

Response to Psychologic Stress in Persons Who Are Potentially Hypertensive

By ROBERT E. HARRIS, PH.D., MAURICE SOKOLOW, M.D., LEWIS G. CARPENTER, JR., PH.D.,
MERVIN FREEDMAN, PH.D., AND SAMUEL P. HUNT, M.D.

College women who are prehypertensive and matched controls were exposed to emotion-provoking situations, psychologic tests, and psychiatric interviews. Patterns of response differentiating the groups were observed. The prehypertensives were less well controlled, more impulsive, more ego-centric, and generally less adaptable in the stressful situations. In the psychiatric interviews, behavior similar to that of patients with hypertension was noted. The findings suggest that prehypertensives are more vulnerable in situations involving psychologic stress, and hence more subject to the autonomic concomitants of emotion, including repetitive rises of blood pressure.

ESSENTIAL HYPERTENSION is a disease of unknown etiology. As in other diseases with obscure causes and chronic but variable course, a number of investigators have claimed that emotional factors play a role in what is probably a very complex network of events, some of which can be described physiologically and anatomically, and others psychologically. They have supported their assertions in a series of provocative and at times persuasive clinical psychiatric studies. Evaluated as scientific evidence, these studies have three major limitations.

1. Patients with hypertension who have been studied by psychiatrists have usually been referred by internists, who are likely to refer their "interesting" and troubled patients, neurotic persons whose psychologic problems may have no causal connection with elevations of blood pressure. Other hypertensive patients may find their way to psychiatrists because of multiple vague physical symptoms of a hypochondriac nature, again with no necessary relation to hypertension.

2. Clinical psychiatric methods are notably impressionistic and qualitative, perhaps inevitably so by their very nature. There are no unequivocal criteria for establishing the presence or absence or the degree of important

phenomena such as unconscious hostility or neurotic conflict. To the probing eye of a psychiatrist, few people are "normal."

3. It can be argued that the neurotic problems found in hypertensive patients may be secondary to other processes involved in the disease, or to the fact that the patient knows he has a disease which will probably shorten his life span.

In our research, we have controlled a number of variables related to these problems and, in addition, have attempted to demonstrate the presence of psychologic deviations in persons who are not now hypertensive but who probably will become so. Such a demonstration would add weight to the argument that psychologic factors are relevant in the complex etiology of hypertension, since they then would be shown to exist *before* the onset of fixed hypertension.

In selecting our subjects, we have taken advantage of the fact that an elevated blood pressure in early adult life, even though transient, has prognostic significance for the later development of hypertension. Figure 1, adapted from Hines,¹ demonstrates an increasing incidence of clinically diagnosed hypertension after 10 years as a function of initial systolic and diastolic readings. Figure 2 presents similar data for a 20-year follow-up period. Supporting data are available from the studies of Diehl² on college students and Levy and co-workers³ on army officers, as well as from certain insurance data.

Accordingly, we selected for our experi-

From the Departments of Psychiatry and Medicine, University of California School of Medicine, San Francisco, Calif.

Supported in part by a research grant (H-754) from the National Heart Institute, United States Public Health Service.

mental group 40 undergraduate college women who at the time of their initial physical examinations on matriculation had shown blood pressures which exceeded 140 systolic or 90 diastolic or both.* They were matched with 40 women whose pressures were less than

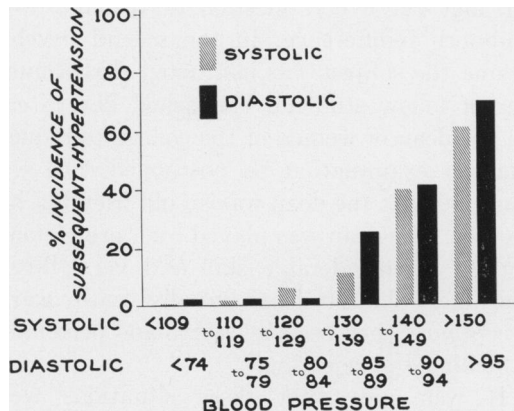


FIG. 1. Relation of blood pressure to incidence of subsequent hypertension. Ten year follow-up. (Adapted from Hines.¹)

