THE EFFECTS OF RELAXATION THERAPY ON HYPERTENSION

ADRIAN DESMOND COOMBS

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by

Adrian Desmond Coombs, B.Sc.(Hons.)

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Department of Psychology
Memorial University of Newfoundland

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ABSTRACT

In this study the effects of relaxation therapy on the control of hypertension were examined. From each of four rural clinical settings 10 hypertensive subjects, ages 24 to 55 years, total of 18 males and 22 females, were assigned to the following conditions: (1) No-treatment control; (2) Relaxation; (3) Education; and (4) Education Plus Relaxation. In the Relaxation condition the subjects received four 45-minute sessions of group relaxation while the Education condition received four 20-minute education sessions consisting of a slide-and-tape presentation and a 20-minute group discussion. The Education Plus Relaxation condition combined the procedures of the Relaxation and the Education conditions. For all conditions the subjects' blood pressure measures were taken on four occasions, at a pretreatment session, after the final treatment session, and during the 2-week and 4-week follow-up sessions. A 3-way analysis of variance (Conditions x Sessions x Pressures) was performed with the subjects nested under the four conditions.

A significant Sessions effect, a significant Sessions x Conditions interaction, and a significant Sessions x Pressures interaction were found. Although this was not the main intention of this study it did make methodological contributions by demonstrating the weakness of the single group design on which other studies in this area have frequently relied. In the future much more attention must be paid to a careful and standardized methodology.

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This paper is dedicated to Sondra, my wife, and Marc, my son, who provided the motivation to complete the study.

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INTRODUCTION

Hypertension, or high blood pressure, is a major cause of heart failure, stroke and kidney failure which accounts for a large proportion of adult deaths in the United States and Canada. The best known and most widely accepted definition of hypertension has been provided by the World Health Organization (WHO) Expert Committee on Arterial Hypertension (WHO, 1978). The most recent WHO report defines hypertension as a systolic pressure equal to or greater than 160 mm Hg. (21.3 KPa) and/or a fifth-phase diastolic pressure equal to or greater than 95 mm Hg. (12.7 KPa). Prior to the 1978 WHO report hypertension was defined by only a single blood pressure reading, however. The WHO report recommends, for clinical purposes, the average of at least three readings on at least two different occasions to arrive at a diagnosis of hypertension.

Although WHO defines hypertension as a blood pressure of 160/96 or higher, research shows that the frequency and severity of complications increase at a rapid rate when diastolic blood pressure rises above 90 mm Hg. or when systolic pressure rises above 140-145 (Paul, 1975). Furthermore, recent literature indicates that patients with blood pressure that exceeds 140/90 mm Hg. should be treated (Chobanian, 1983).

Secondary hypertension, hypertension secondary to an organic disorder, can usually be cured by surgery or other direct methods. Hypertension without a known cause is

direct methods. Hypertension without a known cause is termed "primary", "essential" or "idiopathic" hypertension. Hypertension, independently of its etiology, involves multiple physiological, psychosocial, behavioural and dietary factors which have attracted a great deal of research and clinical investigation from a wide range of disciplines including the following: physiology, pharmacology, public health, epidemiology, genetics and psychology.

The traditional therapeutic approach for hypertension is antihypertensive drug therapy. Collaborative studies have shown that pharmacotherapy leads to significant reduction of complications of hypertension (Veterans Administration Co-operative Study Group on Antihypertensive Agents, 1967, 1970). The higher the pretreatment pressure, the more benefit obtained by the medication. Among 73 treated patients with diastolic pressure between 115 and 130 mm Hg., there was an incidence of severe complication with only 2 over a 1½ year period as compared with 27 for the 70 patients treated with placebo (VACS, 1967). These complications included sudden death, advanced retinal changes, renal malfunction, strokes, myocardial infarction, congestive heart failure and malignant hypertension. On the other hand, in patients with diastolic pressure of 90-114 mm Hg., the estimated risk of developing a complication over a 5-year period was reduced from 55% to 18% by treatment (VACS, 1970). Finally, patients with mild hypertension unless they were over 50 years old or already had cardiovascular or senile abnormalities, derived minimal

benefit from medication. This decreased effectiveness for drugs for mild hypertension was confirmed in a 10-year controlled intervention study by Smith (1977). In this study cardiac abnormalities on electrocardiogram or on x-ray were more common in placebo groups (53.1% vs. 23.8%), but the major complications of death, myocardial infarction and stroke occurred as frequently in the pharmacologically treated group as in the control group. In addition, a larger proportion of patients in the treatment group dropped out because of drug intolerance (9.8% vs. 2%).

The pharmacological treatment of hypertension has produced marked reductions in blood pressure as well as increased life expectancy (Freis, 1971). The incomplete control of blood pressure and the side effects of medication have created the incentive to search for other methods of blood pressure control to supplement pharmacological treatment.

In the early 1970's, the biofeedback approach was widely studied in an attempt to find a nonpharmacological treatment. Although numerous studies (Benson, Rosner, Marzetta, & Kleinchuk, 1974a; Blanchard & Young, 1973, 1974; Elder, Ruiz, Deabler, & Dillenkoffer, 1972; Miller, 1972) have shown that humans are able to reduce their blood pressure with the assistance of biofeedback, a literature review by Blanchard and Young (1974) concluded that most studies showed changes of small magnitude and duration and failed to demonstrate generalization to the natural environment. Blanchard and Young (1974) speculated that other

methods, particularly relaxation therapy, might prove to be more effective than biofeedback.

The studies of the application of relaxation or relaxation-like procedures could be classified according to three research designs: single group, group studies with a nonrandomly selected control group and control group with random assignment of subjects.

The early studies reviewed in the following paragraphs used the single group design.

