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THE EFFECTS OF SELF-MONITORING BY PATIENTS
ON THE CONTROL OF HYPERTENSION

by

James Earl Carnahan

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF PSYCHOLOGY

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

I hereby recommend that this dissertation prepared under my
direction by James Earl Carnahan
entitled The Effects of Self-Monitoring by Patients on the
Control of Hypertension
be accepted as fulfilling the dissertation requirement of the
degree of Doctor of Philosophy

W. B. Moore

Dissertation Director

6-7-73

Date

After inspection of the final copy of the dissertation, the
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SIGNED: James Earl Cornahan

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ABSTRACT

This study investigated the effect of self-monitoring of blood pressure by hypertensive patients on the regularity with which they kept their clinic appointments and on the degree to which they achieved a reduction in blood pressure. Experimental subjects were given a sphygmomanometer and instructed in its use for daily monitoring of their blood pressure.

Previous research has shown a high dropout rate for hypertensive patients. This tendency to not continue with medical treatment even after being told by a physician that one has high blood pressure is usually attributed to the fact that hypertension is for the most part an asymptomatic disease unless complications such as stroke, coronary heart disease, or uremia appear. It was hypothesized that the self-monitoring of blood pressure would serve to make visible an otherwise asymptomatic condition, and thereby increase motivation to seek and continue medical treatment. It was also hypothesized that the self-monitoring might cause a reduction in blood pressure in a manner analogous to that reported in biofeedback studies.

One hundred patients beginning treatment in the hypertension clinic at the Tucson VA Hospital were randomly divided into experimental and control groups. Subjects in the experimental group were given a sphygmomanometer and instructed in its use for daily monitoring of their blood pressure at home. Both groups were given similar

hypertensive medication. There were no differences in blood pressure between groups at the beginning of treatment.

It was hypothesized that experimental subjects would achieve better blood pressure control by the end of three months, have fewer dropouts, keep a higher percentage of their appointments, and take their medication on a more regular basis than control subjects.

At the end of the three-month treatment period systolic blood pressure was significantly lower in experimental than in control subjects. Diastolic blood pressure was also lower for experimental subjects, but the difference did not reach statistical significance. There were no differences between groups in the number of dropouts from treatment or percentage of appointments kept. Valid data was not obtained on the amount of medication taken.

The results indicated that self-monitoring is effective in lowering blood pressure.

CHAPTER 1

INTRODUCTION AND BACKGROUND RESEARCH

Community surveys have indicated that 10 to 20 per cent of adult Americans have high blood pressure (Wilbur and Barrow 1972, Hypertension Study Group 1971). The same surveys indicate that the majority of people with hypertension go undetected, untreated, or are inadequately treated. Among those patients who are aware that they are hypertensive, a large percentage fail to return to their physician for follow-up management or fail to continue to take their medication. In the above survey, 22.6 per cent of the persons surveyed were classified as hypertensive. However, in each step of the process, from screening to diagnosis and treatment, to continuing treatment, and to achievement of blood pressure control there was a significant dropout. In their work Wilbur and Barrow (1972) found that for each 100 persons screened, 25 will be hypertensive, 16 will reach a physician for diagnosis and treatment, and four will achieve blood pressure control for at least one year. It is generally assumed that the asymptomatic nature of hypertension is responsible for the patient's poor motivation to continue treatment (Freis 1966, Wilbur and Barrow 1972).

Some of the previous studies dealing with hypertension have acknowledged the dropout problems and have dealt with it by eliminating those subjects who were considered most likely to discontinue treatment from their research program (Freis 1966). For example, in a Veterans

Administration Cooperative Study (1970), about one third of the subjects were eliminated as non-compliant before starting treatment.

It has been suggested that in order to achieve better hypertension control an intensive, detailed patient education program is needed, in which the dangers of untreated hypertension are impressed upon the patient (Wilbur and Barrow 1972). However, there is some social psychological research which indicates that communications that deal with anxiety-arousing topics are ineffective in altering behavior (Janis and Feshback 1953). There is also the problem of persons expressing a change of attitude following exposure to a communication, but not exhibiting a corresponding change in behavior. For example, in a study evaluating the effectiveness of the anti-smoking commercials, O'Keefe (1971) found that the commercials were largely ineffective with persons who did not want to stop smoking. He also found that persons outside the target population, i.e., nonsmokers, perceived the campaign as being more effective than did the smokers. In view of this research, some method other than a purely educational one would seem desirable to deal with the lack of interest in hypertension treatment. Patients' self-monitoring of their own behavior has been effective in areas such as smoking reduction, and therefore this might be an effective way of dealing with the motivation problem in hypertension.

