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PERSONALITY FACTORS AND
THE OUTCOME OF TREATMENT
IN ESSENTIAL HYPERTENSION

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"The cardiovascular system commends itself to psychiatric study, not as a nonspecific index of arousal or emotion, but as a highly specific and apparently quite delicate response mechanism, integrated at the highest levels with the affective and cognitive variations among people, and revealing specific personal idiosyncrasies in the way people deal with their external world".

Lacey and Lacey (1970)

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SUMMARY

The thesis explores the relationship between personality characteristics, perceived life stress, and outcome of drug treatment for patients with moderately severe essential hypertension.

In the Introduction, attention is drawn to the hiatus which exists between personality studies of hypertensives on the one hand, and clinical drug studies on the other. An opportunity to assess a consecutive series of patients before drug treatment and after 12 months, provided a means of studying the possible relevance of personality characteristics to the clinical course under drug treatment conditions.

The Review of Literature includes an historical perspective in the two broad areas of Biological/Clinical Studies and Psychosocial Studies. Since psychological influences must be mediated via physiological mechanisms, modern concepts of pathophysiology such as neural control of renal mechanisms, are examined. A clinical perspective is gleaned by reviewing studies which demonstrate the effect of drug treatment on morbidity and mortality.

Regarding psychosocial factors, approaches reviewed include epidemiological, animal experimental, and human psychophysiological. There appears to be compelling evidence for the potential for psychosocial forces to influence cardiovascular functioning, although precise definition of an aetiological role in hypertension in humans remains elusive in this highly complex and intricate frontier of research.

Psychoanalytically derived studies have long suggested that personality characteristics related to the modulation and disposition of aggression (submissiveness, paranoid traits) deserve close scrutiny.

Much of the psychosomatic literature is concerned with issues of aetiology and pathogenesis; in the clinical setting available to the author for the present study, it seemed more profitable to address the more circumscribed issue of the possible influence of selected psychosocial factors on the course of the illness, than to attempt to explore aetiological factors. Hypotheses derived from previous studies could still be tested in the treatment setting. Using blood pressure reduction as the criterion variable, it was hypothesized that the following groups of persons would have less satisfactory outcome:

- (i) persons with purportedly pathogenic traits of "submissiveness" or "suspiciousness".
- (ii) persons who perceived their current life situation (family, marriage, work) as intrinsically stressful.
- (iii) persons who anticipated negative effects from drug treatment.

Over a 3 year period, 75 patients were assessed by semistructured interview and questionnaires (Cattell's 16PF, and Kupfer-Detre System I and II) prior to beginning treatment; 71 completed diuretic therapy, 61 were able to be reassessed at 3 months, and 55 at the 12 month stage. Patients received one of four antihypertensive drugs (clonidine, methyldopa, oxprenolol, bethanidine) as well as a diuretic (cyclopenthiazide); differences in outcome between the drug groups were not significant.

From findings depicted in the Results Section it is evident that the predictions were rather simplistic. While generally in the predicted direction, statistically significant correlations across as 3 phases (pretreatment, diuretic, combined drugs) were not seen between the dependent variable (percentage reduction in blood pressure) and the

predictor variables. Different psychosocial correlates were noted at different phases, and there were striking sex differences regarding specific psychosocial variables. For example, the "suspiciousness" trait appeared to be more telling in females, while "work stress" was clearly important among men.

In addition to the findings related to predictions, it was found that another personality characteristic (Factor A of the 16PF) which appears to reflect the "engagement-involvement" dimension of personality functioning, was a more significant predictor of blood pressure change (persons rating lower on "involvement" having better outcome) than either of the two personality traits studied predictively. A further literature search following this serendipitous discovery revealed a consistent theme within the psychophysiological literature regarding this characteristic, suggesting that low "involvement" may be an adaptive behavioural style in the face of an over-reactive pressor system. This theme has generally been overshadowed by that concerning the personality configuration related to aggression.

Other issues related to personality which emerged included "placebo" effects, compliance/non compliance with drug treatment, and decisions made by patients regarding life style changes during treatment. The major theme described above, together with these associated issues, point to a clear need for further integration of psychologically oriented approaches with those of clinical pharmacology and medicine, if further challenges of the modern epidemic of essential hypertension are to be faced.

The main areas wherein this thesis is considered to advance medical knowledge are:-

- (i) Relationships between specific psychological characteristics of patients with essential hypertension, and change of blood pressure before and during drug treatment.
- (ii) The evidence that different psychological variables are related to blood pressure change for different phases (a) pretreatment phase, (b) diuretic phase, and (c) phase of combined diuretic and antihypertensive drug treatment.
- (iii) The evidence that although blood pressure changes were similar for the sexes, psychological measures correlating with blood pressure change differed considerably between the sexes.
- (iv) Patients with a personality configuration of low "involvement-engagement" have a significantly better outcome over 12 months of treatment, than patients with the opposite characteristics of high levels of "involvement-engagement" in personal interaction. It is possible that this interactive style represents an adaptive behavioural strategy for a person with a hyper-reactive pressor system; those persons who cannot thus adapt are therefore exposed to higher levels of stimulation which may counteract the antihypertensive effect of drug treatment.

STATEMENT OF ORIGINALITY

The planning and execution of this work is original. The methods of recording findings and evaluating data have been personally selected, and the composition of the thesis is my own.

The thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and to the best of my knowledge this thesis contains no material previously published or written by another person except where due reference is made in the text.

C.G. BARROW

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CHAPTER IINTRODUCTION

The writer's interest in the relationship between personality factors, situational stress, and treatment of essential hypertension, was stimulated by an invitation to participate in a prospective antihypertensive drug treatment study at The Queen Elizabeth Hospital, a general teaching hospital affiliated with the University of Adelaide. In this study there were to be extensive clinical, physiological and biochemical investigations, before, during and after treatment; the availability of this data influenced the decision to participate and to attempt to study the relevance and possible influence of psychosocial factors in the response to medical treatment, in this group of patients.

In discussion with colleagues both in general and specialist medical practice, it became apparent that there was a wide spectrum of opinion and practice regarding the possible relevance of personality factors and situational stress in the aetiology, course and prognosis of essential hypertension. At one end of the spectrum were those practitioners who regarded such aspects as largely irrelevant, and who directed their energies entirely to the task of reduction of blood pressure levels by the use of appropriate drugs. At the other end were those who believed the pathogenesis and course of essential hypertension to be significantly stress-related, and placed due weight in their management on recommendations of alterations of life style, and reduction of psychic tension with advice concerning relaxation or the use of tranquillizing drugs. Any group of patients would be expected to have a similar spectrum of attitudes about the condition, partly derived from the particular medical opinion received, and partly derived from personal experience, family history, and prevailing community beliefs.

Inspection of the results of some community surveys both in Australia (Prineas, Stephens and Lovell, 1973), and in the U.S.A., (Wilber and Barrow, 1972), revealed that only a minority of patients with essential hypertension were considered to have been adequately treated, despite widespread publicity in the medical literature concerning the advantages of treatment in preventing major complications in severe hypertension (e.g. Reports of the Veterans Administration Cooperative Study Group, 1967 and 1970). While part of this problem may have been attributed to such factors as intolerance of side effects of certain antihypertensive drugs, this hardly explains the whole picture. The matter of compliance or noncompliance with treatment has broader significance, and inevitably leads to a consideration of personality traits, attitudes to diagnosis, and attitudes to accepting the long-term patient role.

As far as published research is concerned, it soon became apparent that there was a rich and extensive literature regarding personality factors and stressful life experience in essential hypertension. A considerable body of psychological literature had already appeared in the two decades preceding the availability of effective antihypertensive drugs in the mid 1950's, and perhaps it is natural that as the focus shifted to pathophysiological and pharmacological aspects, the psychologically-oriented literature appeared less significant or at any rate of less practical importance. There is a close parallel in clinical psychiatry regarding the concepts of, and treatment of, depressive illness before and after the advent of antidepressant drugs.

It appears therefore that a 'split' had developed conceptually concerning models of essential hypertension: personality theory progressing rather uncertainly on one pathway, pharmacology and pathophysiology progressing somewhat more confidently, hand in hand, along

another. Should the two pathways not converge? A.P. Shapiro (1956) had advocated combined psychological, pharmacological, and clinical approaches to the management of essential hypertension in the early years of antihypertensive drug therapy, but in fact very few of the hundreds of subsequent drug studies had incorporated any psychological dimension in a systematic way.

Within the setting of the present drug treatment study, it seemed to the writer that it would be more feasible and profitable to concentrate on the possible relevance of personality factors, emotional state, and situational stress (work, family, marital) on the course of the condition during treatment, than to attempt to study retrospectively the possible aetiological role of these factors.

A study of the influence of personality traits and environmental stress on treatment outcome could potentially prove of practical value. If significant effects were discovered there would be reinforcement of the attitude which favoured therapeutic intervention into psychosocial aspects. On the other hand, if no significant effects were discovered, there would be support for the contention that pharmacotherapy could effectively cause blood pressure reduction whatever the personality structure, emotional state, or presence of stress factors in the social environment, at least insofar as these would have been assessed by the methods to be described in this study.

The literature search became a quest to answer such questions as:-

- (1) have specific personality traits been found to be linked with essential hypertension?
- (2) have environmental factors been found to be of significance regarding aetiology or the course of the condition?
- (3) are models available which link these variables with current physiological knowledge regarding higher central nervous system control of vascular homeostasis?

A substantial literature has developed over the past 50 years regarding the possible relevance of such psychosocial factors as personality structure, intrapsychic conflict, and stressful life events to the pathogenesis of essential hypertension. While the major focus of this thesis is an inquiry into the role of such factors in the course of treated hypertension, rather than in pathogenesis of untreated hypertension, it is highly relevant to consider the literature pertaining to aetiology to gain a broad perspective of this field, as well as to develop and formulate testable hypotheses for the present study.

Clearly, the survey of the literature concerning psychological aspects cannot be considered in isolation from current thinking regarding physiological and clinical aspects. Since there is much controversy concerning the aetiological significance of psychosocial factors, it behoves one to review current knowledge of the pathophysiology of essential hypertension, especially the aspect of central nervous system control of the vascular system, and blood pressure regulation in particular.

Since the present study takes place in a treatment setting, it is also appropriate to obtain a medical perspective by reviewing the evidence that persistently elevated blood pressure does influence morbidity and mortality, and that reduction of persistently elevated blood pressure modifies the prognosis.

The review is therefore structured as follows: -

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In the review which follows the following abbreviations

have been used:-

BP	=	blood pressure
CO	=	cardiac output
CNS	=	central nervous system
DBP	=	diastolic blood pressure
EH	=	essential hypertension
mmHg	=	millimeters of mercury
NA	=	noradrenaline
SBP	=	systolic blood pressure
SNS	=	sympathetic nervous system
TPR	=	total peripheral resistance

REVIEW OF THE LITERATURE

A. Biological and Clinical Studies1. Historical Aspects

The term "essential hypertension" is an imprecise translation of "essentielle hypertonie," which term was coined by Frank in 1911. The concept of high BP of unknown cause as a condition with potentially serious medical consequences had been formed slowly in preceding decades, as medical thinking for most of the 19th century had been dominated by Bright's (1827) linking of renal disease with major cardiovascular consequences such as heart failure. Clarification of these issues could not depend simply on advances in clinical observation and pathology, as the technical means by which BP could be accurately recorded were not available until Rive-Rocca's invention of the mercury sphygmomanometer in 1896. Nonetheless, as early as 1879 Mahomed had challenged the medical assumption of his day that all vascular sclerotic changes were secondary to renal disease, in a description of the clinical aspects of 100 cases of "granular kidneys". He suggested the reverse possibility that impeded circulation led to the cardiovascular changes, and that the renal damage associated with Bright's disease was a consequence of these changes.

While this viewpoint was also too simplistic, it did focus attention on the vascular phenomena, and in the next few decades terms such as Huchard's (1889) "presclerosis", "latent arteriosclerosis", Allbut's (1895) "senile plethora" which was later changed to "hyperpiesis"; indicate this development of a concept of a primary vascular disorder. Further progress was made with the publication in 1914 of Volhard and Fahr's classification, which not only separated the primarily nephritic conditions from the primarily hypertensive

conditions, but divided the arteriosclerotic conditions into simple benign hypertension on the one hand, and the "malignant" form on the other. The latter condition was at that time thought to be a combination of "sclerosis" with "nephritis"; however, subsequently Pickering (1942) made it clear that the form of hypertension designated "malignant" was a function of the intensity and severity of the hypertension whatever the cause.

From these beginnings in clinical medicine, progress has occurred in very diverse fields such as neurophysiology, epidemiology, and psychology as applied to hypertension. An early example of the benefits of a multidisciplinary approach in fundamental research was Cannon's (1915) demonstration of the link between changes in physiological and biochemical responses (increased sympathetic activity and adrenaline secretion) and a behavioural response (fight or flight), and the further ramifications of this basic link are still being sought in the field of neurophysiology and its interaction with the vascular system.

It was not long before certain personality characteristics drew the attention of observant clinicians. The earliest description of personality patterns and psychological functioning in hypertensive patients was that of Moschowitz (1919), who seemed in no doubt that patients with EH revealed striking personality characteristics. Although his observations were uncontrolled, they are noteworthy as the forerunner of the studies which will be reviewed in this thesis: "the greatest proportion of patients with hypertension are terribly tense and pursue their vocation with tremendous seriousness, and worry over trivialities. In consequence, they are irritable. They are the antithesis of the child. They do not play. They have no time for play. They have narrow intellectual horizons".

In subsequent decades the thinking of clinicians has been much influenced by such discoveries as Goldblatt's (1934) demonstration of the effects on the circulation of occlusion of the renal arteries, and the discovery of such humoral agents as renin and angiotensin. Such discoveries tended initially to raise hopes that a specific pathophysiological "fault" would be discovered, and these hopes were based on a concept that a qualitative difference existed between persons with EH and normotensives, and that these specific differences were ultimately genetically determined. During phases of enthusiasm for such biological causes there was generally a reduction of interest in psychological aspects. The lack of discovery to date of such a "fault" is one factor which has tended in recent years to induce the pendulum to swing back to more adequate consideration of psychosocial factors. Nonetheless, research into the various factors has not, does not and cannot be expected to proceed as a smoothly integrated whole.

The concept of EH accepted as a working basis for this thesis is that developed by Pickering (1968). The model proposed is that (1) raised BP itself is a sign and not a disease, (2) there is no natural dividing line between normality and abnormality, i.e. a sharp division of "hypertensives" from "normotensives" is an artefact, as the differences are purely quantitative, (3) persons designated essential hypertensives constitute "that section of the population having arterial pressure above a certain value selected on arbitrary grounds, and having no disease to account for the raised pressure".

2. Physiological and Pathophysiological studies.

The review of this section will be necessarily highly selective. In this most complex field of active physiological research, the author's goal is to assess the evidence from physiological studies that CNS influences might lead to permanent changes in BP levels. If experiential factors are to be shown to be significantly related to the pathogenesis of essential hypertension, the discovery of intermediary mechanisms subserving such influences becomes a matter of high priority.

Models of CNS-vascular interaction will also need to be congruent with currently accepted models of homeostatic cardiovascular mechanisms in normal persons, as well as with models of pathophysiological disturbance in EH.

The section can be conveniently organized under the following headings: -

- (1) Renal function, fluid balance, and haemodynamics of blood pressure control.
- (2) The sympathetic nervous system and catecholamines.
- (3) The renin-angiotensin-aldosterone system.
- (4) Summary.

(1) Renal Function, Fluid Balance, and Haemodynamics of Blood Pressure Control.