Benson, Rosner, Marzetta, and Kleinchuk (1974a, 1974b), in two uncontrolled single group studies, investigated the effect of transcendental meditation on moderately hypertensive subjects. Subjects were selected based on the criterion of having blood pressure greater than 140 mm Hg. systolic or 90 mm Hg. diastolic. The blood pressure was measured once a week during a 6-week period to obtain a baseline. After initiation of the meditation sessions, the subjects were followed for an average of 20-25 weeks. Blood pressure measurements were taken with a random zero sphygmomanometer at a time when the subjects were not meditating. These studies differed in one respect: medication was not used in the first (Benson et al., 1974a), but in the second antihypertensive medication was kept at a constant dose level (Benson et al., 1974b). In the first study in which medication was not used (Benson et al., 1974a), the results indicated an average reduction of blood pressure of 7.0 ($p < .001$) mm Hg. for systolic and 3.9 ($p < .002$) mm Hg. for diastolic pressure from an average pretreatment level of 146.5/94.6 mm Hg.

in the 22 subjects. In the second study (Benson et al., 1974b) which kept the medication dose constant, the 14 subjects reduced their blood pressure by an average of 10.6/4.9 mm Hg. from an average pretest level of 145.6/91 4 mm Hg. These results were reported to be significant at $p < .01$ for systolic and $p < .05$ for diastolic pressure.

Blackwell, Bloomfield, Gartside, Robinson, Hannesan, Magenheim, Nidich, and Zigler (1976) replicated the Benson et al. (1974b) study with seven subjects who were on a stable course of antihypertensive medication. Statistical tests for significant treatment effects were performed on individual subject data. Four out of seven showed significant reductions in both systolic and diastolic pressure, whereas one subject showed a significant increase in systolic and diastolic pressure. The mean decrease for the group was 4.2/1.6 mm Hg. from an average baseline of 138.8/97.7 mm Hg. Patel (1973) used a treatment procedure similar to a yogic exercise called Shavasan (Sanskrit for "corpse posture") to treat 20 patients. They administered a half-hour session on a three times a week basis along with home practice for three months. The patients were instructed to relax in supine position, and to concentrate on phrases, similar to those used in autogenic training with each exhalation. After treatment the mean reduction of blood pressure was 24.6/14.4 mm Hg. from an average pretreatment level of 159.1/100.1 mm Hg. In a later 12-month follow-up study Patel (1975) reported that the changes in systolic and

diastolic pressure continued to be significantly different ($p < .001$).

As pointed out by Jacob, Kraemar and Agras (1971) in a review of relaxation therapy in the treatment of hypertension, these single group studies provide little evidence for the efficacy of relaxation because the single group design did not control for alternative variables such as: (1) regular visits to a therapist or experimenter; (2) unplanned consequences of treatment (e.g., changes in diet or life-style); or (3) effects of environmental changes unrelated to therapy (e.g., alterations in physical or social surroundings).

In the following sections, experiments that included a control group in an attempt to rule out these alternative explanations will be described. First, two studies with nonrandomized control groups are reported.

Patel (1975) followed up the subjects of her 1973 study and added a control group that was matched for age and sex. No more training sessions were given; however, the treatment subjects were encouraged to continue practicing the relaxation procedure during the follow-up period. The control group was required to attend a clinic three times weekly during which they were asked to rest on a couch without receiving specific relaxation instructions. The treatment group showed a significant reduction in blood pressure (24.6/14.4 mm Hg.) from an average pretreatment level of 159.1/100.1 mm Hg., and the treatment effect was maintained

after 3 months (143.9/84.0 mm Hg.), after 6 months (146.7/88.3 mm Hg.), and after 12 months (144.4/86.7 mm Hg.). The control group showed an initial change from 163/99.1 to 162.6/97.0, a reduction that was reported not to be statistically significant; moreover, no significant changes during the follow-up periods were obtained.

In a similar group, Stone and De Leo (1976) reported the effects of a technique based on Buddhist meditation. The subjects were required to sit in a chair in an upright position, loosen tight clothing, relax their muscles, and concentrate on counting their breathing cycles. After five 20-minute training sessions, the subjects were instructed to repeat the technique twice daily for a duration of 10 to 15 minutes. The treatment group showed a mean reduction of blood pressure of 9.0/8.1 as compared to a control group that showed an increase in blood pressure +1.1/2.1. In both studies (Patel, 1975; Stone & De Leo, 1976), a control group was added; however, the assignment of subjects to treatment or control was not random. Although the design of their experiment may control for some placebo effects (effects due to contact with the clinic or research team), it does not control for any systematic bias that could be present in the assignment of subjects to treatment or control group.

Although the above studies with nonrandomized control groups make a more convincing argument for the efficacy of relaxation-like techniques than the single group studies,

they still lack the methodological stringency of the following groups of studies. In this final section, studies are presented which used random assignment of subjects to treatment or control.

Patel and North (1975) studied the effects of controlled trials of yoga in the management of hypertension. In this study educational material about hypertension, the effects of emotions on bodily processes and the physiology of relaxation was presented. Treatment lasted 12 sessions, two per week, and subjects were encouraged to practice at home twice daily. The control group attended the same number of sessions for the same length of time as the experimental subjects; during these sessions they were asked to relax in a couch or reclining chair without receiving instructions in the technique of relaxation. Blood pressure was taken by a nurse who was blind to the experimental conditions. The 17 subjects of the treatment group showed an average blood pressure reduction of 26.1/15.2 mm Hg. from an average pretreatment level of 167.5/99.6 mm Hg. An equal number of subjects in the control group showed an average decrease of 8.9/4.2 mm Hg., from an average pretreatment level of 168.9/100.6 mm Hg. The differences between treatment and control groups were reported to be statistically significant ($p < .005$ for systolic and $p < .001$ for diastolic pressure).