In a study of the effects of self-monitoring on normal smoking behavior, McFall (1970) noted that subjects in behavior modification research are sometimes required to monitor and record their own behavior. He hypothesized that such self-monitoring may be reactive, producing its

own behavior changes, and confounding treatment effects. To test this hypothesis, observers unobtrusively monitored the subjects' smoking frequency and duration throughout base-rate, experimental, and return to base periods. In the experimental period, the subjects self-monitored their frequency of smoking. Smoking frequency and duration were significantly reduced by the self-monitoring, indicating that self-monitoring is a reactive, data gathering procedure.

In a later study McFall and Hammen (1971) reviewed the outcomes of major stop-smoking studies and found a great similarity of data across a variety of different procedures, populations, and theoretical orientations. The elements of motivated volunteering, structure, and self-monitoring were regarded as nonspecific factors common to all these stop-smoking studies. A stop-smoking clinic was designed which offered no "treatment" but encouraged motivated volunteers to employ self-control and required them to monitor their smoking and report their progress at regular intervals. The outcome of the nontreatment clinic program was comparable to others reviewed and suggested that the nonspecific factors studied may account for the temporary behavior change found in most smoking treatments.

Stollack (1967) utilized self-monitoring as one of several methods in treating obesity. The various conditions included self-monitoring of food intake, self-monitoring plus two short visits per week with the experimenter, self-monitoring and contact with the experimenter plus 10 noncontingent shocks during the interview, and self-monitoring and contact with the experimenter plus shock when discussing

fattening foods. At the end of eight weeks only the group utilizing self-monitoring and contact with the experimenter showed a weight loss significantly greater than zero. Their weight loss was also significantly greater than all the other groups. The author implied that the relationship with the experimenter was the crucial variable, and that when another variable such as shock, contingent or noncontingent, is introduced, the positive effect of the relationship disappears. However, the study failed to include a group utilizing only short meetings with an experimenter. Unfortunately, the effects of self-monitoring and contact with the experimenter were confounded.

Thomas, Abrams, and Johnson (1971) utilized self-monitoring as one technique to eliminate multiple tics in an 18 year old male subject. The tics, which had been present since about age five, consisted of spasmodic, involuntary jerks of the neck, convulsive-like movements of his hands, and of plosive bursts of air that sounded like a sharp, loud bark. It was decided to work with the vocal tic first, and the patient was given a quiet lever counter and instructed in self-monitoring. Following the introduction of self-monitoring the rate of the vocal tic went to essentially zero. However, despite the reduction in the vocal tic proper, there were subtle aspects of response noted by the investigators after the vocal tic essentially disappeared, which were labeled minor vocal sounds. Base rates were taken for these sounds, as well as for the neck movements, and the patient was instructed in self-monitoring of these tics, while at about the same time relaxation training was initiated. The effect of the self-monitoring was most evident

for the vocal tic because the change was dramatic and occurred prior to the introduction of the relaxation and reciprocal inhibition regimen. They also hypothesized that self-monitoring served to reduce the minor vocal sounds and the neck tic, but the changes in both instances were less dramatic than for the vocal tic and may be attributable in part or fully to the relaxation training or the reciprocal inhibition procedure.

Rutner and Bugle (1969) utilized self-monitoring to reduce auditory hallucinations in a 47 year old female diagnosed as schizophrenic. The patient, who had been hospitalized for 13 years, felt that the voices controlled all her behavior. For the first three days of the procedure she was instructed to privately record the frequency of her behavior attributed to her hallucinations. Next she was instructed to publicly record the daily frequency of this hallucinatory behavior on a recording chart which was placed behind the nursing station. The chart, besides providing immediate feedback to the subject, also functioned as a stimulus for social reinforcement on the part of the staff and other patients.