The BP level is a function of CO and TPR. Since in most cases of established EH there is normal CO but an elevated TPR, at first sight the hypothesis that CNS influences might be mediated by such mechanisms as central control of SNS innervation of peripheral arterioles appears plausible and attractive. That this viewpoint is quite insufficient, however, has been amply demonstrated by Guyton and coworkers who in a series of articles in the past decade have emphasized the overriding importance of renal function and control of

fluid balance in chronic elevations of BP levels. The conclusions of these studies by Guyton and Coleman (1969), Guyton, Coleman, Bower and Granger (1970), and Guyton, Young, DeClue, Trippodo and Hall (1975) are summarized (and over-simplified) in the following paragraphs.

A fundamental finding was that changes in peripheral arterial resistance without simultaneous changes in renal arterial resistance, had no effect whatsoever on the final equilibrium arterial pressure. For example, studies with patients whose arteriovenous fistulae were closed, thus markedly increasing TPR, and animal studies in which TPR was increased by injection of microspheres into the circulation excluding the renal circulation, revealed that compensatory mechanisms such as increased excretion of salt and water resulted in a steady return of BP to normal levels. However if renal function was impaired, an inordinately high arterial pressure became necessary to cause the overflow of fluid required to excrete normal amounts of water and salt. Guyton's conclusions were as follows: - "factors which increase renal resistance at the same time that they increase resistance elsewhere in the body would be expected to cause chronic elevation of arterial pressure, but factors that increase resistance in all areas besides the kidneys would not be expected to cause chronic hypertension".

Support for these conclusions has come from other studies. Dickinson (1970), who investigated central actions of angiotensin and NA, concluded that while both substances may play a part in the pathogenesis of neurogenic hypertension, "the paradox remains that neurogenic and all other varieties of hypertension must be sustained by the kidney, for if the kidney is not participating in maintaining hypertension, the blood pressure rise could not be sustained. The kidney would simply excrete salt and water faster, by reason of raised BP, and thus automatically restore the status

quo. Thus, neurogenic hypertension must be renal, but it is equally true to say that renal hypertension, and probably every other variety of hypertension, is at least in part neurogenic".

The sympathetic innervation to the renal vasculature is an obvious pathway by which such neuro-renal influences might be mediated. From what has been stated above, if "neurogenic" factors are important in the pathogenesis of EH, then it ought to be able to be demonstrated at an early stage in such cases that there is an increase in renal arterial resistance due to vasoconstriction from sympathetic stimulation.

Such demonstrations depend on technical advances as well as conceptual clarity. Recent work by Hollenberg, Adams, Solomon, Merrill, Chenitz, Burger and Abrams (1975), is of the utmost interest here. Measurements of renal blood flow usually do not discriminate between functional and structural abnormalities, and the significance of changes are not easy to assess because of the magnitude of the normal range.

Using techniques of xenon washout and renal arteriography, these authors assessed the effect of vasodilators on renal vascular status in three groups (1) patients with mild EH, (2) patients with hypertension secondary to renal disease and (3) normal subjects. The expected increase in blood flow induced by acetylcholine and dopamine was blunted strikingly in patients with advanced renal disease, as measured by both techniques. Conversely, the response to each vasodilator was potentiated in 9 of 13 patients with mild EH. It was also noted that phentolamine infused into the renal artery increased renal blood flow significantly in 6 of 9 patients with EH, but in none of 15 normal subjects. The authors consider that these findings suggest "a quantitatively important, functional renal vascular abnormality -

perhaps mediated by the SNS - in many patients with mild EH". This raises the question of higher central control of such possible SNS activity and these authors state that "regionally differentiated activation probably representing outflow from different central neurone pools has been well demonstrated in many systems, including the renal vasculature. Thus activation can lead to a highly focal increase in renal vascular resistance".

These recent studies add a further dimension to the conclusions drawn by classic studies of haemodynamic changes in patients with early and established EH. These workers (e.g. Brod, 1960) drew particular attention to the importance of regional haemodynamics in BP homeostasis and pathogenesis of EH, emphasizing that normal values for TPR could be observed in instances where regional vasoconstriction in some regions (renal, splanchnic, skin) was counterbalanced by vasodilatation in others (skeletal musculature). It is highly relevant that values of renal vascular resistance are higher in EH than in normotensives for all levels of TPR. Only when the progressive rise in vascular resistance in kidneys, splanchnic area, and skin is not balanced by the dilatation in the vascular bed of the musculature will TPR start to increase.

It is pertinent to note here that Brod and his coworkers used a psychological stressor (mental arithmetic performed under time pressure) in their early work which demonstrated these fundamental physiological patterns. This aspect of their work will be referred to again in the later section on psychophysiological studies (pages 59 and 60).

We may now turn to the relationship between BP levels, CO, and TPR in the pathogenesis of EH. In a paper entitled "Physiological comparison of labile and essential hypertension", Frohlich, Kozul, Tarazi and Dunstan (1970), reported a study involving 30 patients each with labile, mild and moderate EH, and 16 with severe EH. Patients with labile hypertension showed evidence of a hyperkinetic circulation, with increased HR and CO. With development of fixed diastolic hypertension there was a progressive and significant rise in TPR, but CO was normal until clinically severe EH was demonstrated. Brod, discussing this paper, emphasized that as the normal TPR in the early stages masked the increase in renal vascular resistance referred to above, the high CO was thrown into a partly constricted, unyielding, peripheral vascular bed. When TPR finally started to increase, CO could come down to normal levels again. This type of study which emphasizes the longitudinal haemodynamic changes during the course of EH is a considerable advance on studies which simply analyse the patterns in established EH. The familiar pattern therein of high TPR and normal CO can now be seen to be secondary to the changes in the dynamic state described above.

(2) The Sympathetic Nervous System and Catecholamines.

The studies of basic physiology selected and reported thus far provide a context and perspective against which the following studies may be placed.

Nestel and Esler (1970), studied catecholamine excretion in urine in subjects with EH and in normotensive subjects. Although as a whole hypertensive patients do not excrete increased amount of catecholamines, differences between a more homogeneous group of young,

untreated patients with mild EH, and normotensive subjects are noted in certain situations. In response to orthostatic stress, and the mental stress of timed mental arithmetic, the EH group showed greater changes in BP and higher rises in catecholamine output. The correlations between change in BP and change in catecholamine output were highly significant. While these findings suggest increased SNS activity, the authors caution that measures of catecholamine excretion do not necessarily correlate with SNS activity as many other variables can influence catecholamine excretion levels.

Louis, Doyle and Anavekar (1973), studied NA levels in EH, using a sensitive radioenzymatic assay for NA. In 31 patients with EH, there was a highly significant relationship between resting DBP and basal plasma NA concentrations, but not plasma adrenalin levels. Changes in DBP and NA following ganglionic blockade were equally highly significant. While these associations do not permit deductions concerning aetiology, as they may be secondary to established EH, the findings are consistent with the hypothesis that the level of sympathetic activity is an important factor in determining the height of the BP.

Koch-Weser (1973), in a review of studies to that date, commented that since elevated BP normally causes reflex withdrawal of sympathetic tone, in patients with EH the sympathetic function is clearly too intense in relation to the BP. However, he urged caution in interpreting elevated NA levels as necessarily reflecting unusually intense SNS activity, as other unknown factors might stimulate release from nerve endings, and decreased reuptake of released NA could also result in elevated levels.

Evidence suggesting that increased SNS activity leading to increased neurotransmitter biosynthesis might be a major component in BP elevation, arose from a study by Dequattro, Miura, Lurvey, Cosgrove and Mendez (1975), who studied plasma catecholamine concentrations and NA biosynthesis in 57 men who underwent vasectomy, correlating these parameters with BP levels. The systemic indices and the regional indices (NA concentrations and activities of NA biosynthetic enzymes in the vas deferens), showed significant correlation with BP levels.

More recently, DeChamplain, Farley, Cousineau and Van Ameringen (1976), have studied catecholamine levels in 15 normotensive and 22 patients with EH. Mean levels were significantly higher in the latter group. (NA = .370 compared with .218 ng/ml). Within the EH group there were some with normal levels, however, and this group had lower SBP and HR compared with those with high levels.

Taken together these studies leave little doubt that, at least in the majority of patients with EH, the SNS is hyperreactive and may be directly responsible for maintenance and severity of hypertension in this group. The results are consistent with theories which emphasize an aetiological role for increased SNS activity, with the proviso stated in the preceding section that the claim for aetiological significance requires the additional demonstration that increased renal arterial resistance is a function of the increased SNS activity.

An important growing edge of research involving neurophysiology and cardiovascular physiology is the task of unravelling the pathways and connections involving the limbic system and higher centres, the

hypothalamus, brain stem, and the SNS outflow tracts. It is not appropriate to go into detail of these aspects in this review, except to mention that further elucidation of such pathways would permit more specific understanding of ways in which experiential factors might result in stimulation of specific neuronal pools with subsequent influence on cardiovascular functioning. The mechanism of action of certain antihypertensive drugs is also more adequately determined by such neurophysiological and neurochemical studies. A major review of recent work was carried out by Chalmers (1975), while Haeusler (1975), concluded that "it seems that two central adrenergic systems exist with opposing effects on cardiovascular control. These are an excitatory hypothalamic and an inhibitory bulbar adrenergic system" "Impairment of central adrenergic function or imbalance of the two central adrenergic mechanisms may represent a trigger mechanism for the initiation of hypertension".

(3) The Renin-Angiotensin-Aldosterone System.

Controversy exists concerning the precise role of this system in relation to the systems described above, in the development and perpetuation of EH. Abnormalities in renin metabolism are considered by most workers to be secondary to increase in BP (Berglund, Aurell, Wilkstrand and Wallentin, 1976), although some authors have ascribed more fundamental significance to these changes (Laragh, Baer and Brunner, 1972). The influence of advancing age on changes in this system has been stressed by others (Padfield, Brown, Lever, Schalekamp, Beever, Davies, Robertson, and Tree, 1975).

As Vagnucci and Shapiro (1974), pointed out, the present problem with EH is not to seek a unique cause but to direct attention to understanding the relationship between known causative mechanisms. Weiner (1975), reviewing distribution curves for plasma renin activity, angiotensin II levels, and urinary aldosterone excretion, concluded that in up to 53% of cases studied, the expected relationship between these parameters did not exist, suggesting a disturbance of regulatory relationship. The vexed problem whether such disturbance precedes or succeeds the establishment of EH, however, is not yet able to be answered.

Summary:

At this stage of research development there are still as many questions as answers concerning the pathophysiological disturbance in EH. Indeed, a Lancet Editorial (February 14th 1976), concluded soberly: "the unhappy truth remains - we still do not know why the blood pressure is raised in patients with essential hypertension. We can measure certain variables, and these may be abnormal: when asked how far these changes are the consequences of hypertension or how far they are responsible for it, we have to concede defeat".

Clearly, therefore, although there is some evidence in support of the hypothesis that CNS influences operating via the sympathetic outflow might be of aetiological significance, further studies are required to provide confirmation or refutation of this hypothesis. To emphasize the importance of renal mechanisms in long term homeostasis of BP control does not detract from this hypothesis, as the sympathetic innervation of renal vasculature provides a pathway by which disturbance of basic homeostatic mechanisms might occur. Unravelling of central

pathways is far from complete, but there is undoubted higher CNS control over the bulbar and spinal efferent systems.

From this review, the sum of evidence from neurophysiological and vascular studies is consistent with the hypothesis that influences which ultimately refer to personal experience, mediated by CNS and peripheral autonomic pathways, might be of significance in the pathogenesis and course of EH.

3. Genetic Influences.

Controversy has long existed concerning the relative contribution of genetic and environmental factors in the pathogenesis of EH. The matter has direct clinical relevance, because assumptions concerning inherited aspects may determine to a considerable extent the inclination of clinicians to pay attention to psychosocial factors in management. If the genetic and biological aspects are assumed to be over-ridingly important there is less obligation or justification for a serious investment of time and effort in exploring the patient's personal life in a search for contributing factors. No less important are assumptions by patients themselves. The patient's concept of the nature of his or her condition may influence attitudes to the need for chronic drug treatment on the one hand, and the possible need for changes of lifestyle, on the other.

The three methods which have proven most useful in assessing the degree to which EH is an inherited condition are -

- (1) Comparisons of BP between monozygotic and dizygotic twins
- (2) Measurements of BP in the relatives of patients with EH.
- (3) The "Family Set Method" - examining aggregation of BP level within families in the general population.

(1) Twin studies.

Essentially similar findings are revealed in three early studies comparing monozygotic and dizygotic twins. The studies by Von Verschuer and Zipperlen (1929), Stocks (1930), and Kahler and Weber (1940) all showed a greater correlation between members of monozygotic than dizygotic pairs. The differences were less striking in normotensive pairs than when one member had EH.

(2) Measurements of BP in relatives of patients with EH.

A study which was to be the basis for much controversy and debate over the succeeding decade was that reported by Hamilton, Pickering, Roberts and Sowry (1954), in which relatives of subjects with benign EH were screened, together with a control group consisting of relatives of subjects attending the same hospital but whose DBP had not exceeded 85 mm Hg; these two groups were also compared with a third group of subjects considered to be representative of the population at large. The findings are reviewed in Pickering's (1968) book.

The frequency distribution curves for the three samples were found to be similar in shape. Relatives of hypertensive propositi had higher pressures than the relatives of propositi without hypertension, at all ages. Significantly, the rate of rise of BP with age was similar in all three samples, from which it may be deduced that although the tendency to higher pressures at all ages may be to some extent inherited, inherited influences do not apparently determine the rate of rise with age.

Much of the controversy surrounding this study concerned the question whether inheritance was determined by a Mendelian dominant gene, or whether it was polygenic or multifactorial. Pickering (1968) described in detail the thinking which led to his conclusion that the latter type of inheritance had much more support from the data available than the former. These genetic studies contributed to a significant change of thinking, from the concept that EH was a qualitative "disease" in which case it should have been possible to divide subjects into those with the condition and those without, to the quite different

concept that BP level was on a continuum in the population, as the frequency distribution curve which was unimodal did not reveal any naturally occurring dividing line. There is a close parallel between these concepts concerning EH and the conclusions from very early studies by Galton (1889), concerning height and weight in the population.

While the survey quoted above had suggested a quantitative resemblance between first degree relatives in the hypertensive series, it had not resolved the problem whether a similar pattern was to be found in the population at large. In a series of studies in South Wales, Miall and Oldham (1955, 1958 and 1959), large surveys were carried out. Their findings largely substantiated that of the London group as the findings indicated that the lower the pressure of the propositi, the lower the pressure of the first degree relatives of all kinds: the higher the pressure of the propositi, the higher the pressure of the first degree relatives. This relationship was found to be strictly linear. Inheritance was considered to be of the same kind, i.e. polygenic, whether arterial pressure is less than the norm or exceeds the norm to the extent that it merits the term "essential hypertension".

These latter studies also enabled the authors to make an assessment of the size of the genetic component. It was not possible to be too precise about the relative contribution of inheritance and environment, but the minimum percent variance attributal to heredity was calculated to be 33%, while the maximum was calculated to be 67%. The "environment" was thus considered to contribute from 67% to 33% respectively.

The arguments in favour of a single gene hypothesis or Mendelian dominant inheritance, were made most forcibly by Platt (1959), who

conceptualized EH as an inherited tendency to develop high BP in middle life and assumed "that there are two populations, one in which blood pressure rises significantly in middle age, often reaching heights at which it seriously contributes to mortality, and another population in which the blood pressure rises very little if at all with increasing years". This viewpoint was considered by Pickering to be quite inconsistent with his findings that there was no consistent difference of rate of rise of pressure with age between hypertensive and control relatives.

