Proceedings of the 1990 International Symposium on Health, Environment, and Social Change: Emerging Health Problems in Rapid Socioeconomic Development, 1990.

INTERVENTION ON BLOOD PRESSURE CONTROL IN COMMUNITIES

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ABSTRACT:

In order to investigate the effect of health intervention on the control of adult blood pressure, 590 cases residing in 50 communities in northern Taiwan were selected. Those cases with BP levels ≥ 140/90 mmHg were randomly assigned to a relaxation, BP-measurement, self-learning, or comparison groups. Intervention activities had been implemented in 1989. It was found that: (1)the dropout rates of the groups were high, but no significant difference among groups was found; (2)three interventions including relaxation, BP-measurement, and self-learning showed significant reductions in systolic BP; (3)some of the subjects in the self-learning group significantly changed their BP from abnormal to normal. Overall, the introduction of educational strategies for blood pressure control in communities was ascertained.

INTRODUCTION

Hypertension control represents a major health problem challenging the medical profession and public health workers in Taiwan. Most previous studies[1-2] have focused on the hypertension problems of specific racial groups, vocational groups, or geographical areas. The first study that addressed the hypertension problem of the whole province was published in 1973. This study [3],using age-adjusted death rates from cerebrovascular disease (CVD) for 1952-54 and for 1962-64, summarized the geographical distribution of mortality from CVD in Taiwan. It was noted that the death rates of CVD were higher in the northern regions of Taiwan but lower in the southern and eastern regions. This study suggested that a significant association exists between the CVD death rate and the degree of urbaniaztion.

Another epidemiological study of hypertension in Taiwan was conducted in 1976[4-5]. It was found that the prevalence of hypertension was 14.1% for those over 18 years of age. About 95.5% of hypertensives were undetected, untreated, and uncontrolled. For those hypertensives who were untreated, the annual death rate was 39.4%. Mortality from strokes among untreated hypertensives was 21 times higher than that of normotensives. It was also found that about 72% of cerebral hemorrhage and thrombosis were accompanied by hypertension.

The most recent nationwide eqidemiological investigation on hypertension was conducted in 1988[6]. The age-adjusted prevalence rate for females over 18 was 18.7% while that for males was 16.9%. Similar to previous studies, this study concluded that the prevalence rate of hypertension increased with age, that the prevalence rate in the northern part of Taiwan was higher than that in the southern part, and that metropolitan precincts showed a higher prevalence rate than urban and rural townships.

Cerebrovascular accidents (CVA), heart disease (HD), and hypertensive disease ranked respectively as the 2nd, 4th, and 7th leading causes of death in Taiwan[7]. Chronic disease has become the major cause of death in Taiwan since 1980[8]. Hypertension is a universal risk factor of CVA and HD. Furthermore, its complications result in increased medical expenditures, lost personal income,

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and death. Therefore, hypertension control is a major issue in health care systems.

Previous studies indicate that the hypertension control program, early detection, and treatment is imperative, especially for residents of northern Taiwan. Although pharmacotherapy is well established as the standard treatment for essential hypertension,many patients complain about the side effect of medications and the necessity of a long-term course of medications. Chen's study[6] found that the treatment compliance rate of hypertensives who were referred to the clinics especially designed for the study was 81.6% and that at health insurance clinics was 50.6%. The patient's major reasons for non-compliance were "feeling better", "having no more symptoms or signs," and/or " being too busy to visit the doctor".

The recognition that some factors promoting hypertension largely result from an unhealthy litestyle has led many to the conclusion that the primary prevention and control of hypertension must begin with the modification of the individual's behavior. The U.S. Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure[9] recommends nondrug therapies, including biofeedback and relaxation as the initial treatment for individuals with uncomplicated, mild hypertension. However, behavioral approaches to hypertension control have never been studied in Taiwan. As a preliminary attempt to examine the effects of a community-based education program for hypertension control, behavioral and traditional teaching methods were designed and conducted in 50 communities selected from northern Taiwan. The purposes of this study were:(1)to find out which factors significantly affected the subjects' blood pressure (BP) levels at pretest; (2)to examine the group differences of data at pretest among experimental and control subjects who completed both pretest and posttest; and (3) to evaluate the effects of various interventions.

