ORIGINAL ARTICLE

Journal of
Clinical Nursing

The impact of illness perception on adherence to therapeutic regimens of patients with hypertension in Taiwan

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Aims. To examine the predictive effects of illness perception on adherence to therapeutic regimens of patients with hypertension.
Background. Illness perception is an important predictor for adherence to therapeutic regimens. Hypertension is asymptomatic. How the lay views, especially identity and causal attribution, affect the patients' adherence to therapeutic regimens need to be further explored.
Design. A cross-sectional survey.
Methods. Purposive sampling was conducted at the cardiovascular clinics of two teaching hospitals in central Taiwan. A sample of 277 patients was included in this study. Guided by the Self Regulation Model, a series of variables including socio-demographic variables, clinical variables, illness representations, identity and causes were evaluated for their relationships with adherence to the antihypertensive regimen and recommendations of self-management.
Results. Predictors of adherence to prescribed medications in the hierarchical logistic regressions were treatment control, risk factors and psychological attribution. In the self-management model, we found that symptoms experienced after a hypertension diagnosis, symptoms for blood pressure prediction, personal control, balance and cultural causal attribution were significant predictors of adherence to self-management, adding an additional 21% of the variance. The results of analysis of variance showed that those who were unsure if they had experienced symptoms after a hypertension diagnosis were more likely to self-regulate (increase or decrease) prescribed medications than those without symptoms.
Conclusions. The findings suggest that the Self Regulation Model may provide a useful framework for understanding and explaining adherence to therapeutic regimens of patients with hypertension across cultures.
Relevance to clinical practice. Factors that affect the patients' adherence to prescribed medications and self-management recommendations differ greatly. Despite its subjectivity, identity showed significantly predictive effects on adherence to self-management. Understanding patients' lay views on hypertension allows health professionals providing effective care for better adherence to therapeutic regimens.

Key words: adherence, illness perception, medication, nurses, nursing, self-management

Accepted for publication: 15 September 2008

Introduction

Hypertension is the third leading killer in the world, causing one in every eight deaths worldwide (World Health Organization 2003). Despite the availability of effective treatments, the control rate of hypertension is still around 30% (Chobanian *et al.* 2003). In Taiwan, the control rate is also fairly low (Pan *et al.* 2001). Non-adherence is a major factor responsible for the inadequate control (Yiannakopoulou *et al.* 2005). It is estimated that the mean adherence rate for the

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doi: 10.1111/j.1365-2702.2008.02706.x

anti-hypertensive ranges from 50–70% (World Health Organization 2003) and adherence to non-pharmaceutical therapeutic regimens is even lower (Kyngas & Lahdenpera 1999). Non-adherence may lead to an increased number of adverse events of cardiovascular disease (Flack *et al.* 1996), higher health care costs (Hodgson & Cai 2001) and a worsening health-related quality of life (Handler 2005). Adherence to therapeutic regimens is becoming a significantly important step in campaign to control high blood pressure (HBP).

Many studies have explored the issue of non-adherence from biomedical and behavioural viewpoints, but very few have been conducted from patients' perspectives (Vermeire *et al.* 2001). Many theories have been used to understand patient adherence; however, the Self Regulation Model (SRM) is useful for understanding how people think about their illnesses and how this subjective lay viewpoint may guide individual adherent behaviours and health outcomes. In particular, the model recognises the impact of socio-cultural and environmental factors in shaping patient health beliefs and behaviours through two parallel processes: cognitive and emotional representations (Leventhal *et al.* 2003). Many studies have provided support for the influence of illness perception on non-adherence to therapeutic regimens (Horne & Weinman 2002, Jessop & Rutter 2003, Ross *et al.* 2004), but some studies found no impact on patient health behaviours or behaviour outcomes, especially in samples without obvious symptoms (Byrne *et al.* 2005).

According to the assumptions of the SRM, symptoms and labels are important signs for eliciting the development of illness representations (IR) and action behaviours. When a disease label/symptom is presented, patients usually search for causes to attribute to the illness and correspondingly shape their actions to cope with the illness (Leventhal *et al.* 2003). From a biomedical perspective, hypertension is asymptomatic with multi-factorial organic causes for which long-term adherence to therapeutic regimens is required for undesirable cardiovascular events. But some studies found that the hypertensive does report symptoms (Kjellgren *et al.* 1998, Kyngas & Lahdenpera 1999) and the symptom experiences were associated with treatment adherence (Meyer *et al.* 1985, Kyngas & Lahdenpera 1999). Some patients even can predict when their blood pressure is up by symptom presentation (Meyer *et al.* 1985) and alter their treatment decision-making accordingly, even if the estimation may be made incorrectly based on false assumptions (Pennebaker & Watson 1988).

For Chinese, symptoms and illness attribution are the major reasons for patients to seek help from the health professionals as well (Chang 2000). In Taiwanese Chinese society, three healthcare systems (Western medicine, traditional Chinese medicine and Taiwanese folk medicine) simultaneously coexist. Maintaining one's health is to live in harmony with social and environmental conditions and attain an inner ecological balance (Chen & Swartzman 2001). The patient may accept the health recommendations from different health care systems at the same time and adopt those that work best for their health problems. The health care decision is made based on their interpretation of the illness. For example, when the patients perceive the symptom as acute, they will seek help from Western medicine. If individuals attribute their illnesses to external causes such as feng shui (geomancy) or pa tzu (the specific time of one's birth), they are more likely to seek help from Taiwanese folk medicine. On the contrary, they will take advises from the traditional Chinese medicine if they attribute the cause of illness to imbalance between internal and external ecological environments (Chang 1983, 2000, Chen & Swartzman 2001).