Interpretation of genetic studies is made the more difficult by the fact that although the resemblance between close relatives is most easily explained by their sharing genes, it could also be influenced by the fact that they share environment. For example, at least one study (Chazan and Winklestein 1964) reported a positive correlation between spouses' blood pressures, although this had not been found in an earlier study (Gearing, Clark, Perera and Schweitzer, 1962). The epidemiological method to be described below reveals an attempt to overcome this dilemma.

(3) The Family Set Method

In a major study carried out in Detroit, Harburg, Erfurt, Schull, Schork and Colman (1977) attempt further resolution of the "genetic influence" versus "environmental influence" conflict by a quite different research strategy from earlier workers. A "Family Set" consisted of 3 persons having genetic relation (index, his/her sibling, and a first cousin selected as closest in age to the index), and 2 persons having an environmental nexus, a spouse and an unrelated person matched to the index were also assessed.

The target populations were 4 census areas in Detroit, carefully delineated on sociological parameters as "black high stress area", "black low stress area", "white high stress area" and "white low stress area". A sample of 461 family sets was accumulated. Expected correlations of BP level with sex, age, race and percent overweight were found; these variables could then be adjusted for statistically in estimating the influence of genetic factors.

There was only weak aggregation of SBP and DBP in the family sets, and comparison of observed proportions with expected proportions failed to support a dominant or recessive genetic model. Results suggested "prior studies may have overestimated the genetic contribution to blood pressure, possibly by confounding of age and temporal changes". The aggregation is "not consonant with any genetic model which posits a biological distinction between normotensive and hypertensive individuals". The "Platt" model is therefore not supported by this evidence, but neither is the "Pickering" conclusion that a third and two thirds of inter-individual variation in BP may be due to genetic determinants: "neither can advocates of a large heritable component in blood pressure variation find solace here".

Analysis also failed to disclose significant racial differences in heritability, and suggests that for blacks and whites, nongenetic variables contribute more to variation in BP between individuals than do genetic differences. The contrast between these results and earlier studies is attributed to the tendency "to ascribe effects to genetic causation which in fact were due to shared environments or temporal trends". Average estimates for heritability (in the

broad sense) were $-.05$ for SBP and $.04$ for DBP, and for heritability in the narrow sense, estimates were $-.47$ and $-.24$ for SBP and DBP respectively. As the highest estimates do not reach 50%, this is tantamount to accounting for less than 25% of the variability between random individuals.

Interestingly, all the nongenetic variables measured in the study (race, sex, age, per cent overweight, environmental stress, perceived life stress) accounted for less than 30% of the variability between individuals. Much of aetiological significance therefore eluded assessment by the methods chosen in this study.

Summary: The evidence outlined points to a limited but definite role for genetic influences, accounting for less than 25% of the variance in BP between individuals. The component of BP attributable to heredity is inherited as a graded characteristic throughout the ranges of normal BP and those classified as indicating "hypertension". Since the rate of rise with age is similar in relatives of hypertensive propositi and the population at large, it is likely that this rise is determined mainly by environmental factors.

4. Morbidity and Mortality.

We need to ask the question - what is the relevance of chronically elevated BP levels to morbidity and mortality? The justification for extensive study of influences which may cause or aggravate sustained elevation is much enhanced if it can be clearly demonstrated that sustained elevation of BP is causally related to secondary disease and death.

A useful starting point is the evidence from actuarial studies. A report of the Metropolitan Life Insurance Company (New York) in 1961, showed a clear relationship between mortality and BP level. Increased mortality is predictable not only by slight increases above the average in SBP and DBP, but the relation extends into the accepted normal range.

The effects of elevated BP on cardiovascular morbidity and mortality were analysed in the Framingham Study reviewed by Kannel (1974). The finding that the risk of cardiovascular disease and death is increased in direct proportion to elevation of BP and indices of clinical severity, supports the data from actuarial sources. Cardiac and cerebral complications were seen to be the major source of morbidity and mortality, while renal complications were especially important in malignant hypertensive disease. There was a significant sex difference in that mortality rates were greater in men than women.

The effect of elevated BP is not uniform, however, as its effect is greatly influenced by concomitant risk factors. BP may be usefully conceptualized as one ingredient of a cardiovascular risk profile, of which others include serum cholesterol, carbohydrate tolerance, and cigarette habit. Morbid events such as myocardial

infarction, and cerebral vascular episodes, are more likely to be fatal in the hypertensive than the normotensive person. Kannel concludes that it is possible to delineate in the general population a segment (10%) from which 25% of coronary disease, 40% of occlusive peripheral arterial disease, and 50% of strokes will emerge. Of all the risk factors, high BP emerges as the most common, most potent, and most universal contributor to cardiovascular mortality.

Steward (1974) reported a 5 year followup of 2 groups of 22 subjects, each of whose DBP initially was in the range 95-114 mm Hg with one group free of the other risk factors outlined. Using indices such as death from cardiovascular disease, clinical or ECG deterioration, and increase in DBP, it emerged clearly that groups without other risk factors had significantly less morbidity than the group in whom 2 or more additional risk factors were present. These findings are closely parallel to those of Kannel (1974), who assessed a more severely hypertensive group.

The clinical data are further substantiated by data from pathological surveys. Roberts (1975), reported from an extensive study that while 50% of patients with fatal acute myocardial infarction had been clinically hypertensive, 75% showed cardiomegaly at autopsy. In his series 90% of patients with intracerebral haemorrhage, 90% of patients with renal failure, and 50% with sudden death had been hypertensive. He stressed the devastating consequences of hypertension in association with hyperlipidaemia in accelerating atherosclerosis, and concluded "systemic hypertension is a greater risk factor to the development of other cardiovascular diseases than previously suspected".

From these surveys, the evidence that high BP is a major health hazard seems incontrovertible. It is necessary to consider however that in any group of patients with high BP there will be some whose disease will run a much milder course than the studies listed above would indicate.

The studies to be mentioned below are older, and contain possible methodological flaws, but contain much of interest concerning variation in the course of EH.

As early as 1939, Keith, Wagener and Barker at the Mayo Clinic delineated 4 groups in a series of 200 cases -

1. Benign non-progressive cases.
2. More marked hypertension with few symptoms but without retinitis.
3. Those with mild vasospastic retinitis.
4. Malignant hypertension.

Burgess (1948), also emphasized that there was a benign form of hypertension, not associated with cardiac or renal disease, in which near normal life expectancy could be expected.

Evans (1957), followed up 50 recruits with raised BP on entering military service, 10 years later, and compared them with 50 normotensive recruits. Neither group showed increase of BP after the 10 year interval, at which time the mean age of both groups was 35 years.

These early studies may be seen as the forerunners of more refined studies which assess the significance of 'borderline' hypertension. In a comprehensive study of the concept of borderline hypertension, Julius and Schork (1971), concluded that the risk of hypertension in the initially borderline group was at least twice as high as in a normotensive population, that the

risk of morbidity and mortality at all age groups was also twice as high as in normals, while the incidence of borderline hypertension itself increased with age.

In a study which examined these aspects subsequently, Freis (1974), produced evidence that patients with borderline hypertension (SBP 150-160 mm Hg, DBP 90-100 mm Hg) have three times the risk of developing established hypertension as normals. Of all such borderline hypertensives, only 25% will develop established hypertension however. Other determinants of risk include sex, age, race, family history, and hyperlipidaemia.

Summary:

There is strong evidence that elevated BP, systolic or diastolic or both, plays a significant part in subsequent morbidity and mortality. These conclusions appear valid for the whole range of BP elevation, from borderline to severe hypertension. The actual risk is much enhanced if elevated BP levels coexist with other defined cardiovascular risk factors. In absence of such risk factors, a more benign course may be predicted. There is no mention in the studies reported above of potential relevance of personality structure and conflict, or environmental stress as additional risk factors. These aspects will be considered in later sections of this review.

5. Effects of Drug Treatment.

This section consists of a brief review of the trends in drug treatment of hypertension over the past thirty years, with an appraisal of the results of recent studies aimed at establishing the efficacy of antihypertensive drug treatment in preventing complications of hypertension.

There was little cause for optimism in the medical management of hypertension in the decades preceding the availability of the drugs mentioned below in the early 1950's. On the other hand, there was frequent reference in the literature in those early years to the importance of such measures as attempts to influence the life style and coping mechanisms of patients, and the influence of the doctor-patient relationship on the condition (e.g. Lipkin, 1949). These early descriptive studies did not include any objective assessment of the efficacy of such measures as were available. The conservative medical approach available up to that time included attention to such factors as excessive salt in the diet, weight reduction, and the use of sedative drugs such as phenobarbitone. Another approach was surgical, namely lumbo-sacral sympathectomy, but there were significant side-effects from this procedure as well as limited success.

During the early 1950's, three different groups of drugs became available - ganglion blocking agents such as Hexamethonium salts, vasodilators such as Hydrallazine, and the centrally acting drug Reserpine. These were also not without significant side-effects, for example postural hypotension, problems with visual accommodation, and disturbance of sexual function in the case of the ganglion blocking drugs. It was difficult to establish the efficacy of the vasodilator group, and

Reserpine was also not without other complications such as a risk of depressive illness in some cases. Shapiro and others (Shapiro, Myers, Reiser and Ferris, 1954), (Shapiro, Teng and Trimble, 1957), and Shapiro, (1956) drew early attention to the difficulties in establishing efficacy of antihypertensive drug treatment in the presence of other variables such as hospitalization, the doctor-patient relationship, and the placebo effect.

During the 1960's, other drugs became available which were more acceptable to patients because of reduced side-effects, although that problem was by no means overcome completely. Such drugs as Methyldopa which acted centrally, selective post ganglionic blocking agents such as Bethanidine, and beta-blocking drugs such as Propranolol, were all proven to be able to reduce blood pressure levels through a variety of mechanisms. More recently another centrally acting drug Clonidine has been added to this group. Current practice favours appropriate combinations of diuretics, beta-blocking agents and vasodilators as basic treatment for the moderately severe hypertensive patient, while Methyldopa continues to be widely used for this group also.

There have been two major hurdles as far as establishing efficacy of treatment is concerned. The first is that it is not enough to demonstrate that a drug can reduce BP levels, it is also necessary to establish that a drug or group of drugs can reduce the incidence of "morbid events" i.e. known complications of hypertension such as cerebro-vascular accidents, renal failure and myocardial infarction. The 1967 report of the Veterans' Administration Cooperative Study Group on antihypertensive agents did appear to establish conclusively that such reduction and incidence could be achieved, in

a study comparing the effects of a drug combination (Reserpine, Hydrochlorothiazide, and Hydrallazine) with placebo in patients with moderately severe hypertension (DBP averaging 115 to 129 mm Hg). The controlled study was abandoned after a certain point in time when it became apparent that the active drugs were highly significantly superior to the placebo in reducing the frequency of serious morbid events. Generalizations from this study must be made with caution however, as patients were all males over the age of 45, and had been highly selected for compliance by rigid testing and screening in the initial stage of investigation.

Whether the drug treatment of patients with less severe hypertension e.g. those with DBP in the 90-115 range is as effective is not yet conclusively proven. For example a British study involving teams led by Barraclough and Bainton (1973), showed that in 58 men and women aged between 45 and 69 years, DBP levels initially in the 100-115 mg. range could be reduced to below 100 mm Hg readily enough, but no effect was shown on terminating events, when these findings were matched with 58 control patients.

The second report of the Veterans Cooperative Study Group (1970) also revealed a reduced risk for the actively treated group of developing morbid events in the group of moderately severe patients over a 5 year period. The results were not as clear cut as in the preceding study involving the more severely affected group. "The degree of benefit was related to the level of pre-randomization blood pressure". Treatment was considered to be more effective in preventing congestive heart failure and stroke than in preventing the complications of coronary artery disease.

These studies have had a powerful influence on subsequent medical practice, and have increased efforts to screen populations for patients requiring antihypertensive drugs. There has been some criticism of this approach, for example by Chasis (1974), who based some of his criticisms on the fact that the patients in the above-mentioned studies were predominantly male, were observed for a relatively short period, and had complications at a young age with a high incidence of previous target organ vascular disease. He considered that this group of patients with rapidly progressive disease was quite unrepresentative of typical EH patient groups. Such criticisms were in turn vigorously rebutted in a further article by Freis (1974).

Another perspective on this problem is gained by examining a later report of the Veterans Administration Cooperative Study Group (1975), in which the drug treatment outlined above was discontinued in 86 patients whose diastolic pressure averaged less than 96 mm Hg for the second year of treatment. Sixty patients were then assigned to placebo and 26 continued on active drugs, in a double blind study. Of the placebo group, 42 needed to resume specific medication over the next 18 months because of a return of elevated BP, and only 9 (15%) remained normotensive. The rate of rise in arterial pressure in the placebo group appeared to be related directly to the height of the pressure prior to the initiation of active treatment, and was inversely related to the age of the patients. These observations indicate that although arterial pressure is capable of modification following long term treatment, this is not permanent except in a minority of cases. As these patients all had established hypertension,

those with labile hypertension being excluded, it may be surmised that a higher percentage of patients would have remained normotensive if borderline patients had been included.

Summary:

While there is little controversy concerning the efficacy of active treatment in the more severely ill patients, many unanswered questions remain with regard to the effectiveness of treatment in milder forms of hypertension. The unsolved problems receive regular comment in editorials, as in the Lancet (1975), and in The Medical Journal of Australia (1976). Large scale trials yet to be finally reported have been started in the U.S.A., Britain, other European countries and Australia designed to attempt to reveal the optimal current treatment for mild to moderate hypertension. These uncertainties are relevant to the present study in which the author is engaged, as the patients tend to fall into the group of mild or moderate severity.

6. Summary of 'Biological and Clinical Studies'.

- (1) There is no evidence that a specific pathophysiological "fault" is to be found in hypertensive persons. The differences between normotensives and hypertensives are quantitative, not qualitative, i.e. there is no natural dividing line between two groupings made on arbitrary lines.
- (2) There is suggestive evidence that CNS influences operating through the sympathetic outflow including renal innervation, might be of aetiological importance. Determination of the higher CNS control over bulbar and spinal efferent systems is far from complete: pathways exist by which personal experience might influence cardiovascular mechanisms.
- (3) The genetic influence might have been over-rated in earlier decades, as recent evidence points to a role accounting for less than 25% of the variance in BP between individuals. The rise of BP with age is considered to be due largely to environmental factors.
- (4) Elevated BP levels play a very significant role in cardiovascular morbidity and mortality. Both systolic and diastolic levels are implicated, and the risk factor increases across the range of BP elevation from borderline to severe hypertension.
- (5) Drug treatment is of proven efficacy in patients with severe hypertension but efficacy in terms of reduction of morbid events is more difficult to prove for persons with mild EH (e.g. DBP < 110 mm Hg).

B. Studies of Psychosocial Factors.

1. Epidemiological Studies.

The epidemiological approach is fundamental to studies in EH, for reasons both theoretical and practical. Knowledge of socio-cultural and demographic factors which may contribute aetiologically may be acquired, while an appreciation of the extent to which services for education and treatment are required in a community may also be achieved.

The epidemiological approach is of great interest to the psychiatric investigator as certain surveys can allow testing of the theory that psychological and environmental factors acting through CNS pathways are fundamental in the pathogenesis of EH.

Epidemiological approaches include: -

1. Determination of prevalence and incidence rates in particular communities or groups.
2. Comparison of prevalence rates -
 - (a) Between different ethnic groups in the same community
 - or
 - (b) Between communities with differing sociocultural conditions.
3. Correlation studies between BP level and such demographic parameters as age, sex and occupational status.
4. Estimation of BP responses in situations of major social stress.

In this review studies from each of the four approaches will be cited, and in the summary a synthesis of these findings will be attempted together with conclusions from major reviews undertaken by previous authors.

