged from 69.91 to 74.77 at the pre test and after 12 months. Due to the widely observed scores, the low means suggest that a floor effect was apparent in the study. The lowest percentage scores had been shown in the role limitation of emotional problems in both groups at the pre test (41.0% in the control group and 49.2% in the treatment group). After 12 months follow up, these scores were presented in the same role in both groups (46.9% in the control group and 30.3% in the treatment group).The highest percentage scores at the top of the range were in the role limitation of emotional problems (21.2%) in the control group and in the role limitation of physical health (37.6%) in the treatment group.

Quality of life (SF-36) assessments compared between the treatment and control groups:

Table 3.54 shows the results of the two groups at the pre test and after 12 months in terms of mean scores and standard deviation. The lowest mean scores were recorded in role limitation due to emotional problems at the pre test in both groups, after 12 months general health showed the lowest mean scores in the treatment group while the control group rated lowest mean scores in role limitation due to emotional problems. The highest mean scores were recorded in social functioning in both groups. The results showing significant differences between groups were present in the scales of 'physical functioning', 'role-physical', 'bodily pain' and 'role-emotional', $p < 0.05$. Moreover, all the mean scores in the treatment group were higher than in the control group. These meant that patients in the treatment group had better quality of life than patients in the control group in terms of less limitation in performing all physical activities, less following problem which resulted from the effect on the physical health caused by their work or regular daily activities, less intensity of pain and less interference of pain with normal work including both outside and house work, and less emotional problems related to the work or regular daily activities after pharmacist involvement for 12 months.

Quality of life (SF-36) assessments compared within each group between the pre test and after six months:

Table 3.55 shows the mean scores and standard deviations. Most of the mean scores in the treatment group were higher after 12 months except in social function subscales. Surprisingly, most of the mean scores in the control group decreased except

in bodily pain, vitality and mental health subscales. The treatment group showed significant improvement after 12 months follow up in the scales of 'physical functioning', 'bodily pain', 'vitality' and 'role-emotional', $p < 0.05$. There were no significant improvements in any of the scales in the control group. This meant that by the pharmacist involvement for 12 months patients in the treatment group reported the improvements in the limitation in performing all physical activities, in the intensity of pain and the interference of pain with normal work including both outside and house work, in the subjective well-being, including feeling full of life and lots of energy versus feeling worn out and tired. On the other hand, overall quality of life of patients in the control group tended to deteriorate from the pre test.

Health reported transition scale

Percentage responses for health reported transition were reported in Table 3.56. Most patients in the control group rated highest that their health was about the same as one year ago (31%), whereas patients in the treatment group reported that their health was somewhat better now than one year ago (32.10%). After 12 months follow up, the treatment group showed significantly higher percentages in the first three items while the control group rated higher percentages in the middle three items, $p < 0.05$, also shown in Figures 3.8 and 3.9. Conversely, after 12 months patients in the treatment group rated lowest in 'much worse now', 3.70%, while 'much better now' was rated smallest in the control group, 5.30%.

Table 3.52 Descriptive statistics of SF-36 in the pre test and after 12 months for the treatment group (Ref. 23)

Scale*	Pre test (N=118)					After 12 months (N=109)				
	Mean (SD)	s.e.	Range	% Floor	% Ceiling	Mean (SD)	s.e.	Range	% Floor	% Ceiling
PF	63.36 (21.16)	1.95	11.1-100	1 (0.85)	3 (2.54)	67.86 (22.00)	2.11	0-100	1 (0.92)	6 (5.50)
RP	50.21 (36.76)	3.38	0-100	27 (22.88)	26 (22.03)	56.88 (39.51)	3.78	0-100	22 (20.18)	41 (37.61)
BP	52.29 (17.77)	1.64	10-100	1 (0.85)	5 (4.24)	60.16 (20.41)	1.96	10-100	1 (0.92)	12 (11.01)
GH	46.56 (17.14)	1.58	10-87	3 (2.54)	1 (0.85)	47.56 (15.42)	1.48	5-97.50	1 (0.92)	1 (0.91)
VT	56.44 (16.40)	1.51	0-100	1 (0.85)	1 (0.85)	60.92 (17.68)	1.69	15-100	1 (0.92)	5 (4.59)
SF	74.77 (19.20)	1.77	25-100	1 (0.85)	26 (22.03)	74.08 (19.37)	1.86	0-100	1 (0.92)	24 (22.02)
RE	36.49 (41.57)	3.83	0-100	58 (49.15)	28 (23.3)	49.54 (40.98)	3.96	0-100	33 (30.27)	35 (32.11)
MH	63.39 (16.81)	1.55	28-100	1 (0.85)	3 (2.54)	65.21 (16.56)	1.59	28-100	2 (1.83)	4 (3.67)

* codes of the SF-36 scales are shown in Table 3.24

Table 3.53 Descriptive statistics of SF-36 in the pre test and after 12 months for the control group (Ref. 23)

Scale*	Pre test (N=117)					After 12 months (N=113)				
	Mean (SD)	s.e.	Range	% Floor	% Ceiling	Mean (SD)	s.e.	Range	% Floor	% Ceiling
PF	63.63 (22.42)	2.07	10-100	1 (0.85)	3 (2.56)	60.58 (24.39)	2.29	0-100	2 (1.77)	3 (2.65)
RP	47.01 (36.28)	3.35	0-100	29 (24.79)	23 (19.66)	42.92 (37.72)	3.55	0-100	34 (30.09)	23 (20.35)
BP	52.86 (20.65)	1.91	0-100	1 (0.85)	10 (8.55)	54.27 (18.61)	1.75	10-100	2 (1.77)	7 (6.19)
GH	47.59 (17.76)	1.64	5-92	1 (0.85)	3 (2.56)	45.89 (17.74)	1.67	0-97.5	1 (0.88)	1 (0.88)
VT	55.98 (15.05)	1.39	5-95	1 (0.85)	1 (0.85)	58.50 (17.24)	1.62	20-100	1 (0.88)	1 (0.88)
SF	71.47 (19.20)	1.78	25-100	3 (2.56)	19 (16.24)	69.91 (16.92)	1.59	25-100	1 (0.88)	11 (9.73)
RE	42.17 (42.07)	3.89	0-100	48 (41.03)	33 (28.21)	35.40 (39.91)	3.75	0-100	53 (46.90)	24 (21.24)
MH	63.11 (16.91)	1.56	16-100	1 (0.85)	1 (0.85)	64.00 (17.74)	1.67	0-100	1 (0.88)	1 (0.88)

* codes of the SF-36 scales are shown in Table 3.24

Table 3.54 Mean SF-36 scores for the treatment and the control groups in pre test and after 12 months follow up (Ref. 45)

Scales	Treatment group Mean (SD)		Control group Mean (SD)		p value at pre test	p value after 12 months
	Pre test (N=118)	After 12 months (N=109)	Pre test (N=117)	After 12 months (N=113)		
PF	63.36 (21.16)	67.86 (22.00)	63.63 (22.42)	60.58 (24.39)	0.877	0.024
RP	50.21 (36.76)	56.88 (39.51)	47.01 (36.28)	42.92 (37.10)	0.502	0.008
BP	52.29 (17.77)	60.16 (20.41)	52.86 (20.65)	54.27 (18.61)	0.924	0.015
GH	46.56 (17.14)	47.56 (15.42)	47.59 (17.76)	45.89 (17.74)	0.690	0.617
VT	56.44 (16.40)	60.92 (17.68)	55.98 (15.05)	58.50 (17.24)	0.867	0.353
SF	74.77 (19.20)	74.08 (19.37)	71.47 (19.20)	69.91 (16.92)	0.197	0.064
RE	36.49 (41.57)	49.54 (40.98)	42.17 (42.07)	35.40 (39.91)	0.264	0.008
MH	63.39 (16.81)	65.21 (16.56)	63.11 (16.91)	64.00 (17.74)	0.973	0.882

p values were calculated by Mann-Whitney U test
* codes of the SF-36 scales are shown in Table 3.24

Table 3.55 Comparison of mean scores within each group for the pre test and after 12 months follow up (Ref. 45)

Scales*	Treatment Mean (SD)			Control Mean (SD)		
	Pre test (N=118)	After 12 mo (N=109)	p value	Pre test (N=117)	After 12 mo (N=113)	p value
PF	63.36 (21.16)	67.86 (22.00)	0.024	63.63 (22.42)	60.58 (24.39)	0.141
RF	50.21 (36.76)	56.88 (39.51)	0.119	47.01 (36.28)	42.92 (37.10)	0.182
BP	52.29 (17.77)	60.16 (20.41)	< 0.001	52.86 (20.65)	54.27 (18.61)	0.318
GH	46.56 (17.14)	47.56 (15.42)	0.787	47.59 (17.76)	45.89 (17.74)	0.348
VT	56.44 (16.40)	60.92 (17.68)	0.015	55.98 (15.05)	58.50 (17.24)	0.104
SF	74.77 (19.20)	74.08 (19.37)	0.867	71.47 (19.20)	69.91 (16.92)	0.384
RE	36.49 (41.57)	49.54 (40.98)	0.001	42.17 (42.07)	35.40 (39.91)	0.066
MH	63.39 (16.81)	65.21 (16.56)	0.216	63.11 (16.91)	64.00 (17.74)	0.683

p values were calculated by Wilcoxon signed-rank test
* codes of the SF-36 scales are shown in Table 3.24

Table 3.56 The percentage responses of health reported transition compared between the treatment and the control groups and compared within each group (Ref. 25)

Items	Treatment group Number (percent)		Control group Number (percent)		p value at pre test	p value after 12 months
	Pre test (N=118)	After 12 mo (N=109)	Pre test (N=116)	After 12 mo (N=113)		
Much better now than one year ago	18 (15.30)	23 (21.10)	18 (15.50)	6 (5.30)	0.996	0.001
Somewhat better now than one year ago	33 (28.00)	35 (32.10)	32 (27.60)	33 (29.20)		
About the same as one year ago	20 (16.90)	28 (25.70)	22 (19.00)	35 (31.00)		
Somewhat worse now than one year ago	28 (23.70)	19 (17.40)	26 (22.40)	23 (20.40)		
Much worse now than one year ago	19 (16.10)	4 (3.70)	18 (15.50)	16 (14.20)		

p values were calculated by chi square

Figure 3.8 Percentage responses for health reported transition between the treatment and the control groups at the pre test

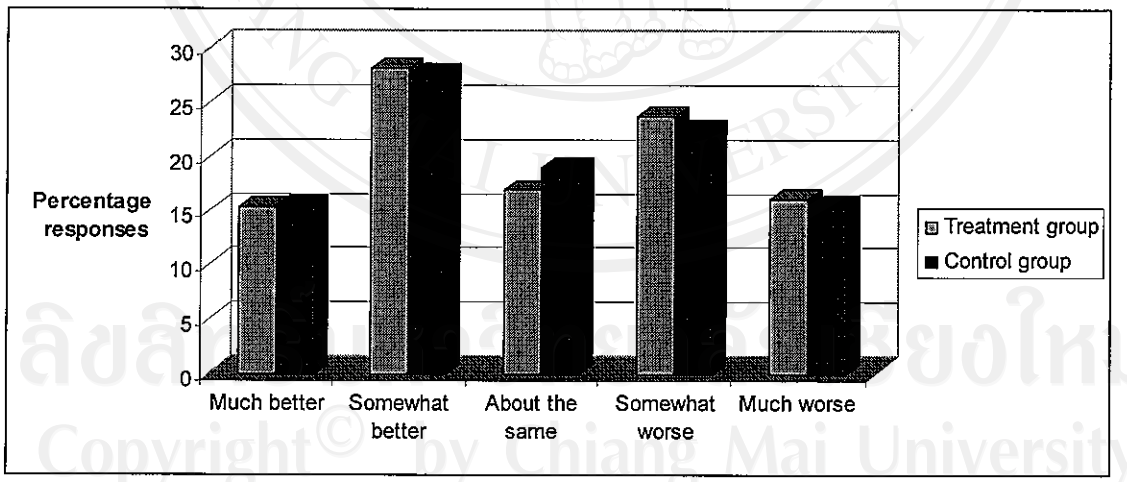
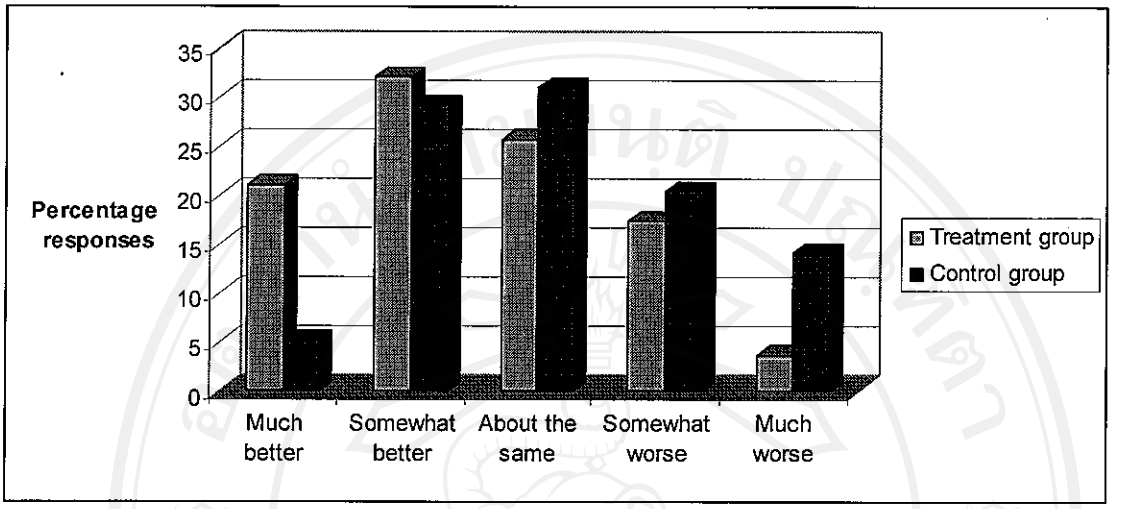


Figure 3.9 Percentage responses for health reported transition between the treatment and the control groups after 12 months



3.2.2.4.4 Digit span test

The digit span test results after 12 months follow up are shown in Table 3.57. There was no significant difference between groups. There were significantly decreased means of forward numbers in both groups, $p < 0.05$, but there were no significant difference in the reverse numbers in either group, $p > 0.05$. Due to the possibility that the reduction in forward numbers in both groups might not be related to the pharmacist's involvement but rather to the anxiety of the procedure of interviewing or misunderstanding the procedure, these results were inconclusive.

Table 3.57 Mean scores of the Digit Span test compared between the treatment and the control groups and compared within each group between pre test and after six months (Ref. 26)

groups outcomes (range of possible scores)[n]	Treatment group			Control group			p value [1]	p value [2]
	Pre test (N=118)	After 12 months (N=109)	p value*	Pre test (N=116)	After 12 months (N=113)	p value*		
Forward numbers	6.02 (1.31)	5.50 (1.29)	0.001	5.85 (1.40)	5.59 (1.23)	0.034	0.267	0.673
Reverse numbers	2.31 (1.01)	2.50 (1.09)	0.218	2.42 (1.28)	2.53 (1.06)	0.378	0.167	0.951

* p values were calculated for the difference within group by Wilcoxon signed-rank test.
[1] p values at the pre test and [2] p values after 12 months which show the difference between groups by Mann-Whitney U test.
[n] normal: 7 ± 2 digits forward and 5 ± 1 digits in reverse

3.2.2.5 Economic outcome: Costs of medications

Economic outcome are presented for eight months from 1 July 2003 to 28 February 2004. Cost was divided to be costs of all medications, costs of hypertension medications and costs of non hypertension medications.

There were a total of 13 patients, seven patients in the control and six patients in the treatment group, who were missing from the calculation of costs of all medications. Four patients died, one patient was disabled from a second stroke, one patient received care from another provincial hospital, one patient did not get medications for hypertension right from the beginning of the study, and six patients received medications less than three times during these eight months.

3.2.2.5.1 Cost of medications

Costs of medications assessment during July 03-Februry04 between the treatment and the control groups:

The results in Table 3.58 show that a patient in the treatment group spent a little higher cost of all medications than a patient in the control group, 2641.82 baths or 330.23 baths per month in the treatment group and 2224.36 baths or 278.05 baths per month in the control group. The costs of hypertension medications for a patient were recorded a bit lower in the treatment group compared with a patient in the control group, 902.40 baths or 112.80 baths per month in the treatment group and 1070.14 baths or 133.67 baths per month in the treatment group. For non hypertensive medications, a patient in the treatment group spent 1171.65 baths or 221.46 baths per month, while a patient in the control group spent 1241.78 baths or 155.22 baths per month. Nevertheless, there were no significant differences in either total costs of all medications or average costs of total medications between the control and the treatment group, $p > 0.05$.

Costs of medications assessment across eight months (during July03-Februry04) between the treatment and the control groups:

An 8x2 Factorial ANOVA was conducted to evaluate the effects of groups and times on costs. The means, standard deviations, minimum and maximum of costs are presented in Table 3.59 to 3.61. The costs were not transformed because they met the assumption of Levene's test of homogeneity of variance.