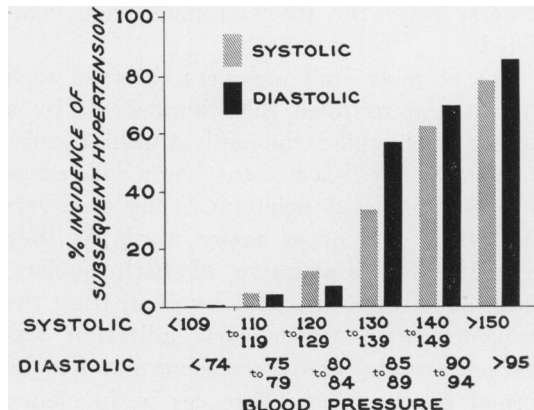


FIG. 2. Relation of blood pressure to incidence of subsequent hypertension. Twenty year follow-up. (Adapted from Hines.¹)

120/80. In the former group, which we shall call *prehypertensive*, we expect a greater incidence of hypertension in later adult life than in the normal controls. At present the evidence for the prediction is presumptive; the actual

incidence of essential hypertension for the two groups will be checked by later studies.

The subjects were unaware of the purposes of the study and of the reasons why they had been selected. The experimenters, interviewers and observers did not know which subjects were prehypertensive and which were controls until all the data had been recorded.

METHOD AND RESULTS

I. The Psychiatric Interview

Eighteen of the prehypertensive group and 20 of the normals were interviewed by one of us, a psychiatrist (S. P. H.), who sought to identify their characteristic psychologic reactions and to infer which subjects were prehypertensive and which were normal. From

TABLE 1.—Accuracy of Identifications of Prehypertensives and Normals from Psychiatric Interview

Interview Rating	Group	
	Normals N = 20	Prehypertensives N = 18
0	14	6
1-3	6	12

Ratings on 0-3 scale indicating increasing degrees of hypertensive personality features.

$$\chi^2 = 5.1$$

p = less than 0.02 (single tail)

previous interviews with more than 100 patients with fixed hypertension he had derived hypotheses about characteristic psychologic features associated with the disease. He rated each student on a scale from 0 to 3, indicating the degree to which she showed similarities to the personality pattern of fixed hypertensives. The results are presented in table 1.

Note that 14 of the 20 normals (70 per cent) were assigned a rating of zero, while only six (33 per cent) of the prehypertensives were assigned a like score. If a rating of one or more is taken to indicate the presence of hypertensive features, the psychiatrist was found to identify correctly 26 of the 38 cases (68 per cent). The significance of this finding is given by the chi square which is significant at the 2.0 per cent level of confidence; that is, such a finding would occur by chance only twice in 100 repetitions.

* We are grateful for the assistance given us by Dr. William G. Donald, University Physician, and by Dr. Margaret Zeff, Ernest V. Cowell Memorial Hospital, University of California.

Although not the major focus of this preliminary report, the basis on which the psychiatrist made his correct identifications is of some interest. An important factor was his estimate of the degree of neurotic involvement in each subject. Of the eight women whom he described as most normal, those with good scholastic and social adjustment, seven were from the control group and only one was prehypertensive. Of the 16 most severely disturbed, either markedly neurotic or schizoid, 11 were prehypertensive and only five were controls. More specifically, the psychiatrist's judgements were based on his evaluations of the dynamics and economics of conscious and unconscious hostility. These involved an estimate of the quantity of hostility latent in the personality, the strength of the defenses, the breakthrough of hostility into consciousness under stress, and the degree of anxiety when the hostility was perceived. These data and interpretations support the hypotheses developed from the clinical experience of most psychiatric observers.