1. Prevalence and Incidence Studies

In the Western world, data from such regions as the United States of America, Australia, Europe and Israel reveal approximately similar findings as far as the white adult population is concerned. Thus, in the National Health Survey of 1960-1962 (U.S. Department of Health, Education and Welfare 1966), it was estimated that approximately 14% of white adults had elevated SBP (>150 mm Hg) or DBP (>90 mm Hg), and that 33 million people in the U.S., had definite or borderline hypertension. A range of prevalence rates from 5-25% was found in studies reviewed by Schweitzer, Gearing, and Perera (1965).

In four Australian studies carried out to 1976, the data of which have been summarized by Christie, McPherson, and Vivian (1976), prevalence rates from those with DBP >95 mm Hg range from 11-29% for males, and 7-28% for females, in the age range 50-59 years. These figures would be higher, if those persons currently receiving treatment but whose DBP at the time of the survey was <95 mm Hg, were included. In Sweden, a survey of 2322 men between 50 and 53 (Hedstrand and Aberg, 1976), revealed a prevalence rate of only 3.8% using a more strict criterion for hypertension (DBP >105 mm Hg), and if to this figure were added the number of men already receiving treatment, a prevalence rate of 7.5% of the total population was achieved. Data from a survey in a Scottish town (Hawthorne, Greaves, and Beevers 1974), revealed a prevalence rate of 15.6% in subjects aged 45-64 years, using a DBP of 100 mm Hg as the cutoff point.

Turning to studies of incidence, important findings emerged from a study in Israel, (Kahn, Medalie, Heufeld, Riss and Goldbourn, 1972).

These workers investigated 10,000 male civil service workers in 1963, and carried out followup studies in 1964 and 1968 at which latter date 95.3% of those examined on the first occasion were available for re-examination. The overall age-adjusted incidence rate was 51 per thousand while the annual incidence per thousand for the age groups 40-49, 50-59 and 60 plus at the time of the first assessment was 8, 13 and 20 respectively. This rise in incidence rate with age has a close parallel in a study from U.S.A., (Dunn, 1970), in which figures of 6, 11 and 17 per thousand per year for the age groups 30-39, 40-49, and 50-59 respectively were recorded.

2. Comparisons between ethnic and racial groups.

Numerous surveys in the U.S.A., have confirmed the finding that the prevalence rate of hypertension for the black population is approximately twice that of the white population. Explanations for this finding tended to be sought in biological and adaptational terms; for example, Schulze and Schwab (1936) attempted to explain the discrepancy in prevalence rates between blacks in U.S.A., and blacks in Africa as follows: - "the negro, biologically unequipped to cope with a complex environment, finds his nervous system subjected to much stress and strain during the process of attempted adaptation to occidental civilization. The vasomotor system, as an integral part of the nervous system, participates in this upheaval and becomes sensitized or conditioned to react with greater agility".

This somewhat limited explanation on "biological" terms omits reference to socioeconomic circumstances as potential determinants. More recent studies have given greater emphasis to these aspects. Thus, the importance of the socioeconomic gradient was emphasized

in a study in Jackson, Mississippi (Langford, Watson and Douglas 1968), involving 2600 negro female students, in whom differences in BP levels between rural and city girls were found to be correlated with socioeconomic status. In a comprehensive study in Detroit, Harburg, Erfurt, Hauenstein, Chape, Schull and Schork (1973), found that the differences between white and black males occurred only in social conditions which were designated "high stress areas" and not in "low stress areas".

Several authors have looked at the effect of "acculturation" with emphasis on the need for adaptation to new social demands. For example Cruz-Coke (1960), noticed a significant difference in mean BP levels of two groups of young men attending a police academy in Peru; a group who came from a primitive society and a group who had lived in the urban region before entering the academy. In an important study investigating the relationship of stress, high blood pressure and urban and rural existence for the South African Zulu, Scotch (1963), found as expected the urban Zulu had significantly higher BP levels than his rural counterpart, but that the definition of stress is one situation depending on the social context and could not be transposed from one to the other. The author concluded "those persons were more likely to be hypertensive who maintained traditional cultural practices and were unable to adapt successfully to the demands of urban living".

3. Correlation studies between blood pressure level and such demographic parameters as age, sex, and occupational status.

- (1) Age: while it is generally assumed in Western countries that there is a gradual increment of BP levels with

increasing age, this finding is not constant for all communities or all racial groups (Henry and Cassel 1969). In their review of epidemiological evidence these authors concluded that absence of the usual rate of change with age tended to be found "where the culture is stable, traditional forms are honoured, and the group members are secure in their roles and adapt to them by early experience". For example Cruz-Coke (1960) had found mean SBP in a primitive Peruvian group to be 115 mm Hg at age 62 years, compared with 153 mm Hg for a British sample of the same age.

- (2) Sex: concerning male/female differences, there is a general tendency for the sex ratio to vary with age in Western countries with men showing a higher prevalence in the age range 25-60 and women a higher prevalence in the over 60 age group. (Pickering, 1968).
- (3) Occupation: the hypothesis that EH may be unduly frequent in certain occupations which are stress-laden received some support in such studies as that of Cobb and Rose (1973), who found the prevalence rate of diagnosed EH among air traffic controllers to be four times higher and the annual incidence of new cases six times higher than the rates for second class airmen. The former group had a significantly earlier onset of hypertension; this was particularly so for those controllers working in high traffic density situations.

A refinement of the epidemiological approach includes the incorporation of measures of specific personality variables into community surveys in which environmental stresses are under study.

Two such studies have been carried out thus far: -

- (i) In the Detroit study, (Harburg, Erfurt, Hauenstein, Chape, Schull and Schork (1973), there was a striking correlation between suppressed hostility (keeping anger in when attacked and feeling guilt if one's anger is displayed when attacked) and BP levels for black males from "high stress" areas, while in whites, high BP readings were associated with "guilt after anger" in "high stress" areas.
- (ii) In the Israeli study described earlier (Kahn, Medalie, Heufeld, Riss and Goldbourt 1972), a number of psychosocial variables were measured in relation to BP, and highly significant associations were found between BP level in these male civil service workers and scores on such psychological parameters as "feeling hurt by superiors but brooding" and "feeling hurt by superiors but restraining retaliation". These two variables as well as two others which produced significant associations ("feeling hurt by co-workers but brooding" and "conflict with wife but keeping it to oneself") all have a common denominator in that they represent a conflict situation of restraint or suppression of frustration and aggression.

In both these studies the inclusion of these items concerning specific personality variables was based on the psychodynamic formulations of personality structure (Alexander 1939, Saul 1939), in patients with EH, which formulations will be discussed in a later section of this review.

4. Estimation of blood pressure responses in situations of major social stress.

An early study of relevance is that of Graham (1945) who found elevated levels of DBP among British soldiers immediately after the North African desert campaign in 1943; the elevated levels remained high for an average period of two months following cessation of hostilities. Miasnikov (1962), described an "epidemic" of high BP during the seige of Leningrad in World War II. The victims of the Texas city blast disaster were noted, (Ruskin, Beard and Schaffer 1948), to have persistence of elevated BP in the weeks and months following the acute stress experience.

Reviews of Epidemiological Evidence.

Extensive reviews of the epidemiological evidence were carried out by Scotch and Geiger (1963), Henry and Cassel (1969), and Gutmann and Benson (1971). The first authors commented on the extreme complexity encountered when an attempt was made to disentangle personality and social variables "the ability to generalize upon these observations is limited by the methodological problems of distinguishing between personality, perception of environment, social variables in the environment, reaction to the environment, and 'stress'". They did not however ignore the importance of biological pre-disposition "hypertension thus appears as one of the ways that threatened, frustrated and over-burdened men can react to their experiences - but it is only one of many ways".... "some hypertensives have a proclivity for viewing their life situations in a manner which, in the biological sense, implies that they respond with a pattern of adaptation that includes an elevation of the blood pressure:.

Not only is it difficult to disentangle personality and social variables, but dietary factors especially salt and caloric intake must be taken into account. The importance attributed to these

dietary factors varies widely, and Henry and Cassell (1969) concluded that these factors appeared less relevant than psychosocial experience. They combined an epidemiological perspective with animal experimental evidences (to be reviewed in a later section), and concluded that "dissonance between the social milieu in later life and expectations based on early experiences during the organism's development stages may be one of the critical factors. The blocking of aspirations and the uncertainty that the organism will be able to satisfy behavioural urges through programmed goals appear to be important causes of chronic psychosocial stimulation. These can then lead through the identifiable physiologic mechanisms of the defense alarm reaction to essential hypertension and eventually, in some cases, to full-blown patho-physiologic states such as renal hypertension.

Gutman and Benson (1971) stated that "environmental situations requiring continuous behavioural adjustments may be translated through the central nervous system into haemodynamic events which contribute to essential hypertension", and "environmental conditions which require continuous behavioural adjustments are perhaps most effective in producing sustained elevations in blood pressure".

Summary.

Prevalence studies indicate that in Western countries EH is a common disorder. The increase in incidence with age appears to be environmentally determined. Apparent differences in prevalence rates between white and black groups are related to social, economic, and personality variables. Major social stress can lead to an increased incidence of hypertension which may persist for weeks or months.

Factors such as dietary intake, in particular salt and caloric intake, may play aggravating roles but are not considered to be of primary significance or to explain the significant differences

noted between groups in differing environments.

Environmental demands requiring considerable behavioural adjustment, role uncertainty, and thwarting of goal achievements, are generally considered to be of importance in interpretations of epidemiological data in essential hypertension.

The major reviews quoted support the view that psychosocial factors may be of crucial importance aetiologically, while emphasizing the considerable methodological difficulties encountered in attempting to evaluate objectively and precisely the variables considered most significant in pathogenesis.

2. Psychophysiological Studies in Animals

The necessary constraint regarding the type, intensity and duration of "stress" which can be applied experimentally to human subjects is one factor which has encouraged development of the assessment of cardiovascular reactions to "stress" in various animal species. A basic assumption is that the neurophysiological regulation of cardiovascular dynamics is essentially the same in humans and in species in whom such investigations have been carried out. However, since so much of what is stressful to man depends on highly specific stimuli and symbolic meaning, some types of stress used to evoke reactions in animals (e.g. avoidance schedules for electric shock) may have limited relevance to problems of perceived threat in the human situation.

A study by Charvat, Dell and Folkow (1964) described one approach to the understanding of higher centre control of the cardiovascular system. "Stress" was defined as "a set of events which modify the steady state condition within the organism so as to activate adaptive mechanisms". The term "defence alarm reaction" was used to indicate a basic set of responses which have persisted in man as well as being evident in animal species, even though the threat which constitutes the "set of events" may be largely psychological rather than physical in man.

The three efferent pathways which take part in the "defence alarm reaction" are:-

- (1) the somatomotor system
- (2) the viscero-motor system
- (3) the endocrine system

These authors described experiments in which stimulation of the anterior part of the hypothalamus in the cat puts the animal into a state of readiness for "fight or flight", and all the systems mentioned above are activated. The hypothalamus is influenced by the reticular activating system and by the cerebral cortex; and the reticular activating system in turn is sensitive to humoral factors such as circulating adrenaline. It is therefore conceivable that where regulatory mechanisms are inadequate, a positive feedback situation is set up so there is continuously enhanced sympathetic activity.

The characteristic cardio-vascular changes include dilatation of arterioles in muscles, increased secretion from the adrenal medulla, elevation of BP, CO and heart rate, with reduction of blood flow to the gastro intestinal tract, kidneys and skin. These changes are identical with those induced in man by mental stimulation (Brod, 1960). A variety of other changes in the endocrine system and in blood constituents occur but need not be detailed here.

The area of social and environmental stress factors is one which does attract research interest. It is possible to study such effects as crowding, lack of social training, and isolation, over prolonged periods of time in the experimental animal in a way which is not possible in the human, and furthermore the exact nature of pathological changes induced in arterioles, kidney

and heart may be defined by autopsy study.

In an imaginative study, Henry, Meehan and Stevens (1967), described the effects on BP of mice of four techniques for psychosocial stimulation.

- (1) Mixing adult males which had never previously been in contact,
- (2) submitting male and female mice to chronic threats from a predator,
- (3) reducing the floor space available until animals were so closely aggregated that the fur was in contact, and
- (4) exposing males and females to an inter-connecting box system leading to chronic territorial conflict.

The experiments lasted 6 to 12 months; all methods resulted in sustained elevation of SBP to approximately 160 mm Hg in males, and 140-150 mm Hg in females. Castrated male mice showed minimal BP elevation. On returning the mice to a less stimulating situation, BP usually subsided towards the baseline level. If the animals had been isolated in early life, the BP elevating effects of territorial conflict were enhanced. On the other hand, prolonged isolation itself was not associated with BP elevation.

The results were taken to support the hypotheses that:-

- (1) in a constant external environment the systemic arterial pressure of a group is a measure of the symbolic stimuli received during social interaction, and
- (2) early experience plays a role in determining the arousal value of the stimuli perceived.

In a subsequent study, Henry and Cassel (1969), pursued these lines of evidence further:-

The mice were placed in an inter-communicating box system. This was done both with normal mature siblings that had been raised together and with animals that had been isolated from weaning until maturity, deliberately to stunt the development of their social responses. Weight loss, failure to breed, cannibalism of the newborn, adrenal hypertrophy, thymus atrophy and chronic BP elevation to a mean of some 160 mm Hg developed in the deprived group during and following the period of intense mutual stimulation.

In a further development of this work, Henry, Stephens and Santisteban (1975) attempted to study the factor of the length of time for which it is necessary to expose the experimental animal to stress in order to induce permanent changes in cardiovascular system. The sequence of pathophysiological changes that can result from the stimulating effects of a sustained disturbance of the social environment was studied in ten colonies of socially deprived mice. 16 formerly isolated males were placed with 16 normal females in population cages consisting of 7 inter-communicating boxes. 6 of these socially disturbed 32-member colonies were terminated after periods of interaction ranging from 2 days to 9 months.

The remaining 4 were terminated a month or more after the males had been returned to individual isolation. Indirect BP measurements, total body and heart weights, and sections of hearts and aortae were studied in the males. Following the shorter exposures, BP reverted to normal in a few days. Exposures of 6 months or more were associated with unchanged body weights but sustained increases in heart weight and BP readings. In addition,

there was a significant development of aortic arteriosclerosis and myocardial fibrosis. These changes persisted despite prolonged return to isolation.

It is interesting to contrast these significant positive findings regarding psychosocial disturbance and the development of sustained high BP in mice, with another study reporting reactions to stress in animals. For example, Dahl, Knudsen, Heinze and Leitl (1968), reported that they failed to induce hypertension or aggravate existing hypertension in rats selected for strong genetic tendencies to high BP, using as stressors such stimuli as intermittent electric shocks, interruption of conditioned reflexes between light and sound signals, and crowding. The observation times were up to 6 months and in the authors opinion it was unlikely that further prolongation would have modified the results. The animals developed hypertension rapidly with a variety of other physical techniques such as high salt intake, unilateral renal artery compression, and steroids. It is not easy to explain this negative finding regarding crowding in the light of the findings of Henry's groups mentioned above, except to note that in the latter studies the experimental animals had experienced social deprivation with isolation before exposure to the crowded situation, whereas in the studies by Dahl and others this was not the case.

What is the evidence from higher species? Forsyth and Harris (1970), subjected 9 rhesus monkeys to 3 different shock-avoidance schedules lasting 2 to 14 months, and contrasted the results of BP responses with four controls. BP was measured

automatically with indwelling arterial catheters. In comparison with a control group, the levels of BP in the 9 experimental rhesus animals rose after a variable length of time to levels that would be clinically significant in man. It appeared that the severity of the stress did correlate with the rate and magnitude of the developing hypertension. The BP was higher throughout the day, not just during the periods of the behaviourally induced stress. The rise in BP correlated with rises in CO and PR, while TPR generally decreased.