Both symptoms and causal attributions affect patients' IR (Leventhal *et al.* 2003) and also play important roles in psychopathological processes as well as adaptation of health threats such as adherence (Kirmayer *et al.* 1994). The contents of illness perception and the process of self-regulation for adapting to health threats are strongly influenced by individual social and cultural contexts (Leventhal *et al.* 1998). Very few studies explore the relationship between adherence and illness perception within the Chinese societal contexts. Guided by the theoretical framework of the SRM, the aims of the study were to assess the effects of illness perceptions on adherence to the prescribed medications and recommendations of self-management of patients with hypertension in Taiwan.

Methods

Participants

A purposive sample of 310 hypertensive patients was recruited from the cardiovascular clinics of two teaching hospitals in central Taiwan. Patients who met the criteria were invited to participate in the study: (1) aged 18 years and older, (2) with a diagnosis of essential hypertension confirmed by a cardiovascular physician and (3) having been prescribed to an antihypertensive for treating their illness for at least three months prior to the study. Exclusion criteria included those patients who were medically unstable as determined by their cardiovascular physicians, with any critical or acute episodes, or with a diagnosis of secondary hypertension or psychological problems. Permission to access the study sites was granted from the participating hospitals and ethical approval was obtained from the local human rights committee. Patients who met the study criteria and

agreed to participate were asked to sign a consent form. Anonymity and confidentiality are guaranteed to our participants. Complete data were collected from 277 patients.

Instruments

Illness perception questionnaire – revised (IPQ-R)

The original IPQ was developed by Weinman *et al.* (1996) and was subsequently revised by Moss-Morris *et al.* (2002) to assess patient illness perception. The IPQ-R is comprised of three components: IR, causes and identity. The IR consists of 38 questions with seven subscales including timeline, timeline cyclical, consequences, treatment control, personal control, coherence and emotional representation. All items are ranked on a five-point response scale ranging from 'strongly disagree' to 'strongly agree'. A higher score indicates a stronger belief for a specific dimension.

The original 'cause' component of the IPQ-R consisted of 18 items with four subscales of psychology, risk factors, immunity and accident/chance (Moss-Morris *et al.* 2002). For the study purpose, two subscales, balance and cultural attributions, were added to assess causal attributions from the perspectives of traditional Chinese medicine and Taiwanese folk medicine. The items of accident and germs in the original causal component were excluded, because they were irrelevant to the aetiology of hypertension. Instead, an item of 'physiological changes in the blood vessels' was added. Finally, a total of 22 items, scored on a five-point scale from 1 (strongly disagree) – 5 (strongly agree), was included in the cause component.

Identity was measured by two sets of items: identity scores (symptom related to HBP) and identity monitoring (symptoms used to monitor their HBP) (Leventhal *et al.* 1998, Jessop & Rutter 2003). The identity score was obtained by asking a patient to rate 32 symptoms which might be hypertension related by selecting from a range of autonomic, sensory and psychosomatic domains as well as possible side effects of the medication (Pennebaker *et al.* 1982, Pennebaker & Watson 1988, Kjellgren *et al.* 1998). Only those symptoms that were identified by patients as hypertension related were counted in the identity score. A higher score of identity indicated that more symptoms were experienced by a patient. To assess patient alternative for monitoring their disease status, two other items were asked to indicate if they had experienced symptoms after the hypertension diagnosis and if they could predict HBP through symptom presentation on a ordinal response scale of yes, uncertain, or no.

Some studies have provided good evidence for the psychometric properties of the English IPQ-R (Moss-Morris *et al.* 2002, Hagger & Orbell 2005). Still we evaluated the reliability and validity of the Chinese IPQ-R in our sample before use. A series of factor analysis using principal axis analysis (PAA) were undertaken to validate the factorial structures of the Chinese IPQ-R. First of all, the 38 items of the IR were entered into a PAA with equamax rotation. However, three items were deleted because the factor loadings were $< 0{\cdot}3$. The remaining 35 items of the IR in a second PAA produced seven factors and accounted for 58·92% of the variance with factor loadings of $\geq 0{\cdot}40$. The seven factors were consequences, timeline cyclical, illness coherence, personal control, emotional representation, timeline and treatment control, which respectively explained 20·94, 12·46, 6·66, 6·14, 4·76, 4·14 and 3·53% of the variance.

Secondly, the factor structure of the 22 causal items was examined by a PAA with varimax rotation. The items of hereditary, pollution and physiological changes in blood vessels were deleted because they were loaded on the psychological attribution or with low factor loadings. Eventually, a four-factor solution was extracted which explained 56·22% of the variance. The four factors were psychological attribution, balance, culture and risk factor and these respectively accounted for 27·88, 11·14, 8·99 and 8·20% of the explained variance. The psychological attribution was similar to the scale identified by Moss-Morris *et al.* Six items contain in the balance subscale, including weather, sleeplessness, parchedness or blood impassability, immunity, aging and poor medical care in my past. Only three items (smoking, alcohol consumption and dietary or eating habits) were loaded on the risk factor and three items (feng shui, pa tzu and bad luck) were loaded on the cultural component. Cronbach's alpha for the Chinese IPQ-R ranged from 0·65–0·86 (Table 2).

The adherence inventory

The Medication Adherence Inventory (MAI) and the Inventory of Adherence to Self-Management (IASM) were designed to assess a patient's adherence to the prescribed medication and self-management activity on a scale of five points. The MAI was modified from Hu *et al.* (1996) Inventory of Medication Compliance. Three more items were added to encompass the attributes of unintentional non-adherence to the medication regimen. Eventually, 13 items were included in the MAI, containing three subscales: the decrease type of dosage deviation (subtracting dosage, frequency and types of medications, taking only part of the prescribed medication, did not consume all the prescribed medication), increase type of dosage deviation (adding dosage, frequency and types of medications) and un-intentional type such as taking medication intermittently, drug holiday and deviation in timing,

forgetting and stopping to take mediation (Velligan *et al.* 2006). The scores of the negative statement were reversed, with a higher score indicating a greater adherence rate. For the data analysis, patients were further classified into two groups (low and high adherence) according to the mean adherence rate. Eighty percent was used as a cutoff point, because an adherence rate of 80% to one's prescribed medication is necessary to achieve optimal control of blood pressure (Haynes *et al.* 1976).