Meterials and Methods

Based on a two-stage sampling proportionate to population size and respondent selection, 2000 families including 3128 adults were chosen in 1988 from 50 communities of northern Taiwan. Reports on the analysis of adult health behavior could be found elsewhere[10,11]. A continuing program focusing on hypertension control was conducted in 1989. Subjects of this study were selected according to their BP levels which were measured during the previous survey. 220 cases (8.7%) had BP levels>160/95 mmHg, 304 cases (12.0%) had BP levels> 140/90 mmHg, but the cases with under 160/95 mmHg were chosen. In addition, 66 cases who had been diagnosed as having hypertension but whose BP was measured as under 140/90mmHg were also selected in total, 590 cases were drawn.

Experimental Design

Three interventions (biofeedback relaxation training at home, BP-measurement at the specified sites, and self-learning by reading printed materials) and a control group formed the various treatment groups. 50 communities selected from northern Taiwan were viewed as 50 clusters for randomization. Due to budget limitation, the 50 communities were randomly assigned to 5 groups first. Three groups were then randomly assigned to one of the treatment groups and the rest to the control group.

TREATMENT

Biofeedback Relaxation at Home. The participants were instructed to tense and relax their muscle groups[12]. They were also trained to use the information on their BP change to control their bodily processes. Using a digital sphygmomanometer (model UA-741, Takeda Medical Co.), moment-to-moment changes in these processes were monitored. All subjects were encouraged to practice the relaxation skills at home daily. Intervention for this group involved four one-hour treatment sessions. Before the intervention sessions began, 10 nurses working at health stations in communities which had been assigned to this group attended a two-day training course. They needed not only to master the relaxation skills, but also to familiarize themselves with the teaching methods. After training, each public health nurse brought a tape recorder and a number of recorded-tapes back to their communities. During the intervention period, they visited the subjects at their home at the appointed time.

BP-Measurement at Specified Sites. During the intervention period, subjects of this group were informed to have their BP measured freely at 10 sites. The BP records were kept at the sites and given to the subjects. In order to set up the BP-measurement sites, the researchers visited clinics, drug stores, as well as Health Stations. Volunteers at 10 sites agreed to offer free services to the subjects.

Self-Learning by Reading Printed Materials. A set of pamphlets focusing on hypertension control included six different topics. Each topic was mailed weekly to the subjects in the group. In order fo evaluate the subjects progress, we encouraged the subjects to read the contents and fill out the attached answer sheets by sending them a gift when they returned all of the completed answer sheets.

MEASURES

Blood pressure. A mercury sphygmomanometer was used to measure the arterial BP. At the pretest, two readings of the subjects' BP were taken by investigators on each of two occasions. These readings were then averaged for data analysis and comparison. During intervention, subjects' of the "relaxation" group had their BP measured at pre-treatment, inter-treatment, and post-treatment by public health nurses at three-minute intervals. A series of BP readings were used as informative feedback to the learner. At the posttest, the averaged BP readings were derived from the same procedures as at the pretest.

Selt-report measures. The questionnaire included the following sections: (1)demographic factors; (2)personal health behavior; (3) hypertension control behavior; and (4)high blood pressure (HBP) knowledge test. The subjects were asked to complete this questionnaire at the pretest and the posttest. They were also asked to fill in a treatment evaluation questionnaire at the posttest. During treatment, subjects of the relaxation group were asked to record the degree of tension which they perceivecd prior to and following the training session.

PROCEDURE

After a two-month preparation on treatment design and arrangement. people involved with the study were recruited and trained for data collection and intervention implementation. A group ot college students, investigators of this study, who collected data both at the pretest and the posttest were kept "blind" to the subjects' treatment group. During intervention, the subjects of the "relaxation" group were visited for treatment at their own homes; the subjects of the "BP-measurement" group needed to visit the neighboring "site" frequently for BP readings; and the subjects of the "self-learning" group were encouraged to read the pamplets and mail the answer sheets back to the researchers. The treatment lasted two moths. A pretest and a posttest were conducted one month prior to and after the treatment respectively.

RESULTS

1. Loss of Subjects

Male and female hypertensives aged 18

years and older who had not been interviewed in the last survey conducted in northern Taiwan were invited to participate in this intervention study. Although the interval between this study and the previous survey was less than one year, the dropout rate soared far beyond the researchers' estimation. Table 1 shows the number of subjects of four treatment groups at various stages. At the pretest, 66.4% of the selected subjects were visited. 33.6% of the subjects could not be approached because they had moved, died, gone abroad, worked far from home, or refused. Even though the researchers sent each of the subjects a letter detailing the nature of treatment and an invitation describing the process of participation, only about half of the selected subjects (50.7%) could attend both pretest and posttest data collection sessions. There was no significant difference in dropout rates among the treatment groups ($X^2=1.01$ $p>0.1$) however.