Taylor, Farquhar, Nelson, and Agras (1977), in a well-designed three group experiment attempted to control the effects of differential treatment intensity and experimenter

enthusiasm. The subjects of the relaxation group were informed that reducing tension would lead to a reduction in blood pressure, and they were given instruction in relaxation according to a standardized tape-recorded program. Subjects received an average of five weekly 30-minute sessions, during which their progress in relaxation was monitored. The subjects were requested to practice relaxation at home at least once daily and to record the time and place of their practice on a self-monitor chart. An alternative treatment group received an average of five 30-minute sessions of "non-specific therapy" in which subjects were first informed of the relationship between hypertension and life stress and encouraged to find alternative ways to deal with tension. Using a self-monitor form the subjects recorded stressful situations on a daily basis. The third group was a medication-only group. All three groups were given pharmacological treatment. The 11 subjects of the relaxation group, with average pretreatment pressure of 149.8/96.2 mm Hg., showed an average reduction in systolic pressure of 13.6 mm Hg. as compared to 2.8 mm Hg. for the 10 subjects of the non-specific therapy group and 1.1 mm Hg. for the 10 subjects of the medication-only group. Statistical analysis indicated that relaxation was significantly more effective than nonspecific therapy or medication-only ($p < .05$ and $p < .01$), respectively. The difference between the non-specific therapy group and the medication-only group was not significant. The average reductions for diastolic

pressure for all three groups were not found to be significant.

In a stringently designed experiment by Shoemaker and Tasto (1975) 15 subjects were matched for diastolic blood pressure and randomly assigned to relaxation, biofeedback, and control groups. When pretreatment and posttreatment measures were compared, the following average reductions in diastolic pressure were reported: 7.6 (relaxation); 1.2 (biofeedback); and -1.2 (control) mm Hg. Further analysis showed that the treatment effects for both the relaxation and biofeedback groups were statistically significant. On the other hand, the reductions of systolic pressure (6.8, -0.6, and -1.2 mm Hg.) were not significantly different.

One should note that the Taylor et al. (1977) and Shoemaker and Tasto (1975) studies differ in whether systolic or diastolic pressures are significantly reduced while both claim to demonstrate the effectiveness of relaxation treatment. This inconsistency raises two questions. Firstly, what are the components of the procedure that elicit the result and, secondly, which criterion or criteria (reduction in systolic, reduction in diastolic, or a combination of both) should be used to measure the effectiveness of relaxation treatment. This first methodological question requires further research in identifying and standardizing the most effective relaxation technique. The methodological issue will be addressed further in the Discussion. Prior to answering the second question concerning assessment criteria,

the issue of whether reductions in systolic versus diastolic pressure best represents an improvement in the control of hypertension requires clarification. However, this issue has not yet been resolved in the literature (Kannel, Gordon, & Schwartz, 1971).

Furthermore, it should be noted that the relaxation studies, currently reported in the literature in regard to hypertension, based their claims on data obtained primarily in nonclinical settings. It seems appropriate, therefore, that the next step in the research would attempt to evaluate the effectiveness of relaxation procedures in lowering blood pressure in a clinical setting. Only after psychological methods have successfully been incorporated into basic medical care will they accomplish their full potential in the treatment of hypertension. Basler, Brinkmeier, Buser, Haehn, and Molders-Kober (1982) studied the effects of psychological group treatment of essential hypertension in general practice settings.

In the Basler et al. (1982) study, 107 obese patients with essential hypertension from 8 general practices were assigned to groups of up to 15 subjects and received one of the following psychological group-therapy procedues: (1) modification of nutritional patterns; (2) modification of nutritional patterns plus self-monitoring of blood pressure and training in social competence; (3) modification of nutritional patterns plus Jacobson's relaxation training; and (4) information about the causes and consequence of high

blood pressure. An approximately equal number of patients served as a waiting-control group. All patients had received pharmacological treatment for at least a year. After 12 weekly sessions, the blood pressure values measured before and after intervention showed a significant reduction in blood pressure in the treatment groups compared to the waiting-control group. No differential effect among treatment procedures was found.

Basler et al. (1982) attempted to evaluate the Jacobson's relaxation method; however, they combined the relaxation procedure with modification of nutritional patterns. This contamination of the relaxation treatment by another independent variable prevents a definitive analysis of the data. In the present study, therefore, the experimental design will provide for a group of subjects who receive only relaxation training.

In view of the ambiguities in the present state of knowledge as revealed in the above survey of the current research literature, it seemed important for the present experiment to attempt an evaluation of the following questions:

(1) In addition to the reduction brought about by medication, can group relaxation in a clinical setting show still further reduction in blood pressure?

(2) Would blood pressure reduction be further enhanced and/or maintained by supplementing the group relaxation treatment with an education program?

The education program consisted of four 20-minute slide and tape presentations, "Hypertension", "Low Fat Diet", "Exercise", and "Stress" from Trainex Health Care Counselling Program (Alexander, 1978). Those presentations were followed by group discussions. The function of the group discussions was to clarify and summarize the presentations. The education program was designed to promote the patients' cooperation and help relieve anxiety (Alexander, 1978). The effectiveness of supplying educational information about hypertension risks has not yet been unequivocally established (Sackett, Gibson, Taylor, Haynes, Hackett, Roberts, & Johnson, 1975; Levine, Green, Deeds, Chwalow, Russell, & Finlay, 1979). However, if the patient has understood the material presented, he will be aware of his responsibilities in maintaining his own health.