The factor structures of the MAI were assessed by a PAA with oblimin rotation. A three-factor solution was extracted which explained 68·77% of the total variance. These factors were made up of five, three and five items labelled the decreasing type, increasing type and un-intentional type and respectively accounted for 48·75, 13·03 and 6·98% of the variance. Concurrent validity of the MAI was found in the significant correlations between diastolic blood pressure (DBP) and the total score of the MAI ($r = -0{\cdot}15$, $p = 0{\cdot}018$) as well as the score of unintentional type ($r = -0{\cdot}19$, $p = 0{\cdot}002$). The score of decrease type was negatively associated with the symptoms related to side effects of medications ($r = -0{\cdot}14$, $p = 0{\cdot}022$).

The IASM is a self-developed instrument based on a literature review and consists of 14 items with four subscales: an unhealthy diet (extra seasonings, eating salty food, fatty meat, viscera and fried food), a healthy diet (change of diet habits, increase consumption of fresh food or vegetables, attending to food labelling and a diet for weight control), exercise regimen and appointment keeping. Each item has a five-point response format ranging from 1 (never)–5 (always). A higher score indicates a greater adherence to self-management recommendations. In a PAA analysis of the IASM, the oblimin rotation method yielded four factors in the final solution. However, the factor of appointment keeping was eliminated because the internal consistency was low (Cronbach's $\alpha = 0{\cdot}38$). The remaining three factor solutions accounted for 56·13% of the IASM variance. The explained variances were 24·48, 17·23 and 14·41% respectively for the factors of an unhealthy diet, a healthy diet and exercise regimens. Adequate internal consistency of the adherence measures was also found (Table 2).

Data analysis

Data were analysed using SPSS version 11·0 for window (SPSS, Chicago, IL, USA). Descriptive statistics were used to characterise the basic data of the sample. Potential associations or differences between independent variables and the adherence scores were examined using correlational analyses or one-way analysis of variance (ANOVA). The predicting factors of adherence to self-management were evaluated using multiple linear regressions with a hierarchical strategy for dependent variables that were continuous. A hierarchical logistic regression was used for the categorical variable of medication adherence. Prior to analysis, the total score of the IASM was examined for congruence with the regression assumptions. The data fit a normal distribution. Residuals of the dependent variables met the requirement for homoscedasticity. Independent variables that correlated with the total scores of MAI and IASM were entered into the initial step of the separate multivariate regression models as covariates. The scores of the IPQ-R were then offered as potential independent predictors in the second step of the regression models.

Results

Descriptive findings

Table 1 summarises the demographic and illness characteristics of the sample. Most of the sample were male (59·9%), were married (87·7%), were living with family (88·1%), were unemployed/retired (64·5%) and had limited accessibility to the hospital (53·1%). About 51·3% of the respondents received years of education less than six years. The mean age of the sample was 65·96 (SD 12·31) years, with a mean duration of hypertension of 10·46 (SD 8·41) years.

The mean values of blood pressure were 139·53 (SD 14·94) mmHg for systolic blood pressure (SBP) and 79·60 (SD 11·80) mmHg for DBP. The average numbers of medications were 5·66 (SD 3·33). Over half of the respondents had a family history of hypertension (53·1%) and were afflicted with at least one other disease (55·6%). The majority of the respondents was non-smokers (59·2%) and did not have diabetes (80·1%) or hyperlipidaemia (63·4%). About 43·7% of the sample experienced symptoms after a hypertension diagnosis. Thirty-eight percent of the sample would predict their HBP by symptom presentations.

The descriptive information of the measures is presented in Table 2. To compare the scores of the subscales, average means were divided by the number of total items. For the IR component, the highest scores were found for the timeline and treatment control, following by personal control. The lowest scores were found for the timeline cyclical, consequence and emotional representation, indicated stability of disease variation and little emotional response aroused by the illness. Most patients thought their illness was caused by psychological and risk factor attributions. Adherence to prescribed medication was high and 82·3% of the patients exhibited ≥80% adherence to the prescribed medications.

Table 1 Summary of demographic data and illness characteristics

Variables	*N* (%)	Mean (SD)
Gender		
Male	166 (59·9%)	
Female	111 (40·1%)	
Marital status		
Married	243 (87·7%)	
Others	34 (12·3%)	
Living arrangement		
Alone	33 (11·9%)	
Not alone	244 (88·1%)	
Employment status		
Employed	97 (35·5%)	
Unemployed/retired	180 (64·5%)	
Accessibility		
Yes	130 (46·9%)	
No	147 (53·1%)	
Education level		
0–6 years	142 (51·3%)	
> 6 years	133 (48·0%)	
Missing	2 (0·7%)	
Family history of hypertension		
No	130 (46·9%)	
Yes	147 (53·1%)	
History of diabetes		
No	221 (80·1%)	
Yes	56 (19·9%)	
History of hyperlipidaemia		
No	176 (63·4%)	
Yes	101 (36·6%)	
Comorbidity		
No	123 (44·4%)	
Yes	154 (55·6%)	
Smoke		
No	164 (59·2%)	
Yes	107 (38·6%)	
Missing	6 (2·2%)	
Symptom after diagnosis		
Yes	121 (43·7%)	
Uncertain	86 (31·0%)	
No	68 (24·5%)	
Missing	2 (0·7%)	
HBP prediction		
Yes	106 (38·3%)	
Uncertain	82 (29·6%)	
No	87 (31·4%)	
Missing	2 (0·7%)	
Age		65·96 (12·31)
History of hypertension (year)		10·46 (8·41)
Systolic blood pressure		139·53 (14·94)
Diastolic blood pressure		79·60 (11·80)
Numbers of medications		5·66 (3·33)
Symptoms related to medication		0·65 (1·28)

The mean adherence rate for self-management was about 63%. The lowest adherence scores were found for un-intentional adherence and adherence to a healthy diet.