Further evidence of the pathogenic effect of noxious stimuli came from a study by Benson, Herd, Morse and Kelleher (1970) who subjected 5 squirrel monkeys to an avoidance schedule for a noxious stimulus, and noted marked and persistent elevations of mean arterial BP. One monkey who died following this experiment had already developed obliterative changes of the renal arteries.

All the studies reviewed thus far in this section have assumed a stimulus-response model, with the cardiovascular responses at the end of efferent pathways reflecting brain function called "arousal" or "activation" or "emotion". Lacey and Lacey (1970) argue persuasively that this concept of the autonomic nervous system as an effector system is very limited, citing evidence that brain function is itself influenced by afferent input from the heart, carotid sinus and aortic arch. Bonvallet, Dell and Hiebel (1954) had shown that electroencephalographic changes from fast to high voltage slow activity followed distension of the carotid sinus, indicating an inhibited cortex; decreased muscle tone had also been noted following carotid sinus stimulation. In

1963, Bonvallet and Allen described an ascending bulbar pathway, which exerted inhibitory control on the duration and course of cortical, autonomic, and muscular responses to internal and external stimuli. Baccelli, Guazzi, Libretti and Zanchetti (1965) showed that sham rage in the acutely decorticated cat could be abruptly terminated by stimulation of pressoreceptive fibres which increased cardiovascular feedback.

Rather than viewing the hypertension and tachycardia observed in acutely stressful states simply as an index of arousal, therefore, the Laceys suggest that these cardiovascular changes "may be a sign of the attempt of the organism instrumentally to constrain, to limit, and to terminate the turmoil produced inside the body by appropriate stimulating circumstances". The increases are thus seen as "a physiological attempt to restrain excitatory processes", and they may produce therefore a "stimulus barrier" which serves a psychologically useful purpose for the organism. This controversial viewpoint is further considered in the next section dealing with psychophysiological response in human subjects.

Summary: In general, there is persuasive evidence that not only temporary but permanent cardiovascular changes can be induced in experimental animals through different types of cerebral stimulation. Direct repetition of electrical stimulation in the anterior hypothalamic region of cats can induce persistently elevated BP levels. Social deprivation with subsequent crowding and mobilization of aggression can produce cardiovascular changes with permanently elevated BP, in mice. The evidence reviewed by the Laceys point to a subtle afferent inhibitory influence on brain function from baroreceptor feedback, raising the interesting possibility that high BP may have adaptive value for the organism in reducing excitatory processes.

3. Psychophysiological Studies in Humans.

In this section studies of cardiovascular responses to continued laboratory stress situations are reviewed. The ready demonstration that specific changes occur, and that these changes are more pronounced and more prolonged in the hypertensive than in the normotensive subject, does not in itself indicate that sustained elevations of BP are stress related; the differences in response between hypertensives and normotensives could be a consequence of the effects of sustained elevated BP on CNS functioning, for example. The fairly conclusive animal experimental evidence brought forward by Henry and coworkers does not have an exact parallel in human studies.

Rather than present a strictly linear historical review of this important aspect I have selected those studies which appear the most significant, beginning with the more basic and leading to the more complex studies.

Reference has briefly been made to the work of Brod, Fencl, Hejl and Jirka (1959), who studied regional cardiovascular haemodynamics in hypertensives and normotensives, using mental arithmetic under time pressure as a standard stressor. In one study, physiological measures were made before, during and after this stress, in 10 hypertensives and 8 normotensives. In all subjects, redistribution of blood flow occurred, with vasodilation in skeletal muscle vasculature, and vasoconstriction in renal and splanchnic blood vessels. The elevation in BP which regularly occurred was due to increase in CO in some subjects, and increase in TPR in others. Whether TPR increased or not depended on the balance between vasoconstriction and vasodilatation in different regions. The shift of blood flow from viscera to muscles was similar to that seen in strenuous muscular exercise. Responses in hypertensives were different only quantitatively, and not qualitatively, from normals. The differences

were in the direction of an increased renal and splanchnic vasoconstriction without parallel augmentation of CO, and these responses were more persistent in hypertensives than normotensives. No assessment of personality structure was made in this study, nor were the subjects' subjective responses to the stress situation described. The results do demonstrate conclusively that humans share basic cardiovascular response patterns with other animal species, that this response is essentially a preparation for a physical response (fight or flight), appearing to be inappropriate for helping the organism deal with purely mental stress.

A development of the fundamental work described above occurred in a study by Richter-Heinrich and Lauter (1969) in which measures of SBP, DBP, PR and galvanic skin response (GSR) were made before, during and after the stress of timed mental arithmetic. Increased reactivity and lability in patients with mild EH compared with normotensives was noted, and when an additional acoustic stimulus was added, the hypertensives showed a lower threshold of response to this stimulus, a reduced adaptation physiologically, and impaired concentration compared with normotensives. The increased reactivity occurs therefore not only under mental stress, but also in response to originally indifferent weak acoustic stimuli. The early or pre-hypertensive may be distinguished from the normotensive by this type of test, according to these authors.

Richter-Heinrich and Lauter's work has generally confirmed some earlier studies such as that of Jost (1952) who compared certain C.N.S and autonomic reactions to simple physical and psychological stresses in 34 hypertensives and 35 normotensives, and found increased lability in GSR, and increased respiratory rate as well as greater BP changes in

the hypertensive group. Interestingly, PR changes were less in the EH group, who also showed a greater suppression of alpha rhythms on the electroencephalogram than normotensives.

The earlier American work now to be described was greatly influenced by the psychoanalytic model of EH proposed by Saul (1939) and Alexander (1939), which will be discussed in detail in a subsequent section of this review. The basic concept which many researchers explored, was that suppression of aggression was causally related to sustained BP elevation.

In a major study, Wolf, Pfeiffer, Ripley, Winter and Wolff (1948) reported observations and experimental data on 58 moderately severe EH patients, 42 nonhypertensive healthy persons, and 140 patients with vasomotor rhinitis or bronchial asthma. Changes in BP levels and renal blood flow were recorded in one component of the study, while psychologically disturbing material specific for the individual (marital disharmony, adverse past experience, problems with doctors) were discussed selectively. Only a few of the many findings can be quoted here, for example "it was invariably possible, by introducing subjects which aroused serious conflicts, to bring about a sharp rise in both systolic and diastolic pressures": "a prompt decrease in renal blood flow occurred coincidental with the rise in arterial pressure during the interview, and the diminution of renal blood flow usually outlasted the period of elevated blood pressure". Normotensives showed moderate rise in BP during discussion of conflicts, and slight renal vasoconstriction. The authors state that it was possible at will to invoke in hypertensive subjects an accentuation of their characteristic biologic pattern of mobilization by confronting them with an adequate threat to their security. This pattern included a sharply decreased blood supply to the kidneys.

Some aspects of the relationship between suppressed anger and cardiovascular functioning were tested in a study by Funkenstein, King and Drolette (1954) who used a stress technique of timed mental arithmetic coupled with an interviewer's expression of criticism and frustration at the subjects' responses, in 69 college students. BP and ballistocardiograph tracings were taken throughout. It was predicted that those subjects reporting feelings classified as "anger-in" would differ in physiological patterns from those reporting feelings classified as "anger-out", and that the latter group would also differ from those reporting "anxiety", assuming that it was suppression of anger which contributed to the "anxiety". 21 subjects were classified as "anger-out", 22 as "anger-in", and 9 as "anxiety". While the hypotheses were broadly confirmed, it is noteworthy that the major differences were in PR and electrocardiographic patterns, rather than in BP levels. DBP levels did not differ in the three groups, while SBP levels were significantly different only between the "anxiety" group and the "anger-out" group.

The study described above took place with normotensive volunteer subjects. Schachter in 1957 contrasted the reactions of 18 patients with EH, 15 labile hypertensives, and 15 normotensive persons to a standard physical stress (the Cold Pressor test) and to the psychological stress of contrived laboratory situations designed to induce fear or anger. It was predicted that EH patients (1) would show greater BP elevations during pain, fear or anger but (2) would report such emotion less, than normotensives. The first prediction was borne out, but the second was not. Indeed, the intensity of the psychological reaction tended

to correlate with the degree of pressor response, especially regarding anger. The author suggests that selection factors might have played a part in this finding, in that the subjects were all volunteers for a specific research project and the EH subjects might therefore be unrepresentative of the total population of EH persons. Very different selection factors had operated for the group of patients on whom the original psychoanalytic investigations were made (Saul, 1939), and the finding of subnormal assertiveness and suppression of aggression described therein also might not be typical of all EH patients either. This concept has been a stimulus for much research, and support for the original hypothesis has come from such studies as that of Pilowsky, Spalding, Shaw and Korner (1973), who found significant correlations between haemodynamic measures and scales measuring psychological traits such as "deference" and "abasement" derived from the Edwards Personal Preference Schedule. Scores on the "deference" scale correlated with resting TPR and amount of change after autonomic blockade, while scores on the "abasement" scale correlated with resting SBP and DBP, resting TPR, and degree of change after blockade in SBP and DBP.

The studies reported above in which the 'hypertensive response' is described included reports of the use of nonspecific stressors which are non personal (timed mental arithmetic), and stressors which are of personal significance (content of interview). Attempts have been made to identify more precisely the specifically stressful components of interpersonal interaction in hypertensive subjects. One such attempt was that of Williams and McKegney (1965) who found significant differences from baseline of DBP but not SBP, measured automatically, during three specific psychological test situations (Word association test, structured interview, and Thematic apperception test (TAT)). A further study (McKegney and

Williams 1967) revealed that the greatest elevations in SBP and DBP occurred in the personal discussion phase, and these elevations were more pronounced in hypertensives than normotensives. This finding was investigated further in a subsequent study (Williams, Kimball and Willard 1972) in which 17 subjects of whom 9 were hypertensive, were interviewed in such a way that three components of the interview (novelty, content, personality interaction) were systematically varied, while DBP was monitored.

The results indicated that novelty as such did not result in significant change in DBP, while the amount of interaction was more important than the interview content in determining the change in DBP. Nonverbal components thus emerged as the most significant.

The field of 'psychophysiology' shades imperceptibly into that of 'personality and EH', and studies which link with those of Williams but are more appropriately discussed in subsequent sections are those of Weiner, Singer and Reiser (1962), and Sapira, Scheib, Moriarty and Shapiro (1971) in which perception of others by hypertensive subjects is considered.

The studies mentioned so far all consider the efferent limb of the CNS-cardiovascular axis, but Lacey and Lacey (1970) have described experiments in which the afferent limb seems to play an important part. Following on from the animal experimental evidence described in the previous section, they studied physiological responses while volunteer subjects were engaged in specific tasks, some stressful and some relaxing (photic flashes, white noise, mental arithmetic, reversed spelling, cold pressor test). While these tasks all induced increased palmar skin conductance, increased respiratory rate as would be expected from 'arousal' theory, cardiovascular responses were bidirectional. Tasks requiring

internal cognitive elaboration of a problem solving sort, or exposure to noxious stimuli, produced massive cardiac acceleration and a rise in BP, whereas tasks requiring only simple environmental reception produced significant cardiac deceleration and reduction in BP. Cardiac deceleration was related to electroencephalographic activation. Linking these findings with the animal experiments described previously, these authors conclude "the key to the understanding of the psychophysiological results does indeed lie in the operation of visceral afferent feedback pathways which enable the heart to communicate with the brain".... and suggest a closer scrutiny of this relationship "the cardiovascular system commends itself to psychiatric study, not as a non specific index of arousal or emotion, but as a highly specific and apparently quite delicate response mechanism, integrated at the highest levels with the affective and cognitive variations among people, and revealing specific personal idiosyncrasies in the way people deal with their external world".

Summary: Significant cardiovascular haemodynamic changes occur in normotensive and hypertensive subjects when subjected to mental stress e.g. performing mental arithmetic under time pressure. Reduction of renal blood flow routinely occurs, while changes in CO and TPR occur variably. Hypertensive subjects show greater cardiovascular changes which take longer to revert to normal, than normotensives.

Structured interview situations reveal that changes of BP level correlate with the intensity of interaction between interviewer and subject, while the content of the interview is of lesser importance but more so than the novelty of the situation.

4. Personality Structure

A major issue in the literature concerns the question of specificity of personality structure in EH. Approaches to this question include clinical descriptive, psychoanalytic, and psychometric methods. An historical approach to this aspect reveals the unfolding and modification of ideas through recent decades. This section may conveniently be classified into -

- 1) early descriptive studies
- 2) psychoanalytic studies - the specificity hypotheses
- 3) psychometric studies
- 1) Early descriptive studies

The earliest description of personality characteristics by Moschowitz (1919) has already been mentioned in the section on Historical Aspects, and bears repeating at this point: -

"the greatest proportion of patients with hypertension are terribly tense and pursue their vocation with tremendous seriousness, and worry over trivialities. In consequence, they are irritable. They are the antithesis of the child. They do not play. They have no time for play. They have narrow intellectual horizons".

These uncontrolled observations, even if accurate, could not in themselves indicate whether such traits were predisposing to EH or a consequence of it, or a mixture of both: Ayman (1933), a Boston physician, did attempt a simple controlled study, using a standardized clinical interview approach about habitual traits, with items such as "have you been the sort of person whose feelings are unusually easily hurt?" and "have you been the sort of person who loses his temper quickly?" His study group of 182 ambulant persons included 2 groups of

middlegaged hypertensives, one with and one without symptoms, a third group of young hypertensives, and two control groups matched for age. Striking differences emerged: for example, 52% of hypertensives compared with 5% of controls stated that they had been "unusually highly strung" throughout life: for "losing temper quickly" the respective percentages were 48% and 8%. Similar findings were noted for traits such as "sensitivity", "excessive worry", and "increase in physical activity". Ayman considered that these traits could not be considered to be simply a consequence of the hypertensive state. So regular was their occurrence that he advised increased diagnostic suspicion if a hypertensive subject lacked these traits, that a renal or other cause would be found. Nor were these traits considered irrelevant to therapy" any rational therapy of EH must attempt to modify this personality, either by education, sedatives, or both".

Further case reports, a literature review and a classification of the possible relationships between anxiety and hypertension, came from Rennie (1939). The 5 patterns delineated were (i) acute emotional crises leading to temporary elevations of BP (ii) anxiety about temporary elevations of BP (iii) anxiety about high BP even in the absence of significant elevation (iv) chronic anxiety leading to true EH (v) true EH with secondary fears and anxieties.

Rennie focussed on the 'emotional state' of the patients, and did not consider that a specific personality type would be revealed as universal, but his attention was drawn to the matter of hostility "the outstanding emotional pattern appears to be one of resentment, sometimes coupled with a frank desire for revenge". Like Ayman, in those days of negligible pharmacotherapy, he emphasized the psycho-

therapeutic approach "psychotherapy is a positive mode of attack, often the only really effective one available, attention to which can spell years of comfort and security, and neglect of which may lead to profoundly disabling and unnecessary invalidism".

2) Psychoanalytic studies: The specificity hypotheses.

The most radical, controversial, and far-reaching theory was formulated by Saul, and Alexander, in 1939, and will be considered in some detail accordingly.

The studies were made on patients referred by physicians to psychoanalysts at the Chicago Institute of Psychoanalysis and an immediate criticism of any findings accrues from this fact, since the cases may well have been highly selected as suitable for psychiatric treatment, rather than being in any way representative of the spectrum of hypertensive disease in the general population. Another reservation about this method lies in the fact that the investigator already has in mind a "model" of personality structure, namely the psychoanalytic model. As a result he may attempt to fit his patient to his conceptual framework, or at least tend to focus on dynamic factors involving sexual and aggressive drives which are of basic importance to the psychoanalytic theoretical framework, to the relative exclusion of other data.