Reported hallucinations decreased in frequency from 181 on the first day, to 11 on the third day of private recording. No hallucinations were reported on the first day of public recording. Reported hallucinations then increased in frequency to 16 and decreased and leveled off at zero on the sixteenth day. Reported hallucinatory behavior remained at zero with no remissions reported for approximately six months of follow-up. Because of the design of the study it is impossible to say whether the hallucinatory behavior would have decreased

to zero and remained there with self-monitoring alone, since social reinforcement was provided following the third day. The authors also stressed that there was no evidence to suggest that the results obtained with that particular patient can be generalized to all patients exhibiting similar behavior since self-monitoring requires patient cooperation and participation in carrying out the procedures without direct supervision.

There is also a growing body of literature in the area of biofeedback which indicates that some reduction in blood pressure can be achieved by providing subjects with frequent information on the level of their blood pressure and advising them to lower it. For example, Shapiro, Schwartz, and Tursky (1972) found that when provided with external feedback of their diastolic blood pressure and incentives to respond appropriately, normal male subjects learned to raise or lower their diastolic pressure in a 35-minute training session. The difference between increase and decrease groups at the end of conditioning was 7.0 mm Hg or 10 per cent of baseline. Shapiro et al. (1971) obtained similar changes in systolic blood pressure using the same experimental procedure. Thus, it is possible that in addition to making the patient's hypertension more visible and thereby providing motivation to continue medical treatment, self-monitoring might serve to reduce the patient's blood pressure in a manner analogous to a biofeedback paradigm. Blanchard and Young (1973) have noted that most of the research on biofeedback has utilized normal subjects rather than hypertensive patients. More research in this area with actual hypertensive patients is needed.

CHAPTER 2

GENERAL PURPOSES AND HYPOTHESES

The purpose of this study is to examine the effect of self-monitoring of blood pressure by patients on their hypertension and on the regularity with which they keep their clinic appointments. Previous research in this field has shown that the highest percentage of dropouts occurs during the first two months of follow-up (VA Cooperative Study 1960). The present study investigated the number of appointments kept for a three-month period following the initiation of treatment in the VA hypertension program. In addition, the effect of treatment on the patient's blood pressure at the time of clinic visits was examined. It is hypothesized that the self-monitoring will serve to make visible an otherwise asymptomatic condition, and thereby increase motivation to seek and continue medical treatment. No effort was made to eliminate undesirable subjects.

The following specific hypotheses were examined:

Hypothesis 1. Patients in the self-monitoring group will achieve better blood pressure control by the end of the three-month test period than will the control patients.

Hypothesis 2. Fewer patients will discontinue treatment without achieving blood pressure control in the experimental group than in the control group.

Hypothesis 3. Patients in the self-monitoring group will keep a higher percentage of their appointments than will the control group.

Hypothesis 4. Patients in the self-monitoring group will take their medication on a more regular basis than will control patients.

CHAPTER 3

METHOD

Subjects

The study was conducted at the Tucson VA Hospital in the Hypertension Program rooms. One hundred patients starting treatment for essential hypertension were randomly assigned to an experimental or to a control group. There were 97 males and three females in the sample. All were veterans receiving treatment at the VA Hospital.

The criterion for inclusion in the hypertension treatment program at the VA Hospital was that the patient's diastolic blood pressure be above 90 mm Hg. Since blood pressure is frequently quite labile (Wilbur and Barrow 1972), the pressure was taken three times with the patient seated and the three measurements were averaged.

Equipment

Experimental subjects were given a Stethoscopic Sphygmomanometer (Ultrasphyg) manufactured by the Lumiscope Company, Inc., 836 Broadway, New York, N. Y. 10003. No model number was given.

Procedure

Patients in the experimental group were given a sphygmomanometer with a built-in stethoscope for self-monitoring blood pressure and were instructed in its use. They were also requested to bring a record of their own blood pressure determinations at home to each clinic visit.

The control patients were not given a sphygmomanometer for home use and were not encouraged to purchase one.

