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Comparison of Relaxation Techniques, Routine Blood Pressure Measurements, and Self-Learning Packages in Hypertension Control[1]

LEE-LAN YEN, SC.D.,[2] WALTER K. PATRICK, M.D., PH.D.,* AND WEI-CHU CHIE, PH.D.†

*Institute of Public Health and †Institute of Epidemiology, National Taiwan University, No. 1, Section 1, Jen-Ai Road, Taipei, Taiwan, Republic of China 10018; and *Department of Community Health Development, School of Public Health, University of Hawaii, Honolulu, Hawaii 96822*

Background. **Even though the effectiveness of meditation and relaxation skills is controversial in blood pressure control, extensive field studies are limited. A national study targeting 50 communities randomly selected from northern Taiwan was conducted to test and compare the effectiveness of hypertension control incorporating three strategies.**

Methods. **Five hundred ninety hypertensives identified from 3,128 adults at a screening survey among the 50 communities were invited to participate in the study and were randomly assigned to three treatment modalities, (a) relaxation techniques training at home, (b) routine blood pressure measurement by a health professional, and (c) reading self-learning packages, or to a control group.**

Results. **After a 2-month intervention period, the three treatment groups showed a significant reduction in systolic blood pressure levels compared with the control group (11.O mm Hg for group 1, 9.2 mm Hg for group 2, and 5.1 mm Hg for group 3). The relaxation group had the most significant reduction in systolic blood pressure levels, followed by the routine blood pressure monitoring group and the self-learning group. However, the effect of relaxation training at home was not significantly greater than routine blood pressure measurement by a health professional.** © 1996 Academic Press, Inc.

INTRODUCTION

Chronic diseases have become the major cause of death in the last decades in Taiwan. Cerebrovascular accidents, heart disease, and hypertensive disease are now the second, fourth, and seventh leading causes of death, respectively.[1,2] As hypertension is considered a major risk factor for cardiovascular and, particularly, for cerebrovascular accidents,[3,4] hypertension control is one of the major health challenges facing urban and rural populations in Taiwan.[5]

Chang et al. conducted two nationwide studies on death from cerebrovascular disease (CVD) for 1952–1954 and 1962–1964 in Taiwan[6] and found that populations in the northern regions of Taiwan had higher death rates from CVD than populations in the southern and eastern regions. The authors indicated that age-adjusted CVD death rates were significantly higher in more urbanized areas than in less urbanized areas.

Another nationwide baseline study conducted in 1988 prior to a multiple communities hypertension clinical trial revealed that age-adjusted prevalence rates were 18.7% for females and 16.9% for males over age 18 years. The prevalence rates of hypertension increased with increasing age for both genders, with males having a higher rate before the age of 50 years and a lower rate after the age of 50 than females. A recent study has reported similar findings.[8] These studies concluded that (a) the prevalence rate of hypertension increased with increasing age, (b) the prevalence rate in the northern part of Taiwan was higher than that in the south, and (c) metropolitan precincts revealed a higher prevalence rate than rural townships.

The relationship between urbanization, stress, and hypertension has been well documented. Sensory deprivation,[9] social isolation,[10] noise,[11] crowding,[12] high temperatures,[13] and air pollution[14] have been suggested as factors associated with stress. The urban environment is generally characterized by high levels of environmental stimulation. The concept of psychosomatic medicine has made important contributions in the research laboratory when investigating the relationship between stress and diseases. For example, the link between eight measures of perceived stress and angina, hypertension, and other risk factors has been reported.[15]

Although there is strong evidence that pharmacologic treatment can save lives by lowering blood pressure, concerns persist about the potential adverse effects of such treatment and the necessity for a long-term course of medication. Chen et al.[7] found that the treatment compliance rates of hypertensives were

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[2] To whom reprint requests should be addressed.

81.6% for patients referred to clinical studies and 50.6% for nonreferrals in general clinics. This demonstrates the effectiveness of high-credibility professional communication and sustained follow-up of university clinic study subjects compared with those attending general clinics. The patient's major reasons for noncompliance were "feeling better," "having no symptoms or signs," and/or "being too busy to visit the doctor."