Table 3.59, ANOVA indicated no significant interaction between groups and time, F(7, 1760) = 0.280, p >0.05, neither did the main effect of groups, F (1, 1760) = 3.657, p >0.05, nor the effect of times across nine months in each group, >0.05. The main group effect indicated that the control and the treatment groups spent the same amount of money for total cost of all medications over eight months as also shown in Figure 3.10.

Table 3.60, ANOVA indicated no significant interaction between groups and time, F(7, 1672) = 0.366, p >0.05, neither the effect of times across eight months of each group, p >0.05, nor did the main effect of groups, F(1, 1672) = 1.384, p >0.05. The main group effect indicated that the control and the treatment groups spent the same amount of money for total costs of hypertension medications over eight months as also shown in Figure 3.11.

Table 3.61, ANOVA indicated no significant interaction between groups and time, p >0.05, neither did the effect of times across eight months of each group, p >0.05. But, there was a significant difference of the main effect of groups, F (1, 1760) = 12.533, p <0.05. This indicated that the treatment group spent a lot more money on non hypertension medications than the control group as also shown in Figure 3.12.

3.2.2.5.2 Cost of medications on admission

Table 3.62 shows the results of the number of admissions and costs of medications used during July03-February04. Total admissions in the treatment group were lower than in the control group, 9 compared with 19 times. Maximum admission in one patient was two times in the treatment group while in the control group it was six times. Average cost of medications during hospitalization in the treatment group it

was 1712.38 bahts with a SD of 1782.87 while in the control group was 3922.55 bahts with a SD of 6845.81. Average cost of hypertensive medications in the treatment was more in the control group when compared with the treatment group, 1254.65 and 47.25 bahts, respectively.

Table 3.58 Total costs of all medications during July 03-February 04 compared between groups (Ref. 27)

Measurement (N of the treatment group, N of the control group)	Treatment group Mean (SD) (Median, Mode, Min-Max, Mean rank)	Control group Mean (SD) (Median, Mode, Min-Max, Mean rank)	Mann-Whitney U	p value**
Total cost of all medications (N=112, 110)	2641.82 (3629.65) (1421.98, 326.00, 87.50-25500.00, 115.38)	2224.36 (2878.86) (1259.75, 1880.00, 139.50-18437.00, 107.55)	5725.00	0.363
Total cost of all medications per month (N=112, 110)	330.23 (453.71) (177.75, 40.75, 10.94-3187.50, 115.38)	278.05 (359.86) (157.47, 235.00, 17.44-2304.63, 107.55)	5725.00	0.363
Total cost of hypertension medications (N=108, 101)	902.40 (1700.81) (310.50, 300.00, 22.50- 13430.00, 107.57)	1070.14 (2188.45) (310.00, 240.00, 47.5-14245.00, 102.25)	5176.00	0.369
Total cost of hypertension medications per month (N=108, 101)	112.80 (212.60) (38.81, 37.50, 2.81-1678.75, 107.57)	133.67 (273.56) (38.75, 30.00, 5.94-1780.63, 102.25)	5176.00	0.369
Total cost of non hypertension Medications (N=112, 110)	1771.65 (2728.51) (767.50, 0.00, 0.00-15668.00, 115.54)	1241.78 (1541.92) (736.50, 0.00, 0.00-9015.00, 107.39)	5707.50	0.344
Total cost of non hypertension medications per month (N=112, 110)	221.46 (341.06) (95.94, 0.00, 0.00-1958.50, 115.54)	155.22 (192.74) (92.06, 0.00, 0.00-1126.88, 107.39)	5707.50	0.344

** p value shows the difference between groups calculated by the Mann-Whitney test

Table 3.59 Total costs of all medications compared within each group and between the treatment and the control groups (Ref. 47)

Months	Total cost of all medications (Bahts)*					
	Treatment group (N=112) Mean (SD) (Minimum-Maximum)	Control group (N=110) Mean (SD) (Minimum-Maximum)	df1	df2	F	P value
Jul03	362.69 (656.46) (0-4740.00)	281.13 (366.72) (0-1770.00)				
Aug03	290.58 (485.08) (0-2610.00)	265.72 (473.06) (0-3098.00)				
Sep03	299.20 (657.41) (0-5820.00)	218.66 (336.00) (0-1800.00)				
Oct03	361.36 (587.78) (0-3503.00)	254.11 (419.38) (0-2118.00)				
Nov03	303.49 (753.49) (0-7100.00)	273.07 (394.36) (1-1790.00)				
Dec03	318.91 (522.81) (0-3162.00)	302.51 (523.98) (0-2595.00)				
Jan04	370.35 (867.25) (0-7840.00)	286.94 (536.25) (3181.00)				
Feb04	335.23 (544.13) (0-4210.00)	342.22 (760.92) (0-6980.00)				
Total*	330.23 (643.64) (0-7840.00)	278.05 (492.10) (0-6980.00)	1	1760	3.657	0.056
Times: for 8 months						
Control group			7	872	0.587	0.767
Treatment group			7	888	0.270	0.965
Interaction: for group*time			7	1760	0.280	0.962

* Total cost was not transformed before using 8x2 Factorial ANOVA to compare between the control and treatment groups over 8 months.

Table 3.60 Total costs of hypertension medications compared within each group and between the treatment and the control groups (Ref. 48)

Months	Total cost of hypertension medications (Bahts)*					
	Treatment group (N=108) Mean (SD) (Minimum-Maximum)	Control group (N=103) Mean (SD) (Minimum-Maximum)	df1	df2	F	P value
Jul03	116.96 (273.20) (0-1900.00)	122.52 (263.44) (0-1770.00)				
Aug03	86.54 (156.14) (0-960.00)	152.95 (412.89) (0-2940.00)				
Sep03	110.96 (403.81) (0-3690.00)	101.62 (274.61) (0-1800.00)				
Oct03	105.71 (185.90) (0-1130.00)	111.33 (288.16) (0-1785.00)				
Nov03	138.18 (462.73) (0-4260.00)	126.04 (280.44) (0-1790.00)				
Dec03	101.72 (179.38) (0-750.00)	145.71 (378.02) (0-1810.00)				
Jan04	131.86 (407.10) (0-3580.00)	152.51 (413.14) (0-2940.00)				
Feb04	110.47 (238.35) (0-1770.00)	137.94 (347.58) (0-1920.00)				
Total*	112.80 (308.46) (0-4260.00)	133.77 (339.41) (0-2940.00)	1	1672	1.384	0.240
Times: for 8 months						
Control group			7	816	0.330	0.940
Treatment group			7	856	0.306	0.951
Interaction: for group*time			7	1672	0.366	0.922

* Total cost was not transformed before using 8x2 Factorial ANOVA to compare between the control and treatment groups over 8 months.

Table 3.61 Total costs of non hypertension medications compared within each group and between the treatment and the control groups (Ref. 49)

Months	Total cost of non hypertension medications (Bahts)					
	Treatment group (N=113) Mean (SD) (Minimum-Maximum)	Control group (N=110) Mean (SD) (Minimum-Maximum)	df1	df2	F	P value
Jul03	249.91 (512.85) (0-2840.00)	166.40 (252.22) (0-1457.00)				
Aug03	207.13 (421.08) (0-2491.00)	122.50 (201.08) (0-1265.00)				
Sep03	192.21 (365.32) (0-2330.00)	123.51 (197.33) (0-1179.00)				
Oct03	259.43 (525.05) (0-3443.00)	149.86 (301.77) (0-2118.00)				
Nov03	170.25 (373.29) (0-2840.00)	155.05 (248.06) (0-1642.00)				
Dec03	220.82 (456.91) (0-3102.00)	166.07 (319.50) (0-2145.00)				
Jan04	243.20 (541.16) (0-4260.00)	144.14 (274.13) (0-1572.00)				
Feb04	228.71 (480.29) (0-4150.00)	213.05 (543.11) (0-5060.00)				
Total*	221.46 (462.89) (0-4260.00)	155.22 (309.82) (0-5060.00)	1	1760	12.533	< 0.001
Times: for 8 months						
Control group			7	872	0.952	0.465
Treatment group			7	888	0.480	0.849
Interaction: for group*time			7	1760	0.452	0.870

*Both transformed data and original costs were violated Levene's test. The original results were decided to present, nevertheless, both results were similar.

Table 3.62 Costs of medications and number of hospitalizations during July 03-February 04 (Ref. 31)

	Treatment group Mean (SD), Min-Max, Sum (N=8)	Control group Mean (SD), Min-Max, Sum (N=10)
No of hospitalization	1.13 (0.35), 1.00-2.00, 9.00	1.90 (1.60) 1.00-6.00, 19.00
Costs of medication	1712.38 (1782.87) 200.50-5373.50, 13699.00	3911.55 (6845.81) 90.00-22735.00, 39115.50
Costs of hypertension medications	47.25 (70.90), 0-189.00, 378.00	1254.65 (3686.82) 0-11738.00, 12546.50

Figure 3.10 Total costs of all medications during July 03-Februry 04

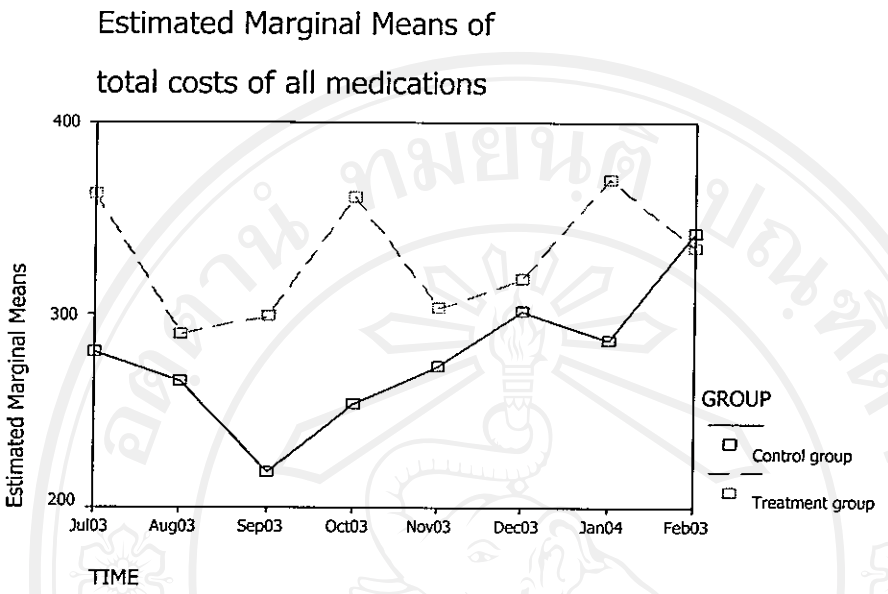


Figure 3.11 Total costs of hypertension medications during July 03-Februry 04

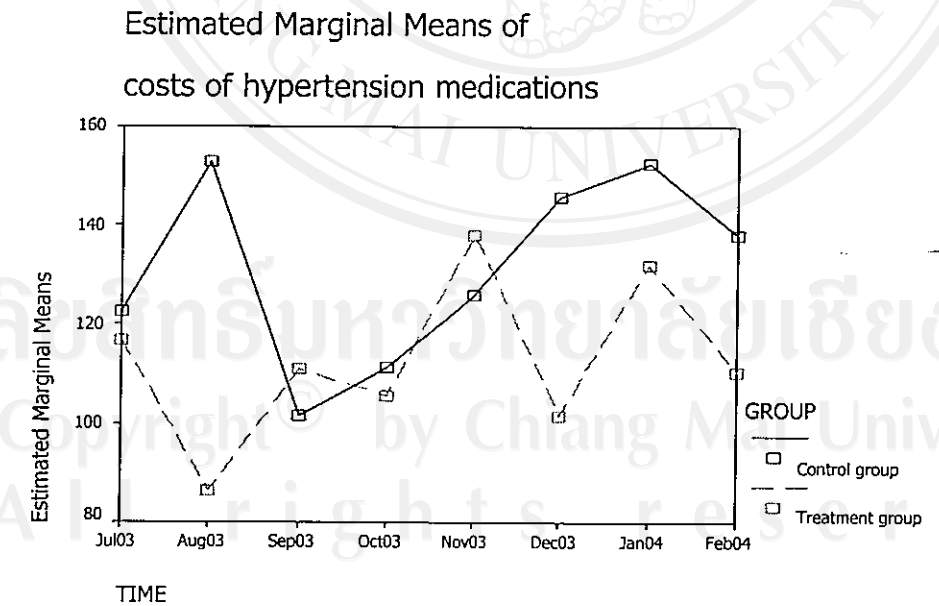
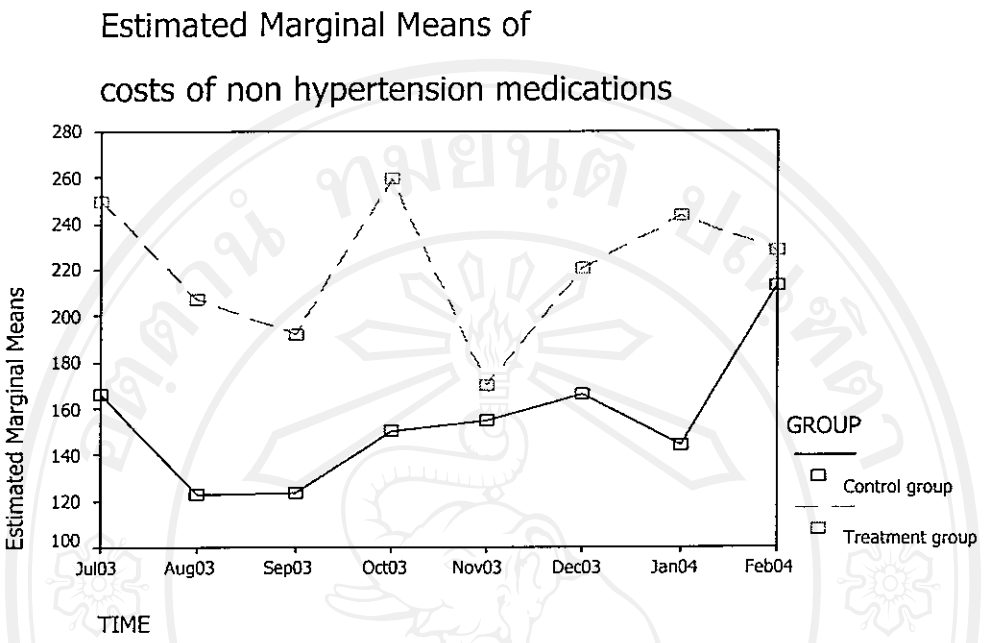


Figure 3.12 Total costs of non hypertension medications during July 03-Februry 04



3.2.2.6 Conclusions

After 12 months follow-up, patient outcomes were measured again in three perspectives: clinical outcomes, humanistic outcomes and economic outcomes.

Clinical outcomes:

Patients in the treatment group who received a pharmacist involvement during 12 months tended to have better BP control and greater BP reduction when compared with the patients who received the traditional service. Nevertheless, both groups showed better improvement in BP control after 12 months follow-up. BP improvement was gradually maintained to the goals due to the 58.91% pharmacist interventions which were accepted by doctors in changing medication and more investigations. This also resulted from the pharmacist intervention with patients to achieve the good compliance rate and change of their life-style, at least in exercise performance and a restriction of a salty diet. Obviously, Patients who received a pharmacist's involvement visited the clinic significantly more often than patients who received the traditional service.

Humanistic outcomes:

1) Patient knowledge

The knowledge compared between groups in each item show significant differences in two items, Nos 1 and 13, nevertheless, after 12 months the treatment group had better knowledge than at the pre test in 10 items while the control group had

a better knowledge than at the pre test in only five items. Both groups showed a significant improvement in the total score.

The comparison between groups showed that the patient knowledge of the treatment group was better than of the control group in hypertension knowledge and the proper use of medication. Nevertheless, both groups showed better knowledge in all subscales when compared with the pre test.

2) Patient satisfaction

In the single construct pro forma of 16 items, the treatment groups showed significantly more satisfaction in 11 items compared with the control group. There was only one item in which the treatment group was less satisfied than the control group. Nevertheless, both groups were more highly satisfied with the pharmacist's involvement after 12 months than at the pre test in most items. That is the treatment group with the research pharmacist's involvement and the control group with the hospital pharmacists' traditional involvement. The exception was item No 15 in the control group. In the six subscales, patients in the treatment group showed significantly more satisfaction in most of them, except finance, than patients in the control group. Nevertheless, patients in both groups had significantly greater satisfaction after 12 months than at the pre test in all subscales except in continuity of care in the control group.