II. Experimentally Induced Stress

In the second procedure, we exposed the subjects to situations involving psychologic stress. The technic devised to evoke stress was that of staged interpersonal situations or psychodramas, interactions between two people. One of two roles was assigned to a subject; the other was played by a staff member. The method has several advantages over other contrived laboratory methods for inducing stress:

1. Plots can be constructed which are realistic and approximate those life situations that are especially meaningful to the subjects.
2. Plots can be constructed which are directly relevant to the presumed psychodynamics of hypertension.
3. The amount of stress may be varied by the protagonist (staff member).
4. The method seems to have an inherent power to produce a high level of motivation or ego-involvement in the subjects.

In the first of the two psychodramas used here, the subject was instructed that she was a college student, that she was going to a dance

that evening, and that she was to pick up an evening gown which she had left at a dry cleaner's. In the experimental room, on a slightly raised platform, she was met by a staff member who played the role of the proprietor. He informed her that her gown was not ready, that it was not even in the shop. He met her every question or demand with stubborn indifference. In the second psychodrama the subject was instructed that a number of fellow students had asked her to call on the dean of women of the college to request that an examination be postponed. She was also told that the dean was an old friend of her mother. The dean was played by a professional actress of considerable skill and versatility.* She met the student initially with warm acceptance, then became critical and personally attacking and rejecting.

It was clear that these situations were emotion-provoking for the subjects, from the fact of visible autonomic responses, from disturbances of verbal and motor behavior, and from retrospective accounts related by the subjects after the psychodramas were completed.

Two or more staff members observed each student and recorded their impressions by a variety of methods. One method utilized a list of 389 adjectives selected to cover a wide range of personality and behavior.† The observers checked as few or as many words as they thought were descriptive of each subject. These data were analyzed by comparing the frequency with which each adjective was checked for the prehypertensive and for the normal groups. The differences in frequency were then tested for statistical significance and two lists compiled: one list of those 43 adjectives checked significantly more often for the prehypertensives, and another of 42

* We wish to express our indebtedness to Mrs. Grace Macouillard, whose facile ingenuity contributed greatly to the successful execution of the emotion-provoking situations; and to Mrs. Julia Lee for keeping the observers unaware of the subjects' identity.

† Adapted from H. G. Gough: Predicting success in graduate training: A progress report. Berkeley, The University of California Institute of Personality Assessment and Research, 1950. (Mimeographed.)

checked more often for the controls. The first list, describing the prehypertensives, is shown in table 2.

Note first that the majority of these adjectives have a negative tone; that is, they describe personality in unfavorable terms; for example, there are the words *obnoxious*, *irritable*, *unsympathetic*, and *self-centered*. Second, many of these adjectives may be described as referring to inadequate control of behavior or emotionality, for example such words as *changeable*, *erratic*, *excitable*, *impulsive*, *unstable*, and *restless*. A third characteristic of this list is that the words describe an ego-

TABLE 2.—*Adjectives Checked Significantly More Often for the Prehypertensives than for the Normals by One or Two Observers*

aggressive	imprudent	provident
awkward	impulsive	prudish
blustery	infantile	queer
changeable	intense	resentful
clever	irritable	restless
despondent	loud	self-centered
emotional	nagging	sour
erratic	nervous	stubborn
excitable	noisy	sulky
fearful	obnoxious	talkative
grave	opinionated	temperamental
guarded	peculiar	unsympathetic
headstrong	persistent	unstable
idealistic	pessimistic	wary
	precise	

centric kind of person, for example, *self-centered*, *unsympathetic*, *stubborn*, *temperamental*, and *headstrong*. Fourth, there are words which suggest moodiness, for example *despondent*, *pessimistic*, *resentful*, *sour*. In general one may describe this list of words by saying that the observers found the subjects in this group unattractive, and they tended to describe them in negative, unflattering terms.