The present experiment was designed to test the following hypotheses which emerge from the preceding survey of the existing literature. First, that after relaxation therapy there will be an immediate and enduring reduction in blood pressure. Second, that presenting educational material in a group setting with subsequent discussion will increase the probability of the subjects taking positive health measures, and that this will also be reflected in a reduction in blood pressure after treatment and at follow-up. Third, that a combination condition, Education Plus Relaxation, would show a compounding effect of the education program and relaxation at follow-up greater than the effect that would result in

the case of either the relaxation therapy or the education program alone.

The following research paradigm is designed to test the above hypotheses, and has three features that distinguish it from the previous studies: (1) It evaluates the effectiveness of a group administration of relaxation procedures in reducing blood pressure rather than individual administration; (2) it tests the effectiveness of relaxation procedure in a clinical rather than a laboratory setting; (3) it investigates the effects not only of relaxation training and an education program, but also the effects of combining these in a unified treatment.

METHOD

Subjects

From each of four settings, 10 subjects, ages 24 to 55 years (total of 18 males to 22 females) were assigned to the following conditions: (1) No-treatment Control; (2) Relaxation; (3) Education; and (4) Education Plus Relaxation. Subjects were selected from the out-patient population of a Regional Medical Clinic in St. Albans and three hospital settings, Baie Verte, Buchans and Harbour Breton, Newfoundland. The conditions were randomly assigned to settings (St. Albans--Control, Harbour Breton--Relaxation, Buchans--Education, and Baie Verte--Relaxation Plus Education).

Although it was not possible randomly to assign subjects to the conditions, the distributions of the subjects' ages, genders, and education do not differ systematically in any

way from location to location (see Appendices A and B). It is legitimate, therefore, to treat the data as though individual subjects had been randomly assigned to four conditions.

All subjects were on medication which was kept constant over the time of the study. The selection criteria were: (1) a diagnosis of hypertension; (2) a blood pressure level at the most recent doctor's visit of at least 140 mm Hg. systolic and/or 90 mm Hg. diastolic; (3) the same blood pressure level (140 mm Hg. and/or 90 mm Hg.) on the pretreatment measure; and (4) informed consent and willingness to participate in the project as indicated by signing a behavioural contract (Appendix C).

Apparatus

Tape recorder and film strip projector were used. Blood pressure measurements were taken with a mercury sphygmomanometer and stethoscope.

Materials

The materials for the relaxation program consisted of instructions and tapes on progressive muscle relaxation and differential relaxation (Budzynski, 1978). The education materials consisted of four tape-and-film strips on Hypertension, Exercise, Stress, and Low Fat Diet (Alexander, 1978).

Procedure

Pretreatment blood pressure measures were obtained for all subjects. Once the subject had adapted to a sitting position for approximately 5 minutes, the first of three

blood pressure measurements using sphygmomanometer and stethoscope was taken. During the pretreatment interview information related to the subject's eating, exercising and smoking habits was obtained (Appendix D). At the fifth and tenth minutes of the interview the second and third blood pressure measures were taken. The mean of these three measures was used as the pretreatment measure.

The subjects of the No-treatment control group had contact with the experimenter during the pretreatment session and four additional consecutive weekly sessions. Each session was similar to the pretreatment session in which the blood pressures were taken and brief nondirected conversation took place with the experimenter. The blood pressure measurements at the pretreatment and at the fourth weekly session were taken as the pretest and posttest measures.

In the Relaxation condition in addition to the above procedures of the control condition, the subject received a 4-week group relaxation program (Budzynski, 1978). Weeks one and two concentrated on progressive muscle relaxation, while weeks three and four concentrated on differential relaxation. In addition to the approximately 45-minute relaxation session administered by the experimenter subjects received taped relaxation instructions and were encouraged to practice the technique daily.

The subjects in the Education program condition received in addition to the procedures applied to the control group, a 4-week educational program consisting of a 15-20 minute

slide-and-tape presentation and a group discussion. The function of the group discussion was to clarify and summarize the slide-and-tape presentation. The four areas of concentration were: (1) Hypertension; (2) Low Fat Diet; (3) Exercise; and (4) Stress.

The Education Plus Relaxation condition was a combination of the procedures of the relaxation and the Education program conditions. The subjects participated in the 45-minute relaxation session followed by a 15-20 minute educational session.

The blood pressure measures were taken by the same method as in the pretreatment session, by the experimenter, on completion of treatment at the fourth session. The 2-week and 4-week follow-up measures for all groups were obtained in the same way by nurses who were blind to the experimental conditions (see Appendix F).

RESULTS

A three-way analysis of variance (Conditions x Sessions x Pressures) with subjects nested under the Conditions factor was performed on the data. In this experiment there is only one dependent variable, blood pressure in mm Hg., which has two levels, systolic and diastolic. There were four Conditions (Control, n=8; Relaxation, n=7; Education, n=6; and Relaxation Plus Education, n=9), and seven measuring sessions (pretreatment, treatments one through four, and follow-ups one and two), and two levels of Pressure (systolic and diastolic). Session 1 is pretreatment; Sessions 2 to 5 are

treatment sessions while Sessions 6 and 7 are follow-up sessions. The analyses showed a significant Sessions effect (F (16,156) = 13.67, $p \leq .001$), a significant Sessions x Conditions interaction (F (18,156) = 2.34, $p \leq .05$) and a significant Sessions x Pressures interaction (F (6,156) = 2.22, $p \leq .05$) (see Appendix E). The means for the significant effects are shown in Table 1.

The Sessions effect was analyzed using Tukey's method (Berenson, Levine, & Goldstein, 1983). The results indicated that Sessions 2 through 7 were significantly different from Session 1 (Q. 96; 6,158 = 4.36; $p \leq .05$). As shown in Table 1 the treatment sessions (Session 2 to 5) and the follow-up sessions (Sessions 6 and 7) are significantly different from the pretreatment session (Session 1).