3) Quality of life

SF-36 results showed that patients in the treatment group had a higher quality of life after 12 months than those in the control group in physical function, role

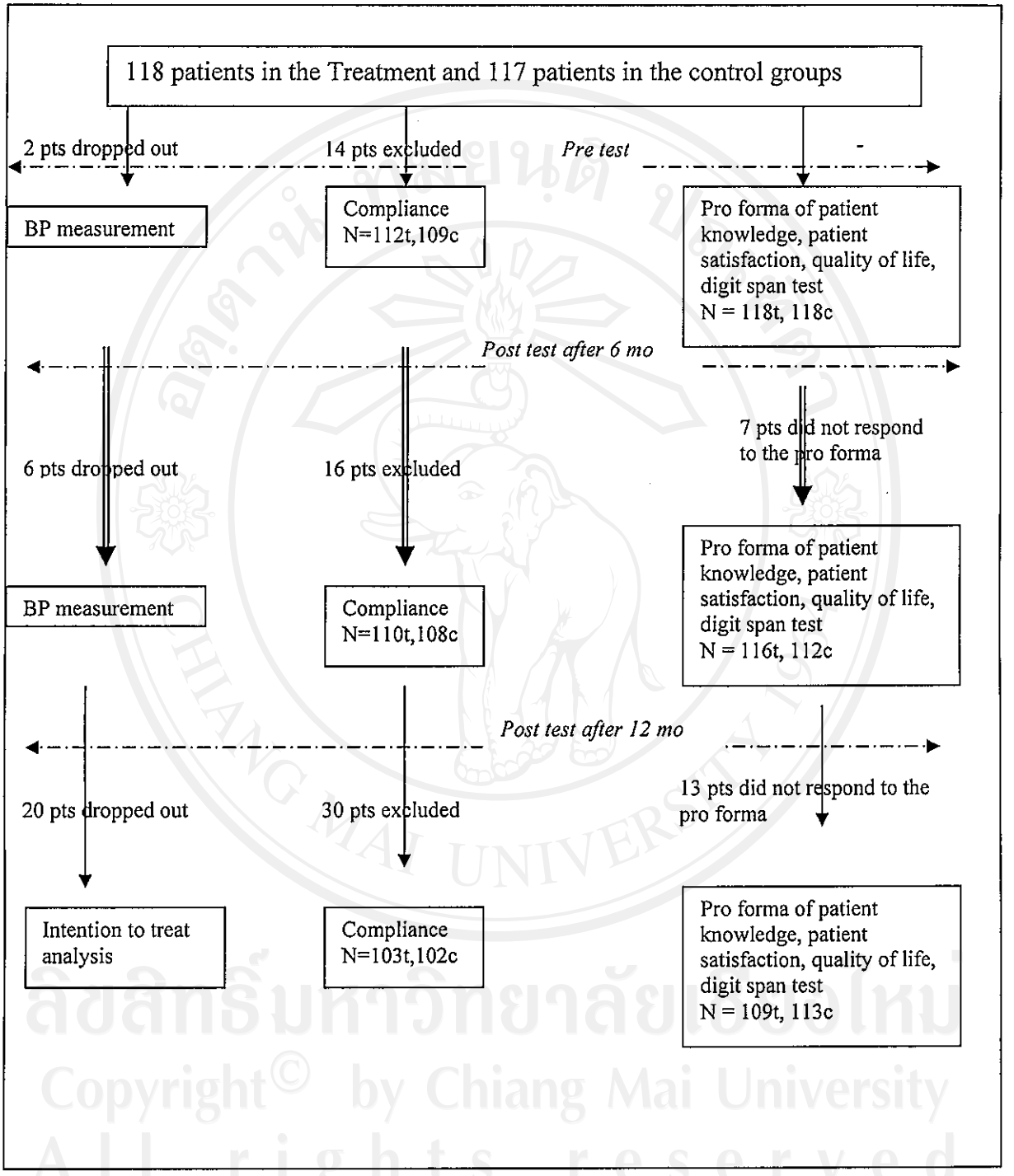
physical, bodily pain and role-emotional. Moreover, SF-36 results indicated that patients in the treatment group had a better quality of life after 12 months follow-up but the results did not show better outcomes in the control group. Health reported transition also showed significantly better outcomes in the treatment group when compared with the control group. The results of the Digit span test were inconclusive.

Economic outcome:

Although the results of costs analysis by Mann-Whitney did not show any significant difference between groups, the results from more reliable test, ANOVA, showed that the costs of medications results in the treatment group were spent more money on all medication and non hypertension medications when compared with the control group. Nevertheless, costs of all medications and hypertensive medications during hospitalization in the control group were higher than in the treatment group.

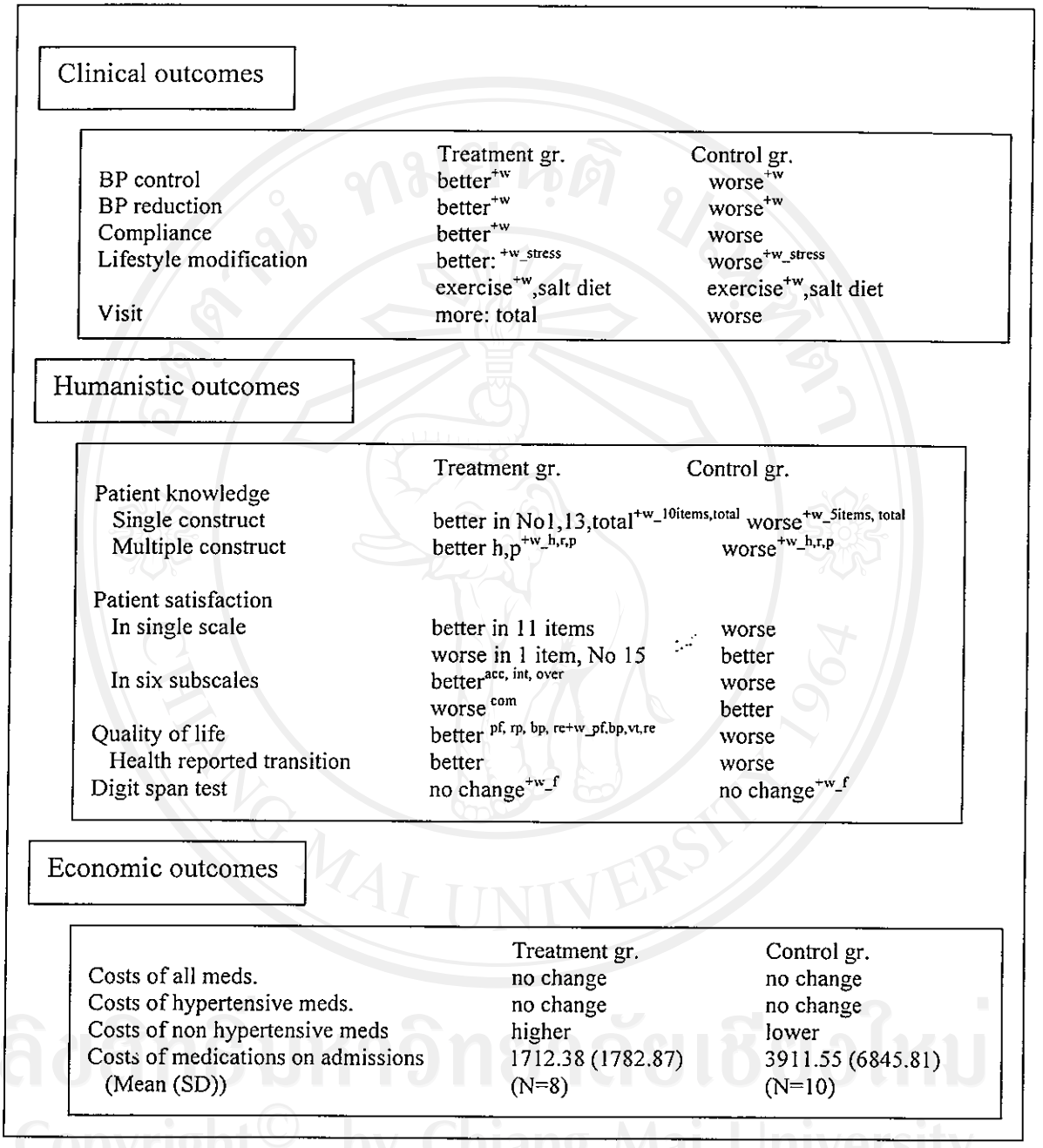
The summary of the procedure and the summary of the outcomes of the study are shown in Figures 3.13 and 3.14.

Figure 3.13 Summary of the process for the study over a whole year



t = treatment group, c = control group
pts = patients, mo = months

Figure 3.14 Summary of the significant outcome results after 12 months



Each superscript in the figure shows a significant difference; $^{+w}$ means a significant difference from the results of within group comparisons

In patient knowledge: h=hypertension knowledge, r=risk factor management, p=the proper use of medication; In patient satisfaction: com = communication and management, acc = accessibility and convenience, fin = finance, int = interpersonal relationship, con = continuity of care, ove = overall satisfaction; In quality of life: pf =physical function, re=role physical, bp=bodily pain, gh=general health, vt=vitality, sf=social functioning, re=role emotional, mh=mental health, f= forward number

Visit: total = total visit, non Ht= non hypertensive visit

3.2.3 The results at 1 year (October 2002-February 2004)

After one year follow-up, BP controls and BP reductions had been measured three times, at the pre test, after six months and after 12 months. Multiple comparisons were performed by 3x2 factorial ANOVA to analyze the difference between groups and across times for continuous variables because of the more power to reject the null hypothesis than obtained with nonparametric statistics. Nominal scale variable multiple logistic regression was used to compare difference between groups at each period of time.

3.2.3.1 Pharmacist's interventions

Table 3.63 shows that the pharmacist's recommendations were communicated as letters and notes which were sent to doctors who took care of hypertensive patients. Some 50.25% of recommendations were accepted and resulted in changes to medication and laboratory investigations. A minority of 41.27% of recommendations were not accepted. The remainder of 8.47% was not seen by the doctors. Examples of the pharmacist's consultations and the hypertensive medication class and numbers of hypertensive medications used are shown in 3.2.1.2 and 3.2.2.1.

Table 3.63The response of physicians to the pharmacist's recommendations on modification of patient's medications over 12 months

	Total No. of recommenda-tions	No. of pharmacist recommendations accepted		No of pharmacist recommend-ations not accepted	No of recommend-ations not seen
		Drug modification	More investigations*		
Pharmacist's Letters	159	78	20	44	17
Pharmacist's Notes	219	83	9	112	15
Overall recommendations	378 (100%)	161 (42.59%)	29 (7.67%)	156 (41.27%)	32 (8.47%)

*These are pharmacist's recommendations which related to laboratory tests such as renal function or lipid profile. Patients' whose symptoms indicated they were at risk were also referred.

3.2.3.2 Visits

When the number of visits was lower than three visits in each period then it was technically defined as 'missing' with reference to the cost of medications analysis. The number of visits which took place in each period of time was summed for the calculation of one year. The total visits and non hypertension visits had the same number of patients. Only one patient dropped out from the analysis and that was because he went to another provincial hospital after the beginning of the study. In the hypertension visits, there were seven patients who dropped out. Four patients did not receive hypertension medication from the beginning of the study, two patients went to other hospitals, one patient had their hypertension medication discontinued by a doctor and the number of their visits was less than three times.

Visits assessment between the treatment and the control groups:

Table 3.64 shows the number of visits compared by Mann-Whitney U test. There were significant differences between groups in the total visits and non hypertension visits, $p < 0.05$. This indicated that patients in the treatment group had made more visits to the clinic which were related to non hypertension disease than the control group after 12 months.

Table 3.64 Numbers of visits to receive medications in the treatment and the control groups

	Treatment group Mean (SD) (Min-Max, Mean rank)	Control group Mean (SD) (Min-Max, Mean rank)	Mann-Whitney U	P value
Total visits (N=116 control, 117treatment)	12.45 (2.97) (4-17, 129.89)	11.30 (3.00) (3-17, 104.00)	5278.00	0.003
Hypertension visit (N=113 control, 115 treatment)	10.77 (2.93) (3-17, 122.67)	10.04 (3.02) (3-17, 106.19)	5558.00	0.058
Non hypertension visit (N=116 control, 117 treatment)	1.76 (1.90) (0-10, 126.35)	1.35 (1.97) (0-10, 107.57)	5692.00	0.027

Mann-Whitney was used to evaluate the difference between groups.

3.2.3.3 Clinical outcomes

3.2.3.3.1 BP control

BP control assessment compared between the treatment and the control groups:

Proportions of patients who achieved BP control in both 235 and 158 samples are shown in Table 3.65. Multiple logistic regression was conducted to evaluate the

difference between groups. The analyses were performed after six months adjusted with the pre test and after 12 months adjusted with the pre test and with after six months.

The proportion of 235 patients who achieved BP control was higher in the treatment group than in the control group, 27 of 118 and 21 of 117 at the pre test; 78 of 118 and 67 of 117 after six months; and 92 of 118 and 76 of 117 after 12 months, respectively. These proportions showed significant differences between groups only after 12 months follow-up, odds ratio 1.85, $p < 0.05$ covaried with the pre test, odds ratio = 1.81, $p < 0.05$ covaried with after six months. This indicated the patient benefit of pharmaceutical care being practiced over a prolonged period of time.

In 158 samples, the proportion of patients who had BP controlled at the targets was significantly higher in the treatment group than in the control group, 46 of 76 and 34 of 82 after six months, 56 of 76 and 48 of 82 after 12 month. Odds ratio showed that BP control in the treatment group was 2.17 times higher than in the control group after six months and was 1.98 times higher than in the control group after 12 months. These results again demonstrated the benefits of pharmaceutical care.

BP control assessment compared within each group at pre test, after six months and after 12 months:

Table 3.66 indicates that the proportion of 235 patients who achieve BP control increased in both the control and treatment groups across the three times, 22.88%, 66.10% and 77.97% in the treatment group and 17.95%, 57.26% and 64.96% in the control group. A Cochran's test was performed to evaluate the difference between related proportions of each group. There were significant differences in both groups,

χ^2 (2, N = 117) =65.28, p <0.001 for the control group and χ^2 (2, N = 118) = 84.60, p <0.001 for the treatment group. Follow-up pairwise comparisons performed using a McNemar's test indicated that there were significant increases in the treatment group after six months, and after 12 months when compared with the pre test and when compared with after six months. In the control group, the results showed a significant improvement in BP control after six and 12 months only when compared with the pre test. This is also shown in Figure 3.15. This meant that patients who received a pharmacist's involvement had their BP control led significantly more than patients who received the traditional service after 12 months. The treatment group of patients constantly increased their BP control after six and 12 months compared with the pre test and also a significant increase between the interval between six and 12 months. On the other hand, patients in the control group had similar results compared with the pre test but without a significant increase in control between six and 12 months interval. This is considered to be an important funding because it indicates that pharmaceutical care when practical consistently can produce increasing patient benefits with time.

For the 158 sample, Table 3.66 indicates that the proportion of patients who achieved BP control was higher after six months and highest after 12 months in both the treatment and the control groups. Significant changes were found after six and 12 months when compared with the pre test in both groups. With this group of patients, the control group showed a significant difference after 12 months when compared with after six months. This is illustrated figuratively in Figure 3.16. Nevertheless, it should be noted that patients in the treatment group who had their BP at the beginning of the study higher than 140/90 mm Hg had their BP control led to a greater extent after six

and 12 months than patients who had received the traditional service. The treatment group of patients achieved a significant increase in their BP control after six and 12 months compared with the pre test but without any significant change during the interval between six and 12 months, whereas, the patients in the control group had a constant increase in their BP control across six, and 12 months compared with the pre test and also at 12 months compared with six months. This again confirms the patient benefit of the consistent practice of pharmaceutical care compared with the traditional care.

Table 3.65 BP control compared between groups at each period of time measurement and a covariate (Ref. 7&32)

Time & N (Treatment group/Control group)	Treatment group		Control group		Exp (B)	95% CI	P value*
	BP controlled	BP uncontrolled	BP controlled	BP uncontrolled			
N_1=235 (N=118 /117)							
Pre test	27	91	21	96	1.36	0.72-2.57	0.349
After 6 months[1]	78	40	67	50	1.75	0.98-3.13	0.061
After 12 months[1]	92	26	76	41	1.85	1.03-3.34	0.040
After 12 months[2]					1.81	1.00-3.25	0.049
N_2=158 (N=76/82)							
Pre test	0	76	0	82	-	-	-
After 6 months	46	30	34	48	2.17	1.15-4.09	0.017
After 12 months[1]	56	20	48	34	1.98	1.01-3.89	0.046
After 12 months [2]					1.78	0.90-3.55	0.099

N_1 means the Total group of the 235 patients
N_2 means patients who had BP $\geq$ 140/90 mm Hg, at the pre test
*p values were calculated by Multiple logistic regression was performed to evaluate a difference between groups;
[1] pre test was used as a covariate.
[2] after 6 months was used as a covariate.
Interactions which did not show significant difference were excluded from the model. Dash line showed that the statistics could not be produced because of the constant at the pre test.