It should be noted that not all of these adjectives were applied by the observers to all of the subjects. Hence there may be apparent contradictions within the list. For example, there are pairs of words which are approximately opposite in meaning: *persistent* and *changeable*, *wary* and *headstrong*, *guarded* and *impulsive*. All of these words are on roughly

the same continuum, that of control of emotionality and behavior, but at opposite ends. All may be thought of as representing the extremes of over- and under-control, and contrast sharply with the more adaptive, less effortful control found in the normals. The inference would be that the prehypertensives betray their greater degree of emotional upset, some by behaving erratically, others by a tense kind of repressive control. Both kinds of behavior indicate tension which is unresolved and are therefore inadequate. The important thing is the fact of greater emotional upset. The prehypertensives are less efficient in meeting these

TABLE 3.—*Adjectives Checked Significantly More Often for the Normals than for the Prehypertensives by One or Two Observers*

adaptable	cooperative	poised
affected	dependable	precise
affectionate	easy-going	relaxed
apathetic	efficient	respectful
appreciative	even	simple
broad-minded	gentle	sociable
cautious	humane	sophisticated
conciliatory	kind	sympathetic
conscientious	liberal	tactful
conservative	likeable	tender
considerate	mannerly	tranquil
consistent	meticulous	trusting
contented	peaceable	unambitious
conventional	pleasure-seeking	witty

emotion-provoking situations in both a psychological and (presumably) a biologic sense.

Turning now to those adjectives which the observers checked more frequently for the normals than for the prehypertensives, we find a quite different list of words, as tabulated in table 3.

Note first that most of these words are positively toned, that is, they are "nice" things to say about people, quite in contrast to those checked for the prehypertensives. For example, there are words like *kind*, *adaptable*, *likeable*, *cooperative*, *sociable*, *tactful*. Second, note the absence of words denoting impulsiveness and, in their place, words suggesting *tempered* control, like *consistent*, *even*, *adaptable*, *efficient*. Third, many more words in this list than in the prehypertensive list describe

relations with people, for example such words as *gentle, affectionate, cooperative, considerate, sympathetic, trusting, humane*. Fourth, these words describe persons with social poise, for example *tactful, poised, relaxed, tranquil, sophisticated, contented*.

Clearly the groups behaved differently in these stressful situations, and consistent personality pictures emerge. An important overall difference between the groups, but one which is difficult to document briefly, is that the prehypertensives were less effective in carrying out their assigned tasks, that is, in getting the dry cleaner and dean to comply with their requests. This is evidenced in part by the fact that although the prehypertensives

they are less effective in achieving their ends. Further, they are likely to create an unfavorable social impression, just as they did in our observers.

III. Self-Descriptions

In order to obtain a third and entirely different kind of data, each subject was asked to check on the same list of adjectives used by the observers those words which she thought described herself. The data were analyzed in the same way as the observers' checks, and two lists compiled. These suggest the subjects' perceptions of themselves and their behavior.

Table 4 lists those adjectives checked more frequently by the prehypertensives than by

TABLE 4.—Adjectives Checked Significantly More Often by Prehypertensives than by Normals—Self-Checks

adventurous	foolish	rash
artistic	frugal	reflective
awkward	guarded	repentant
clever	hotheaded	self-possessed
compassionate	humble	self-reproachful
conceited	hurried	self-reproving
confused	indifferent	shy
curious	nervous	simple
daring	original	spendthrift
docile	passive	submissive
dreamy	peculiar	tender
egotistical	preoccupied	tense
fearful	prudent	tranquil

were checked on rating scales as being more involved in the situations, they were also checked as being less well controlled and organized than the normal subjects, who took the scenes much more "in stride." In playing their roles, the staff members tried to be consistent from one subject to the next, making each scene roughly equally stressful. Apparently the prehypertensives *interpreted* the situations as more stressful than did the normals and behaved as if these situations were more emotion-provoking. At the risk of overgeneralizing from one situation, a semilaboratory one at that, one may say that the prehypertensives are likely to bring more anxiety to real-life problem situations, that they become more emotionally involved, and that