The problem of low perceived risk in asymptomatic conditions like hypertension leading to complacency and noncompliance requires strategic behavior modification techniques.[16] Thus, nonpharmacologic approaches in the treatment of essential hypertension have been explored. In a meta-analysis of the relaxation therapy literature, Jacob et al. reported quite encouraging results of relaxation therapy in the treatment of hypertension.[17] However, in 1991, Jacob et al. updated the original meta-analysis and indicated that different impressions regarding the efficacy of relaxation therapy are reached depending on whether all studies or only methodologically sophisticated studies are examined.[18]

There seems to be an emerging consensus in the United States that relaxation therapy has no genuine treatment effect for hypertension. Several studies have reported on the effects of repeated monitoring of blood pressures in normotensives and hypertensives.[19,20] Hence, experimental study on the efficacy of behavioral techniques as a tool for primary prevenion of hypertension is warranted.

Primary prevention of hypertension can be achieved by techniques aimed at modifying the lifestyles of the general population. Modifying lifestyles, including the promotion of a healthy diet by lowering the intake of sodium and calorie content and promotion of physical activity and moderation in alcohol consumption, has been successfully utilized for the treatment of mild hypertension. The evidence is less convincing for stress management.[16] Rapid urbanization, dramatic sociocultural shifts and extensive changes in family structure have occurred in Taiwan.[21] Stress and hypertension are prevalent in Taiwan as found in epidemiological studies conducted in various communities.[6,7,22–24] However, behavioral techniques for hypertension control have never been attempted in Taiwan. The purpose of this study, therefore, was to examine the effectiveness in hypertension control of using behavioral techniques and conventional teaching strategy in northern Taiwan where the condition is more prevalent.

MATERIALS AND METHODS

Subjects

An initial hypertension prevalence screening survey was conducted among 50 communities randomly selected from northern Taiwan. Based on a two-stage sampling technique proportionate to population size and respondent selection, 2,000 families were identified and 3,128 adults were selected using a stratified probability protocol providing for variation in family size and gender difference. According to the study protocol, hypertensives were defined as those with diastolic blood pressure (BP) greater than or equal to 90 mm Hg or systolic BP greater than or equal to 140 mm Hg. In addition, those who were taking antihypertensive medication at the screening were also included.[25,26]

The initial screening showed that the age-standardized hypertension prevalence rates were 27.2% for males and 13.6% for females. The screening survey thus identified 590 persons as potential participants for the intervention including 220 adults (8.7%) with BP levels ≥160/95 mm Hg and 304 adults (12.0%) with BP levels ≥140/90 mm Hg but <160/95 mm Hg. Additionally, 66 persons who had been diagnosed as having hypertension by their physicians, but with BP measured as under 140/90 mm Hg at the screening, were also included.

Fifty communities were randomly assigned into one of the following study groups: (1) relaxation techniques training at home, (2) routine BP measurement by health professional, (3) reading self-learning packages, (4) without intervention, and (5) without intervention. Groups 4 and 5 were combined to serve as the control group. All eligible potential subjects were invited to participate in the intervention. There were 120, 111, 124, and 235 potential participants in groups 1, 2, 3, and control, respectively.

Intervention Procedures

There was a 2-month intervention period for each participant once he or she agreed to participate. During the intervention period, the subjects of the relaxation group were visited once a week for relaxation training at their own homes. The subjects of the BP measure group were encouraged to visit the neighborhood service "sites" at least twice a week to receive their BP checks by professionals. Subjects of the self-learning group were encouraged to read the pamphlets and return the answers to a quiz to the study team. Subjects of the control group received no educational activity until after the completion of the study. All participants in both intervention groups and control received a preintervention data-collection interview 1 month prior to the intervention and a postintervention data-collection interview 1 month after the intervention. Twelve college students were recruited and trained to conduct interviews. They were kept blind to the subject's study group at all interviews. They were not involved in any of the interventions.

Relaxation techniques training at home. Intervention for this group involved four 1–hr and one-on-one treatment sessions at the subject's home by 10 trained and certified nurses. The participants were instructed individually on relaxation techniques to tense and relax their muscles.[27] This was reinforced by a 30-min taped message of progressive relaxation procedures from a physician. Relaxing music included in the tape enabled the subjects to control their breathing following the rhythm. The subjects were also encouraged to perform Buddhist meditation. Using a digital sphygmomanometer, the subjects were able to monitor their BP changes responding to their physiological state of relaxation. All subjects were encouraged to practice the relaxation techniques at home daily.