Table 3.66 Results of proportions of patients having BP control compared within each group across three times; the pre test, after six months and after 12 months (Ref. 50)

N (Treatment gr./Control gr.)	Treatment group					Control group				
	Pre test	After 6 mo	After 12 mo	χ^2	p value*	Pre test	After 6 mo	After 12 mo	χ^2	p value*
N_1=235 (N=118/117)										
BP Controlled	27 (22.88%)	78 (66.10%)[1]	92 (77.97%)[2,3]	84.60	<0.001	21 (17.95%)	67 (57.26%)[1]	76 (64.96%)[2]	65.28	< 0.001
BP Uncontrolled	91 (77.12%)	40 (33.90%)	26 (22.03%)			96 (82.05%)	50 (42.74%)	41 (35.04%)		
N_2=158 (76/82)										
BP Controlled	0	46 (60.53%)[1]	56 (73.68%)[2]	82.34	<0.001	0	34 (41.46%)[1]	48 (58.54%)[2,3]	60.93	<0.001
BP Uncontrolled	76 (100%)	30 (39.47%)	20 (26.32%)			82 (100%)	48 (58.54%)	34 (41.46%)		

N_1 means Total group of 235 patients
N_2 means patients who had BP ≥140/90 mm Hg at the pre test
*p values were calculated by Cochran's Q test.
Pairwise comparisons showed significant difference by McNemar test, $p < 0.05$, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

Figure 3.15 Means of BP control in 235 patients across pre test, after six months and after 12 months

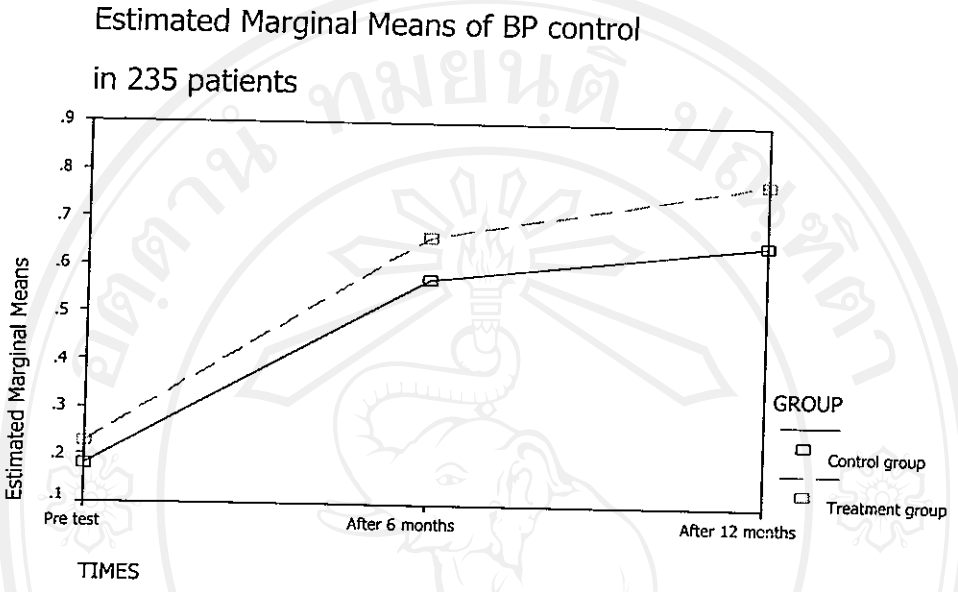
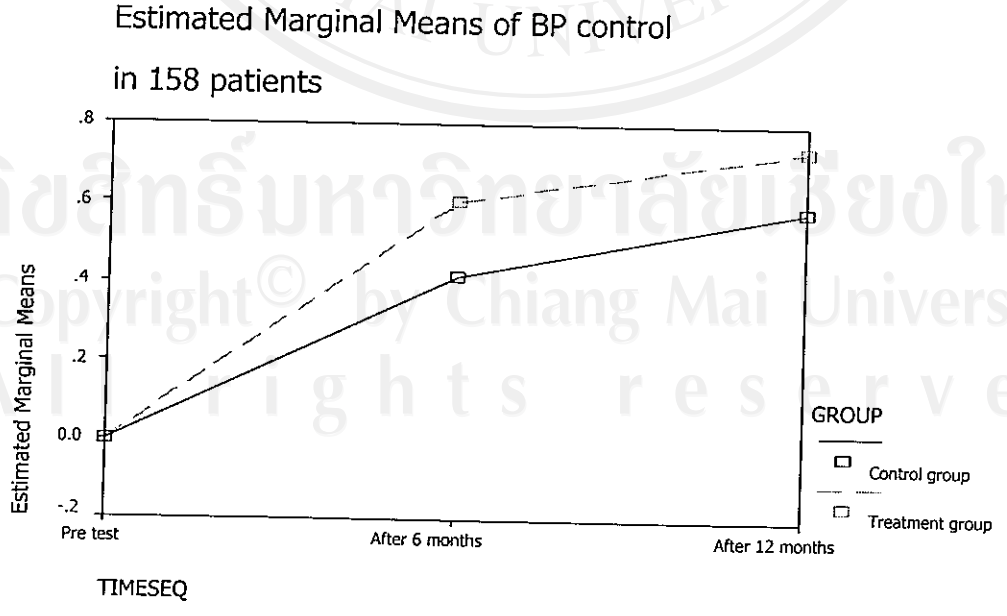


Figure 3.16 Means of BP control in 158 patients across pre test, after six months and after 12 months



3.2.3.3.2 BP difference

BP reductions assessment compared between the treatment and the control groups across three times of measurement:

Table 3.67 shows the results of a 3x2 factorial ANOVA which was conducted to evaluate the effects of pharmacist involvement with the treatment group compared to the control group across three times. Transformations to stabilize the variance were used.

In 235 patients, the SBP results indicated that there were significant main effects between groups, $F(1, 699) = 11.88$, $p < 0.001$, a significant effect across time, $F(2, 699) = 102.08$, $p < 0.001$, and a significant interaction between group and time, $F(2, 699) = 8.42$, $p < 0.001$. The diastolic blood pressure results showed that there were significant differences between the control and treatment groups, $F(1, 699) = 6.80$, $p < 0.05$, a significant effect across times, $F(2, 699) = 85.80$, $p < 0.001$, and a non significant difference between the interaction of group and time, $F(2, 699) = 1.55$, $p > 0.05$.

Post hoc tests are shown as superscriptions in Table 3.67. The sample sizes between groups were not equal and the equality of variance was violated in SBP. Thus, Gabriel's and Tamhane's pairwise tests were appropriated to control Type I error. The results of both tests showed the same pattern and so one was chosen and Gabriel's results were used to show the effect on systolic pressure in these tables. Due to the significant interaction found in SBP, the analyses of each group was performed. The results show that both the treatment and the control groups had a significant

difference in SBP and DBP between pre test and after six months follow up and between pre test and after 12 months follow up ($p < 0.001$). But, the comparison within each group did not show a significant difference between after six or 12 months ($p > 0.05$).

In the group of 158 patients who had existing BP of at least 140/90 mm Hg at pre test, a 3x2 factorial ANOVA was also conducted to see the difference between groups across times as shown in Table 3.68. The SBP results indicate that there was a significant main effect of groups, the control and the treatment groups, $F(1, 468) = 11.72$, $p < 0.05$, a significant effect across times, $F(2,468)=143.29$, $p < 0.001$, and a significant interaction between groups and times, $F(2, 468) = 8.74$, $p < 0.001$. Due to the significant interaction, analyses were performed for each group across three times with alpha set at 0.008 (0.025/3). Gabriel test showed significant changes after six months and after 12 months when compared only with the pre test, $p < 0.001$, for both groups. This meant that both the control and treatment groups tended to improve in their BP control after six and 12 months.

Diastolic blood pressure results showed no significant difference between groups, $F(1, 468) = 3.20$, $p > 0.05$, nor an interaction between groups and times, $F(1, 468) = 1.52$, $p > 0.05$. But there was a significant difference across times, $F(1, 468) = 82.80$, $p < 0.001$. Post hoc tests showed that there were significant differences between pre test and after six months, $p > 0.05$, and between pre test and after 12 months, $p > 0.05$, but not between after six months and after 12 months, $p < 0.001$.

In 235 patients, the interaction between groups and SBP meant that patients who received a pharmacist's involvement tended to have greater SBP reduction than patients who received the traditional care. Nevertheless, the results were supported

that patients in the treatment group had more BP reduction in both SBP and DBP than patients in the control group over 12 months. In 158 patients, the interaction between groups and SBP was also found. However, this firm of analysis indicated that patients who received a pharmacist's involvement had a significantly greater SBP reduction, but not a significantly greater DBP reduction, than patients who received the traditional service. The greater reductions in both groups and both samples were found after six and 12 months when compared with the pre test, but by this analysis were not significantly reduced between the interval of six and 12 months.

Table 3.67 Mean BPs comparison by 3x2 factorial ANOVA for 235 hypertensive patients (Ref. 51&52)

Variable	Treatment group (n=118) Mean ± SD	Control group (n=117) Mean ± SD	df1	df2	F	p value
Total group (N=235)						
Pre test between groups						
Systolic mm Hg	144.76 ± 19.69	142.41 ± 19.81				
Diastolic mm Hg	85.72 ±13.56	85.96 ± 12.94				
After 6 months between groups						
Systolic mm Hg	121.47 ±14.90 [1t]	124.77 ± 17.97 [1c]				
Diastolic mm Hg	71.55 ±10.80 [1t]	74.23 ±11.87 [1c]				
After 12 months between groups						
Systolic mm Hg*	118.03 ± 13.67 [2t]	130.08 ± 20.63 [2c]				
Diastolic mm Hg	72.19 ± 10.68 [2t]	76.22 ± 10.61 [2c]				
Group:						
Systolic			1	699	11.88	0.001
Diastolic			1	699	6.80	0.009
Times:						
Systolic: Treatment gr.			2	351	93.91	< 0.001
Control gr.			2	348	28.35	< 0.001
Diastolic: Treatment gr.			2	351	54.73	< 0.001
Control gr.			2	348	32.88	< 0.001
Interaction: group*time						
Systolic			2	699	8.42	< 0.001
Diastolic			2	699	1.55	0.213
Patients hypertensive at the pre test[a] (N=158)						
Pre test between groups	155.19 (15.51)	152.19 (16.17)				
Systolic mm Hg	90.47 (13.85)	89.73 (12.96)				
Diastolic mm Hg						
After 6 months between groups	124.16 (14.23)[1t]	130.36 (16.83)[1c]				
Systolic mm Hg	73.08 (10.68)[1t]	76.52 (12.35)[1c]				
Diastolic mm Hg						
After 12 months between groups						
Systolic mm Hg	121.59 (11.68)[2t]	133.44 (19.64)[2c]				
Diastolic mm Hg	73.94 (9.77)[2t]	77.12 (11.32)[2c]				
Group:						
Systolic			1	468	11.72	0.001
Diastolic			1	468	3.37	0.067
Times:						
Systolic: Treatment gr.			2	225	137.62	< 0.001
Control gr.			2	243	36.89	< 0.001
Diastolic: Treatment gr.			2	225	48.72	< 0.001
Control gr.			2	243	28.35	< 0.001
Interaction: group*time						
Systolic			2	468	8.74	< 0.001
Diastolic			2	468	1.33	0.267

[a]BP ≥140/90 mm Hg
*Both transformed data and original SBP data violated Levene's test. The original SBP was presented; however, both results were similar. DBP was transformed; these results were presented in the table.
df1 means degrees of freedom in each comparison, BP df1=1, times df1 =2 and interaction df1 =2, in overall df1 =5
df2 means degrees of freedom of both groups in total observations in pre test, after six months and after 12 months.
Post hoc test, Gabriel test, showed significant difference, p <0.001, within each group between pre test and after 6 months [1,1], between pre test and after 12 months[2,2], between after 6 and 12 months[3,3]
[t] means compared within the treatment group
[c] means compared within the control group

3.2.3.3.3 Results of patient outcomes after one year follow-up

Table 3.68 shows that after one year follow-up, the number of patients who were disabled was higher in the control group, 3.42%, than the treatment group, 1.69%. The number of patients who died in the treatment group was 3.39%. Four patients in the treatment group died during the study and another two in the control group, 1.71%. The frequency of hospital admission in the control group was higher than in the treatment group. However, the total number of admissions in a year was equal in both groups, 18.64% and 18.80% in the treatment and the control group.

Table 3.68 Patient clinical outcomes during October 2002-February 2004 in the treatment and the control groups

Patient clinical outcomes	Treatment group (N=118) Percent (No)	Control group (N=117) Percent (No)
Disabled	1.69 (2)	3.42 (4)
Died	3.39 (4)	1.71 (2)
Hospitalization (times)*		
1	16.10 (19)	13.68 (16)
2	1.69 (2)	2.56 (3)
3	0.85 (1)	0.85 (1)
6	0.00 (0)	0.85 (1)
8	0.00 (0)	0.85 (1)
total of hospitalization	18.64 (22)	18.80 (22)

*Hospitalization was recorded by the hospital. The cause of admission was not available.

3.2.3.3.4 Compliance rate

Compliance rate assessment compared between the treatment and the control groups:

Table 3.69 shows the results of patient compliance with their medication. The proportions in 'good compliance' were significantly higher 2.389 – 2.585 times greater in the treatment group than in the control group after six months and 12 months when compared with the pre test and after six months, $p < 0.05$.

Compliance rate assessment compared within each group at the pre test, after six months and after 12 months:

Table 3.70 shows that in the treatment group the proportion of patients who had good compliance increased by three times and was highest after 12 months, while the proportion in the control group decreased and was lowest after 12 months. However, there were no significant differences across the three times for either group, Cochran = 5.41, $p > 0.05$ for the control group, and Cochran = 5.49, $p > 0.05$ for the treatment group.

Table 3.69 Compliance rates compared between the treatment and control groups

Compliance	Good ≥80% compliance	Poor <80% compliance	Odds ratio	95% CI	p value
Pre test					
Treatment group (N=109)	58 (51.33)	54 (48.21)	0.845	0.498-1.435	0.534
Control group (N=112)	61 (56.48)	48 (44.04)			
After 6 months					
Treatment group (N=110)	70 (63.64)	40 (36.04)	2.585	1.136-5.883	0.014 [i]
Control group (N=108)	60 (55.56)	48 (44.86)			
After 12 months[1]					
Treatment group (N = 103)	68 (66.00%)	35 (34.00%)	2.398	1.349-4.265	0.003
Control group (N=102)	47 (46.10%)	55 (53.90%)			
After 12 months[2]					
Treatment group			2.389	1.330-4.290	0.004
Control group					

[1] pre test was used as a covariate
[2] after 6 months was used as a covariate
[i] an interaction between group and the pre test was found.

Table 3.70 Patient compliance rates comparison in the treatment group and the control groups across three times

	Treatment group No (N=102)					Control group No (N=97)				
	Pre test	After 6 mo	After 12 mo	χ^2	p value	Pre test	After 6 mo	After 12 mo	χ^2	p value
Good compliance	53	64	68	5.49	0.064	57	56	44	5.41	0.067
Poor compliance	49	38	34			40	41	53		

*p values were calculated by Cochran's Q test.
The numbers are different from the numbers in Table 3.69 because of the comparison within group method with N=102 in the treatment group and N=67 in the control group

3.2.3.3.5 Lifestyle modification

Table 3.71 shows the results of comparing lifestyle modifications which were compared between groups in each time of measurement. Multiple logistic regression was performed.

Lifestyle modification compared between the treatment and the control groups:

The numbers of patients in each column were not equal due to the limitation from the patient visitation interviews. The results after six months showed that the proportion of patients who did exercise was significantly higher in the treatment group, 65 of 114, than in the control group, 46 of 117, $p < 0.05$. After 12 months follow-up compared with the pre test, the proportion of patients who performed exercise was significantly higher in the treatment group than in the control group, 82 of 108 and 56 of 112 respectively, $p < 0.05$. Sodium avoidance showed similar results to those relating to exercise, and the proportion in the treatment group was significantly higher than in the control group, 61 of 105 compared with 39 of 103, $p < 0.05$. The results after 12 months compared with after six months showed a significant difference between groups only in sodium avoidance, $p < 0.05$. These results showed that patients in the treatment group had been involved with exercise at six and 12 months when compared with the pre test. Moreover, these patients tended to avoid a salty diet more after six and 12 months when compared with the pre test and after six months.

Lifestyle modification compared within each group across three times:

Comparisons within each group were performed by Cochran's Q test. The results were illustrated in Table 3.72. Most lifestyle modification showed significant differences in the treatment group, except alcohol avoidance, $p < 0.05$. They also showed only two significant differences from the control group in exercise and stress avoidance, $p < 0.05$.

Pairwise comparisons by the McNemar test were performed. In both groups, the proportion of patients who exercised was significantly higher after12 months when compared with the pre test and with after six months, $p < 0.05$. For stress avoidance, the proportion in the treatment group showed significant improvement after six and 12 months when compared with the pre test, but not when compared with after six months. The control group showed a significant difference pairwise only after 12 months when compared with the pre test, $p < 0.05$. Sodium avoidance showed a significant improvement only in the treatment group after 12 months when compared with after six months. In the case of no smoking which showed significant difference across the three times, there was no significant difference in the pairwise comparison. That may be because of the extremely low numbers of patients who were smoking, 4 of 105 or 5 of 104, which may lead to a false positive result using the Cochran's Q test. These results showed that patients in the treatment group had increased taking exercise, stress avoidance and salty diet avoidance after 12 months and patients in the control group also improved in exercise and stress avoidance after 12 months.