Patients in both groups were advised of the advantages of reducing their diastolic blood pressure to less than 90 mm Hg. All were given medications in a similar order of increasing potency. Briefly, this meant that the patients were treated with hydrochlorthiazide initially. If this did not result in a lowering of blood pressure then reserpine was prescribed, followed by propranolol and later hydralazine if reserpine was not effective. Guanethidine was prescribed for some patients with difficult to control hypertension. Methyldopa was prescribed instead of reserpine for those patients who could not tolerate reserpine or when its use was contraindicated.

All patients were asked to bring their medication for each clinic visit. Records of the patients' appointments, as well as records of any medication returned, were kept by the secretary in the hypertension program. The physicians and nurses were not informed of the patients' group membership.

Both groups of patients were to be seen at regular intervals and for at least seven appointments during the three months of the study. If an appointment was missed, the clinic contacted the patient once and encouraged him to continue treatment.

CHAPTER 4

RESULTS

Only three subjects who could not be accounted for dropped out of the program. Two of these were in the experimental group and one was in the control group. Thus, with regard to the second hypothesis there was no significant difference between the groups in number of subjects dropping out of treatment. Since none of these subjects possessed a telephone, the clinic was unable to achieve a follow-up contact. Four remaining subjects failed to return for treatment, but the reasons in these cases were known to the clinic. Three persons resided out of town but happened to be in Tucson during the initial screening and were thus included in the study. None of these subjects lived closer than 125 miles to Tucson. One of the three is known to be receiving treatment at another VA hospital. The fourth subject was being treated for hypertension by a VA physician at the time the hypertension clinic opened. After his initial clinic visit he called and said that he preferred to continue treatment with his original physician.

More appointments were missed by control subjects than experimental subjects, but the difference was not significant. The clinic made nine phone calls to control subjects and seven to experimental subjects regarding missed appointments. All of these subjects scheduled and kept another appointment after being contacted by the clinic.

Unfortunately, valid data was not obtained with regard to whether or not patients were taking their medication regularly. After the study began it was learned that a number of the subjects had a supply of hypertensive medication on hand at the time they began treatment in the VA clinic. It was also learned during the study that the VA pharmacy was refilling the clinic's prescriptions without recording how much medication remained in the bottle. Because of these two circumstances the information as to the exact amount of medication given to each subject was not accurate. Finally, as the study progressed, the clinic secretary noted that some subjects were not bringing in their medication bottles as they had been instructed. Because of these factors it was not possible to compute the amount of medication taken by each patient.

Following the initial screening in the hypertension clinic, the subjects' blood pressures were recorded three times and averaged at each clinic visit. The three-month treatment period was divided into thirty-day periods for purposes of analysis, and the mean blood pressures were computed for each group (See Table 1). Because of circumstances beyond the experimenter's control, every patient was not seen during each thirty-day period. Therefore, an analysis of variance was not possible, and the data were analyzed by the use of a t-test between means for each thirty-day period. The mean systolic blood pressures for each thirty-day period are presented graphically in Figure 1, and the mean diastolic pressures are presented in Figure 2. For the systolic pressures, there was no significant difference between groups for the initial blood pressure, or during the first 30 days. However, for the period from 31 to

Table 1. Mean Blood Pressures During Treatment

Experimental Group				
	Initial	2 - 30 Days	31 - 60 Days	61 - 90 Days
Systolic	153.3	145.9	135.9	137.9
Diastolic	102.1	96.1	93.2	93.3
Control Group				
	Initial	2 - 30 Days	31 - 60 Days	61 - 90 Days
Systolic	156.6	147.1	147.0	148.6
Diastolic	103.6	96.1	95.8	96.9

Figure 1. Systolic Blood Pressure

Figure 2. Diastolic Blood Pressure

60 days the difference was significant ($t = 2.304$, $P < .05$). The difference for the period 61 to 90 days was also significant ($t = 2.065$, $P < .05$). For the diastolic pressure none of the differences reached statistical significance, although the data in Figure 2 would indicate that there is a trend in the predicted direction.