Table 2 Distribution of scores for the measures

Variable	Item	Mean	SD	Mean by items	Cronbach's α
Symptom	32	9·54	5·49		0·84
Identity		3·19	3·99		
Representation	35				
Timeline	5	18·71	2·92	3·74	0·79
Timeline cyclical	4	10·16	3·10	2·54	0·83
Consequence	5	12·77	3·65	2·55	0·81
Personal control	6	20·79	3·35	3·47	0·77
Treatment control	4	14·95	1·90	3·74	0·65
Coherence	5	15·52	3·67	3·10	0·80
Emotional	6	15·91	4·70	2·65	0·86
Cause	19				
Psychological	7	22·60	5·08	3·22	0·82
Balanced	6	18·55	3·97	3·09	0·72
Cultural	3	6·30	2·09	2·10	0·80
Risk factor	3	9·39	2·71	3·13	0·73
Medication	13	59·95	6·29	4·61	0·89
Increase	3	14·54	1·42	4·84	0·90
Decrease	5	23·47	2·84	4·69	0·89
Unintentional	5	21·95	3·08	4·39	0·74
Self-management	12	42·08	6·90	3·59	0·70
Healthy diet	5	15·74	4·27	3·14	0·70
Unhealthy diet	5	19·88	3·05	3·97	0·72
Exercise	2	6·35	3·00	3·17	0·96

Relationships between illness perceptions and adherent variables

The intercorrelations between the measures are displayed in Table 3. Except for identity and emotional representation, significant associations were found between the rest of the IPQ-R scores and the adherence scores. Treatment control and personal control were positively associated with most of the adherence scores. Timeline cyclical and consequences were negatively correlated with most subscales of the MAI; and coherence, timeline, balance attribution and risk factors were significantly correlated with most subscales of the IASM. The strongest correlation was found between the score of IASM and personal control.

The mean group differences of adherence variables and identity monitoring groups were analysed by ANOVA. Significant differences were found by symptoms after a hypertension diagnosis in the adherence scores of decrease type ($F = 3{\cdot}95$, $p = 0{\cdot}020$), increase type ($F = 3{\cdot}64$, $p = 0{\cdot}028$), the total score of the IASM ($F = 5{\cdot}13$, $p = 0{\cdot}007$), unhealthy diet ($F = 4{\cdot}02$, $p = 0{\cdot}019$) and exercise regimens ($F = 4{\cdot}02$, $p = 0{\cdot}019$). Post-hoc analyses of Scheffe found that those who were uncertain about symptoms presentation after a hypertension diagnosis had significantly

Table 3 Intercorrelations between the independent and dependent variables

	Adherence to medication				Adherence to self-management			
Items	Total	Increase	Decrease	Un-intentional	Total	Healthy diet	Unhealthy diet	Exercise
Identity	–0·09	–0·04	–0·10	–0·06	–0·04	–0·02	0·02	–0·07
Timeline	0·09	0·10	0·04	0·09	0·15*	0·10	0·10	0·02
Timeline cyclical	–0·20***	–0·15*	–0·17**	–0·18**	–0·05	0·05	–0·01	–0·05
Consequence	–0·12*	–0·04	–0·11	–0·11	–0·10	–0·02	–0·07	–0·09
Personal control	0·14*	0·12*	0·12	0·12*	0·30***	0·34***	0·06	0·11
Treatment control	0·20***	0·17**	0·17**	0·18**	0·18**	0·16*	0·11	0·01
Coherence	0·10	0·05	0·10	0·09	0·14*	0·16**	0·07	0·02
Emotional	–0·09	–0·01	–0·08	–0·09	–0·02	0·10	–0·08	–0·07
Psychological	–0·23***	–0·11	–0·20***	–0·23***	–0·17**	–0·10	–0·10	–0·19***
Balanced	–0·10	–0·09	–0·06	–0·07	–0·20**	–0·22***	–0·04	–0·09
Cultural	–0·19**	–0·14*	–0·18**	–0·16**	–0·30***	–0·25***	–0·19***	–0·05
Risk factor	–0·08	–0·01	–0·05	–0·11	–0·15*	–0·13*	–0·13*	–0·03

*$p < 0·05$; **$p < 0·01$; ***$p < 0·001$.

lower adherence scores in the decrease type, the total scores of the IASM, unhealthy diet and exercise than those without symptom experience. By the HBP prediction, those who could predict their HBP by symptom presentation had lower scores in the unhealthy diet ($F = 8·53$, $p < 0·001$) and total score of the IASM ($F = 3·48$, $p = 0·043$) than those who could not predicted or uncertain about their HBP prediction.