With these reservations in mind, it is still worth examining closely the thinking of these authors, as the personality structure of selected cases was examined in depth by the psychoanalytic method, thus providing information of a sort which is not obtainable either by structured questioning or by the written questionnaire method.

The paper by Saul (1939) is the most specific concerning psychopathology and will be described in some detail accordingly. There were only 7 patients in the series and of these the BP levels of 4 ranged between 140 to 200 (SBP) and 80 to 130 (DBP). There were 2 males and 2 females among these 4 patients: in the 3 other patients the BP levels were described as lower, without figures being given. Immediately it may be said that persons with BP below 140/80 are not customarily defined as hypertensive, and this limits the usefulness of the conclusions of this study.

Saul emphasized the status of particular conflict situations in these patients. The main conflict elicited was described as follows: -

"A masochistic, submissive and oral dependent attitude, initially to a parent, then to the conscience, and then to parent-substitutes in later life - all of these unconscious, and linked to chronic, unsuccessful, unsatisfied rebellion and hostility in protest against this submission. This hostility was nearer consciousness but was not expressed, for fear of loss of love".

The second conflict elicited and described was an excessive fear of heterosexuality.

Both the oral dependent wishes and the hostile aggressive impulses had been inhibited, and never satisfied in life, or expressed in symptoms as is the case with the psychoneuroses. The patients could give in to neither trend. When they did however, there was said to be a reduction of BP level.

The lack of resolution of this conflict is contrasted with strategies used by other persons: -

- (1) Persons who shun any submissiveness "can't work for a boss".
- (2) Persons who submit to authority with narcissistic compensation.
- (3) Persons with organized neuroses.
- (4) Persons who act out sexual or aggressive impulses.

Saul made the important point that the major conflict itself is a very general one and not peculiar to patients with EH. The material suggested none the less that the "prominence" of this particular conflict, rather than its existence as such, might be peculiar to patients with EH.

In Saul's opinion the "status of the hostilities" was the central issue in analysis of these patients. They were seen to be intensely and chronically "boiling with rage" and yet to have inhibited this expression even appearing overly gentle in some relationships. He discovered that his patients had considerable conscious hostile fantasy, although with no adequate outlet for this in behaviour, or through sexual activity, or even in dreams. Both the hostility and the regressive passive wishes were blocked and were unacceptable to the person. These conflicts had been intimately organized into the whole personality, and rendered motivation for treatment a more problematical matter.

Saul was suitably modest in his conclusions in so far as he stated that his series was too small to establish conclusively whether or not the abovementioned psychological features were generally typical for cases of EH.

It was Alexander (1939) who went on to make further hypotheses concerning the relationship between the states of disturbed emotion, and

the development of the hypertensive condition. Referring to the early "labile" phase he wrote "I assume that this instability of the vasomotor system is the expression of a specific psychoneurotic conflict situation, characterized by the inability to handle accumulated hostile impulses". This was considered to lead to a functional overtaxing of the circulatory system.

In 1950 Alexander in his text book "Psychosomatic Medicine" elaborated this earlier thinking. It was postulated that in response to emotional and physical stimuli, marked vasoconstriction of the blood vessels of the kidney in particular occurred, therefore indirectly leading to the release of pressor agents. It is of interest in the light of more recent developments in pathophysiology, that angiotensin was undiscovered although postulated in 1950 and Alexander's line of thinking was specifically accurate regarding the existence of this pressor substance. In support of the "neurogenic" view was the observation that the BP of many patients with EH dropped during transient blockade of the autonomic ganglia, whereas patients with other types of hypertension secondary to e.g. glomerulonephritis, did not show such a response to autonomic blockade. It seemed that in the majority of patients therefore the main factor was neurogenic.

Alexander was well aware that as the disease progressed, non-neurogenic factors played an increasingly important role. "There appears to be little question of the fact that neurogenic factors play an important part in the maintenance of hypertension and even in the genesis of the syndrome. With the progression of the disease, tissue changes tend to play a greater and greater role. These changes favor the production of pressor substances, so that in the patient with a well-advanced hypertension the humoral factor may later become the dominant one".

Alexander referred to Cannon's early demonstration (1915) that with fear or rage there was activation of the sympathetic nervous system and secretion of adrenalin by the adrenal medulla, and that these hormones in turn played an important role in producing such physiological changes in the cardiovascular and other systems as could permit the organism to combat an attacker or to flee from danger. It was the inhibition of such aggressive impulses, and the association with anxiety which was so striking in the "hypertensive personality". A typical subject was seen to be superficially well-adjusted, frequently eager to please, on the whole highly controlled, and sexually inhibited. The psychoanalytic method revealed the pronounced conflict between passive dependent needs and compensatory aggressive hostile impulses so that the more that the patients gave in to the former, the greater was the reactive hostility which in turn created fear, causing retreat from competition thus accentuating the passive attitudes, and completing the vicious circle. "The opposing tendencies of aggression and submission stimulate and block each other at the same time with a sort of emotional paralysis as a result".

"It is postulated that this continuous conflict is partly a function of modern society which requires that the individual should have complete control over all his hostile impulses. It may be assumed that chronically inhibited rage induced by such restrictions may lead to a chronic elevation of BP because the rage cannot be discharged either in physical aggression or in some more sublimated form of self-assertive behaviour". Alexander cites the discrepancy between prevalence of hypertension among African blacks compared with blacks in U.S.A., as an instance of the effect of modern civilization which requires suppression of hostile impulses.

Although his conclusions are far reaching there is no claim that the psychodynamic factors alone are responsible for the development of hypertension. "Only in combination with unknown, possibly inherited somatic factors can psychodynamic influences produce chronic disturbance. The possibility that hypertension is related to inheritance of an unstable vasomotor system does not minimize the etiologic significance of psychodynamic factors". At the time of Alexander's work, drug therapy was as yet poorly developed and there was widespread optimism about the further use of psychotherapy. "It may be predicted that the most beneficial contribution to the problem of hypertension will come from earlier diagnosis and the application of psychotherapeutic measures to incipient cases".

The major criticism of this hypothesis is that mentioned during the discussion of the paper by Saul, namely that an elegant superstructure was erected on what was perhaps a shaky foundation in that only limited numbers of selected patients were studied in this way.

Wolf, Pfeiffer, Ripley, Winter and Wolff (1948) carried out an extensive psychophysiological study of 58 hypertensive subjects. Fifty of the 58 were said to fit the following general description, "they were non-reflective and displayed a taste for dealing with problems by action. Many of them exhibited signs and symptoms of excessive skeletal muscle tension. From the standpoint of attitudes as well as circulatory physiology they were mobilized for combat, but did not engage in it against the pertinent adversary. Under a facade which was often affable and easygoing, they were tense, wary and suspicious, afraid of committing themselves. They were poised to strike, but withheld their punch with a guilty fear of its consequences. At the same time they displayed a strong need to

conform and keep peace. This coupled with inability to throw themselves wholeheartedly into things because of fear and suspicion made it difficult for them to believe strongly in anything or to derive real satisfaction from their accomplishments. They felt a need to show prowess without exhibiting aggression and continually feared that they would not succeed in doing so". The authors also comment on the tendency for such persons to have excelled at sport, to be preoccupied with appearances and saving face, to have been shy as children, to blush easily, to find difficulty in admitting that they were wrong, and if married to have selected domineering mates. The authors relate this to their childhood background "many of the mothers were stiff and domineering". "In brief our hypertensive subjects, often gentle, poised and apparently easygoing, were filled with aggressive drive which was tightly restrained by a need to please".

Ackerman (1950) also elaborated on the basic picture depicted by Alexander and Saul in describing the personality structure.

He stated that "the dramatic feature of the hypertensive personality is the extraordinary facade of rigid external emotional control, behind which there is intense conscious agitation and turmoil. Such patients exhibit a pervasive sense of trapped, helpless, exposed to the danger of aggressive injury, usually in a context in which the threat seems to derive from the very person on whom the patient depends for security. They are ever-alert to such danger, and their psychic energies are continuously absorbed with the effort to counteract it. It is the feature of their emotional reactivity which makes it appear that they live out their lives negatively and with little joy. There is conspicuous impoverishment of pleasure-toned activity. The drive for security and

self-preservation is paramount. It prevails over the pleasure aims, subordinates the sex drives, and in the final choice, the urgency of the dependent craving for security proves stronger than their fear of injury: it induces them to submit and expose themselves even in those relationships from which they anticipate aggressive harm. If, temporarily, they are impelled by their fear of harm to retreat from close human ties, they are always driven back by the intensity of their dependent longings. It is this trend that imparts to these personalities a masochistic, self-destructive tinge, and makes them behave as though they invited hurt and suffering in their personal relationships".

Valuable as these descriptions are, they leave as many questions as answers, as it cannot be deduced from these approaches alone whether such personality patterns and conflicts are indeed present more commonly in EH patients than in normotensive persons.

3) Psychometric studies

An early attempt to test certain aspects of the theories concerning personality structure was that of Hamilton (1942) who investigated a group of 5470 college students between the age of 16 and 23, and who were not informed about the level of their BP for the purpose of this study. Following the tabling of the frequency distribution of BP, a small group whose SBP was greater than 138 mm Hg (1.53 s.d. above the mean of 128) were compared with an equal number of persons with BP levels at the mean. None of the subjects were known hypertensive patients. The rating scales in use at that time included a trait rating scale, a submissiveness scale and a scale to measure neurotic tendencies.

Using these measures no evidence was found to support the contention that persons with elevated BP levels were neurotic or unstable. There were tendencies toward such traits as submissiveness but they were not highly statistically significant ($p=.03$). The authors mentioned a limitation of their study, which only tapped those aspects of personality structure and behaviour revealed by the measures selected, and the evidence was considered neither to refute or to confirm the psychoanalytic contention that it is unconscious "inhibited hostile impulses" which are significantly related to persistent BP elevation.

In an attempt to surmount the problem that correlation studies at a particular point in time after the appearance of clinical disease do not allow ready deductions concerning the presence of emotional disturbance before the onset of the disease, Bruce and Thomas (1953) attempted a prospective study of medical students using the Rorschach technique, and "teased out" 10 personality factors cited in the literature and possibly relevant to hypertensive disease. These factors were (1) obsessive compulsive trends, (2) passivity, (3) aggression-hostility, (4) anxiety, (5) feelings of inadequacy, (6) depressive trends, (7) impulsiveness, (8) introversion, (9) intellectual conformity, and (10) neurotic trends.

The results of their initial studies did not reveal any correlation between level of BP and degree of disturbance as measured by the Rorschach methods, on the factors described.

Perhaps significant were the findings that traits of 'aggression-hostility, obsessive compulsive trends, and feelings of inadequacy' were more prevalent among offspring of parents with hypertensive disease compared with those born of healthy parents: these differences were said to "approach statistical significance".

A significant attempt to overcome the limitations of selection, description and retrospective assessment was made by Harris, Sokolow, Carpenter, Freedman and Hunt (1953), who compared a "prehypertensive" group of 38 undergraduate women with SBP >140 mm Hg or DBP >90 mmHg, with a matched group with BP 120/80 mm Hg.

Psychodynamically oriented interviews were carried out by psychiatrists unaware of BP grouping, and prediction of that grouping was based on the presence or absence of the specific conflict over disposition of hostility. 26 of the 38 'prehypertensives' were predicted, a finding significant at the 2% level of confidence.

All subjects were then rated on a 389 adjective checklist by 2 observers unaware of BP grouping after exposure to a psychodrama in which negative emotion was deliberately induced. The 'pre-hypertensive' subjects interpreted the situations as more stressful, and in behaviour showed less effective ways of dealing with the themes revealed in the psychodrama; they tended to be rated by the observers on such adjectives as 'erratic, unstable, self-centred, temperamental, resentful'.

The third psychometric method was self-description, and terms indicating defect of control, moodiness, and egocentricity, i.e. a negative self-evaluation, were strikingly more apparent in the pre-hypertensive group. Interestingly, the self-image included submissiveness and passivity, traits which had not been observed by the raters but which might have been predicted from psychoanalytic theory.

The authors concluded that 'prehypertensives' showed reduced capacity for handling stressful or frustrating situations without becoming emotionally upset, and would therefore have been more likely

to be subject to the autonomic accompaniments of emotion including repetitive rises in BP. The fact that the subjects were all young females limits the extent to which these findings can be generalized, but overall they offered support to the theory of conflict over hostility as a personality trait.

In 1961 a followup study was reported from the same research unit (Kalis, Harris, Bennett, and Sokolow). 20 of the 'prehypertensives' and 22 controls were re-examined, using psychiatric interview, rating scales of personality traits assumed relevant to EH, and adjective check lists: prediction as to BP states was again made "blind" after these ratings. This time, prediction was accurate at just below the 5% level of confidence. Terms discriminating the groups were strikingly similar to those revealed in the earlier study - 'irritable, unsympathetic, selfcentred, sulky, resentful, awkward, erratic, changeable, excitable, restless'. Since the interviewers in this study had not been involved in the earlier study, the correspondence of results pointed to the stability of these personality traits over time.

Other material emerging from Q-sort descriptions can be summarized as follows: the 'prehypertensives' showed conflict over sexual identification, were overly sensitive to real or imagined criticism, and showed an inability to be assertive without being hostile. They were relatively independent, struggling actively with their environment. Defence mechanisms against both internal impulses (aggression) and perceived external threats were brittle, and were reflected in overt anxiety, muscular tension, and signs of autonomic discharge. At a mean age of 25 years, 25% were married and 5% had children, compared with 59% and 36% respectively for controls.

The question whether the personality characteristics of these 'prehypertensive' women were akin to those with established hypertension, was the focus of another study by the same group (Kalis, Harris, Sokolow, and Carpenter, 1957). Using similar techniques of psychometric evaluation as in the earlier study, they compared 14 known female hypertensives (mean BP 172/107) with 22 controls (mean BP 119/73). Two psychodramas designed to elicit healthily assertive responses, and friendly conciliatory responses respectively, were used. The hypertensives were more selfpunishing, suppressed anger, appeased, denied guilt, felt uncertain and confused, and were more submissive, than controls with regard to the first psychodrama, and more hostile in an in-effectual way with regard to the second.

Overall, there was more suppression of anger and more inappropriate expression of anger in the hypertensive group.

Combining the results from these three important studies, the following conclusions were reached "both the hypertensives and the prehypertensives seem to suffer from defects of socialization which frequently bring them into conflict with other people. They seem overly ready to perceive other people as hostile and demanding, and their own attitudes and behaviour tend to elicit the kinds of responses in others which make their interactions stressful. It seems likely that they experience emotional upsets more frequently than normals, and these upsets may be larger and more prolonged." Vasopressor episodes, reflecting the autonomic components of emotional arousal "could be expected to correspond in frequency, magnitude and duration, so that the total pressure integrated over time would be greater than in normals".

From the psychiatric point of view, the traits described above are akin to those observed in persons diagnosed as paranoid character disorders, with the psychological defence mechanism of projection much in evidence. Some confirmation of this description comes from the study of Thaler, Weiner and Reiser (1957), who studied 75 male subjects from a U.S. Army source. The subjects included 15 hypertensive patients, while the remainder were peptic ulcer patients, and controls. The psychometric instrument used was the Thematic Apperception Test (TAT), depicting doctor-patient relationships of varying kinds.

Hypertensive subjects perceived these scenes significantly differently from the other groups. They perceived the doctors as threatening, were more defensive and mistrustful, and showed a need to control and dominate in their identification with themes depicted on the cards. They "reacted indignantly to the projective interpersonal stimulus".

The authors considered that "the provocative, challenging, attitude reflected a paranoid character disorder", and further interpreted this defensiveness as a need to avoid closeness such as in a dependent relationship. Whereas ulcer patients tended to feel hostile if dependent needs were not met, hypertensive patients tended to feel hostile if dependent needs emerged in a relationship.