Table 3.71 Lifestyle modification compared between groups across three times (Ref. 11, 35 & 54)

After 6 months[1]	Treatment group		Control group		Odds ratio	95% CI	p value
	Pre test	After 6 mo	Pre test	After 6 mo			
Alcohol avoidance	108 (N=118)	103 (N=112)	106 (N=117)	105 (N=116)	0.64	0.16-2.48	0.514
Exercise	56 (N=115)	65 (N=114)	40 (N=98)	46 (N=117)	2.35	1.21-4.57	0.012
Stress avoidance	102 (N=118)	107 (N=112)	100 (N=117)	106 (N=116)	2.13	0.67-6.75	0.201
No smoking	110 (N=118)	108 (N=112)	110 (N=116)	110 (N=116)	0.17	0.01-2.09	0.165
Sodium avoidance	53 (N=115)	41 (N=114)	32 (N=87)	58 (N=114)	1.50	0.69-3.26	0.306
After 12 months[1]	Pre test	After 12 mo	Pre test	After 12 mo	Odds ratio	95% CI	p value
Alcohol avoidance	108 (N=118)	98 (N=109)	106 (N=117)	103 (N=113)	1.20	0.39-3.69	0.749
Exercise	56 (N=115)	82 (N=108)	40 (N=98)	56 (N=112)	2.08	1.11-3.92	0.023
Stress avoidance	102 (N=118)	105 (N=109)	100 (N=117)	106 (N=113)	1.74	0.49-6.19	0.392
No smoking	110 (N=118)	104 (N=109)	110 (N=116)	107 (N=113)	0.28	0.02-3.58	0.326
Sodium avoidance	53 (N=115)	61 (N=105)	32 (N=87)	39 (N=103)	2.38	1.29-4.39	0.006
After 12 months[2]	After 6 mo	After 12 mo	After 6 mo	After 12 mo	Odds ratio	95% CI	p value
Alcohol avoidance	105 (N=116)	98 (N=109)	103 (N=112)	103 (N=113)	1.98	0.46-8.47	0.358
Exercise	46 (N=117)	82 (N=108)	65 (N=114)	56 (N=112)	1.84	0.99-3.42	0.054
Stress avoidance	106 (N=116)	105 (N=109)	107 (N=112)	106 (N=113)	1.53	0.42-5.52	0.518
No smoking	110 (N=116)	104 (N=109)	108 (N=112)	107 (N=113)	4967.58	0.00-7.06E+62	0.903
Sodium avoidance	58 (N=114)	61 (N=105)	41 (N=114)	39 (N=103)	1.96	1.10-3.50	0.022

Multiple logistic regression was used with the pre test as a covariate[1], with after 6 months as a covariate[1]

Table 3.72 The proportion of patients who had made lifestyle modifications after 12 months compared between the treatment and the control groups and pairwise comparison between the pre test, after six and after 12 months in each group (Ref. 54)

	Treatment group N achieved/N not achieved					Control group N achieved/N not achieved				
	Pre test	After 6 mo	After 12 mo	χ^2	p value	Pre test	After 6 mo	After 12 mo	χ^2	p value
Alcohol avoidance	10/99	9/100	11/98	0.60	0.741	10/102	11/101	10/102	0.29	0.867
Exercise	55/53	64/44	82/26[2,3]	27.00	<0.001	38/56	37/57	55/39[2,3]	12.28	0.002
Stress avoidance	93/16	104/5[1]	105/4[2]	14.00	0.001	96/117	103/10	106/7[2]	6.32	0.042
No smoking	8/101	4/105	5/104	6.50	0.039*	7/106	6/107	6/107	2.00	0.368
Sodium avoidance	49/56	39/66	61/44[3]	8.18	0.017	29/45	34/40	29/45	0.89	0.640

*p value which was calculated by Cochran's Q test across three times, but there was no significant difference by pairwise comparisons.

Pairwise comparisons showed significant difference by McNemar test, $p < 0.05$, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

3.2.3.4 Humanistic outcomes

3.2.3.4.1 Patient Knowledge

Patient knowledge assessment compared between the treatment and the control groups:

The results of patient knowledge were compared between groups, after six months and after 12 months as shown in Table 3.73. The percentage of correct answers was higher in the treatment group when compared with the control group after 12 months, except for Nos 8 and 12. However, for the results after 6 months which were adjusted by the pre test showed significant differences between groups in two items, Nos 1 and 13, $p < 0.05$. The results after 12 months adjusted by after six months showed significant differences between groups in three items, Nos 1, 13 and 14.

Patient knowledge assessment compared within each group over three times; the pre test, after six months and after 12 months:

Table 3.74 shows the results within groups and indicates that after 12 months the control group had significant differences in the percentage of correct responses in seven items, Nos 2, 4, 6, 7, 9, 10, 12 and the total score, $p < 0.05$. Interestingly, they were higher significant differences than the result in section two, five items. The treatment group showed significant differences in ten items and the total score but not in Nos 3, 6, 8 and 12, $p > 0.05$.

Pairwise comparisons were performed which showed significant improvement after six months in the treatment group in three items, Nos 6, 7 and 10, and in the control group in three items, Nos 2, 9 and 10. After 12 months, adjusted with the pre test, there were significant improvements in item Nos 1, 2, 4, 7, 9, 10, 11, 13 and 14 in the treatment group and Nos 2, 7, 9, 10 and 12 in the control group. The results after 12 months adjusted with after six months, showed significant improvements in item Nos 1, 2, 5 and 11 in the treatment group, and Nos 4, 6 and 7 in the control group. In overall terms these results showed that patients in both groups tended to improve their knowledge over 12 months, however, patients in the treatment group showed the improvement in more items than patients in the control group.

Patient knowledge assessment compared between groups and within groups in three subscales:

Table 3.75 shows there were significant differences between groups across three times found in the scales of 'hypertension knowledge' and 'proper use of medications', $p < 0.05$, without significant interaction between group and time, $p > 0.05$. Across three times in each group, there were significant differences in hypertension knowledge only in the treatment group, $p < 0.05$. In risk factor management and proper use of medications, both groups showed significant changes across the three times.

Post hoc test was conducted by Gabriel's test. 'Hypertension knowledge' and 'Risk factor management' showed significant improvement only in the treatment group after 12 months when compared with the pre test. 'Proper use of medications'

showed significant improvement after 12 months in the treatment group and both after six and 12 months in the control group, $p < 0.05$.

These results showed that in one year patients in the treatment group tended to have more knowledge in hypertension and the proper use of medication than patients in the control group. However, both groups showed an improvement over one year in risk factor management and proper use of medications. The exception was in hypertension knowledge in which only the treatment group showed improvement across all three times.

Table 3.73 Percent correct response compared between the treatment and the control groups

Patient knowledge item	% correct response of within group						p value [1]	p value [2]	p value [3]
	Treatment group			Control group					
	Pre test (N=118)	After 6 (N=112)	After 12 (N=109)	Pre test (N=117)	After 6 (N=116)	After 12 (N=113)			
1. Hypertension is a curable disease.	32.20	41.07	55.96	27.35	31.90	36.28	0.220	0.005	0.011
2. Medications improve better symptoms but do not extend your life longer.	5.93	14.29	26.61	5.98	17.24	23.01	0.525	0.534	0.445
3. Uncontrolled hypertension can cause stroke.	71.19	76.79	78.90	66.67	68.10	73.45	0.192	0.423	0.670
4. High salt diet makes blood pressure uncontrolled	64.41	68.75	77.98	59.83	56.90	69.91	0.073	0.192	0.385
5. Uncontrolled blood pressure leads to kidney disease.	63.56	63.39	75.23	59.83	62.93	68.14	0.883	0.301	0.201
6. High body weight is one risk factor of uncontrolled hypertension.	62.71	67.86	74.31	61.54	56.90	70.80	0.083	0.581	0.918
7. Exercise in hypertensive patients should be avoided.	54.24	73.21	80.73	53.85	60.34	73.45	0.029	0.181	0.615
8. Most uncontrolled hypertensive patients have headache and blurred vision.	4.24	9.91 (N111)	3.70 (N108)	8.55	6.03	7.08	0.184	0.420	0.116
9. Hypertensive patients can adjust doses of hypertensive medication depending of each BP measurement.	59.52 (N115)	66.07	69.72	51.28	68.97	66.37	0.608	0.701	0.366
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors or pharmacists or nurses.	59.32	73.87 (N111)	79.82	55.56	68.97	69.91	0.569	0.134	0.131
11. Smoking and uncontrolled hypertension can cause heart disease.	62.71	61.61	71.56	65.81	63.79	65.49	0.869	0.129	0.194
12. Stress makes blood pressure harder to be controlled.	72.88	76.79	80.73	72.65	80.17	84.07	0.515	0.459	0.684
13. All medications which be taken without prescriptions should be let a pharmacist check to avoid drug interactions.	75.42	79.28 (N111)	86.24	73.50	76.72	69.03	0.645	0.002	0.003
14. If you recognize that you miss a dose, for example you are taking a daily dose, it does not need to take this dose at the time you recognize because the time has gone by.	40.68	46.43	56.88	34.19	42.24	43.36	0.709	0.070	0.004
Total	51.96	58.40	65.55	49.76	54.37	58.60	0.185[a]	0.014[a]	-

[1] p values were calculated at six months using the pre test as a covariate, [2] p values were calculated at 12 months using the pre test as a covariate, [3] p values were calculated at 12 months using at six months as a covariate [a] p value was calculated by Mann-Whitney U test for total scores after six and 12 months.

Table 3.74 Percent correct response compared between pre test, after six months and after 12 months in each group

Patient knowledge item	% correct response of within group											
	Treatment group						Control group					
	N	Pre test	After 6 mo	After 12 mo	Cochran's Q	p value*	N	Pre test	After 6 mo	After 12 mo	Cochran's Q	p value*
1. Hypertension is a curable disease.	109	33.03	41.28	55.96[2,3]	18.86	< 0.001	113	27.43	31.68	36.28	3.57	0.168
2. Medications improve better symptoms but do not extend your life longer.	109	6.42	14.68	26.61[2,3]	18.35	< 0.001	113	6.20	16.81[1]	23.01[2]	17.87	< 0.001
3. Uncontrolled hypertension can cause stroke.	109	70.64	76.15	78.90	4.07	0.131	113	67.26	68.14	73.45	2.10	0.350
4. High salt diet makes blood pressure uncontrolled.	109	63.30	67.89	77.98[2]	7.59	0.023	113	60.18	56.64	69.91[3]	6.46	0.039
5. Uncontrolled blood pressure leads to kidney disease.	109	64.22	62.39[3]	75.23[3]	7.02	0.030	113	60.18	62.83	68.14	2.38	0.305
6. High body weight is one risk factor of uncontrolled hypertension.	109	62.39	66.97[1]	74.31	5.16	0.076	113	61.06	56.64	70.80[3]	8.04	0.018
7. Exercise in hypertensive patients should be avoided.	109	54.13	74.31[1]	80.73[2]	29.23	< 0.001	113	53.98	60.18	73.45[2,3]	13.54	0.001
8. Most uncontrolled hypertensive patients have headache and blurred vision.	107	4.67	10.28	3.74	5.73	0.057	113	7.97	6.20	7.08	0.43	0.807
9. Hypertensive patients can adjust doses of hypertensive medication depending of each BP measurement.	106	56.60	66.04	69.81[2]	6.24	0.044	113	53.10	69.91[1]	66.37[2]	10.56	0.005
10. Hypertensive patients may stop medications when adverse events occur without telling their doctors or pharmacists or nurses.	108	60.19	73.15[1]	79.63[2]	15.95	< 0.001	113	54.87	69.03[1]	69.91[2]	10.30	0.006

*p values were calculated by Cochran's Q test. [a] p values were calculated by Friedman test
Pairwise comparisons showed significant difference by McNemar test, p <0.05, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

Table 3.74 (cont.) Percent correct response compared between pre test, after six months and after 12 months in each group

Patient knowledge item	% correct response of within group											
	Treatment group						Control group					
	N	Pre test	After 6 mo	After 12 mo	Cochran's Q	p value*	N	Pre test	After 6 mo	After 12 mo	Cochran's Q	p value*
11. Smoking and uncontrolled hypertension can cause heart disease.	109	63.30	60.55	71.56 [2,3]	6.88	0.032	113	67.26	62.83	65.49	0.83	0.662
12. Stress makes blood pressure harder to be controlled.	109	73.39	76.15	80.73	2.80	0.247	113	72.57	79.65	84.07[2]	6.62	0.037
13. All medications which be taken without prescriptions should be let a pharmacist check to avoid drug interactions	108	74.07	78.70	86.11[2]	8.60	0.014	113	73.45	76.11	69.03	2.23	0.328
14. If you recognize that you miss a dose, for example you are taking a daily dose, it does not need to take this dose at the time you recognize because the time has gone by.	109	40.37[2]	46.79	56.88[2]	7.37	0.025	113	33.63	42.48	43.36	4.44	0.109
Total	109	52.06[1,2]	58.04[1,3]	65.44[2,3]		< 0.001 [a]	113	49.94[1,2]	54.24[1,3]	58.6[2,3]		< 0.001 [a]

*p values were calculated by Cochran's Q test. [a] p values were calculated by Friedman test
Pairwise comparisons showed significant difference by McNemar test, p <0.05, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

Table 3.75 Percent correct response compared between groups in each domain of patient knowledge constructed questions (Ref. 60)

Subscale	Treatment Group % of correct answers (N)			Control group % of correct answers (N)			df 1	df2	F	p value
	Pre test (118)	After 6 mo (112)	After 12 mo (109)	Pre test (117)	After 6 mo (116)	After 12 mo (113)				
1.Hypertension knowledge	42.80	47.95	53.44[2]	40.60	42.24	46.24				
Group							1	679	6.87	0.009
Time:Treatment gr.							2	336	5.54	0.004
Control gr.							2	343	1.41	0.245
Interaction							2	679	0.60	0.546
2.Risk factor management	63.39	69.64	77.06[2]	62.74	63.62	72.74[2]				
Group							1	679	2.19	0.140
Time:Treatment gr.							2	336	5.59	0.007
Control gr.							2	343	3.30	0.038
Interaction							2	679	0.42	0.661
3.Proper use of medications	47.61	55.45	63.85[2]	44.10	54.83[1]	54.34[2]				
Group							1	679	4.60	0.032
Time:Treatment gr.							2	336	10.14	<0.001
Control gr.							2	343	5.33	0.005
interaction							2	679	1.50	0.223

Post hoc test, Gabriel test, showed significant difference, $p < 0.05$, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

3.2.3.4.2 Patient satisfaction

Patient satisfaction assessment compared between the treatment and the control groups at three different times:

Patient satisfaction results are shown in Table 3.76. The Mann-Whitney U test indicated that the mean differences between groups were found after 6 months only in item No 11. But after 12 months, the results showed significant differences in 12 items, excepting Nos 2, 5, 7 and 14. These results showed that patients in the treatment group tended overall to be more satisfied with the pharmacist's involvement than patients in the control group after 12 months, as be shown significant differences in 14 of 16 items.

Patient satisfaction assessment compared within each group:

Table 3.76 also shows the results analyzed by Wilcoxon signed rank test. In the treatment group, there were six items which did not show significant improvement after six months, Nos 2, 5, 9, 10, 13, 14 and 16, while the control group showed only four items, Nos 5, 9, 14 and 16, $p > 0.05$.

After 12 months, patient satisfaction in the treatment group showed significant differences in every item, $p < 0.05$ when compared with the pre test and when compared with after six months. Whereas patient satisfaction in the control group showed significant differences in most of the items, when compared with after six months, except items Nos 6, 12, 13 and 15. And the exception was in item No 15 when compared with pre test.

Overall these results showed that patients in both groups were more satisfied with pharmacist involvement after six months with the highest satisfaction after 12 months.

Patient satisfaction assessment in six scale items compared between the treatment and the control groups, and within each group:

Table 3.77 shows the results for six scale items which were analyzed by multiple comparisons of ANOVA.

In 'communication and management', the results of group main effect showed a significant difference between the control and treatment groups, $p < 0.05$ and in time main effect in both groups, $p < 0.05$, without a significant interaction, $p > 0.05$. The group main effect indicated that the treatment group tended to have greater satisfaction in the communication and management than the control group. Every pairwise comparison showed significant differences in both group, $p < 0.05$. This analysis indicates that both groups were significantly satisfied greater after six and after 12 months than at the pre test and after six months.

In 'accessibility and convenience', ANOVA showed a significant difference in the group main effect, $p < 0.05$, and significant main effect for time, $p < 0.05$ but with a significant interaction, $p < 0.05$. Due to the significant interaction, pairwise comparison was performed, the treatment group showed significantly higher satisfaction after 12 months than at either the pre test or after six months while the control group only showed significantly higher satisfaction after 12 months.

In 'finance', ANOVA indicated a significant main effect of time, $p < 0.05$, a nonsignificant main effect of group, $p > 0.05$, and a nonsignificant interaction, $p >$

0.05. These findings indicated that the treatment group and the control group tended to have the same level of satisfaction in finance. Follow-up analysis in each group showed that both groups showed significantly higher satisfaction after 12 months than either at the pre test or after six months, $p < 0.008$.

In 'interpersonal relationship', the results showed a significant main effect of group, $p < 0.05$, and a significant main effect of time, $p < 0.05$, but a nonsignificant interaction between time and group, $p > 0.05$. These findings indicated that the treatment group tended to have greater satisfaction in 'interpersonal relationship' than the control group. The follow-up analyses to the main effect of time in each group showed that both groups had significantly higher satisfaction after 12 months than either the pre test or after six months, $p < 0.008$.

In 'continuity of care', ANOVA indicated a significant main effect of time in the control group, $p < 0.05$, but a nonsignificant main effect of group, $p > 0.05$, and a significant interaction between group and time, $p < 0.05$. The mean scores behaved differently between two groups, in the treatment group significantly decreased over six and 12 months, while the mean scores in the control group fluctuated and showed significantly highest after 12 months. This indicated that the treatment group tended to be less satisfied with pharmacist involvement when compared with the control group.