The Sessions x Pressures interaction was further analyzed using the Tukey method. The results indicated that for the systolic pressure, Session 3 (the second treatment session) through Session 7 were significantly different from Session 1, the pretreatment session (Q. 95; 6,158 = 5.46; $p \leq .05$). For the diastolic pressure, Session 2 through Session 7 were significantly different from Session 1 (Q. 95; 6,158 = 5.46; $p \leq .05$). The results of Tukey's method are shown in Table 2, while the Sessions x Pressures interaction is displayed graphically in Figure 1. The Sessions x Pressures interaction was similar to the Sessions effect, except that for Session 2 (the first treatment session), the systolic was not significantly different from

Table 1

The Means for Significant Effects Shown Cross Section

	SESSIONS						
	Pretreatment		Treatment			Follow-up	
	1	2	3	4	5	6	7
Means Session Effect*	122	117	114	111	112	111	112
Session x Pressure							
Systolic	147	143	137	134	135	135	136
Diastolic	97	91	90	87	88	88	88
Condition x Sessions*							
Control	120	117	112	110	117	113	115
Relaxation	126	124	114	110	113	113	115
Education/Rel.	116	110	117	107	107	107	108
Education	124	116	113	115	109	111	115

*Note these means represent the means of systolic and diastolic combined.

Table 2

The Results of the Tukey's Method Performed on Session x Pressure

	SESSIONS						
	Pretreatment		Treatment			Follow-up	
	1	2	3	4	5	6	7
Systolic $\bar{x}$	147	143	137	134	135	134	136
Pretreatment Session		4	10	13	12	13	11
Critical Value = 5.46		NS	*	*	*	*	*
Diastolic $\bar{x}$	97	91	90	87	88	88	88
Pretreatment Session		6	7	10	9	9	9
Critical Value = 5.46		*	*	*	*	*	*

NS - Not Significant
- $p > .05$
* - $p < .05$

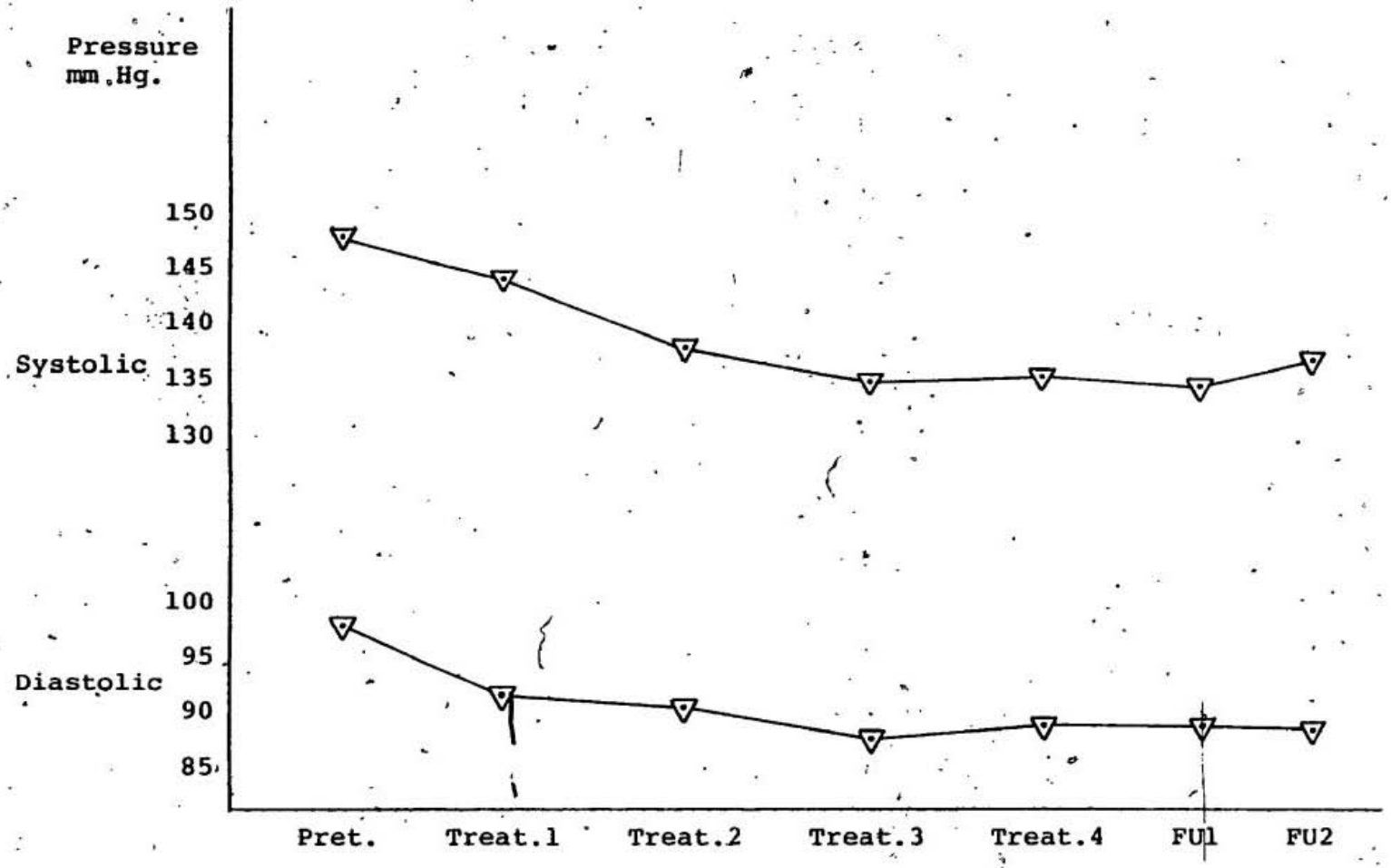

Figure 1. A graph of systolic and diastolic pressure for all Conditions by Sessions.