Before turning to more broadly based psychometric studies, it is convenient at this point to refer to a more recent study which has examined the "perceptual stance" further. Sapira, Scheib, Moriarty and Shapiro (1971) showed 2 films of doctor-patient interaction to 19 hypertensive patients and 15 normotensive persons. In one film, the doctor was behaving somewhat aggressively and negatively, while in the other the doctor behaved warmly in a relaxed manner. Whereas normotensive persons clearly differentiated the two situations, hypertensives tended to deny the differences. Measurements of BP and pulse rate showed significantly greater changes in the hypertensive subjects, both during the film and particularly during the subsequent interview. A questionnaire devised from the results of this experiment, given to another group of hypertensives and another control group, again showed clear differentiation on these psychological dimensions. The authors conclude "hypertensive patients may perceptually screen out potentially noxious stimuli as a behavioural response to the hyperreactive pressor system".

The studies described so far in this section have had in common a psychodynamic perspective. Some of the samples - medical students, college females, army recruits - are hardly representative of the EH persons in the general population. They have tended to be 'in depth' studies of relatively few subjects, and results have generally been confirmatory of the psychoanalytic hypothesis of a basic personality disturbance in EH, a disturbance seen in a character disorder with paranoid and obsessional features, with an unresolved dynamic conflict especially concerning disposition of aggression. If these studies are all valid, it is still too simplistic to consider the raised BP simply

as a consequence of such personality disturbance; for example, as Sapira, Scheib, Moriarty and Shapiro (1971) point out above, the perceptual stance discovered may be a "behavioural response to the hyper-reactive pressor system". If we link this concept with that of the Laceys (1970) described in the section on psychophysiology (p57 and 58) we can also conceptualize the elevated BP as influencing brain function, in the direction of reduced responsivity to internal and external stimuli, and thereby perhaps contributing to the psychological mechanisms of denial and reaction formation indicated by the literature.

The studies to be reported are broader in scope, are not 'tailor made' to the specificity hypothesis, and tend to use instruments devised for general psychiatric and psychological purposes. It would not be expected that such instruments would readily permit confirmation or refutation of a psychoanalytically derived hypothesis, but they do shed some light on the more general question of the relationship between raised BP and emotional disturbance.

Ostfeld and Lebovits (1959) used the Minnesota Multiphasic Personality Inventory (MMPI) to compare a group of 'renal' hypertensives with a group of patients with EH. The majority of the patients were black and all were female. No significant differences on MMPI scales were detected between the two groups. While this result was seen as contrary to what would have been expected if personality disturbance preceded diagnosis of EH, reservations concerning the criteria for diagnosing renal hypertension and the selected samples limit the deductions which can be made from this study. Hardyck, Chun, and Engel (1966) studied personality and marital-adjustment differences in EH in women, using the MMPI and a revision of the

Terman Marital Adjustment Questionnaire as psychometric instruments. There were 42 female EH patients matched with 44 controls on age, income, and education. Both groups showed comparable scores on item analysis of the Marital Adjustment Questionnaire, but hypertensives with high scores on measures of marital complaint showed significantly higher MMPI scores on measures of social alienation, persecutory ideas, anxiety, impulsivity, inner maladjustment, dependency, and lack of hostility control, than did the control group.

The methodological problems arising when assessing personality dysfunction in psychosomatic patients by means of an instrument such as the MMPI was clearly shown by Hardyck and Moos (1966) who used the MMPI in four groups of subjects, (i) rheumatoid arthritis, (ii) EH, (iii) family members of arthritic patients, and (iv) general medical clinic patients. Results showed that subgroups of patients with these two conditions could be as different from each other, as either group is from controls, or as different as one psychosomatic group compared with another. Similarly, two control groups could be as different from each other as either is from a psychosomatic disease group. If these facts are not heeded, strikingly different conclusions about the personality characteristics of patients with a particular condition may be made, depending on the subsets of patients and controls selected for comparison.

Another perspective on the question of EH and personality dysfunction can be gained from a series of British studies now to be outlined.

Sainsbury (1960; 1964) administered the Maudsley Personality Inventory (MPI) to the following groups: - 116 neurotic outpatients, 459 clearly psychosomatic patients, 231 possibly psychosomatic patients, and 546 controls. There were 18 illness types in the psychosomatic group, and the mean neuroticism score for this group was significantly higher than among controls. For EH patients, mean Neuroticism Score was 24.7 compared with 18.2 for the non psychosomatic disorders. While a selection factor might have explained this finding (hypertensives with higher neuroticism might selectively be referred to hospital clinics), the alternative theory was that psychosomatic patients were intrinsically more neurotic than non psychosomatic persons, EH being but one of those conditions.

Robinson (1962) found higher scores for Neuroticism in outpatient hypertensives, compared with those obtained in undiagnosed hypertensives, matched for BP level, detected in a community survey.

While the most ready explanation for this was the selection referral factor mentioned above, this possibility was later investigated in detail by Cochrane (1969) who concluded that drug effects influencing scores on the MPI might have been responsible for the higher levels in the outpatients, as the undiagnosed hypertensive group was of course free of this potentially confounding element.

While such cross-sectional studies are of interest they do not advance causal theory. An attempt to relate episodes of psychiatric illness to raised BP levels was made by Heine, Sainsbury and Chynoweth (1969) who studied BP levels in 25 severely depressed patients who had received electro convulsive therapy, and found significant correlation between BP level

and duration as well as number of episodes of illness. Ratings of anxiety and agitation, but not depression, also correlated with BP levels before treatment and those whose BP level fell on recovery were significantly more anxious than those who did not. Heine (1970) extended the study subsequently to include 15 men and 25 women, and the correlation between spells of illness and BP level was again obtained, but not that with duration of illness. BP levels for the patient population were significantly higher than for a control group (hospital staff) matched for age and sex. The conclusion that "repeated spells of depressive illness, when characterized by marked anxiety and agitation, are accompanied by repeated increases in blood pressure" supported theories linking emotional disturbance with the development of high blood pressure.

It is apparent that methodological issues loom large in this complex area. In order to reduce the influence of certain variables, Davies (1970) studied 128 male factory workers employed in a single workshop, ages ranging from 45 to 54. The subjects were not known hypertensives. Davies found a negative relationship between Neuroticism scores on the Eysenck Personality Inventory (EPI) and BP levels. A history of neurotic traits in childhood, and present neurotic symptoms, also correlated negatively with BP level. These findings differed from those of Sainsbury (1964) who had found a positive relationship in EH outpatients, and from those of Robinson (1962) who had found no relationship in a large community survey. The different settings may help to explain these differences. For the circumscribed group surveyed by Davies, the findings were consistent with psychoanalytic theory, in which the development

of EH is conceptualized as an alternative to overt neurotic disturbance rather than simply a consequence of it.

Davies' finding of a negative correlation between BP level and the EPI measure of Neuroticism in a nonpatient group was not confirmed in a subsequent Australian study by Kidson (1971, 1973). In Kidson's series of 110 non hypertensive males, no correlation with EPI neuroticism score was found, but there was a negative relationship between symptoms as measured by the Cornell Medical Index (CMI) and BP level. Kidson states that both studies indicate that persons with elevated BP "are not specially troubled by anxiety or neurotic symptoms prior to the recognition of raised blood pressure".

Kidson also studied 40 male hypertensives, of whom 24 were EH. Subjects completed Cattell's 16 Personality Factor Questionnaire (16 PF Form C) as well as the EPI and the CMI. The hypertensive patients were significantly more neurotic (EPI N), less intelligent (16PF B), less emotionally stable (16PF C) more conventional (16PF M), more insecure (16PF O) more conservative (16PF Q1) and more tense (16PF Q4) than controls. They also score significantly higher on CMI symptom scores, "the hypertensive group contained a disproportionately large number of patients who might, on clinical assessment, be diagnosed as having an anxiety neurosis". The cross-sectional correlation study could not indicate whether such an "anxiety neurosis" antedated or followed the diagnosis of hypertension, but the absence of correlation between neuroticism and BP level in the non patient group did suggest that "the diagnostic-treatment process is responsible in some way for this disability". Kidson did not consider that his data supported the

psychoanalytic theory concerning disposition of aggression, as the "nonpatient" hypertensives were "neither predominantly 'retentive' nor predominantly 'expressive' of anger, at least according to the measures used". It could be argued that these questionnaires fall short of the measures required accurately or adequately to study the psychodynamic pattern suggested by the 'specificity hypothesis'.

A more direct examination of hostility and BP level was made by Cochrane (1973) who administered Fould's Hostility and Direction of Hostility Questionnaire (HDHQ) as well as the EPI to (1) 32 subjects discovered to be hypertensive, in a large pool of cardiac patients undergoing a drug trial, and (2) to a control group of 64 subjects. No correlation emerged in this group between BP level and EPI Neuroticism, nor were there differences in hostility scores between hypertensive and control subjects. While this result may be taken to tend to refute the specificity hypothesis, it must be borne in mind that again the sample is highly selected; in view of all that has been written about personality characteristics and predisposition to cardiac disease (Rosenman and Freidman, 1963), the hypertensive group drawn from this source can hardly be said to be representative of EH in the general population. The lack of positive correlation between BP level and EPI Neuroticism in a hitherto non hypertensive-designated group is in approximate agreement with the findings of Davies (1970) and Kidson (1973) using this particular measure.

The study by Pilowsky, Spalding, Shaw and Korner (1973) referred to above, in *Psychophysiological Studies* (p63), although carried out on a sample of only 12 male hypertensive subjects, is of interest

in the present context also. The psychometric measures used were the Edwards Personal Preference Schedule (EPPS) the IPAT Anxiety Questionnaire, the Cornell Medical Index, and a sentence completion test designed to assess disposition of aggression. Some findings were consistent with psychoanalytic theory, in that scores on the EPPS for "deference" and "abasement" were positively correlated, while "heterosexuality" was negatively correlated, with DBP level. On the other hand, scores of "aggression" derived from the sentence completion test showed no significant correlations with cardiovascular measures.

Summary

Overall, the evidence from most of the psychodynamically oriented studies supports the hypothesis that persons predisposed to EH have a personality structure in which is found evidence of significant conflict over disposition of aggression. A recurrent theme is that such persons have a defect in appropriate modulation of aggression in interpersonal relationships, with tendencies to reveal either or both of 2 patterns of behaviour -

- (1) Excessive inhibition of aggressive behaviour with manifest compliance, appeasement and deference : traits indicative of defence mechanisms of denial and reaction formation against aggressive impulses.
- (2) Defensive oversensitive reaction to perceived aggression in others, probably indicative of the defence mechanism of projection onto others of unacceptable aggressive impulses within the self.

The evidence from cross sectional personality inventory studies generally indicate an absence of correlation between overt neuroticism and BP level in normotensive and untreated of undiagnosed early hypertensives, but a strong link with overt

anxiety and neuroticism in hypertensive clinic patients. This latter finding suggests that much of this 'neuroticism' may be secondary to the diagnostic-treatment process rather than reflecting premorbid personality disturbance.

The psychoanalytic hypothesis refers to a failure to convert the dynamic conflict into an overt neurosis, as a feature of the psychopathology. It might be hypothesized therefore that the discovery and treatment of the condition with necessary change to 'patient' status, and adoption of a passive role in accepting medical treatment, would facilitate the revealing rather than continued suppression of neurotic conflict, thereby accounting for some of these findings. Another simpler hypothesis is that anxiety is more common after diagnosis simply because of awareness of the morbid and potentially fatal complications of untreated hypertension. One would expect elements of both in a clinic population.

The psychophysiological and psychoanalytic formulations are different perspectives of the one reality. Linking concepts have long been thought to be necessary, but the universe of discourse of the psychoanalytic approach has little in common with that of experimental psychophysiology. A most interesting recent attempt at such a unifying concept is the "dysregulation" hypothesis, well described by Schwartz (1976). The person is basically in a state of "preparedness for threat"; the mental task of coping with perceived but unwanted environmental stimuli is accompanied by a rise in BP, which serves the function via baroreceptor activity of reducing cortical receptivity and reactivity, and dampening aggressive impulses which would otherwise threaten to emerge; the brain may therefore learn to "dysregulate" itself

with regard to cardiovascular homeostasis. Psychological adaptation is achieved at a cost of physiological maladaptation. Whether genetic or early environmental influences predominate in determining the basic temperament of the person predisposed to EH is not clear, but it follows from the theory outlined above that the mediation of overcontrol and suppression of aggression in a developing child may occur instrumentally via cardiovascular feedback to the brain, completely outside awareness.

5. Effects of Non Pharmacological Treatment Methods

This section of the review refers to the following aspects: -

- (1) suggestion and symptomatic relief
 - (2) multiple non-drug variables influencing medical treatment
 - (3) psychoanalytically oriented psychotherapy
 - (4) learning theory, biofeedback, and the relaxation response.
- (1) Suggestion and symptomatic relief.

An interesting early paper, although addressing itself to symptoms rather than BP level was that by Ayman (1930) who referred to symptomatic relief of many of the common symptoms associated with hypertension namely insomnia, headache, nervousness, fatigue, loss of appetite and dizziness. These symptoms do not correlate well with the level of BP but seem to have much more in common with symptoms of psychoneuroses. The author using a "treatment" consisting of 10 drops of dilute Hydrochloric Acid, reported 82% success rate in relieving symptoms. The conclusion was that the symptoms associated with uncomplicated EH could frequently be relieved by the suggestion inherent in any seriously and enthusiastically prescribed drug or other method of therapy.

Goldring, Chassis, Schreiner and Smith (1956) assessed 31 patients with benign hypertensive disease, in order to assess the effects of intensive reassurance coupled with a dramatic mechanical but physiologically innocuous device. BP and subjective symptoms were evaluated, and in 6 out of 9 patients treated in the hospital, there was a substantial decrease in SBP and DBP, and the same occurred in 15 of 31 clinic patients. All patients were substantially improved in respect to subjective symptoms, some to the point of psychic and physical rehabilitation. The symptoms which improved included headache, fatigue, dizziness, nervousness and chest pain. Patients

who had been partially incapacitated were enabled to resume normal activities. The data suggested that intensive reassurance is effective in reducing BP levels transiently in some patients. Significantly, there was no permanent reduction in BP as evidenced by the twelve month followup. For the hospitalized patients, it was apparent that it was the circumstance of hospitalization as such rather than "treatment" which was the more potent factor.

(2) Multiple non-drug variables influencing medical treatment.

In an important paper, Shapiro (1956) considered the multiple variables which are important in the evaluation of antihypertensive drugs, which variables contribute to the antihypertensive effects, to the symptomatic improvement and to the side-effects. The assignment of credit for these changes to the specific drug therefore becomes a formidable problem. Shapiro cautioned that the design of any experiment to test a clinical efficacy of given drug, should include:-

- (1) using the patient as his own control and comparing BP during a period of drug administration with that during a period of no medication,
- (2) standardizing the frequency and time of day of assessments,
- (3) allowing a rest period of constant length before the BP is determined,
- (4) utilizing a standard manometric technique,
- (5) assessment in an environment assumed constant, either in the hospital or in a clinic.

Although most of these features could be controlled, to greater or less extents, other sources of variability still occurred in drug studies:-

- (i) The concept of a stable pre-treatment BP which may be employed as a constant base-line did not seem valid, as the length of time after hospitalization before stabilization of BP occurs was extremely variable and could not always be achieved.
- (ii) Hospitalization or regular clinic visits did not necessarily surround the patient with a neutral environment. In the hospital the patient achieved security, escape from certain environmental turmoil, and received gratification for dependent needs.
- (iii) Reassurance by an interested physician was usually an important by-product of treatment.
- (iv) The administration of a new drug brought with it special attention to the patient from the physician and his staff.