In 'overall satisfaction', the results showed a significant main effect of group, $p < 0.05$, and a significant main effect of time, $p < 0.05$, but a nonsignificant interaction between group and time, $p > 0.05$. These findings indicated that the treatment group tended to have a significantly higher satisfaction in overall satisfaction of pharmacist involvement than the control group. The follow-up analyses to the main effect of time

showed that both groups had significantly higher satisfaction after 12 months than either at the pre test or after six months, $p < 0.008$.

Table 3.76 Mean of patient satisfaction compared between the treatment and the control groups (Ref. 70&70.1)

Satisfaction Scale Item [a]	Treatment group (N=112)			Control group (N= 116)			p value[a]	p value[b]	p value[c]
	Pre test	After 6 mo	After12 mo	Pre test	After 6 mo	After 12 mo			
Communication and management									
1. You felt satisfied with pharmacist's explanation of using medications and life style modification.	3.31 (0.55)	3.55 (0.50)[1]	3.85 (0.38)[2,3]	3.25 (0.52)	3.53 (0.55)[1]	3.73 (0.46)[2,3]	0.292	0.931	0.028
2. You understood how to use medications and life style modification better after talking to a pharmacist.	3.45 (0.50)	3.55 (0.53)	3.84 (0.39)[2,3]	3.37 (0.48)	3.53 (0.55)[1]	3.74 (0.51)[2,3]	0.204	0.814	0.112
3. Sometimes a pharmacist makes you wonder if her/his advice is correct.	2.48 (0.78)	3.01 (0.75)[1]	3.61 (0.65)[2,3]	2.44 (0.71)	2.87 (0.88)[1]	3.36 (0.73)[2,3]	0.702	0.296	0.004
4. A pharmacist did not pay attention to your complaining about disease problems.	2.63 (0.79)	3.27 (0.78)[1]	3.77 (0.60)[2,3]	2.59 (0.82)	3.16 (0.82)[1]	3.50 (0.80)[2,3]	0.795	0.262	0.001
5. You intend to follow the details of this pharmacist's advice.	3.47 (0.50)	3.57 (0.50)	3.83 (0.38)[2,3]	3.46 (0.50)	3.57 (0.55)	3.83 (0.44)[2,3]	0.842	0.866	0.653
Accessibility and convenience									
6. You have not received easy access to see a pharmacist.	2.87 (0.77)	3.29 (0.69)[1]	3.72 (0.54)[2,3]	2.76 (0.83)	3.23 (0.70)[1]	3.30 (0.94)[2]	0.262	0.469	< 0.001
Finance									
7. Although you have extra expense to see a pharmacist, you receive more benefits.	3.23 (0.59)	3.46 (0.58)[1]	3.77 (0.46)[2,3]	3.24 (0.52)	3.46 (0.60)[1]	3.65 (0.65)[2,3]	0.716	0.943	0.188
8. You felt the benefit received was not reasonable compared to the time spent.	2.95 (0.71)	3.46 (0.60)[1]	3.77 (0.46)[2,3]	2.90 (0.71)	3.35 (0.62)[1]	3.60 (0.65)[2,3]	0.592	0.157	0.042
Interpersonal relationship									
9. A pharmacist took care of you very much in medication use and life style modification.	3.47 (0.50)	3.57 (0.51)	3.91 (0.29)[2,3]	3.39 (0.56)	3.48 (0.57)	3.71 (0.53)[2,1]	0.322	0.272	0.001
10. You felt better after talking to a pharmacist about medication use and life style modification.	3.47 (0.50)	3.57 (0.50)	3.87 (0.36)[2,3]	3.34 (0.51)	3.58 (0.50)[1]	3.73 (0.47)[2,3]	0.073	0.925	0.007
11. A pharmacist should smile, greet and talk more to a patient.	2.40 (0.75)	2.79 (0.89)[1]	3.57 (0.76)[2,3]	2.21 (0.78)	2.50 (0.96)[1]	3.28 (0.92)[2,1]	0.067	0.019	0.007
12. A pharmacist ignored what you to tell him/her.	3.04 (0.65)	3.41 (0.64)[1]	3.78 (0.48)[2,3]	2.93 (0.72)	3.40 (0.51)[1]	3.52 (0.60)[2]	0.260	0.493	< 0.001
13. A pharmacist was pleased to listen to your problems not only on hypertension.	3.30 (0.59)	3.42 (0.61)	3.78 (0.48)[2,3]	3.14 (0.64)	3.45 (0.61)[1]	3.55 (0.61)[2]	0.055	0.694	0.001
Continuity of care									
14. You felt warm to see any pharmacist.	3.46 (0.50)	3.51 (0.52)	3.76 (0.47)[2,3]	3.32 (0.51)	3.45 (0.55)	3.65 (0.56)[2,3]	0.046	0.437	0.132
15. If it is possible, you would like to see the same pharmacist.	1.83 (0.77)	1.54 (0.54)[1]	1.26 (0.61)[2,3]	1.89 (0.71)	1.66 (0.67)[1]	1.69 (0.95)	0.389	0.230	< 0.001
Overall satisfaction									
16. In conclusion, you felt satisfied with the pharmacy service of medication use and life style modification.	3.51 (0.50)	3.57 (0.55)	3.88 (0.33) [2,3]	3.44 (0.55)	3.51 (0.55)	3.75 (0.49)[2,3]	0.438	0.343	0.029

p values were calculated by Mann-Whitney U test at the pre test[a], after 6 months[b] and after 12 months[c]; p values were analyzed by Wilcoxon sign rank test for within group comparison [1] means the difference between the pre test and after six months;[2]between pre test and after 12 months; [3] between 6 and 12 months

Table 3.77 The results between groups where patient satisfaction items were grouped by each domain and pairwise follow up results in each group over 3 times by Gabriel test (Ref. 71&71.1)

Satisfaction Scale Item	Treatment group (N) Mean (SD) Pre test (118)	After 6 mo (112)	After 12 mo (109)	Control group (N) Mean (SD) Pre test (117)	After 6 mo (116)	After 12 mo (113)	df1	df2	F	p value
Communication and management	3.07 (0.35)	3.39 (0.36)[1]	3.78 (0.30)[2,3]	3.02 (0.33)	3.33 (0.40)[1]	3.63 (0.37)[2,3]				
Group							1	679	9.92	0.002
Time : Treatment gr.							2	336	126.04	< 0.001
Control gr.							2	343	79.73	< 0.001
Interaction							2	679	1.35	0.260
Accessibility and convenience	2.87 (0.77)	3.29 (0.69)[1]	3.72 (0.54)[2,3]	2.76 (0.83)	3.23 (0.70)[1]	3.30 (0.94)[2]				
Group							1	679	11.84	0.001
Time : Treatment gr.							2	336	44.84	< 0.001
Control gr.							2	343	15.60	< 0.001
Interaction							2	679	3.76	0.024
Finance	3.09 (0.49)	3.46 (0.52)[1]	3.77 (0.40)[2,3]	3.09 (0.45)	3.41 (0.50)[1]	3.62 (0.55)[2,3]				
Group							1	679	3.33	0.069
Time : Treatment gr.							2	336	58.40	< 0.001
Control gr.							2	343	33.36	< 0.001
Interaction							2	679	1.25	0.288
Interpersonal relationship	3.14 (0.38)	3.35 (0.34)[1]	3.78 (0.30)[2,3]	3.00 (0.35)	3.28 (0.36)[1]	3.56 (0.43)[2,3]				
Group							1	679	26.49	< 0.001
Time : Treatment gr.							2	336	101.32	< 0.001
Control gr.							2	343	60.83	< 0.001
Interaction							2	679	2.45	0.087
Continuity of care	2.65 (0.40)	2.52 (0.32)[1]	2.51 (0.35)[2]	2.61 (0.39)	2.56 (0.37)	2.67 (0.54)[2]				
Group							1	679	2.91	0.088
Time : Treatment gr.							2	336	4.99	0.133
Control gr.							2	343	2.03	0.007
Interaction							2	679	3.70	0.025
Overall satisfaction	3.51 (0.50)	3.57 (0.55)	3.88 (0.33)[2,3]	3.44 (0.55)	3.51 (0.55)	3.75 (0.49)[2,3]				
Group							1	679	4.91	0.027
Time : Treatment gr.							2	336	20.01	< 0.001
Control gr.							2	343	10.67	< 0.001
Interaction							2	679	0.32	0.730

p value was calculated by ANOVA
Pairwise comparisons showed significant difference by Gabriel test, p <0.008, within each group between pre test and after 6 months [1], between pre test and after 12 months[2], between after 6 and 12 months[3]

3.2.3.2.3 Quality of life (SF-36)

SF-36 assessment multiple comparisons of the treatment and the control group with times: pre test, after six and 12 months follow-up:

SF-36 results at a year are shown in Table 3.78. A 2x3 ANOVA was used in the analyses because it provided multiple comparisons between groups and times. Levene's test of each subscale met the homogeneity of variance assumption. The mean scores in the scales of 'physical functioning', 'role-physical' and 'social functional' showed significant difference between groups, $F(1, 679) = 4.520$, $p < 0.05$, $F(1, 679) = 5.484$, $p < 0.05$; and $F(1, 679) = 5.796$, $p < 0.05$, respectively. There was a significant interaction in the role emotional subscale, $p < 0.05$, without significant in main effects between groups, $F(2, 679) = 3.294$, $p > 0.05$, nor a significant effect across time, $F(2, 343) = 0.806$ treatment groups and $F(2, 336) = 2.763$ the control group, $p > 0.05$. In the control group, the mean scores had continuously decreased while the mean scores had consistently increased in the treatment group as shown in Figure 3.17.

Post hoc test was analyzed in bodily pain and role emotional subscale. The results indicate that only the treatment group showed significant differences in the mean score between the pre test and after 12 months follow-up in bodily pain subscale. Three pairwise comparisons, between the pre test and after six months, the pre test and after 12 months and after 6 and 12 months, were performed in role emotional subscale. There was a significant difference in the treatment group between the pre test and after 12 months.

Thus, the important conclusion could be made that patients who received a pharmacist's involvement had better quality of life than patients who received the

traditional service. This was in terms of less limitation in performing all physical activities, less problems resulting from the effect on their physical health caused by their work or regular daily activities, more involvement in normal social activities without interference due to physical or emotional problems and less problems with work or other daily activities resulting from emotional problems.

Table 3.78 Mean SF-36 scores for the treatment and the control groups at the pre test and after 12 months (Ref. 72)

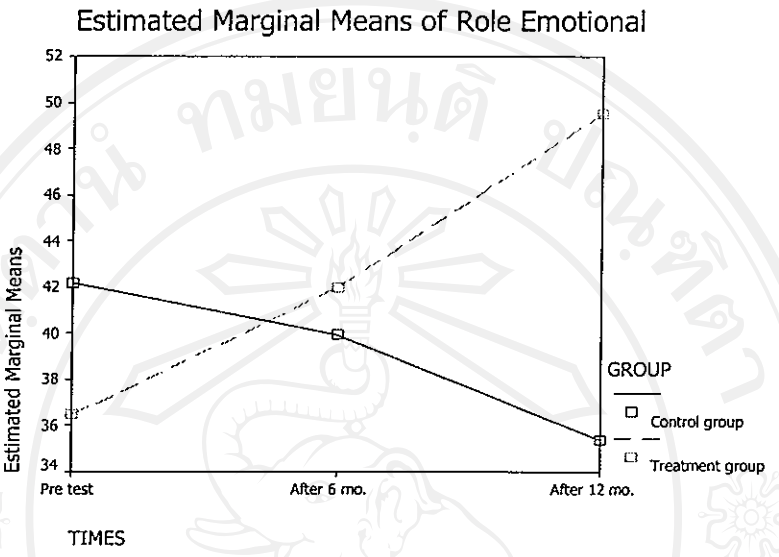
Domains	Treatment group			Control group			df1	df2	F	p value
	Pre test (N=118)	After 6 mo (N=112)	After 12 mo (N=109)	Pre test (N=117)	After 6 mo (N=116)	After 12 mo (N=113)				
Physical Functioning (PF)	63.36 (21.16)	66.92 (220.35)	67.86 (22.00)	63.63 (22.42)	62.97 (24.17)	60.58 (24.39)				
Group							1	679	4.520	0.034
Times										
Control group							2	343	0.528	0.590
Treatment group							2	336	1.451	0.236
Interaction							2	679	1.627	0.197
Role-physical (RP)	50.21 (36.76)	49.33 (39.49)	56.88 (39.51)	47.01 (36.28)	45.91 (40.24)	42.92 (37.10)				
Group							1	679	5.484	0.019
Times										
Control group							2	343	0.352	0.703
Treatment group							2	336	1.267	0.283
Interaction							2	679	1.447	0.236
Bodily Pain (BP)	52.29 (17.77)	56.03 (15.07)	60.16 (20.41)[2]	52.86 (20.65)	54.87 (46.02)	54.27 (18.61)				
Group							1	679	2.371	0.124
Times										
Control group							2	343	0.364	0.695
Treatment group							2	336	5.552	0.004
Interaction							2	679	1.924	0.147
General Health (GH)	46.56 (17.14)	47.63 (16.50)	47.56 (15.42)	47.59 (17.76)	45.03 (14.84)	45.89 (17.74)				
Group							1	679	0.691	0.406
Times										
Control group							2	343	0.744	0.476
Treatment group							2	336	0.154	0.858
Interaction							2	679	0.782	0.458
Vitality (VT)	56.44 (16.40)	58.97 (17.02)	60.92 (17.68)	55.98 (15.05)	56.42 (16.74)	58.50 (17.24)				
Group							1	679	2.013	0.156
Times										
Control group							2	343	0.769	0.464
Treatment group							2	336	1.978	0.140
Interaction							2	679	0.286	0.751

Table 3.78 (cont.) Mean SF-36 scores for the treatment and the control groups at the pre test and after 12 months follow-up

Domains	Treatment group			Control group			df1	df2	F	p value
	Pre test (N=118)	After 6 mo (N=112)	After 12 mo (N=109)	Pre test (N=117)	After 6 mo (N=116)	After 12 mo (N=113)				
Social Functioning (SF)	74.77 (19.20)	72.54 (18.90)	74.08 (19.37)	71.47 (19.20)	69.61 (19.31)	69.91 (16.92)				
Group							1	679	5.920	0.015
Times										
Control group							2	343	0.339	0.713
Treatment group							2	336	0.442	0.643
Interaction							2	679	0.061	0.940
Role-emotional (RE)	36.49 (41.57)	41.96 (43.09)	49.54 (40.98)[2]	42.17 (42.07)	39.94 (41.29)	35.40 (39.91)				
Group							1	679	1.206	0.273
Times										
Control group							2	343	0.806	0.447
Treatment group							2	336	2.754	0.065
Interaction							2	679	3.291	0.038
Mental Health (MH)	63.39 (16.81)	63.14 (16.16)	65.21 (16.56)	63.11 (16.91)	62.52 (15.23)	64.00 (17.74)				
Group							1	679	0.309	0.578
Times										
Control group							2	343	0.230	0.795
Treatment group							2	336	0.517	0.597
Interaction							2	679	0.046	0.955

p values were calculated by 2x3 ANOVA
[2] post hoc test was analyzed, p value < 0.05

Figure 3.17 Illustration of the significant interaction results of role emotional subscale



Health reported transition scale

As in Table 3.79, patients in the treatment group largely reported that their health was somewhat better now than one year ago both after six and 12 months, whereas, patients in the control group mostly reported that their health was somewhat worse now than one year ago, after six months and about the same as one year ago, after 12 months. Figures 5.18 and 5.19 also show the different responses for each item after six and 12 months.