Session 1 (the pretreatment session).

An artefact of the statistical analysis occurred in one, but only one, of the interactions. Although this would be difficult to interpret, the means of the two levels of the dependent variables (systolic and diastolic pressures) were averaged when calculating the Session x Conditions interaction. Although the means resulting from this combination of systolic and diastolic pressures are difficult to interpret clinically, yet they do provide a reasonable measure of change in arterial pressure from session to session.

Thorough analysis of the means of the significant Sessions x Conditions interaction does not yield any meaningful comparison. The means for the Sessions x Conditions interaction are presented in Table 3 and graphed in Figure 2. The results of the statistical analysis of the comparisons are also shown in Table 3.

In summary, the results showed a significant Sessions effect and a significant Sessions x Pressures interaction. The Sessions effect indicated that the means for all conditions for both systolic and diastolic pressure were significantly different for the treatment sessions (Sessions 2 to 5) and for the follow-up sessions (Sessions 6 and 7) as compared to the pretreatment session (Session 1). The Sessions x Pressures interaction showed a similar pattern; however, for the systolic pressure a significant difference compared to the pretreatment did not occur until the second treatment

Table 3

The Results of the Tukey's Method Performed on the Session x Conditions Interaction

	Pretreat.		Treatment			Follow-up	
	1	2	3	4	5	6	7
Conditions							
Control $\bar{x}$	120	117	112	110	117	113	115
1 Pret.-Sessions 1		3	8	10	3	7	5
Critical Value = 14.7		NS	NS	NS	NS	NS	NS
Relaxation $\bar{x}$	126	124	114	110	113	113	119
1 Pret.-Sessions 1		2	12	16	13	13	5
Critical Value = 15.2		NS	NS	NS	NS	NS	NS
Relax./Educ. $\bar{x}$	116	110	117	107	107	107	108
1 Pret.-Sessions 1		6	1	9	9	9	8
Critical Value = 13.4		NS	NS	NS	NS	NS	NS
Education $\bar{x}$	124	116	113	115	109	111	115
1 Pret.-Sessions 1		8	11	9	16	13	9
Critical Value = 16.4		NS	NS	NS	NS	NS	NS
Control $\bar{x}$ - Conditions $\bar{x}$							
1 Control-Rel.1	6	7	2	0	4	0	4
Critical Value = 14.4	NS	NS	NS	NS	NS	NS	NS
1 Control-Relax.Ed.1	4	7	5	3	7	6	7
Critical Value = 12.9	NS	NS	NS	NS	NS	NS	NS
1 Control-Educ.1	4	1	1	3	5	2	0
Critical Value = 17.9	NS	NS	NS	NS	NS	NS	NS