Hierarchical regression

The effects of the potential predictors of both the MAI and the IASM were separately examined in a hierarchical regression analysis. As shown in Table 4, patients who lived with their family were 3·8 times more likely to adhere to prescribed medications than those who lived alone. Patients with a history of hyperlipidaemia were 3·7 times more likely

Table 4 Hierarchical logistic regression analysis of adherence to medication

Step	Variables entered	OR (95% CI)	*p*-value	OR(95% CI)	*p*-value
1	Age	1·01 (0·97–1·03)	0·984	1·01 (0·97–1·04)	0·962
	Living alone (1 = yes; 2 = no)	2·28 (0·94–5·51)	0·068	3·81 (1·33–10·90)	0·013
	Drug number	1·06 (0·95–1·20)	0·654	1·09 (0·95–1·25)	0·214
	History of hypertension	0·99 (0·95–1·03)	0·312	0·99 (0·95–1·05)	0·843
	SBP (1 = ≤140; 2 = >140)	0·54 (1·38–7·26)	0·087	0·45 (0·20–1·03)	0·056
	History of hyperlipidaemia (1 = no; 2 = yes)	3·16 (1·38–7·25)	0·007	3·74 (1·45–9·65)	0·031
2	Identity			0·99 (0·90–1·01)	0·873
	Symptoms after (yes)			0·96 (0·33–2·82)	0·842
	Symptoms after (uncertain)			0·64 (0·22–1·84)	0·406
	Timeline			0·94 (0·81–1·08)	0·391
	Timeline cyclical			0·89 (0·77–1·04)	0·139
	Consequence			0·91 (0·78–1·05)	0·191
	Personal control			1·03 (0·91–1·17)	0·646
	Treatment control			1·30 (1·04–1·61)	0·017
	Coherence			0·99 (0·87–1·13)	0·921
	Emotional			1·14 (1·00–1·31)	0·056
	Balanced			1·08 (0·95–1·22)	0·257
	Psychological			0·85 (0·76–0·94)	0·002
	Cultural			0·83 (0·67–1·03)	0·097
	Risk factor			1·24 (1·05–1·47)	0·013

Block 1: $\chi^2 = 18·29$, $p = 0·006$, Cox and Snell $R^2 = 0·07$.
Block 2: $\chi^2 = 36·28$, $p < 0·001$, Cox and Snell $R^2 = 0·20$.

to report higher adherence score than those without the history. For the IPQ-R components, three variables were statistically significant and independent predictors of medication adherence: stronger beliefs of treatment control, less causal attributions to psychological factors and more attribution to causality of risk factors. The overall regression model was statistically significant ($\chi^2 = 36{\cdot}28$, $p < 0{\cdot}001$) and explained 20% of the variance in the medication adherence. The ratio of case numbers to independent variables for logistic regression in this study is 13:1, which meets the requirement of a preferred ratio of 10:1–20:1. The value of the Hosmer–Lemeshow goodness-of-fit ($\chi^2 = 5{\cdot}58$, $p = 0{\cdot}69$) indicated that the logistic model has adequate fit (Hosmer & Lemeshow 2000, Meyers *et al.* 2006).

For the model of adherence to self-management, at step 1, the set of demographic variables was entered and accounted for 13% ($F = 6{\cdot}83$, $p < 0{\cdot}001$) of the variance. Those patients who were older, have a longer history of hypertension and were well educated were more likely to adhere to self-management. At step 2, after controlling for the contribution of socio-demographic variables, significant predictors of adherence to self-management were: those who had symptoms ($\beta = -0{\cdot}20$, $p = 0{\cdot}009$), who were uncertain about symptoms presentation after a hypertension diagnosis ($\beta = -0{\cdot}30$, $p < 0{\cdot}001$), who were uncertain about HBP prediction by symptoms ($\beta = 0{\cdot}15$, $p = 0{\cdot}030$), personal control ($\beta = 0{\cdot}24$, $p < 0{\cdot}001$), balance attribution ($\beta = -0{\cdot}23$, $p = 0{\cdot}003$) and cultural attribution ($\beta = -0{\cdot}14$, $p = 0{\cdot}032$) (Table 5). The IPQ-R variables contributed an additional 21% of the variance ($F = 3{\cdot}90$, $p < 0{\cdot}001$). Both variance inflation and tolerance values were examined for the possible presence of multicollinearity. The values of variance inflation were ≤2 and the tolerances were greater than 0·43, revealing no violations of the regression assumptions (Meyers *et al.* 2006).

Table 5 Hierarchical regression analysis of adherence to self-management

		Self-management	
Step	Variables entered	Beta	Beta
1	Age	0·26***	0·30***
	History of hypertension	0·09	0·13*
	Accessibility (1 = yes; 2 = no)	–0·15*	–0·11
	Smoking (1 = no; 2 = yes)	–0·12	–0·10
	Education (1 = ≤6 year; 2 = >6 year)	0·23***	0·14*
2	Identity†		0·07
	Symptoms after (yes)‡		–0·20**
	Symptoms after (uncertain)		–0·30***
	HBP prediction (yes)§		0·03
	HBP prediction (uncertain)		0·15*
	Timeline		–0·04
	Timeline cyclical		0·08
	Consequence		–0·10
	Personal control		0·24***
	Treatment control		0·01
	Coherence		–0·01
	Emotional		0·15
	Balanced		–0·23**
	Psychological		–0·01
	Cultural		–0·14*
	Risk factor		–0·10
	R^2	0·13	0·34
	Adjusted R^2	0·11	0·28
	ΔR^2	0·13***	0·21***

Beta, standardised coefficients in the final model.
*$p < 0{\cdot}05$; **$p < 0{\cdot}01$; ***$p < 0{\cdot}001$.
†Identity is the symptom indicated by patients as being hypertension related.
‡§Items that used to assess identity monitoring were rated on a trichotomous response scale; 'no symptom' is the compared group.
‡Symptoms experienced after a hypertension diagnosis.
§HBP predictions by symptoms.

Discussion

The findings of the study indicated that after controlling the influence of clinical and demographic variable, illness perception had a significant influence on both adherence to the antihypertensive regimens and the self-management recommendations. The results were consistent with the theoretical prediction of the SRM (Leventhal *et al.* 1998, 2003) and the findings of previous studies (Patel & Taylor 2002, Ross *et al.* 2004). The significant predictive variables for adherence to prescribed medications and self-management greatly differed. Patients who had a hyperlipidaemia, were living with their families, believed that their hypertension could be cured or controlled, attributed their illness more to risk factors and less to psychological causality were more likely to adhere to prescribed medications. Comparatively, patients who were more likely to adhere to self-management were those who were older, were well educated, had a longer history of hypertension, lacked symptom experience after a hypertension diagnosis, were uncertain if they could predict their HBP by symptoms, had stronger beliefs of personal control over their hypertension and attributed their illness less to balance and cultural causality.