Table 3.79 The percentage responses of health reported transition compared between the treatment and the control groups and compared within each group

Items	Treatment group Number (percent)			Control group Number (percent)			p value[1]	p value[2]	p value[3]
	Pre test (N=118)	After 6 mo (N=112)	After 12 mo (N=109)	Pre test (N=116)	After 6 mo (N=116)	After 12 mo (N=113)			
Much better now than one year ago	18 (15.30)	27 (24.10)	23 (21.10)	18 (15.50)	16 (13.8)	6 (5.30)	0.996	0.046	0.001
Somewhat better now than one year ago	33 (28.00)	35 (31.30)	35 (32.10)	32 (27.60)	25 (21.60)	33 (29.20)			
About the same as one year ago	20 (16.90)	19 (17.00)	28 (25.70)	22 (19.00)	26 (22.40)	35 (31.00)			
Somewhat worse now than one year ago	28 (23.70)	21 (18.80)	19 (17.40)	26 (22.40)	32 (27.60)	23 (20.40)			
Much worse now than one year ago	19 (16.10)	10 (8.90)	4 (3.70)	18 (15.50)	17 (14.70)	16 (14.20)			

p values were calculated by chi square, [1]at the pre test, [2]after six months and [3]after 12 months

Figure 3.18 Percentage responses for health reported transition between the treatment and the control groups after six months

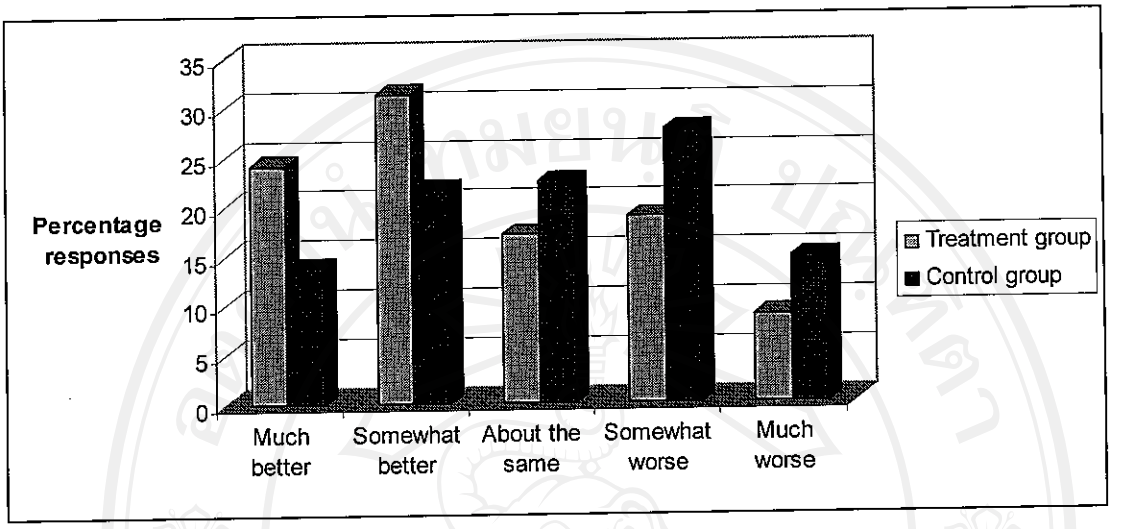
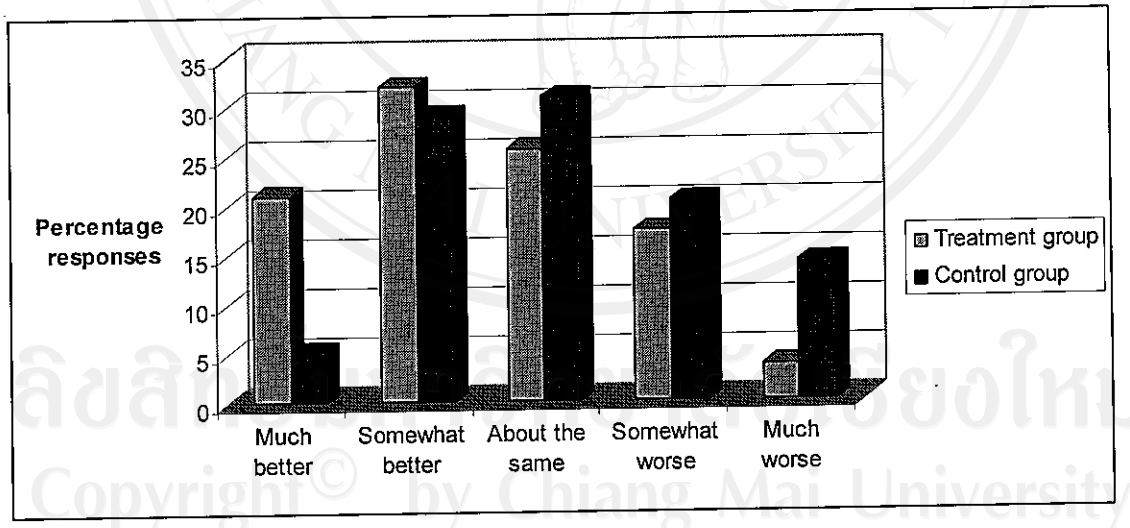


Figure 3.19 Percentage responses for health reported transition between the treatment and the control groups after 12 months



3.2.3.2.4 Digit Span test

The Digit Span test is the specific tool used to measure cognitive function in hypertensive patients' quality of life. There were two groups of different numbers

which began with 2 digits and went up to 9 digits. A patient would say the first group of numbers by repeating what an interviewer said whereas a second group of numbers had to be said in reverse from what the interviewer had just said. The scores were zero, 2, 3, 4 up to 9. The normal rage is 7 ± 2 digits for the forward numbers and 5 ± 1 digits for the reverse numbers.

Table 3.80 gives the results in one year. The forward numbers for both groups, the means obtained were within the range of normal (5-9) but the means for the reverse digits were much lower than for the normal range in both groups (<4). There were no significant differences between groups at any time ($p > 0.05$). The mean scores of the forward numbers were significantly reduced after six and 12 months when compared with the pre test in both groups ($p < 0.05$). These results seemed to indicate that patients in both groups declined in their memory recall and alertness after six months and again after one year. Due to the possibility that the reduction in forward numbers in both groups might not be related to the pharmacist's involvement but rather to the anxiety to of the patient to the procedure of interviewing or to a misunderstanding of the procedure, those results were considered to be inconclusive.

Table 3.80 Mean scores of the Digit Span test compared between the treatment and the control groups and compared within each group across the pre test, after six and 12 months (Ref.77)

groups outcomes (range of possible scores)[n]	Treatment group				Control group				p value [a**]	p value [b**]
	Pre test (N=118)	After 6 months (N=112)	After 12 months (N=109)	p value*	Pre test (N=116)	After 6 months (N=116)	After 12 months (N=113)	p value*		
Forward (0-9)	6.02 (1.31)	5.54[1] (1.24)	5.50[2] (1.29)	0.001	5.85 (1.40)	5.43[1] (1.50)	5.59[2] (1.23)	0.001	0.515	0.673
Reverse (0-9)	2.31 (1.01)	2.38 (1.26)	2.50 (1.09)	0.344	2.42 (1.28)	2.44 (1.12)	2.53 (1.06)	0.869	0.784	0.951

* p values were calculated for the difference within each group across three times by the Friedman test. Pairwise comparison was analyzed by the Wilcoxon signed ranks test, [1] between the pre test and after six months, [2] between the pre test and after 12 months, [3] between after six and 12 months.

** p values show > 0.05 for the difference between groups by the Mann-Whitney U test, [a] at after six months, [b] after 12 months.

[n] normal: 7 ± 2 digits forward and 5 ± 1 digits in reverse

3.2.3.3 Economic outcome

Economic outcome is presented for 17 months from 1 October 2002 to 28 February 2004. The results are shown in three tables of total costs of all medications, costs of hypertension medications and costs of non hypertension medications.

In the calculation of total costs of all medications and total costs of non hypertension medications there were 16 patients missing from each group and 27 patients were missing from total costs of hypertension medications. Four patients died, one patient received care from another provincial hospital, one patient was disabled, and the remaining 10 patients had less than 3 recorded visits in each period of time, October 02-June 03 and July 03-February 04. In the total costs of hypertension medications there were 11 further patients who were missing. Of these six patients had a doctor stop their hypertensive medications, two patients did not receive any hypertensive medication right from the beginning of the study, and four patients had less than 3 recorded visits in each of the time periods.

3.2.3.3.1 Cost of medications

Costs of medications during October02-February04 compared between the treatment and control groups:

Table 3.81 shows the results analyzed by Man-Whitney U, nonparametric analysis. The average costs of all medications were as high as 5066 bahts/17 months or 298 bahts per month per patient in the treatment group while there were 4224 bahts/17 months or 248 bahts per month per patient in the control group. Costs of

hypertensive medications were nearly the same in the treatment and control groups, 1710 bahts/17 months or 100 bahts/month/patient for the treatment group and 1957 bahts/17 months or 115 bahts/month/patient for the control group. Non hypertensive medications costs were higher in the treatment group than in the control group, 3385 bahts/17 months or 199 bahts per month per patient in the treatment group and 2350 bahts/17 months or 138 bahts per month per patient in the control group. Nevertheless, the results of all cost variables were similar for both the treatment and the control groups, $p > 0.05$.

Costs of all medications assessment, multiple comparisons between the treatment and the control groups across 17 months:

A 17x2 ANOVA was conducted to evaluate the effects of groups and times on costs. The costs were transformed to achieve the assumption of Levene's test of homogeneity of variance.

Table 3.82 showing the ANOVA results indicates a significant difference between groups, $F(1, 3821) = 8.441$, $p < 0.05$, but there were no differences in the times nor the interaction between groups and times. This main group effect indicated that patients who received a pharmacist's involvement spent much more money on all medications over 17 months than patients who received the traditional service, as also shown in Figure 3.20.

Cost of hypertension medications assessment, multiple comparisons between the control and the treatment groups across 17 months:

The hypertension medication costs were transformed to achieve the assumption of Levene's test of homogeneity of variance. Table 3.83 giving the ANOVA results indicates no significant interaction between groups and time, $F(16, 3679) = 0.315$, $p > 0.05$, neither the main group effect, $p > 0.05$ nor the effect of times, $p > 0.05$. The main group effect indicated that patients in both groups spent the same amount of money on costs of hypertension medications across 17 months. This is also shown in Figure 3.21.

Cost of non hypertension medications assessment, multiple comparisons between the treatment and the control groups across 17 months:

The costs of non hypertension medications were transformed to achieve the assumption of Levene's test of homogeneity of variance. Table 3.84, ANOVA indicated no significant interaction between groups and times, $F(16, 3812) = 1.017$, $p > 0.05$, neither the time effect, $p > 0.05$. But there was a significant difference in the main group effect, $F(1, 3812) = 25.897$, $p < 0.001$. This main group effect indicated that patients who received a pharmacist's involvement spent more money than patients who received the traditional service on the non hypertensive costs of medications across 17 months, as is also shown in Figure 3.22.

3.2.3.3.2 Cost of medications on admission

Table 3.85 shows the results of the number of admissions and costs of medications used during Nov 02-February 04. Total admissions in the treatment group

were lower than in the control group, 16 compared with 39 times. Maximum admission in one patient was three times in the treatment group while in the control group it was 14 times. Average cost of medications during hospitalization in the treatment group it was 1842.95 bahts with a SD of 2345.56 while in the control group was 4465.83 bahts with a SD of 12411.28. Average cost of hypertensive medications in the treatment group was lower when compared with the control group, 59.78 and 1211.14 bahts, respectively.

Table 3.81 Total costs of all medications, medications for hypertension and medication for non hypertension compared between the treatment and the control groups during October 2002-February 2004 (Ref. 72.1)

Measurement* (N of the treatment group, N of the control group)	Treatment group	Control group	Mann Whitney U	p value
	Mean (SD) (Median, Mode, Min-Max, Mean rank)	Mean (SD) (Median, Mode, Min-Max, Mean rank)		
Total costs of all medications (N =117, 116)	5066.22 (6362.77) (2743.00, 265.50, 265.50-40170.00, 122.00)	4224.20 (5130.01) (2444.75, 1875.00, 222.00-28412.00, 111.95)	6200.50	0.255
Total costs of all medications per month per patient (N=117, 116)	298.01 (374.28) (161.35, 15.62, 15.62-2362.94, 122.00)	248.48 (301.77) (143.81, 110.29, 13.06-1671.29, 111.95)	6200.50	0.255
Total costs of hypertension medications (N=115, 111)	1710.81 (3242.10) (650.50, 400.00, 70.00-25970.00, 115.96)	1957.00 (3976.67) (623.00, 510.00, 55.00-22585.00, 110.95)	6100.00	0.565
Total costs for hypertension medications per month per patient (N=115, 111)	100.64 (190.71) (38.26, 23.53, 4.12-1527.65, 115.96)	115.12 (233.92) (36.65, 30.00, 3.24-1328.53, 110.95)	6100.00	0.565
Total costs of non hypertension medications (N=117, 116)	3384.65 (4844.88) (1530.00, 10.00, 10.00-29565.00, 122.97)	2350.00 (2910.10) (1361.00, 90.00, 10.00-177.28.00, 110.98)	6088.00	0.175
Total costs of non hypertension medications per month per patient (N=117, 116)	199.10 (284.99) (90.00, 0.59, 0.59-1739.12, 122.97)	138.24 (171.18) (80.06, 5.29, 0.59-1042.82, 110.98)	6088.00	0.175

*Follow up period is during Oct02-Feb04. If patients had visits for less than 17 months but at least 6 months of cost data were available, costs were analyzed for that 17 month period.

** p values from Mann-Whitney tested for the difference between groups.

Table 3.82 Total costs of all medications compared within each group and between the treatment and the control groups (Ref.73)

Months	Total cost of all medications (Bahts)					
	Treatment group (N=112) Mean (SD) (Min-Max)	Control group (N=107) Mean (SD) (Min-Max)	df1	df2	F	P value
Oct 02	301.98 (505.84) (0-2935.00)	279.91 (446.42) (0-3159.00)				
Nov02	265.12 (446.54) (0-2820.00)	198.52 (305.95) (0-1882.00)				
Dec 02	334.69 (560.05) (0-2843.00)	296.17 (489.22) (0-3145.00)				
Jan03	191.73 (348.54) (0-2010.00)	209.73 (359.84) (0-2494.50)				
Feb 03	287.04 (486.19) (0-2520.00)	269.19 (442.28) (0-3100.00)				
Mar03	275.75 (513.56) (0-3575.00)	238.79 (304.87) (0-1290.00)				
Apr 03	321.59 (494.70) (0-2520.00)	238.16 (438.71) (0-3125.00)				
May 03	320.39 (688.32) (0-5790.00)	258.33 (422.42) (0-2530.00)				
Jun 03	296.25 (472.44) (0-2903.00)	258.71 (530.17) (0-3175.00)				
Jul 03	362.69 (656.46) (0-4740.00)	269.88 (352.43) (0-1770.00)				
Aug 03	290.58 (485.08) (0-2610.00)	258.44 (473.09) (0-3098.00)				
Sep 03	299.20 (657.41) (0-5820.00)	220.17 (338.71) (0-1800.00)				
Oct 03	361.36 (587.78) (0-3503.00)	255.72 (424.42) (0-2118.00)				
Nov03	303.49 (753.49) (0-7100.00)	273.39 (398.33) (0-1790.00)				
Dec 03	318.91 (522.81) (0-3162.00)	308.46 (529.68) (0-2595.00)				
Jan 04	370.35 (867.25) (0-7840.00)	291.69 (542.65) (0-3181.00)				
Feb 04	335.23 (544.13) (0-4210.00)	349.57 (770.08) (0-6980.00)				
Total	304.13 (570.88) (0-7840.00)	258.31 (452.29) (0-6980.00)				
Total*	12.55 (12.11) (0-88.54)	11.46 (11.27) (0-83.55)	1	3821	8.441	0.004
Time: 17 months						
Control group			16	1880	1.027	0.424
Treatment group			16	1932	1.202	0.258
Interaction between group*time			16	3821	0.479	0.958

*The costs were transformed by square root to achieve Levene's test of homogeneity of variance assumption before using 17x2 Factorial ANOVA to compare between the control and treatment groups over 17 months.

Table 3.83 Total costs of hypertension medications compared within each group and between the treatment and the control groups (Ref. 74)

Months	Total cost of hypertension medications (Bahts)					
	Treatment group (N=108) Mean (SD) (Min-Max)	Control group (N=100) Mean (SD) (Min-Max)	df 1	df2	F	P value
Oct 02	107.14 (222.25) (0-1320.00)	139.01 (359.61) (0-2940.00)				
Nov02	80.65 (175.27) (0-978.00)	92.79 (243.10) (0-1330.00)				
Dec 02	126.93 (309.17) (0-2520.00)	149.10 (391.25) (0-2940.00)				
Jan03	59.57 (146.66) (0-968.00)	88.64 (222.28) (0-1290.00)				
Feb 03	120.49 (326.74) (0-2520.00)	138.31 (389.99) (0-2940.00)				
Mar03	67.94 (132.09) (0-750.00)	107.78 (226.24) (0-1290.00)				
Apr 03	128.43 (311.43) (0-2520.00)	110.68 (354.68) (0-2940.00)				
May 03	118.87 (402.54) (0-3660.00)	114.46 (318.75) (0-2060.00)				
Jun 03	75.26 (136.95) (0-750.00)	115.98 (382.19) (0-2940.00)				
Jul 03	116.96 (273.20) (0-1900.00)	122.85 (266.16) (0-1770.00)				
Aug 03	86.54 (156.14) (0-960.00)	150.79 (415.92) (0-2940.00)				
Sep 03	110.96 (403.81) (0-3690.00)	103.32 (278.34) (0-1800.00)				
Oct 03	105.71 (185.90) (0-1130.00)	110.72 (291.55) (0-1785.00)				
Nov03	138.18 (462.73) (0-4260.00)	125.47 (283.76) (0-1790.00)				
Dec 03	101.72 (179.38) (0-750.00)	149.08 (383.10) (0-1810.00)				
Jan 04	131.86 (407.10) (0-3580.00)	155.83 (418.81) (0-2940.00)				
Feb 04	110.47 (238.35) (0-1770.00)	140.88 (352.25) (0-1920.00)				
Total	103.60 (279.01) (0-4260.00)	120.92 (325.74) (0-2940.00)				
Total*	6.52 (7.82) (0-65.27)	6.64 (8.77) (0-54.22)	1	3679	0.067	0.795
Time: 17 months						
Control group			16	1797	0.883	0.589
Treatment group			16	1882	1.251	0.221
Interaction between group*time			16	3679	0.315	0.996

*The costs were transformed by square root to achieve Levene's test of homogeneity of variance assumption before using 17x2 Factorial ANOVA to compare between the control and treatment groups over 17 months.