Routine BP measurement by health professional. During intervention sessions, 10 sites with physicians volunteered their services and were made available without any charges to the study subjects. Subjects were notified of site locations and advised to have their BP checked regularly, as often as they wanted. The BP records were maintained at the sites by physicians, nurses, or pharmacists and by the subjects for their record as well.

Reading self-learning packages. One pamphlet with pictures and instructions on hypertension control was mailed weekly to the subjects during a 6-week period. Subjects were encouraged to read the pamphlet and answer questions on an attached quiz sheet. An incentive (multiuse pen) was offered when all six quiz sheets were returned.

Control group. During intervention sessions, the subjects in the control group were not exposed to any of the interventions. However, they received the self-learning packages after the posttest was conducted.

Measures

Blood pressure. The pre- and postintervention tests of BP for all subjects were conducted at their homes by the interviewers using a mercury sphygmomanometer. Since the interviewers were college students who were unaware of subjects' group assignment and were different from the physicians at the clinics, the potential for differential "white coat" effects on BP levels might not exist.

Following the procedures suggested by the American Heart Association,[28] each individual's BP was measured in the right arm after 5 min of rest in a quiet room. Two readings were taken at each interview with the subject: one prior to the interview and the other subsequently. These readings were averaged for data analysis and comparison. During the intervention, subjects from the relaxation group had their BP measured at pretreatment, intertreatment, and posttreatment by public health nurses at 3-min intervals. At the posttest, the averaged BP readings were derived by procedures similar to pretest.

Self-reported measures. Both preintervention and postintervention interviews requested background information, personal lifestyle, and experiences related to blood pressure control. During treatment, the subjects of the relaxation group were requested to record the degrees of tension (on a scale of 0 to 10) prior to and following the training courses.

RESULTS

Differences between Dropouts and Study Subjects

This intervention study was conducted 1 year after the screening survey. Among the 590 potential participants, 198 did not participate in the interview at preintervention due to change of residence and/or refusal. Even though the study team sent each of the subjects an invitation letter detailing the nature of treatment and the process of participation, only 66.4% of the selected subjects responded (392 subjects received preintervention interview). Of these 392 subjects, 299 (76.3%) completed the postintervention interview. However, there was no significant difference in dropout rates among the four study groups ($\chi^2 = 1.01$, $P > 0.10$).

Table 1 compares dropouts with subjects who completed the study. Except for systolic BP, no significant difference was noted in any preintervention variable related to the subjects' backgrounds, lifestyles, and blood pressure control. The dropouts had a lower systolic BP level than the study subjects (140.0 mm Hg vs 145.3 mm Hg). Most of the dropouts refused to participate in the sequential activities as they perceived themselves to be healthy with no need for therapy.

Differences in Preintervention Data among Groups

The BP levels at posttest of the participants that remained in the study are shown in Table 2. Before evaluating the intervention effects in BP changes, a multiple regression with stepwise procedure was utilized to select the optimal independent variables that would significantly predict the variation of subjects' BP levels.

Fourteen variables were entered into the regression analysis (sex, birthplace, education, age, urbanization, high-BP knowledge, smoking, drinking, exercising, emotion, high sodium intake, sleeping, age when diagnosed as hypertensive, frequency of BP measures). Only age and urbanization were significant predictors for systolic BP. These two variables accounted for 22% of the variability in systolic BP. The regression model is systolic BP = 106.51 + 0.85 (age) − 1.67 (urbanization).

TABLE 1
Comparison of Differences in General Characteristics between Dropout and Completed Subjects

	Dropout (n = 93)	Completed (n = 299)	P
Background			
Sex			0.41
Male (%)	68.8	64.2	
Female (%)	31.2	35.8	
Birthplace			0.06
Taiwan (%)	65.5	76.5	
Other (%)	34.5	23.5	
Education			0.57
≤6 years (%)	62.4	65.6	
>6 years (%)	37.6	34.5	
Mean age (SD)	51.0 (14.8)	54.5 (14.5)	0.06
Mean level of urbanization (SD)	4.8 (2.6)	5.2 (2.8)	0.31
Mean score of high-BP knowledge (SD)	4.0 (1.2)	4.1 (1.2)	0.43
Lifestyle			
Smoking (%)	43.0	32.5	0.06
Drinking (%)	28.3	35.8	0.18
Exercising (%)	24.4	30.0	0.13
Emotion (%)	47.8	39.1	0.13
Mean score of high sodium intake, meals/week (SD)	4.5 (6.2)	5.6 (9.1)	0.21
Mean sleeping time, hr/day (SD)	6.9 (1.6)	7.1 (1.4)	0.30
Blood pressure control			
Mean age when diagnosed as hypertensive (SD)	50.7 (9.5)	54.1 (12.7)	0.14
Mean frequency of BP measures, times/year (SD)	16.5 (28.7)	13.0 (21.6)	0.31
Mean SBP level at pretest (mm Hg) (SD)	140.0 (18.6)	145.3 (22.5)	0.03*
Mean DBP level at pretest (mm Hg) (SD)	86.9 (13.3)	89.3 (13.3)	0.14