NS $p > .05$

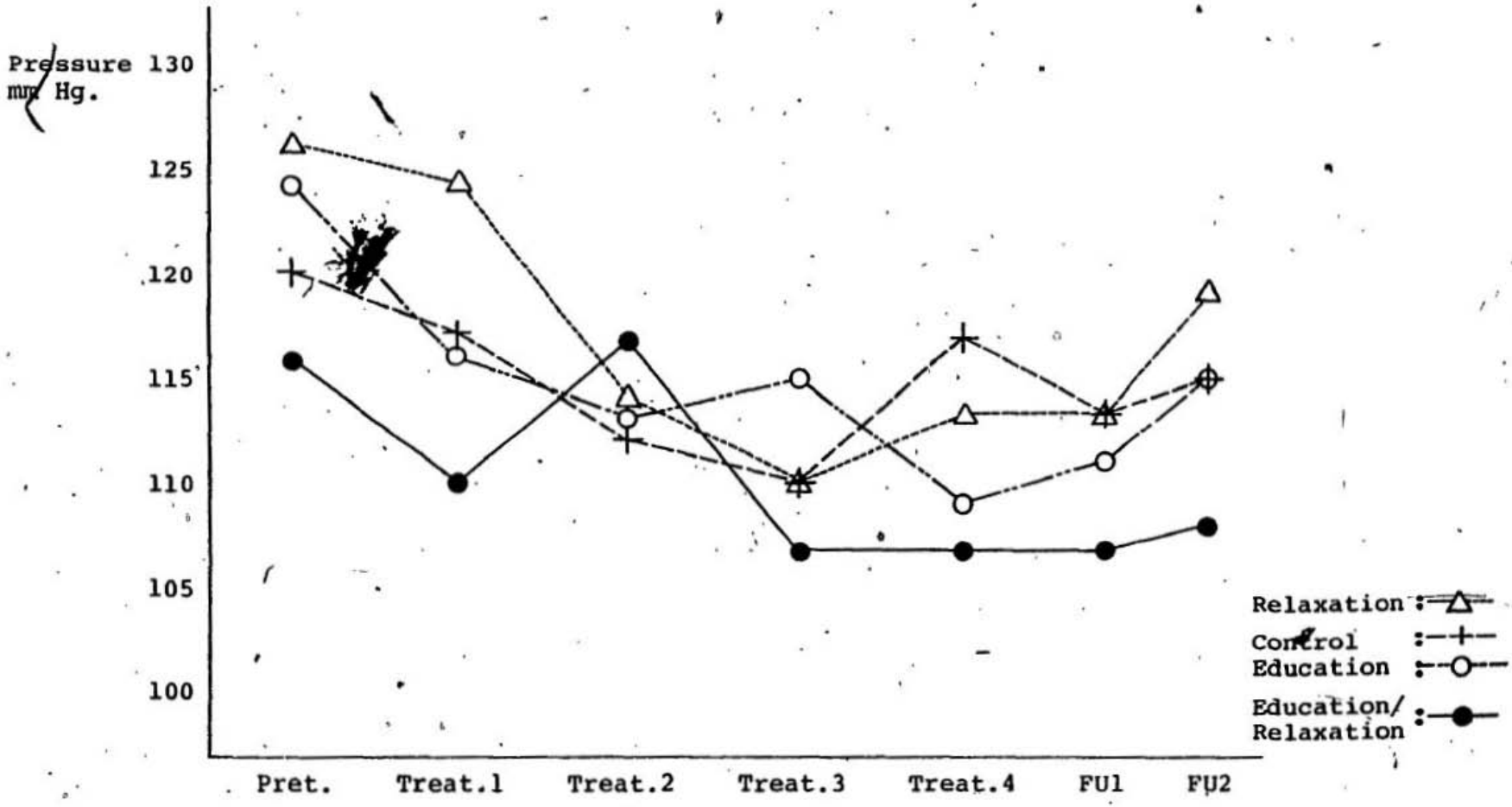

Figure 2. The graph of the Sessions by Conditions interaction.

session (Session 3), while for the diastolic pressure significant difference occurred after the first treatment session (Session 2).

DISCUSSION

In the present experiment, three hypotheses were formulated. The first hypothesis predicted that after relaxation therapy, there would be an immediate and enduring reduction in blood pressure. For the relaxation group, there was a reduction of 13/11 mm Hg. after the final treatment session and 16/9 mm Hg. and 19/14 mm Hg. reductions during the follow-up session. In fact, the predicted reductions did occur; however, these reductions were not significantly different from those of the control group. For this reason the results of the present study cast doubts on the conclusions of the single group studies (Benson et al., 1974a, 1974b; Blackwell et al., 1976). The Benson et al. (1974a, 1974b) studies, for example, showed reductions of 7.0/3.9 mm Hg. and 10.6/4.9 mm Hg., respectively; while Blackwell et al. (1976) showed a reduction of 4.2/1.6 mm Hg. The single group studies claimed significant results while the present study demonstrated that the greater reduction of 19/14 mm Hg. was not significantly different from the control group. The present study also showed greater reductions than the statistically significant reductions reported by Taylor et al. (1977) (13.6 mm Hg. systolic) and Shoemaker and Tasto (1975) (7.6 mm Hg. diastolic), although in the present study these reductions were not statistically

different from the control.

The second hypothesis stated that presenting educational material in a group setting rather than on an individual basis would increase the probability of the subjects taking positive health measures, and that these measures would also be reflected in a reduction in blood pressure after treatment and during follow-up. Although there were 7/11 mm Hg. reductions from pretreatment to the final session and 7/8 and 4/7 mm Hg. reductions from pretreatment to follow-up sessions for the Educational Condition, these reductions were not significantly different from the control group's.

The third hypothesis was that a combination condition, Education Plus Relaxation, would show an enhancing effect of the educational program on the relaxation treatment. As with the second hypothesis, the results obtained did not support this third hypothesis.

The results showed a significant Sessions Effect indicating that all experimental conditions showed significant reduction for both systolic and diastolic pressure after treatment and during follow-up. The Sessions x Pressures interaction showed a similar pattern; however, significant reduction occurred only after the second treatment session for the systolic while significant reductions were reached for diastolic pressure after the first treatment session. As shown in Table 2, the average reductions for all conditions after treatment session four and follow-up sessions were 12/9, 13/9, and 11/9 mm Hg., respectively.

One can only conjecture which factor or factors explain the significant effects in the present study. A possible explanation for the reduction could be the reactivity of the blood pressure measure due to increased familiarity with the experimenter, a context familiarity effect. The effects may reflect the subjects becoming more comfortable and less anxious with the experimenter and the experimental conditions. Before accepting this explanation, however, consideration should be given (see Method section) to the fact that the follow-up measures were taken by nurses who were blind to the experimental conditions. If a context familiarity effect was a significant factor, one would expect an increase in blood pressure when the novel nurse obtained the measures.

Another possible explanation for the reduction over conditions would be presented in terms of a Time Effect. This explanation infers that the blood pressure reductions would occur over time independently of any variable. One should note that the subjects were referred to the experiment because their hypertension was resistant to past interventions. This would indicate that the subjects' hypertension was consistently high over time. Given that the subjects' anti-hypertensive medication was held constant throughout the time of study, one would suspect that reductions found in this study were more than a time effect.

The third and most plausible explanation is that the reductions in blood pressure are the reflections of uncontrolled variables. Possible uncontrolled variables which

may have influenced blood pressure reduction included: (1) a higher than average level of motivation as indicated by the willingness to participate in the experiment as shown by the subjects' signing of a behavioural contract and their active participation; (2) the encouragement and support received from the experimenter; (3) the subjects' knowledge of the experimenter's effort/cost--the experimenter travelled between 100 and 200 km to see subjects; (4) the subjects' receiving feedback on their blood pressure which was taken on a weekly basis for four weeks and every second week for a month.

There are several issues which future research should address. Two of these are standardization of treatment techniques and the use of control groups.

Future studies should attempt to identify the most effective relaxation technique and to standardize the procedure. In the 10 studies reviewed in the introduction, at least four different techniques were administered. These techniques ranged from techniques with a strong cognitive emphasis such as Transcendental Meditation to those with a primarily physical emphasis such as Jacobson's Relaxation Training. The lack of standardization in technique makes it difficult to replicate and to compare studies.