IR and adherence

Treatment control was a significant predictor of medication adherence, while personal control significantly predicted adherence to self-management. Similar to the findings of

previous studies, patients are more likely to be motivated to adhere to prescribed medications if they believe that treatment may bring beneficial effects to their situation (Meyer *et al.* 1985, Jessop & Rutter 2003) and the perception of an individual's ability to manage his/her health threat is a key to adhere to health recommendations (French *et al.* 2006). Positive beliefs of control may improve patients' sense of self-efficacy (Lau-Walker 2004) as well as problem-focused coping strategies and bring about positive adaptive outcomes (Hagger & Orbell 2003). This finding also provides empirical evidence to support significance of a distinction between personal control and treatment control in understanding the influence of illness perception on patient adherence (Moss-Morris *et al.* 2002). However, Horne and Weinman (2002) suggested that treatment representations are usually interplayed with patients' illness perception and are substantially predictive to medication adherence. Adding the variable of treatment belief in the framework of SRM may enhance the power of explained variance in studies of medication adherence (Horne *et al.* 1999). Further studies should be conducted in a more comprehensive design incorporating individual treatment representations in SRM studies of medication adherence.

However, some studies found that lower personal control to be predictive to medication adherence (Patel & Taylor 2002, Ross *et al.* 2004) rather than that of treatment control. The difference may result from the cultural consideration of collective social orientation in Chinese. In collectivistic cultures, maintaining social order and functioning of the group (such as family) are the primary concern in the society (Chen & Swartzman 2001, Chun & Chesla 2004). It is necessary for patients to respect the authoritative prescription for favourable outcomes of their disease. In addition, most of the patient did not live alone. The family members may help the patient to follow the prescribed medications in some way, so that role obligation of the patient may be fulfilled in the group as soon as possible.

Causal attribution and adherence

Previous studies did not find support for associations between adherence and perceived causes of hypertension (Meyer *et al.* 1985, Patel & Taylor 2002, Ross *et al.* 2004). Our findings indicate that both risk factor and psychological attributions were significantly predictive of adherence to the prescribed medication, while balance and cultural attributions were significantly and independently predictive of adherence to self-management. The findings indicate causal explanations of illness are necessary for adaptation to health threat in Chinese patients. It seems to imply that for the pharmacological therapy, the patients may assume the explanation of illness attribution from the viewpoint of health professionals (the Western view). Yet, the beliefs of causal attributions developed from the patients' social-cultural context are more influential predictive of adherence to self-management. This statement is correspondent with the argument of Kirmayer *et al.* (1994) that the Western patient tend to attribute illness causes to personal factors (such as attitudes, risk factors and psychological explanations), while people in Asian societies are more likely to attribute them to situational or contextual factors. However, cultural and balanced attributions are external. Patients who believe that their illness is caused by external factors may perceive there to be less controllability of behavioural outcomes (Jessop & Rutter 2003). As a result, the patient may be less likely to be motivated to adhere to their therapeutic regimens.

On the contrary, the internal factor of psychological attribution did predict its positive effect in the medication model. The patients who were less likely to believe that they had caused their hypertension by psychological attribution were more likely to adhere to the prescribed medication. Causal explanations not only represent the possibility of control over specific events, but may also be associated with social as well as moral responsibility and blame (Kirmayer *et al.* 1994). In Chinese, emotional inhibition and control may consider a sign of social competency and psychological maturation and self-control of emotional reactions is essential for establishing and maintaining a harmonious inner system as well as social relationships (Chen & Swartzman 2001). The less the one attributes his/her illness to psychological factors, the less psychological symptoms he/she may report (Kirmayer *et al.* 1994), the more capability he/she may be able to adapt to the health threat.

Identity and adherence

We did not detect any association between identity scores and adherence. The finding may be because of the low identity score and a fairly stable disease progression. Compared to the findings in patients with rheumatoid arthritis (7·26), chronic fatigue syndrome (9·39) (Moss-Morris & Chalder 2003), or diabetics (7·60) (Paschalides *et al.* 2004), the mean score of identity in this study was low (3·19). Some studies also reported no significant relationships between identity and adherence to therapeutic regimens if identity scores of patients were low (Horne & Weinman 2002, Byrne *et al.* 2005).

But, identity monitoring was found to be significant predictive to adherence to self-management. Those who reported more symptoms and uncertain whether they have symptom presentation were more likely less to adherent to

the therapeutic regimens. These findings indicate that some of the patient experienced symptoms after a hypertension diagnosis, but did not know if they are hypertension related (low identity scores). Despite its subjectivity, symptom monitoring does somehow affect patient adherence to self-management recommendations. According to the SRM, identity is defined by both an abstract label (such as hypertension) and concrete somatic symptoms (Leventhal *et al.* 1998). When experiencing symptoms, individuals will compare them with pre-existing ideas of illness attribution and link to a disease label. On the other hand, individuals will seek disease label for symptoms (Baumann & Leventhal 1985, Leventhal *et al.* 1998). Existence of the symptom monitoring implies that patients need to define the abstract concept such as hypertension in concrete observations (Meyer *et al.* 1985). However, from the perspective of health professionals, hypertension is asymptomatic. Once patients report symptoms after a diagnosis, a discrepancy between symptom attributions of patients and health professionals may arise. Eventually, patients may adopt the perspective of professionals temporarily, but they will continue to try to understand their symptom experience based on personal perceptions, not the illness entity (Pennebaker *et al.* 1982, Skelton 1991). The more symptoms a patient experience, the more conflicts may arise from symptom appraisal and a lower rate of adherence may result. Without recognition of the patients' lay views of symptoms or over emphasis of the asymptomatic nature of hypertension may incidentally disrupt patients' coherent system of self in the adaptive process (Leventhal *et al.* 2003) and create more barriers to adherence to therapeutic regimens.