Note. SBP, systolic blood pressure; DBP diastolic blood pressure.
* Group difference significant, $P < 0.05$.

A comparison between the distributions of age and urbanization among groups revealed no significant difference. Therefore, these factors which might interfere with the effects of the interventions were controlled for in the following tests.

Intervention Effects on BP Control

Analysis of covariance, with BP level at the preintervention as the covariate, was used to test the treatment group differences in postintervention data. The dependent variables used to measure the intervention effectiveness on BP control were systolic and diastolic BP levels (Table 3). Change in systolic BP was significantly greater for subjects of the three treatment groups (11.0, 9.2, and 5.1 mm Hg) than that of the control group. Additionally, the subjects of the relaxation group showed a greater significant difference in systolic BP (5.9 mm Hg) than did those of the self-learning group, and a greater significant difference in diastolic BP (4.7 mm Hg) than did those in the control group. These results revealed that relaxation training through home visits was more effective in decreasing the subjects' BP than the self-learning approach.

The proportion of subjects who had their BP decreased significantly was compared among the groups (Table 4). A decrease of 10 mm Hg or greater in systolic BP and 5 mm Hg or greater in diastolic BP was used as the criterion for defining a significant decrease in BP during intervention. There was a significant difference in systolic BP among the four ($\chi^2 = 9.579$, $P < 0.005$). The proportions of decrease in systolic BP for the relaxation training group (50.0%) and self-learning group (47.8%) were significantly higher than that of controls (29.1%). Overall, the three interventions employed in this study produced various degrees of positive effects on decreasing systolic BP, especially for the treatments of relaxation and self-learning.

DISCUSSION

Some of the factors jeopardizing the validity of the experimental designs must be considered before discussing the intervention effects. Such problems include the dropout rates of subjects from the groups and the subjects' BP levels at postintervention regressing toward the mean of the population. Since equivalent groups were included in the study and no significant difference in dropout rates (21.0–26.3%) occurred among the assigned groups,[29] experimental mortality (or differential loss of respondents from the comparison groups) and statistical regression (operating where groups have been selected on the basis of their extreme BP levels) could be controlled.

The dropouts were those who had lower BP levels, suggesting that risk information was not effective. Patients falling into the "mild hypertension" group might not pay sufficient attention to the potential risk of uncontrolled hypertension. Although lifestyle modification had been recommended to them, the impact of high-BP risk for cardiovascular disease lacked sufficient emphasis and urgency. The Joint National Committee Fifth Report[30] provides a new classification of adult blood pressure based on risk. The traditional terms "mild hypertension" and "moderate hypertension" failed to convey the major impact of high BP on risk for CVD.

A previous study[31] conducted in Cuba showed a 50% response rate to a letter of invitation to visit the hypertension clinic and a 81.4% completion rate in the intervention among the respondents to the invitation. The study of Chen et al.[7] reported a similar attendance rate (81.4%) for those who were referred to the general clinics, but a higher rate (90.4%) for those referred to the study clinics. Significant gains in the completion

TABLE 2

Blood Pressure Levels of Study Groups at Pretest and Posttest

	SBP (mm Hg)			DBP (mm Hg)		
Group	Pretest	Posttest	Adjusted posttest	Pretest	Posttest	Adjusted posttest
Relaxation	141.5	132.7	134.4	88.3	83.8	84.2
BP measure	140.2	134.0	136.6	85.4	84.9	86.1
Self-learning	147.3	137.6	137.2	89.9	85.0	84.2
Control	148.3	142.2	140.7	89.2	89.0	88.0

Note. SBP, systolic blood pressure; DBP, diastolic blood pressure.

rates of intervention studies would be possible if creative public health strategies and substantial resources were committed.