Table 1 — Number of Subjects of Treatment Groups at Sampling, Pretest, and Posttest

	Treatment groups					
	Relaxation	BP - measurement	Self - learning	Comparison	Total	
Items	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	X^2
No. of subjects	120(100.0)	111(100.0)	124(100.0)	235(100.0)	590(100.0)	
Pretest	76(63.3)	81(73.0)	88(71.0)	147(62.5)	392(66.4)	5.38
Posttest	56(46.7)	64(57.7)	69(55.6)	110(46.8)	299(50.7)	5.57
Dropout during intervention	20(26.3)	17(21.0)	19(21.6)	37(25.2)	93(23.7)	1.01

2. Difference between the Dropout and Completed Subjects

Table 2 compares the dropouts and the completed subjects. There was no significant difference in almost all variables related to the subjects' background (gender, birth place education, age, urbanization, HBP knowledge and external locus of control), lifestyles (smoking habits, drinking habits, exercise habits, emotional arousal, high-sodium food intake, and sleeping habits), and BP control (age when diagnosed as having HBP, frequency of BP measures and diastolic BP level). However, the dropouts tended to have lower systolic BP level than the completed-subjects (140.0 mmHg vs 145.3 mmHg).

Table 2 — Comparison of Differences between the Dropout Subjects and Completed Subjects

Items	Dropout Subjects Δ %	Completed subjects@ %	X^2 (p)	Dropout subjects Mean(SD)	Completed subjects Mean(SD)	t (p)
1. Background factors						
Gender: Male	68.8	64.2	0.66(0.41)			
Female	31.2	35.8				
Birth place:Taiwan	65.5	76.5	3.94(0.05)			
Others	34.5	23.5				
Education:Primary/lower	62.4	65.6	0.32(0.57)			
J. high/higher	37.6	34.5				
Age(yrs)				51.0(14.8)	54.5(14.5)	-1.98(0.05)
Urbanization(1-9)				4.8(2.6)	5.2(2.8)	-1.03(0.31)
HBP knowledge(0-6)				4.0(1.2)	4.1(1.2)	-0.79(0.43)
2. Lifestyle						
Currently smoking	43.0	32.5	3.41(0.06)			
Currently drinking	28.3	35.8	1.78(0.18)			
Exercising regularly	24.4	30.0	1.00(0.32)			
Emotional arousal	47.8	39.1	2.23(0.13)			
Having high-sodium foods (meals/wk)				4.5(6.2)	5.6(9.1)	-1.25(0.21)
Sleeping (hours)				6.9(1.6)	7.1(1.4)	-1.04(0.30)
3. Blood pressure control						
Age when diagnosed as having HBP (yrs)				50.7(9.5)	54.1(12.7)	-1.05(0.14)
Freq. of BP measures (times/yr)				16.5(28.7)	13.0(21.6)	1.03(0.31)
SBP level (mmHg)				140.0(18.6)	145.3(22.5)	-2.25(0.03)*
DBP level (mmHg)				86.9(13.3)	89.3(13.3)	-1.49(0.14)

* : $P<0.05$

Δ : Dropout subjects=93

@ : Completed subjects=299

3.Variables Predicting Blood Pressure

To further understand the variable predicting blood pressure, multiple regression with stepwise procedure was applied to select the optimal number of independent variables which could significantly predict the variation of a subject's BP levels. 15 variables on backgroud. Lifestyle and HBP control were entered for selection. As Table 3 demonstrates, age and urbanization are significant predictors of systolic BP. Nearly 22% of the variability in systolic BP can be explained by these two factors A subject's health behavior, BP control experiences, and most of his/her background factors are insignificant predictors. Meanwhile, no independent variable can predict the variation of diastolic BP.

4.Differences in Pretest Data among Groups

When the distributions of age and urbanization among groups were compared (Table 4). No significant difference in distribution was found. Therefore, the factors which might interfere with the effects of the interventions were controlled in the following tests.