TABLE 5.—Adjectives Checked Significantly More Often by Normals than by Prehypertensives—Self-Checks

adaptable	frank	meticulous
bossy	humane	persistent
charitable	independent	reasonable
collected	level-headed	thorough
efficient	mature	thoughtful
fair-minded		tolerant

the controls. In general this list is similar to the observers' checks for the prehypertensives. There is the same negative feeling tone to many of the words; and several of the words, for example, *hurried, hotheaded, rash, daring, adventurous, tense*, describe the same defect of control noted by the observers. Other words with a negative feeling tone are *awkward, confused, peculiar, and foolish*. Also there are words suggesting moodiness and egocentricity. In general the agreement with the observers' check list is striking, except for one important difference. Note such words as *submissive, docile, passive, and humble*, which imply a lack of dominance not noted by the observers.

Table 5 lists those adjectives checked more often by the normals than by the prehypertensives. Note here that the words suggest a positive self-evaluation, for example the words *independent, mature, level headed, collected, and adaptable*, also that they describe a *steady* kind of control, for example the words *efficient, thorough, persistent, and collected*. A third

characteristic of these words is an implied benevolent dominance in social relations, words such as *humane*, *tolerant*, *charitable*, *fair-minded*, and *reasonable*.

Thus we have evidence that the self-appraisals of the prehypertensives and the controls are quite different and, further, that they are congruent with the impressions created in the observers of the stressful situations. The validity of the differences noted by the observers is therefore reinforced. Additionally these self-appraisals provide ground for generalizing beyond the experimental situations. The prehypertensives, thinking of themselves in these negative terms, as moody and egocentric and as less well controlled than other persons, would probably behave less effectively in ordinary everyday problem situations and would more often experience anxiety and frustration.

SUMMARY

In summary, it is clear that by technics of personality study, college women who have a high actuarial probability of becoming hypertensive in later life can be differentiated from normal controls. Our data indicate that the prehypertensives responded characteristically to a psychiatric interview and to interpersonal situations involving psychologic stress. In the stressful situations they behaved less effectively, were less well controlled, less poised, and socially they created a less favorable impression than the controls. The validity of these interpretations was reinforced by the agreement between the observers' descriptions and the subjects' own self-appraisals. Finally, in a psychiatric interview they responded similarly to patients with clinically diagnosed hypertension, and the personality patterns described were like those noted by the observers during stress.

It is suggested, therefore, that the prehypertensives are less well able than normal persons to handle stressful or frustrating situations (of which the initial college physical examination is one) without becoming emotionally upset, and that therefore they are more likely to be subject to the autonomic accompaniments of emotion, including repetitive rises in blood pressure. Such repetitive rises may well be one of the conditions, an important even though perhaps not a necessary or sufficient one, in the network of events leading to fixed hypertension.

SUMARIO ESPAÑOL

Mujeres colegiales prehipertensas y controles emparejados fueron expuestas a situaciones provocadoras de emociones, exámenes psicológicos y entrevistas psiquiátricas. Modelos de repuesta diferenciando un grupo del otro se observaron. Las prehipertensas eran menos controladas, más impulsivas, más egocéntricas y generalmente menos adaptables en las situaciones tensas. En las entrevistas psiquiátricas comportamiento similar al de pacientes con hipertensión se observó. Los hallazgos sugieren que los prehipertensos son más vulnerables en situaciones que envuelven tensión psicológica y naturalmente más sujetos a las emociones autonómicas concomitantes, incluyendo repetidas alzas en la presión arterial.

REFERENCES

- ¹ HINES, E. A.: Range of normal blood pressure and subsequent development of hypertension. *J.A.M.A.* **115**: 271, 1940.
- ² DIEHL, H. S., AND HESDORFFER, M. B.: Changes in blood pressure of young men over a seven year period. *Arch. Int. Med.* **52**: 945, 1933.
- ³ LEVY, R. L., WHITE, P. D., AND STROUD, W. D.: Transient hypertension: The relative prognostic importance of various systolic and diastolic levels. *J.A.M.A.* **128**: 1059, 1945.