The present study demonstrated the importance of making appropriate use of control groups. The fact that the data obtained do not show significant difference between control

and treatment groups casts doubt on the validity of the conclusions based on single group studies. As described earlier in the Discussion, three single group studies of relaxation therapy on hypertension (Benson et al., 1974a, 1974b; Blackwell et al., 1976) have cited comparatively lower reduction in blood pressure as being significant. Benson et al. (1974a, 1974b) reported reductions of 7.0/3.9 mm Hg. and 10.6/4.9 mm Hg. and Blackwell et al. (1976) reported a reduction of 4.2/1.6 mm Hg. In the absence of a control group however, the reasons for the reductions are open to questions especially when in the present study an even greater reduction of 19/14 mm Hg. was found not to be significantly different from the reductions in the control group. These inconsistencies clearly demonstrate the need for studies with proper experimental control.

Further directions for future research include the following issues. Is there an interaction between the type of relaxation technique and the type of anti-hypertensive medication? Would different types of subjects respond to different forms of therapy? What are the individual characteristics of the hypertensive patient that would predict the success of a relaxation treatment? None of the past studies, including this present one, has investigated the cause of the hypothesized sympathetic arousal in hypertensive patients. Prior to attempting to research these questions, there is a need for a more sophisticated psychological and psychophysiological assessment procedure.

Only after a detailed standardized assessment procedure is developed will researchers be able to predict which hypertensive patients will respond to which form of relaxaiton therapy under what conditions.

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APPENDIX A

Table of Subjects' Ages, Genders and Education

Conditions		Age	Gender	Education (Grade)
Control	1	49	Female	6
	2	47	Male	11
	3	53	Female	9
	4	49	Female	8
	5	47	Female	8
	6	33	Male	9
	7	32	Female	8
	8	42	Female	-
	9	53	Male	7
	10	41	Male	-
Rel.	1	50	Female	8
	2	54	Female	-
	3	36	Female	8
	4	44	Female	8
	5	31	Male	11
	6	41	Male	11
	7	47	Male	3
	8	40	Male	9
	9	49	Female	-
	10	51	Male	9
Ed.	1	36	Female	11
	2	49	Female	9
	3	52	Female	9
	4	47	Male	7
	5	44	Female	-
	6	43	Female	8
	7	28	Male	8
	8	24	Female	11
	9	50	Male	-
	10	33	Male	10
Rel./Ed.	1	46	Female	9
	2	41	Female	8
	3	35	Male	8
	4	50	Female	7
	5	42	Female	11
	6	47	Male	6
	7	49	Female	-
	8	37	Male	11
	9	43	Male	11
	10	42	Male	-

APPENDIX B

Table of One-Way Analysis of Variance on Ages of Subjects

Source of Variables	Source of Squares	d.f.	Variance Estimate
Between	468	3	165
Within	10474	36	291
Total	10942	39	F = 0.54

APPENDIX C

DATE: _____

BEHAVIOURAL CONTRACT

I, _____, agree to participate in the Hypertensive Clinic and will complete all exercises and home assignments. All questions about the program have been answered for me to my satisfaction.

NAME: _____

APPENDIX D

DATA SHEET

NAME: _____ AGE: _____ DOB: _____

DATE(S) SEEN: _____

ADDRESS: _____ TELEPHONE NO. _____

EDUCATION: _____

OCCUPATION: _____

PRESENT MARITAL STATUS: MARRIED____ SINGLE____ WIDOW____

DIVORCED____ SEPARATED____

COMMON-LAW____

MEDICATIONS: _____

DURATION OF HYPERTENSION:

RECENT BLOOD PRESSURE READINGS:

COMPLICATIONS WITH MEDICATIONS:

DOCTOR'S ORDERS: (1) Diet

(2) Exercise

(3) Relaxation

(4) Smoking/Alcohol

WOULD PARTICIPATE IN HYPERTENSION CLINIC: YES____ NO____

APPENDIX D

Analysis of Variance Summary Table

Source	Sum of Squares	D.f.	Mean Square	F ratio	
Conditions (A)	1546.4	3,26	515.5	0.6006	NS
Subject (S)	22313	26	858.2		
Session (B)	5770.9	6,156	961.8	13.67	xx
A x B	2960.5	18,156	164.5	2.34	x
S x B	10975	156	70.35		
Pressure (C)	239956	1126	239956	790.1	N/A
A x C	187.5	3,26	62.5	0.203	NS
S x C	7896	26	304		
B x C	385	6,156	64.2	2.22	*
A x B x C	630	18,156	35.0	1.21	
S x B x C	4501	156	28.8		

NS - $p > .05$
N/A- Not Applicable
* - $p < .05$
xx - $p < .01$

APPENDIX F

Procedure Manual

Pretreatment Session

Pretreatment measures were taken for all subjects. Blood pressure measures were taken from the right arm after subjects had adopted a sitting position for approximately 5 minutes, 10 minutes, and 15 minutes. The mean of the three blood pressure readings was used as the pretreatment measure. Between readings the subjects were given time to ask questions.

No-treatment Control Group

Subjects were seen individually and the procedure was the same as pretreatment for each session.

Relaxation Condition

In a group setting subjects received progressive muscle relaxation as developed by Budzynski (1978) from the experimenter. In Sessions 1 and 2 the instructions of tape 1, side 1, were used while in Sessions 2 and 3 the instruction of tape 2, side 1, were used. Subjects were in the supine position on gym mats with pillows. After each session subjects received feedback on their performance which led into a group discussion. Then, blood pressure measurements were taken as in the pretreatment session.

Education Condition

In a group setting the subjects viewed the Trainex slide and tape presentation followed by group discussion to clarify and summarize the presentation. Then blood pressure measurements were taken as in the pretreatment session.

Education and Relaxation Condition

The procedures of both the Education Condition and also the Relaxation Condition were administered in a combined session. During treatment sessions 1 and 3, the relaxation procedure preceded the educational program while during treatment sessions 2 and 4 the order was reversed. Blood pressure measurements were taken as in the pretreatment session.