Results obtained from this study indicated that significant changes occurred in treatment groups' (especially for the subjects of the relaxation and self-learning groups) systolic BP level compared with control group. Overall, the effect of intervention was rather modest. The results also indicated that the impact on the group with relaxation skills training at home was not significantly better than on the group with blood pressure measurement by a health professional. "White coat" or "office" hypertension is often defined as the transient rise or elevation of BP that occurs in the medical setting. One study[32] found that the likelihood of myocardial infarction is increased among patients with higher diastolic BP as measured by a physician rather than a nurse. In this study, the measurements were performed by a nurse at the subject's home, and so the white coat phenomenon might have been circumvented.

Although previous studies[17,33] have demonstrated encouraging results in hypertension control using relaxation therapy, a number of studies have failed to demonstrate the effectiveness of the relaxation techniques.[34–39] Therefore, the 1988 Joint National Committee Report[40] retreated from the position that relaxation therapy can result in significant and consistent blood pressure reductions. Instead, the committee suggested that these promising methods have yet to be subjected to rigorous clinical trial evaluation and should not be considered definitive treatment for patients with high BP.

Results of this research may, therefore, have implications for the design of behavioral strategies to enhance the effectiveness of nonpharmacologic treatments. In order to support the hypothesis that behavioral treatments assist patients in reducing BP levels, among the Taiwanese, further studies of behavioral treatments should be replicated.

Noncompliance of subjects might have been a problem leading to decreased effectiveness of the intervention, implying that vigorous strategies should focus on relapse prevention. When subjects were encouraged to have their BPs measured at the arranged sites including clinics, pharmacies, or health stations, noncompliance was also a problem. Although the primary purpose of organizing a BP measurement site involved measuring and interpreting BP, the site could also provide health education, counseling, screening, medical referral, and social services that meet people's interests and demands.

TABLE 3

Comparison of Differences between Adjusted Means of Blood Pressure Levels among Groups at Posttest

	Difference between adjusted means (95% CI)	
Groups	SBP (mm Hg)	DBP (mm Hg)
Rel vs Ctrl	11.0 (6.2,15.7)*	4.7 (0.9,8.5)*
BP vs Ctrl	9.2 (4.6,13.7)*	3.4 (−0.1,7.0)
S-L vs Ctrl	5.1 (0.6,9.6)*	3.1 (−0.5,6.7)
Rel vs BP	1.8 (−3.3,6.9)	1.3 (−2.8,5.4)
Rel vs BP	5.9 (0.8,11.0)*	1.5 (−2.5,5.6)
BP vs S-L	4.1 (−0.8,9.0)	0.3 (−3.6,4.2)

Note. SBP, systolic blood pressure; DBP, diastolic blood pressure; Rel, relaxation; Ctrl, control; BP, blood pressure measure; S-L, self-learning.

* $P < 0.05$.

TABLE 4

Comparison of Proportions of Subjects Having Significant Decreases in Blood Pressure among Groups

Groups	Decrease in SBP ≥10 mm Hg [number (%)]	Decrease in DBP ≥5 mm Hg [number (%)]	Total [number (%)]
Relaxation	28 (50.0)	27 (48.2)	56 (100.0)
BP measure	26 (40.6)	25 (39.1)	64 (100.0)
Self-learning	33 (47.8)	33 (47.8)	69 (100.0)
Control	32 (29.1)	39 (35.4)	110 (100.0)
χ^2 value	9.579**	3.996	

Note. Relaxation vs control, $\chi^2 = 11.69$**. BP measure vs control, $\chi^2 = 2.43$. Self-learning vs control, $\chi^2 = 6.43$*. SBP, systolic blood pressure; DBP, diastolic blood pressure.

* $P < 0.025$.

** $P < 0.005$.

CONCLUSION

Adopting intervention activities into community programs may be an important strategy in the primary prevention of hypertension and in the monitoring of progress and promotion of adherence of hypertensive persons already receiving therapy. Although hypertension prevention and control is challenging, the potential benefit makes this an important national goal. The desired lifestyle changes are cost saving and potentially feasible. We should use media extensively to disseminate the risk information to create awareness as the starting point toward behavioral change among targeted community populations. Since the relaxation, BP-measurement, and self-learning techniques were found to be moderately effective in this study, it is worth considering these methods of BP control.

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