Limitations

There are several limitations to the study. First of all, this was a cross-sectional study of a convenience sample drawn from the patients with hypertension in central Taiwan. Our findings might not be able to be generalised beyond this population. The causal relationships between illness perception and adherence also cannot be determined in this study design. Secondly, the mean adherence rate in this study was higher than the findings of national survey studies (World Health Organization 2003), but similar to the finding of clinical trials (Hamilton 2003). The high adherence rate may be due to the following reasons. The patients were attended by cardiovascular specialists with standardised treatment protocols for disease treatment over 10 years in the outpatient clinics of the teaching hospitals and their mean blood pressure was below 140/80 mmHg. Thus, they may more-closely adhere to physician prescriptions because of trust or satisfaction with the desirable therapeutic outcomes. With a mean duration of hypertension history of 10, the patient may also be more capable to manage their therapeutic regimens and lead to a higher adherence rate. However, further validation of the findings with a larger sample size is suggested.

The technique of a self-report survey may also possibly contribute to overestimation of the adherence rate. Self-report method for assessing medication adherence has been questioned about its accuracy and the electronic monitoring devices have been suggested to be the gold standard measure. Yet, some studies found that adherence assessing by self-report survey was significantly correlated with the results of the Medication Events Monitoring System (MEMS) (Hamilton 2003) and a self-report tool was useful to assess adherence in busy setting like clinical areas (Schroeder *et al.* 2006). The MAI identifies the most common types of non-adherence found in clinical areas and evidences of satisfactory factorial validity and concurrent validity of the tool were verified. A quick brief of non-adherence pattern in the clinical areas may allow the health professional to provide specific education needs for promoting patients' adherence to therapeutic recommendations.

Finally, the IPQ-R is a tool designed for generic use with all patients but not for patients with particular disease. Even though we have developed disease-specific symptoms and causal items for patients with hypertension, these items still may not sufficient to fully disclose the patients' belief about their illness.

Conclusions

The findings of the study found significant predictors of adherence to prescribed medication and self-management are very much different. It seems that patients adopt the view of the health professional when considering adherence to medication, while the patients' lay views of illness affect adherence to self-management. Health professionals need to acknowledge possible gaps between a layman's view and the professional viewpoints of the illness, when giving medical advices in clinical encounters. Special attention should be given to those who have somatic complaints and attribution of their hypertension to psychological, balance and cultural causes, even though those views are essentially subjective. Lack of recognition of the lay beliefs may contribute to non-adherence to therapeutic regimens and lead to ineffective control of the HBP. The findings of the study contribute to the research community distinctively by identifying the possible role of the identity and cultural specific attributions of illness in adherence to therapeutic regimens of patients with hypertension. Yet, the meaning of identity and its

effects on health behaviour decisions need to be further clarified.

Acknowledgements

This work was supported by grants from the Taichung Veterans General Hospital and Hungkuang University (TCVGH-HK-958008), Taichung, Taiwan, Republic of China.

Contributions

Study design, data collection and analysis and manuscript preparation: SLC, JCT.

References

Baumann LJ & Leventhal H (1985) I can tell when my blood pressure is up, can't I? *Health Psychology* **4**, 203–218.

Byrne M, Walsh J & Murphy AW (2005) Secondary prevention of coronary heart disease: patient beliefs and health-related behaviour. *Journal of Psychosomatic Research* **58**, 403–415.

Chang H (1983) Medical behavior and medical system of Taiwanese peasants: an anthropological inquiry (In Chinese). *The Taiwan Journal of Anthropology* **56**, 29–58.

Chang H (2000) *Illness and Culture: The Folk Medical Anthropology Research Gathers of Taiwanese*. Dao Siang Publisher, Taipei, Taiwan.

Chen X & Swartzman LC (2001) Health beliefs and experiences in Asian cultures. In *Handbook of Cultural Health Psychology* (Kazarian SS & Evans DR eds). Academic Press, San Diego, CA, pp. 390–411.

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jones DW, Materson BJ, Oparil S, Wright JT & Roccella EJ (2003) The seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* **289**, 2560–2572.

Chun KM & Chesla CA (2004) Cultural issues in disease management for Chinese Americans with type 2 diabetes. *Psychology and Health* **19**, 767–785.

Flack JM, Novikov SV & Ferrario CM (1996) Benefits of adherence to anti-hypertensive drug therapy. *European Heart Journal* **17**(Suppl. A), 16–20.

French DP, Cooper A & Weinman J (2006) Illness perceptions predict attendance at cardiac rehabilitation following acute myocardial infarction: a systematic review with meta-analysis. *Journal of Psychosomatic Research* **61**, 757–767.

Hagger MS & Orbell S (2003) A meta-analytic review of the common-sense model of illness representations. *Psychology and Health* **18**, 141–184.

Hagger MS & Orbell S (2005) A confirmatory factor analysis of the revised illness perception questionnaire (IPQ-R) in a cervical screening context. *Psychology and Health* **20**, 161–173.

Hamilton GA (2003) Measuring adherence in a hypertension clinical trial. *European Journal of Cardiovascular Nursing* **2**, 219–228.

Handler J (2005) Quality of life and antihypertensive drug therapy. *Journal of Clinical Hypertension (Greenwich)* **7**, 274–285.