CHAPTER 5

DISCUSSION

The very high degree of compliance with scheduled appointments and the low number of dropouts was very surprising in the light of previous research that has shown that only about one third of the persons found to be hypertensive will continue treatment. The fact that only three out of 100 subjects dropped out of treatment in the first three months of the study deserves some comment. It is likely that the VA population does not represent a community population in several ways. First, there is no charge for services for eligible veterans. Second, it is felt by some employees that the VA system fosters dependence on the part of the patients. Many of the patients are receiving disability payments and must be certified to be disabled by a physician. This situation might tend to produce better compliance with a physician's orders than would a situation at a private office or a community clinic or hospital. Third, a number of the subjects in this study were residents at the hospital domiciliary, and some were hospital employees. The very fact that they were at the hospital each day would make attendance at the clinic more likely than if they had to travel to an appointment. Finally, the hypertension clinic prided itself on the fact that patients were seen very promptly for their appointments. In other parts of the hospital patients must sometimes wait for hours to be seen. Finnerty, Mattie, and Finnerty (1973) found waiting time to be a major

factor in dropouts in hypertension programs. All of these factors likely contributed to the high compliance rate.

Many of the same factors mentioned above also likely contributed to the fact that few appointments were missed, and that there was no difference between the experimental and control groups in number of appointments missed. Many of our subjects were also being seen in other clinics in the hospital and would come into the hypertension clinic on the days that they were at the hospital, even though their appointment might be a few days away. If they came in within a few days of their scheduled appointment, they were not shown as missing their regular appointment.

Several factors also contributed to the fact that we did not obtain valid data on the regularity with which subjects took their medication. It has already been mentioned that a number of subjects had hypertensive medication at the time they began treatment in the VA clinic, and that the pharmacy refilled clinic prescriptions. Another problem with this aspect of the study was that as the study progressed subjects did not consistently bring their medication bottles in with any remaining medication. Part of this is probably due to the fact that if patients were at the hospital for another clinic or physician, they tended to drop into the hypertension clinic on days other than their scheduled appointment days. On these days they would usually not have their hypertensive medication with them. Unfortunately, the loss of this data makes the reduction in blood pressure obtained more difficult to account for.

The systolic blood pressure of the experimental group was significantly lower than that of the control group at the end of the three-month treatment period. The differences in blood pressures between the two groups could have resulted from one or more of three factors. In the first place, it is possible that the self-monitoring produced the lower blood pressure in a manner similar to that used in biofeedback studies. The subjects had been instructed to take their blood pressure at least twice a day, and they could have used this feedback to reduce the pressure. The second possibility is that the experimental group took their medication on a more regular basis. It was originally thought that the self-monitoring might render an asymptomatic condition like hypertension more visible, and thus produce better compliance with physicians' instructions. Since valid data were not obtained on the amount and regularity of medication taken, one cannot with certainty determine from this study the extent to which the medication was responsible for the lowered blood pressure. The third possibility is that by repeated determinations of their own blood pressure, experimental subjects may not have altered their usual blood pressure but did, by some desensitization process, decrease the blood pressure values recorded in the hypertension clinic.

The results of this study indicate that self-monitoring is effective in lowering blood pressure, and holds promise as a useful technique for obtaining blood pressure control. However, clear demonstration of the variables involved in producing the change will have to await a situation where better control can be obtained. Ideally, such

a study should utilize a community clinic or private physician's office rather than an institutional setting. This would show more clearly whether or not self-monitoring is effective in reducing the dropout rate usually found in hypertension treatment programs. Such a setting should also make possible more accurate monitoring of the amount of medication taken by each patient. Thus, it could be more clearly determined whether the lowered blood pressures are due to a biofeedback mechanism involved in self-monitoring, or due to patients' taking their medication on a more regular basis.

APPENDIX A

INSTRUCTIONS GIVEN TO EXPERIMENTAL GROUP SUBJECTS

In addition to providing medication for high blood pressure, we are interested in collecting as much information as possible about hypertension. In order to gather this information we are willing to train selected patients to take their own blood pressure and loan them the necessary equipment to keep at home. We feel that this can be both interesting and beneficial to our patients. If you are interested, we would like to invite you to participate in this program.

(Demonstration of Sphygmomanometer)

We would like you to take your blood pressure twice a day, preferably in the morning and evening, and keep records which you can give to us when you come for your regular appointments. Please give these records to me at each visit, rather than discuss them with the physicians here. We also request that you bring your medication bottles with any leftover medication at each visit. We will provide you with a fresh prescription at each visit.

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