Table 3 – Summary of Stepwise Selection of Independent Variables for Blood Pressure Levels

Dependent variable	no. in	Independent variables	Partial R^2	Model R^2	F(p)
Systolic BP	1	Age	0.20	0.20	31.53(0.0001)
	2	Urbanization	0.02	0.22	3.76(0.0546)

Systolic BP = 106.51 + 0.85(Age) - 1.67(Urbanization)

Table 4 – Differences in Age and Urbanization among Groups

Independent variables	Relaxation		BP-measurement		Self-learning		Comparison		
	mean	SD	mean	SD	mean	SD	mean	SD	F(p)
Age	56.0	1.9	52.0	1.8	54.9	1.7	54.9	1.4	0.90(0.44)
Urbanization	4.7	0.4	5.2	0.3	5.7	0.3	5.0	0.3	1.37(0.25)

5.Effects of Intervention on BP Control

a)Among Groups

Analysis of covariance, with pre-intervention data as the covariate, was used to test the treatment group differences in post-intervention data. The dependent variables used as indicators for testing the effects on BP control were systolic BP and diastolic BP levels (Table 5). It was noted that the subjects of the three treatment groups showed greater significant differences in systolic BP (10.97mmHg, 9.15mmHg and 5.05mmHg) than those in the control group. In addition, the subjects of the relaxation group showed not only a greater significant difference in systolic BP (5.92mmHg) than those in the self-

Table 5 — Comparison of Differences between Adjusted Means of BP at Posttest among Groups

Groups	Post BP (mmHg)	Adjusted Post BP (mmHg)
Relaxation group (Relax)	132.7 / 83.9	134.4 / 84.2
BP-Measurement group (BP - M)	134.0 / 84.9	136.6 / 86.1
Self - Learning group (Self - L)	137.6 / 85.0	137.2 / 84.2
Comparison group (Comp)	142.2 / 89.0	140.7 / 88.0

Group comparisons	Difference between adjusted means		Confidence interval of difference between adjusted means	
	SBP (mmHg)	DBP(mmHg)	SBP(mmHg)	DBP(mmHg)
(Comp)-(Relax)	10.97*	4.67*	6.24~ 15.70	0.88~ 8.45
(Comp)-(BP-M)	9.15*	3.41	4.63~ 13.67	- 0.12~ 7.02
(Comp)-(Self-L)	5.05*	3.13	0.55~ 9.55	- 0.47~ 6.73
(BP-M)-(Relax)	1.82	1.26	- 3.29~ 6.93	- 2.83~ 5.35
(Self-L)-(Relax)	5.92*	1.54	0.82~ 11.01	- 2.54~ 5.62
(Self-L)-(Bp-M)	4.10	0.28	- 0.80~ 9.00	- 3.64~ 4.20

* : $p < 0.05$

learning group, but also a greater significant difference in diastolic BP (4.67mmHg)than those in the control group. These results revealed that relaxation training through home-visits is more effective in decreasing the subjects' BP than BP-measurement and self-learning approcahes.

The proprtion of subjects who had their BP decreased significantly were compared among the groups (Table 6). 10mmHg or greater in systolic BP and 5mmHg or greater in diastolic BP were used as the criteria for defining a significant decrease in BP during intervention. A significant difference in systolic BP comparison was found ($X^2=9.6$ $P<0.025$). The proportions arranged in order were as follows:relaxation training (50.0%), self-learning (47.8%), BP-measurement (40.6%), and control (29.1%). On the whole, the three interventions employed in this study could produce various degrees of positive effects on systolic BP decrease.

b) Within Groups

When hypertension is defined with average levels of diastolic BP at 90 mmHg or greater

Table 6 — Comparison of Proportions of Subjects Having Significant Decreases in BP among Groups

Groups	Decrease in SBP > =10mmHg	Decrease in DBP > =5mmHg	Total
Relaxation	28(50.0)	27(48.2)	56(100.0)
BP-measurement	26(40.6)	25(39.1)	64(100.0)
Self-learning	33(47.8)	33(47.8)	69(100.0)
Comparison	32(29.1)	39(35.4)	110(100.0)
X^2	9.579**	3.996	

* : $p<0.025$

** : $p<0.005$

Relaxation vs Comparison: $X^2= 11.69$**

BP-measurement vs Comparison: $X^2= 2.43$

Self-learning vs Comparison: $X^2= 6.43$*

and systolic BP at 140 mmHg or greater. Table 7 indicates the subjects' changes in BP levels between pretest and posttest within each treatment group. McNemar's test was employed and a significant value of 4.05 was found. For the subjects of the self-learning group, the number of cases who had their BP changed from hypertensive levels to normal levels was significantly more than that of cases who had their BP levels changed from normal levels to hypertensive levels (15 cases vs 5 cases). However, the highest rate of having hypertensives in the group, including members whose hypertensive status never changed during intervention (47.8%), was also found in the self-learning group.