Haynes RB, Sackett DL, Gibson ES, Taylor DW, Hackett BC, Roberts RS & Johnson AL (1976) Improvement of medication compliance in uncontrolled hypertension. *Lancet* **1**, 1265–1268.

Hodgson TA & Cai L (2001) Medical care expenditures for hypertension, its complications and its comorbidities. *Medical Care* **39**, 599–615.

Horne R & Weinman J (2002) Self-regulation and self-management in asthma: exploring the role of illness perceptions and treatment beliefs in explaining non-adherence to preventer medication. *Psychology and Health* **17**, 17–32.

Horne R, Weinman J & Hankins M (1999) The Beliefs about Medicines Questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and Health* **14**, 1–24.

Hosmer DW & Lemeshow S (2000) *Applied Logistic Regression*, 2nd edn. Wiley-Interscience Publication, New Jersey.

Hu W-Y, Tseng C-T, Chiu T-Y & Chao YY-M (1996) The effectiveness of a comprehensive intervention to improve drug compliant behaviors and blood pressure control for hypertensive patients in community. *Chinese Journal of Family Medicine* **6**, 169–179.

Jessop DC & Rutter DR (2003) Adherence to asthma medication: the role of illness representations. *Psychology and Health* **18**, 595–612.

Kirmayer LJ, Young A & Robbins JM (1994) Symptom attribution in cultural perspective. *Canadian Journal of Psychiatry* **39**, 584–595.

Kjellgren KI, Ahlner J, Dahlof B, Gill H, Hedner T & Saljo R (1998) Perceived symptoms amongst hypertensive patients in routine clinical practice – a population-based study. *Journal of Internal Medicine* **244**, 325–332.

Kyngas H & Lahdenpera T (1999) Compliance of patients with hypertension and associated factors. *Journal of Advanced Nursing* **29**, 832–839.

Lau-Walker M (2004) Relationship between illness representation and self-efficacy. *Journal of Advanced Nursing* **48**, 216–225.

Leventhal H, Leventhal EA & Contrada RJ (1998) Self-regulation, health and behavior: a perceptual-cognitive approach. *Psychology and Health* **13**, 717–733.

Leventhal H, Brissette I & Leventhal EA (2003) The common sense model of self-regulation of health and illness. In *The Self-Regulation of Health and Illness Behaiour* (Cameron LC & Leventhal H eds). Routledge, Taylor & Francis Book, London, pp. 42–65.

Meyer D, Leventhal H & Gutmann M (1985) Common-sense models of illness: the example of hypertension. *Health Psychology* **4**, 115–135.

Meyers LS, Gamst G & Guarino AJ (2006) *Applied Multivariate Research: Design and Interpretation*. Sage Publications, Thousand Oaks, CA.

Moss-Morris R & Chalder T (2003) Illness perceptions and levels of disability in patients with chronic fatigue syndrome and rheumatoid arthritis. *Journal of Psychosomatic Research* **55**, 305–308.

Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD & Buick D (2002) The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health* **17**, 1–16.

Pan WH, Chang HY, Yeh WT, Hsiao SY & Hung YT (2001) Prevalence, awareness, treatment and control of hypertension in

Taiwan: results of Nutrition and Health Survey in Taiwan (NAHSIT) 1993–1996. *Journal of Human Hypertension* **15**, 793.

Paschalides C, Wearden AJ, Dunkerley R, Bundy C, Davies R & Dickens CM (2004) The associations of anxiety, depression and personal illness representations with glycaemic control and health-related quality of life in patients with type 2 diabetes mellitus. *Journal of Psychosomatic Research* **57**, 557–564.

Patel RP & Taylor SD (2002) Factors affecting medication adherence in hypertensive patients. *The Annals of Pharmacotherapy* **36**, 40–45.

Pennebaker JW & Watson D (1988) Blood pressure estimation and beliefs among normotensives and hypertensives. *Health Psychology* **7**, 309–328.

Pennebaker JW, Gonder-Frederick L & Stewart H (1982) Physical symptoms associated with blood pressure. *Psychophysiology* **19**, 201–210.

Ross S, Walker A & MacLeod MJ (2004) Patient compliance in hypertension: role of illness perceptions and treatment beliefs. *Journal of Human Hypertension* **18**, 607–613.

Schroeder K, Fahey T, Hay AD, Montgomery A & Peters TJ (2006) Adherence to antihypertensive medication assessed by self-report was associated with electronic monitoring compliance. *Journal of Clinical Epidemiology* **59**, 650–651.

Skelton JA (1991) Laypersons' judgments of patient credibility and the study of illness representations. In *Mental Representation in Health and Illness* (Skelton JA & Croyle RT eds). Springer-Verlag, New York, pp. 108–126.

Velligan DI, Lam Y-WF, Glahn DC, Barrett JA, Maples NJ, Ereshefsky L & Miller AL (2006) Defining and assessing adherence to oral antipsychotics: a review of the literature. *Schizophrenia Bulletin* **32**, 724–742.

Vermeire E, Hearnshaw H, Van Royen P & Denekens J (2001) Patient adherence to treatment: three decades of research: a comprehensive review. *Journal of Clinical Pharmacy and Therapeutics* **26**, 331–342.

Weinman J, Petrie KJ, Moss-Morris R & Horne R (1996) The illness perception questionnaire: a new method for assessing the cognitive representation of illness. *Psychology and Health* **11**, 431–445.

World Health Organization (2003) *Adherence to Long-Term Therapies: Evidence For Action*. WHO Library Cataloguing-in-Publication Data, Geneva, Switzerland.

Yiannakopoulou E, Papadopulos JS, Cokkinos DV & Mountokalakis TD (2005) Adherence to antihypertensive treatment: a critical factor for blood pressure control. *European Journal of Cardiovascular Prevention and Rehabilitation* **12**, 243–249.