Table 3.84 Total cost of non hypertension medications compared within each group and between the treatment and the control groups (Ref. 75)

Months	Total cost of non hypertension medications (Bahts)					
	Treatment group (N=112) Mean (SD) (Min-Max)	Control group (N=107) Mean (SD) (Min-Max)	df 1	df2	F	P value
Oct 02	196.13 (435.87) (0-2860.00)	148.73 (293.61) (0-2337.00)				
Nov02	187.21 (366.83) (0-2340.00)	108.98 (168.03) (0-939.00)				
Dec 02	210.55 (453.47) (0-2798.00)	155.71 (300.71) (0-2350.00)				
Jan03	132.41 (267.31) (0-1361.00)	126.45 (274.24) (0-2382.00)				
Feb 03	170.49 (336.75) (0-2280.00)	137.20 (227.61) (0-1280.00)				
Mar03	209.92 (476.20) (0-3497.00)	137.29 (202.79) (0-1028.00)				
Apr 03	197.35 (377.82) (0-2404.00)	131.22 (257.59) (0-1634.00)				
May 03	205.77 (435.31) (0-2265.00)	151.22 (251.12) (0-1410.00)				
Jun 03	223.54 (420.15) (0-2850.00)	147.51 (365.57) (0-2882.00)				
Jul 03	249.91 (512.85) (0-2840.00)	155.07 (222.39) (0-1457.00)				
Aug 03	207.13 (421.08) (0-2491.00)	118.52 (199.99) (0-1265.00)				
Sep 03	192.21 (365.32) (0-2330.00)	123.61 (198.53) (0-1179.00)				
Oct 03	259.43 (525.05) (0-3443.00)	152.24 (305.49) (0-2118.00)				
Nov03	170.25 (373.29) (0-2840.00)	155.99 (251.06) (0-1642.00)				
Dec 03	220.82 (456.91) (0-3102.00)	169.14 (323.17) (0-2145.00)				
Jan 04	243.20 (541.16) (0-4260.00)	145.91 (277.53) (0-1572.00)				
Feb 04	228.71 (480.29) (0-4150.00)	217.91 (549.87) (0-5060.00)				
Total*	203.18 (427.02) (0-4260.00)	143.70 (284.24) (0-5060.00)	1	3812	25.897	< 0.001
Time: 17 months						
Control group			16	1880	0.809	0.676
Treatment group			16	1932	0.635	0.857
Interaction between group*time			16	3812	1.017	0.434

* Both transformed data and original costs violated Levene's test. The original results were presented, nevertheless both results were similar.

Table 3.85 Costs of medications and number of hospitalizations during July03-February04 (Ref.76)

	Treatment group Mean (SD), Min-Max, Sum N=20	Control group Mean (SD), Min-Max, Sum N=18
No of hospitalization	1.30 (0.57) 1.00-3.00, 26.00	2.17 (3.07) 1.00-14.00, 39.00
Costs of medication	1842.95 (2345.56) 44.00-8231.00, 36859.00	4465.83 (12411.28) 49.50-53386.50, 80385.00
Costs of hypertension medications	59.78 (133.02) 541.00-1195.50, 59.78	1211.14 (4743.45) 0-20188.00, 21800.50

Figure 3.20 Total costs of all medications during 17 months, Oct02-Feb04

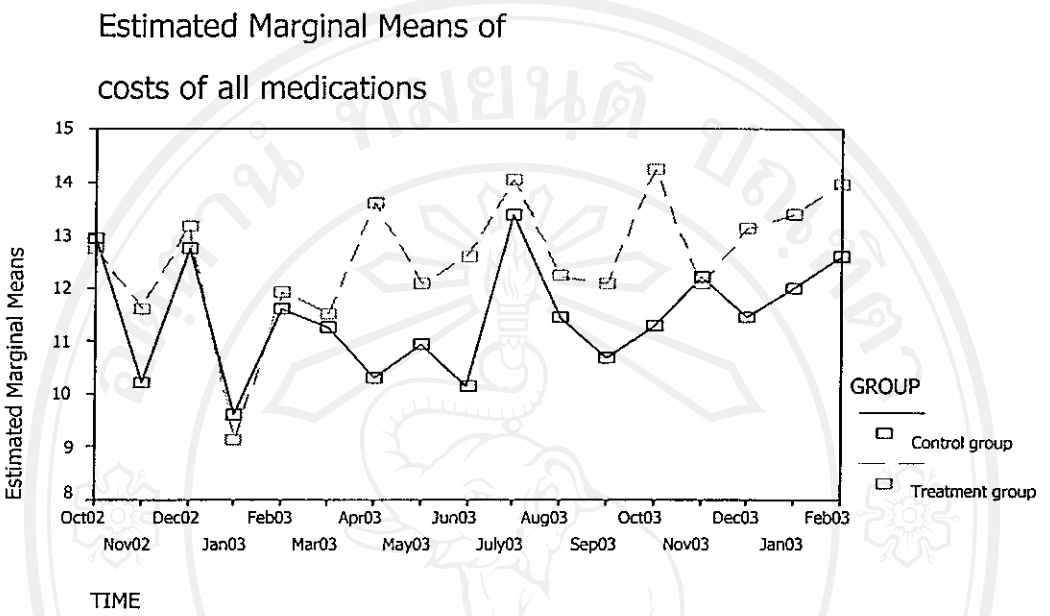


Figure 3.21 Total costs of hypertension medications during 17 months, Oct02-Feb04

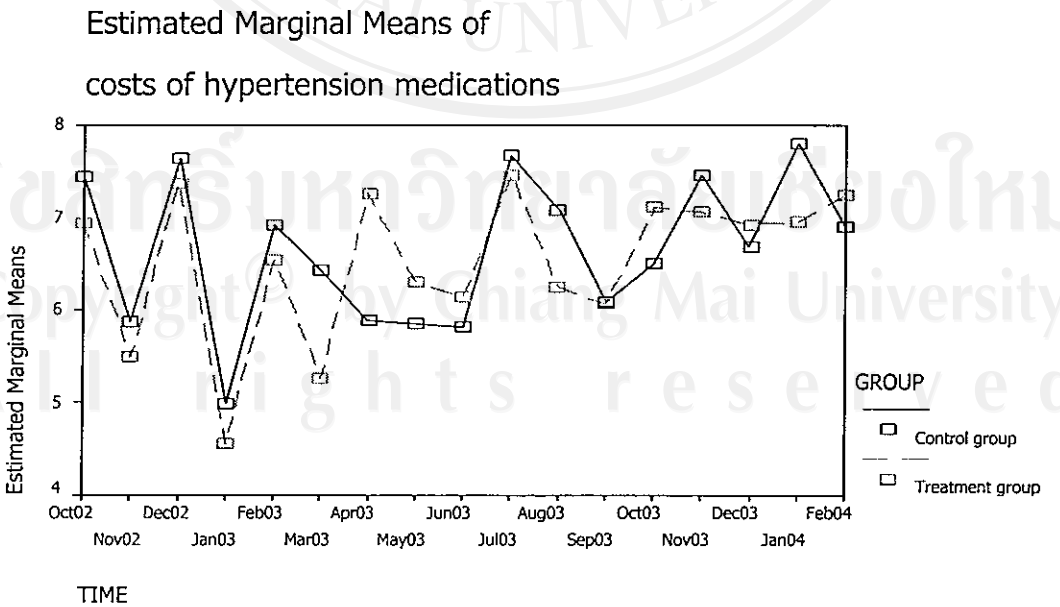
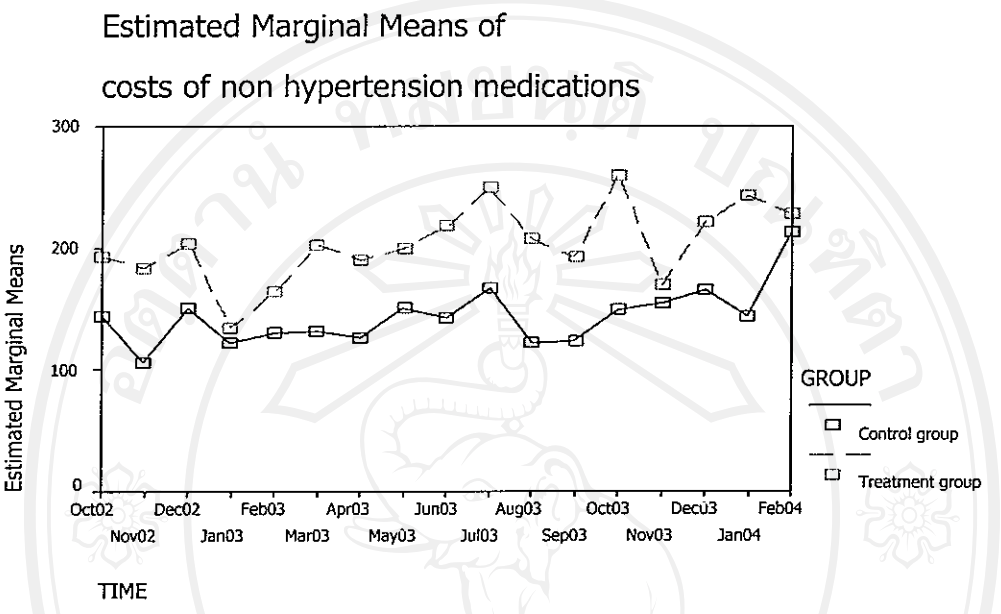


Figure 3.22 Total costs of non hypertension medications during 17 months, Oct02-Feb04



3.2.3.3.4 Conclusions

The results after 1 year were calculated by multiple comparisons, two-way between groups ANOVA, with groups and times, at the pre test, after six months and after 12 months. This method which was applied to continuous variables provided more power to reject the null hypothesis and reduced type I error from many comparisons. For binomial variables, multiple comparisons were not used but comparisons between groups in each time of measurement because this provided more reliable results.

The pharmacist made 378 recommendations to the doctors in the year. Of these the recommendations 50.26% were accepted and 41.27% were not accepted. The remaining recommendations failed to reach the doctor treating the patient.

Clinical outcomes:

The percentage of patients who were disabled was higher in the control group than the treatment group but the percentage of patients who died was higher in the treatment group than the control group. Nevertheless, the total number of patients who were admitted to the hospital was equal in both groups but the frequency of admission rate was higher in the control group than the treatment group.

BP control showed significant improvement after six, 12 months when compared with the pre test and also significantly improved during the interval between six and 12 months. BP reduction had significantly reduced after six and 12 months without significant decrease during the interval between six and 12 months. Nevertheless, the overall results of BP control and BP reduction indicated that patients in the treatment group, who received pharmacist involvement, obtained significantly

higher benefit in BP control and BP reduction than patients in the control group, although both groups had significantly greater improvement after 12 months than at the pre test. The results of medication compliance also showed the benefit of pharmacist's contribution to patients in the treatment group who achieved 'good compliance' which was significantly higher than achieved by patients in the control group. After 12 months follow-up by the pharmacist, the proportion of patients who performed exercise and avoided salty food was significantly greater in the treatment group than in the control group.

Humanistic outcomes:

1) Patient knowledge

Each item analyses provided a significant difference between groups after six and 12 months. Nevertheless, within group comparisons showed significant improvement in knowledge in both groups. This was a little bit greater in the treatment group with 11 items, than in the control group with seven items. Subscale analyses showed clearer results. The patient knowledge score was significantly higher in the treatment group in 'hypertension knowledge' and 'the proper use of medication' than in the control group. However, the results of within group comparisons showed a significant improvement in patient knowledge after 12 months in both groups.

2) Patient satisfaction

After 12 months patients in the treatment groups showed significantly more satisfaction in 12 of 16 items than the control group. This again indicates the value of

sustained pharmacist involvement. Subscale results indicated that patients in the treatment group were significantly more satisfied with a pharmacist's involvement than the control group in most subscales, except for finance and continuity of care. However, both groups showed significantly higher satisfaction after 12 months than at the pre test or after six months.

3) Quality of life

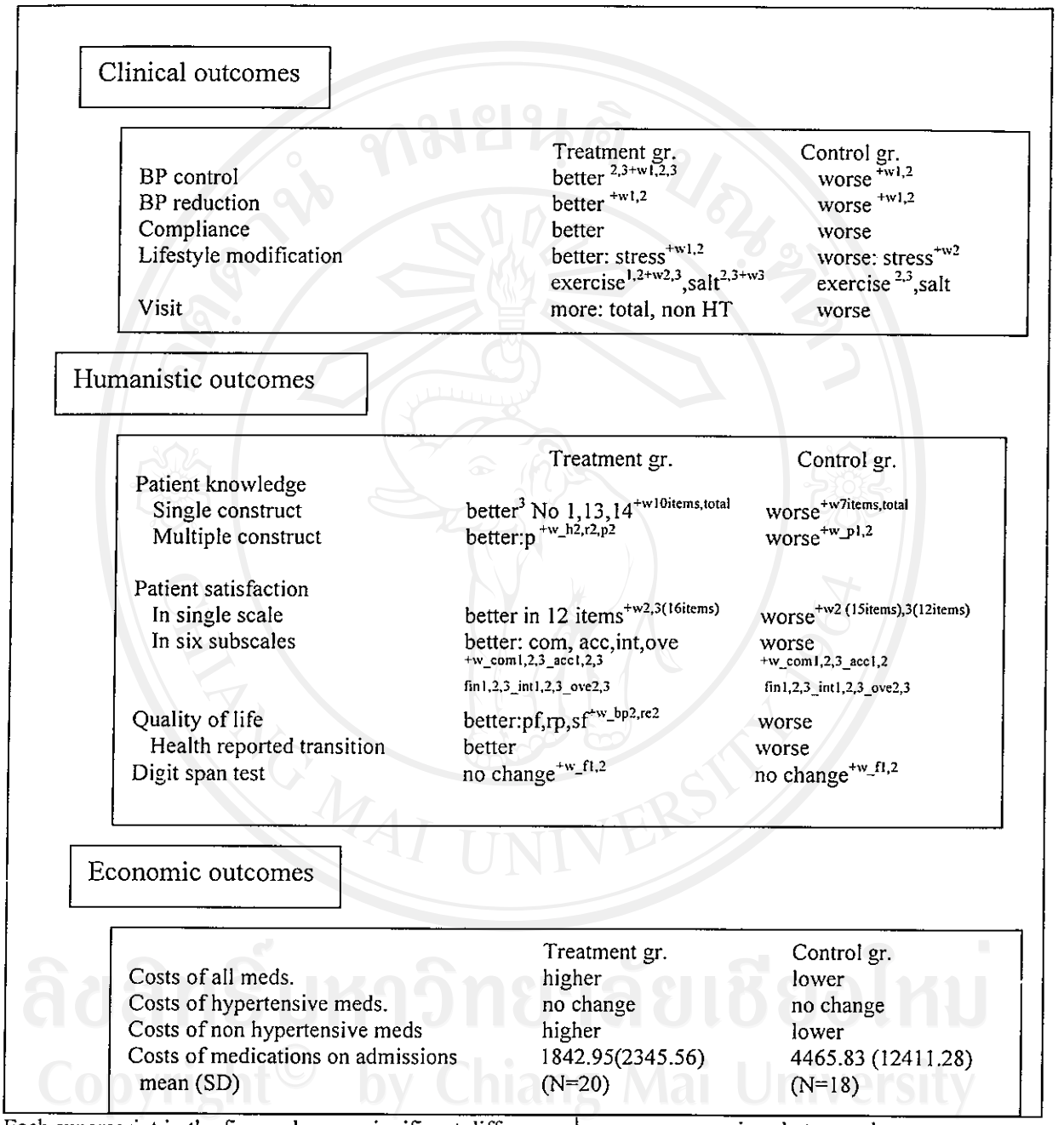
Quality of life using the SF-36 assessment showed that patients in the treatment group had significantly higher ability than the control group in the performance of physical activities without having limitations due to health, less problems resulting from the effects on their physical health caused by their work or regular daily activities, more performance in normal social activities without interference due to physical or emotional problems and less problems with work or other daily activities resulting from emotional problems. In addition the treatment group showed significantly higher scores after 12 months when compared with at the pre test in having fewer limitations due to pain and fewer problems with work or other daily activities resulting from emotional problems in the previous four weeks. Moreover, health reported transition showed that after six and 12 months more patients in the treatment group felt either significantly better or somewhat better than one year previously compared with the patients in the control group. The results from the Digit Span test were considered to be inconclusive.

Economic outcome:

The costs of total medications and non hypertension medications were significantly higher in the treatment group than the control group. And the frequency of clinic visits results showed that patients in the treatment group went to the non hypertensive clinic more frequently than patients in the control group.

The summary of the outcomes after 12 months is shown in Figure 3.23.

Figure3.23 Summary of the outcomes after 12 months by multiple comparisons



Each superscript in the figure shows a significant difference; [1] means a comparison between the pre test and after six months, [2] means a comparison between the pre test and after 12 months, [3] means a comparison between the six and 12 months; [+w] means the within group comparison results

In patient knowledge: h=hypertension knowledge, r=risk factor management, p=the proper use of medication; In patient satisfaction: com = communication and management, acc = accessibility and convenience, fin = finance, int = interpersonal relationship, con = continuity of care, ove = overall satisfaction; In quality of life: pf =physical function, re=role physical, bp=bodily pain, gh=general health, vt=vitality, sf=social functioning, re=role emotional, mh=mental health

Visit: total = total visit, non Ht= non hypertensive visit