DISCUSSION

Some of the factors jeopardizing the validity of the experimental designs need to be considered before discussing the intervention effects. Such problems include: (1) the dropout rate of subjects from the groups and (2) the subjects' BP levels at posttest regressing toward the mean of the population. Since the equivalent groups had been choosen randomly, with no significant difference in dropout rates among groups, experimental mortality and statistical regression could be controlled. However, the high dropout rates of groups during intervention (21.0% to 26.3%)reflected a problem in conducting the follow-up visits.

Table 7 — Comparison of Subjects' Changes in BP Status between Pretest and Posttest within Each Group

BP Status		Treatment Groups			
Pretest	Posttest	Relaxation	BP-measurement	Self-learning	Comparison
		No(%)	No(%)	No(%)	No(%)
Abnormal	Abnormal	19(33.9)	25(39.1)	33(47.8)	47(42.7)
Abnormal	Normal	11(19.7)	10(15.6)	15(21.8)	21(19.1)
Normal	Abnormal	7(12.5)	6(9.4)	5(7.2)	22(20.0)
Normal	Normal	19(33.9)	23(35.9)	16(23.2)	20(18.2)
Total		56(100.0)	64(100.0)	69(100.0)	110(100.0)
McNemar X^2		0.50	0.56	4.05*	0.00

Abnormal : BP> =140/90 mmHg

Normal : BP< =140/90 mmHg

* : P<0.05

It was noted that the subjects' attendance varied with the activities featured and that the dropouts tended to have lower systolic BP level than the completed subjests. A previous study[13] conducted in Cuba showed a 50% response rate to the letter of invitation to visit the hypertension clinic and a 81.4% completion rate among the respondents. Chen's study (6) reported a similar attendence rate (81.4%) for those who were referred to hypertension clinics of a health insurance program, but a higher rate (90.4%) for those referred to the clinics of the study program. When an educational program is focused on hypertension prevention and health promotion, the borderline-HBP cases should be involved. It must be made certain that the subjects are interested in the program and like to participate in all activities.

Using the analysis of covariance to compare the post systolic BP levels among groups, the participants of the three intervention groups showed levels significantly lower than those of the subjects with no treatment. The subjects of the relaxation group also showed greater reduction in diastilic BP than the subjects of the control groups. In comparing the proportions of subjects who had their systolic BP significantly decreased by 10 mmHg or greater, the relaxation (50.0%) and self-learning (47.8%) groups showed rates significantly higher than that of the control group. A significant number of the subjects of the self-learning group singificantly changed their BP status from abnormal to normal. Based on these findings, three interventions are effective in BP reduction. Among them, relaxation proved to be the most effective way for reducing BP. This result is similar to some previous studies[14,15]. Jacob suggested that the changes obtained by relaxation appeared to be largely setting-specific. Since relaxation was employed for hypertension therapy, and hypertensive patients were referred as trainees, the clinic has become the usual setting for relaxation training. Community-based relaxation training focusing on hypertension control is feasible. The residents, with or without hypertension, could be encouraged to practice relaxation in daily life.

The subjects of the BP-measurement group had their BP measured at 10 temporary sites. They were encouraged to visit these sites for BP measures only. Abbott[16] suggested that while the primary purpose of organizing a BP clinic was to measure and interpret BP, the clinic can also be an effective and efficient vehicle for health promotion activities. Therefore, setting up permanent sites and providing educational activities in communities are suggested. Many well-trained nurses who are housewives and who live in the communities can be recruited into organizing health promotion activities.

Some of the subjects with low education levels were assisted in understanding the contents of printed materials. Educating black children by providing them with anti-hypertensive picture books at church and using mass media techniques at the community level had been reported to be successful in enhancing the hypertension prevention in adults and decreasing the 24-hr urinary excretion of sodium in adult women. Self-learning by reading the printed materials can be more effective if it involves other educational strategies such as videos, tapes, or discussions with family members.

In conclusion, disseminating information to create awareness is the starting point in the road toward behavior change. The patient's decision to control BP is highly individualistic. In helping people decide on behavior changes for BP reduction the behaviorally-oriented strategies (relaxation, BP-measurement) and the traditional strategy (self-learning) have proved to be effective in differing degrees. These results may provide us with confidence for sustaining participation at the community level.

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