All these factors tend to exert an hypotensive influence independent of the specific regimen: the following factors could also potentially influence outcome:-

- (v) The ambulatory clinic patient was still exposed to all his usual environmental stresses which continued to exert their effects.
- (vi) The hospitalized patient may have entered a difficult ward situation which could provoke anxiety, and these effects could conceivably counteract the hypotensive effects of various drugs. Although a sampling technique could be devised whereby such variables would operate in a random fashion, the variance induced by these factors would be so large as to necessitate a sample size of prohibitive proportions.

- (vii) Although suggestion could play an important part for the patient it could also influence their doctor's attitude and therefore the doctor-patient relationship, if the physician was aware of the nature of the medication.
- (viii) The elucidation of underlying psychodynamic patterns in the patient under study and observation of the interplay of psychological forces in the experimental situation, needed to be identified and their influence determined so that systematic errors produced by these factors could be assessed.
- (3) Psychoanalytically oriented psychotherapy.

Following the description of specific psychopathology by Saul and Alexander in 1939, there was a spate of interest in psychotherapeutic techniques, not least because the pharmacological approach was so limited at that time.

A case report by Shapiro (1951) provides an example of the use of the psychodynamic model. Attention was focussed on the conflict centred around inhibition of aggression, and reactions to problematic life events. Psychotherapy over a 12 months period was accompanied by symptomatic improvement for the patient described and slight improvement in BP levels occurred; the patient had surmounted two stormy life situations with no evidence of exacerbation of the hypertension. The author emphasised the importance of a highly supportive non-authoritarian role on the part of the doctor.

In a provocative and interesting paper, Moses, Daniels and Nickerson (1956) described the results of extensive psychoanalytic treatment on a small number of cases. There were two components to this study: -

1. Long term psychoanalytically oriented psychotherapy in two patients with a documented five year history of sustained hypertension; they received 630 and 500 therapeutic hours respectively.
2. Four cases of early "labile" hypertension with associated emotional problems; in this group, psychoanalytic therapy varied from 60 to 620 hours.

Concomitant physiological measures were carried out by the therapist himself rather than a colleague because he considered that this introduced less variation into the transference reaction; such influences might impinge not only on the process of psychotherapy but on the cardiovascular response to such investigation. He did not consider that this investigative procedure seriously influenced the psychoanalytic process "the investigative situation can stimulate various psychological responses that are psychodynamically informative and psychotherapeutically useful".

The results of therapy are of considerable interest. Of the 2 cases with sustained hypertension, the first patient, who was known to have had hypertensive disease for 15 years, achieved sustained normal levels after 2 years of intensive therapy and these were maintained over five years with no evidence of progression of the disease. The second patient, known to have had sustained hypertension for nine years, also achieved normotensive levels after 2 years, although therapy was complicated by the death of her husband in the second year of treatment.

All four patients with transient or labile hypertension underwent significant changes, being normotensive on followup at 6, 4, 2 and 2 years respectively. A further patient, however, had accelerated

hypertension and required drug therapy because of the supervention of the malignant hypertensive state. None of the other patients received drug therapy.

The author concluded that successful "reconstructive" therapy depended on the following factors -

1. The nature and severity of the associated psychiatric state.
2. The status of the somatic process and the degree of reversibility.
3. The therapeutic motivation of the patient.
4. The age, intelligence, and talents of the individual.
5. The flexibility of the environmental situation and stresses.
6. The competence and skill of the psychotherapist.

"The complex problem of the psychotherapeutic modification of the hypertensive vascular process, will ultimately depend on the clarification of two crucial questions:

- (1) At what point in this disorder is the secondary, irreversible process initiated?
- (2) Once this secondary process has started, to the continuing psychogenic factors play any further role in the intensification of the sustaining or accelerating mechanisms?

The successful psychotherapeutic reversal in the 4 transient cases, leads the author to suggest that in the prehypertensive states the psychogenic factor is predominant and its modification can lead to clinical remission. As Levy (1945) and Hines (1940) have shown that patients with transient hypertension have an increased probability over normals of developing subsequent hypertension and cardiovascular disease, there would need to be a large group of psychotherapeutically treated cases, if statistically significant results were to be obtained".

The author stressed the complexity of evaluation with psychotherapy: it is insufficient to think simply in terms of reduction of BP levels. Relevant outcome variables include alteration of inhibitory patterns, and of excessive states of anxiety and rage typically discovered in these patients. He advocated assessment across such dimensions as self esteem, assertive behaviour, capacity for pleasure, vocational capacity, and dreams.

This paper among other things illustrates the extraordinarily difficult task of quantifying psychologically significant variables in a research project of this type. The author considered that a minimum of 25 sessions was necessary to allow full, understanding of the psychological and dynamic processes: This 'ideal' requirement would preclude in practice the acquisition of a series large enough to enable findings to be generalized further.

It is difficult to appraise the significance of Moses' paper. While it could be argued that with so few cases the findings might have been idiosyncratic, and there were no controls, the possibility that reduction in BP level was directly related to the psychotherapeutic process should not be prematurely rejected. It is perhaps significant that in the two decades since Moses' paper no papers supporting or refuting his findings have appeared. Apart from the practical difficulty of undertaking such a project, the era of publication of Moses' paper (1956) saw the introduction of active antihypertensive drugs, and medical interest in psychotherapeutic aspects waned accordingly.

After a further decade however, despite very significant improvements in drug regimes, interest in other approaches was re-kindled by discoveries based on learning theory and biofeedback.

(4) Learning theory, biofeedback, and the relaxation response.

Many of the therapeutic approaches such as transcendental meditation, yoga, and hypnosis have been considered to have the common ingredient of evoking the 'relaxation response' (Benson, 1977). The elements integral to such practices include a repetitive mental device, a passive attitude, decreased muscle tonus, and a quiet environment. Physiological changes regularly documented include decreases in oxygen consumption, heart rate, respiratory rate, and arterial blood lactate, and increases in skeletal muscle blood flow and in the intensity of slow α waves on the electro-encephalogram (Wallace and Benson, 1972): such changes are consistent with decreased SNS activity.

A series of studies have demonstrated that regular usage of these specific relaxation techniques lowers BP in patients with EH. Benson, Rosner, Marzetta and Klemchuk (1974) reported a study involving 36 volunteer mild hypertensives, 14 of whom were on unchanged medication and 22 of whom took no medication. SBP/DBP decreased in the former group from means of 146/92 to 135/87, while for the 22 unmedicated subjects the fall was from 147/95 to 140/91. All changes were statistically significant. Pressures reverted to earlier levels within 4 weeks in those who terminated the daily practice of the relaxation response.

Patel (1973, 1975) used a combination of a yogic technique with biofeedback, in 20 EH patients receiving medication. SBP and DBP levels fell by 20 and 14 mm Hg respectively, whereas no changes occurred in a control group. Medication could be ceased in 5 patients, while there were 4 who failed to respond. Patel postulated that yogic relaxation reduced sympathetic discharge in response to environmental stimuli.

Stone and de Leo (1976) also included a control group in a study where an Eastern Meditation exercise was used for the experimental group of patients. Falls of SBP and DBP of 15 and 10 mm Hg respectively occurred, and there was a parallel fall in dopamine beta-hydroxylase, an enzyme which has been shown to correlate with SNS activity.

A study which produced perhaps less impressive results was that of Pollack, Case, Weber and Laragh (1977) who showed in 20 patients practicing meditation, an early significant response after 3 months which was not sustained at the 6 month stage.

Kristt (1975) studied 5 patients with documented history of EH of at least 10 years duration, in a triphasic experiment consisting of a 7 week baseline period, a 3 week period of training in raising and lowering SBP, and a 3 month followup period. SBP fell from 153 mm Hg to 135 mm Hg from Phase 1 - 2. This experiment included strategies of home BP recording, and regular mailing of levels by the patient. The author considers these aspects increased patient cooperation and self esteem. He thought the results were independent of a general 'relaxation effect' however, as pulse rate changes and α -wave changes in the electroencephalogram were not noted in this small series.

While these quite recent results are moderately encouraging regarding the benefits of such relaxation and other techniques as an adjunct to pharmacotherapy, and even as a replacement for such therapy in early cases, the factor of patient compliance and persistence with the treatment programme is obviously just as important and relevant as in pharmacotherapy. Results are not sustained unless the procedure is maintained: we are still faced with the factor of attitude to the conditions, hence of personality traits and conflicts. Since these

techniques do offer the patient increased independence and responsibility, however, compared with a simple passivity in accepting chronic medication, there would seem to be psychological advantages to the EH patient as long as the limitations of these methods are also appreciated.

The evidence for reduction of BP levels, albeit transiently in some cases, by purely psychological techniques tends to strengthen the case for considering psychogenic factors in aetiology very seriously, however difficult it is to disentangle such potential aetiological variables precisely in what is usually a slowly developing condition.

Summary: Non pharmacological influences are diverse and potentially of considerable importance. Within drug studies, the effects of suggestion, placebo responses, hospitalization, relationship with physician, and concurrent significant life events have been described. Relaxation training has been shown to have a certain limited value, assuming that compliance with the treatment programme takes place. Psychotherapy has been of apparent value in a small number of reported cases.

While reduction of BP may occur with these methods, the test of efficacy must in the long run be reduction of incidence of morbid events, as in the classical drug studies (Reports of the Veterans Administration Study Group, 1967 and 1970). Such studies have not yet been described regarding non pharmacological treatment methods, so the current status of these methods is as adjunctive to drug therapy in selected cases, rather than alternative treatment.

6. Summary of Studies in Psychosocial Factors

(1) Difference in prevalence rates between racial groups are related to social, economic and personality variables. Major social stress can lead to persistent elevated BP levels for weeks or months.

(2) In experimental animals persistently elevated BP levels and cardiovascular pathology occurred after periods of prolonged social stress, e.g. crowding following social deprivation.

Concerning brain-cardiovascular relationships (i) repeated stimulation of the anterior hypothalamus may produce a wide variety of physiological response subserving the 'fight-flight' response, leading to persistence of elevated BP.

(ii) Stimulation of the afferent loop via baroreceptors can produce inhibitory CNS effects suggesting that elevated BP might help to produce a "stimulus barrier" for the brain.

(3) In the human subjects short-term changes in cardiovascular haemodynamics are readily induced by mental stress, e.g. performing mental arithmetic under time pressure. The physiological changes induced are similar to the 'fight-flight' responses in stressed animals. Essential hypertensives show greater change in BP level, which are also more prolonged, than normotensives under conditions of experimental mental stress. Studies of BP change during structured interviews shows that intensity of interaction is more significantly related to rise of BP than novelty or the content of discussion.

(4) Psychodynamically oriented studies regularly report a personality configuration with prominent conflict over modulation and disposition of aggressive impulses. The two common behavioural manifestations are (i) submissiveness and (ii) over sensitivity to perceived aggression in others.

Psychometric studies generally do not reveal a correlation between BP level and overt neuroticism in untreated hypertensives in contrast to hypertensive clinic patients who do usually show evidence of increased anxiety and neuroticism. This suggests that the diagnostic-treatment process might contribute to the latter traits.

- (5) Non pharmacological treatment influences can occur in the context of drug treatment or apart from it. Regarding the former, variables such as suggestion and the placebo effect, reassurance and support from a physician and hospitalization may influence response, while compliance is intrinsically related to personality variables.

Relaxation training has recently been studied and found to be of a certain limited value in reducing BP level and there are case reports of benefit from psychotherapy. However long-term studies using reduction of morbid events as the criterion of efficacy, rather than BP level reduction over a short-time interval, have not yet been reported for the non-pharmacological methods.

CHAPTER IIIHYPOTHESES AND METHODOLOGY

This chapter is arranged as follows: -

- (1) Conceptual Hypotheses
- (2) The Present Study: Methodology
- (3) Operational Hypotheses

(1) CONCEPTUAL HYPOTHESES

The central question is whether nonpharmacological factors exert any demonstrable effects on BP levels in patients receiving antihypertensive drug treatment.

The study emerging from the literature review which most directly addressed this issue is that of Shapiro (1956: see p92 in previous Section). In describing the range of possible influences, he recommended inter alia: -

.. " underlying psychodynamic patterns and interplay of psychological forces in the experimental situation needed to be identified and their influence determined so that systematic errors produced by the factors could be assessed".

While the setting of hospitalization itself was not the least important of these factors, the range of potential influences on the ambulatory patient was considerable "the ambulatory patient was still exposed to all his usual environmental stresses which continue to exert their effects".

As an initial step, the potential psychosocial influences may be conveniently considered as

- (i) Personality factors
- (ii) Environmental stresses
- (iii) Attitudes to treatment.

It is evident that these categories will not be mutually exclusive, but for purposes of formulating testable hypotheses may be regarded separately at this stage.

(i) Personality factors

From psychoanalytic theory and personality studies, it emerges that at least two personality patterns or configurations might be found to influence outcome of drug treatment.

(a) The classic psychological and behavioural pattern of "overt submission with inner rebellion" described by Saul and Alexander (1939) would be expected to occur in a proportion of patients. In this configuration of personality, there is a resistance at a psychological level to acceptance of passivity and dependence, but such resistance is not expressed directly or overtly in behaviour, which is characterised instead by submissiveness. For patients with such conflicts, the treatment setting itself, involves an assumption of passivity and dependence regarding medication. On theoretical grounds, this would be expected to stimulate and activate this basic conflict, with adverse effects on BP levels, granted the assumption that such conflicts are indeed expressed through psychophysiological mechanisms. In other words, those patients with evidence of "submissiveness" traits in personality functioning would be expected to have less favourable outcome regarding BP reduction in a drug treatment setting, than patients lacking such traits.

(b) The personality traits of excessive sensitivity to threat, and characteristics of the "paranoid character disorder" described initially by Thaler, Weiner and Reiser (1957), would also be expected to be associated with less favourable outcome, for a

number of reasons. Persons with such traits would be expected to be less tolerant of side effects of drugs, less compliant with medication, and to adapt less adequately to the requirement of participation in repeated complex, physiological laboratory testing in a research study (see Methodology Section, p 114).

(ii) Environmental Stress

The evidence from environmental studies and psychophysiological research leads to a prediction that in an environment perceived as excessively demanding or stimulating, there would be an increased tendency for BP levels to be maintained at a higher level, despite drug treatment. Persons trying to cope with such environmental pressures would be expected to have a less favourable outcome from antihypertensive drugs.

The environmental stresses could be in the home (marital, family relationships), or at work (relationships, work pressure).

This hypothesis can be put forward whether the theoretical basis is that excessively stimulating environments cause BP elevations directly by physiological "arousal", or whether BP elevation is conceptualized as an instrumentally conditioned response directed to limiting cerebral reactivity in the presence of excessive sensory input (derived from the Lacey's hypothesis - see p 57).

(iii) Attitudes to Treatment

A generalization arising from clinical experience with the prescription of any medication is that a positive attitude to drug treatment should correlate with better outcome, through mechanisms of (a) enhanced placebo effect or (b) better compliance with drug treatment.

Conceptual Hypotheses and Clinical Realities

A clinical and psychological study approaching the ideal for the purpose of testing these hypotheses would include the following ingredients: -

- (a) a large number of previously untreated essential hypertensives
- (b) psychological assessments in depth before drug treatment
- (c) a period of placebo treatment on the use of a placebo control group
- (d) the use of antihypertensive drugs which were known to exert their effects by peripheral rather than by central (brain) mechanisms. Drugs which directly alter brain function could directly influence psychological effects mediated by CNS pathways on BP responses
- (e) reliable assessment of compliance with drug-taking
- (f) repeat psychological assessments after placebo treatment and after specific antihypertensive treatment.

As will be indicated in the next section on Methodology, the multidisciplinary study in which the psychiatric investigator found himself was to fall short of these ideal requirements, in several aspects. The singular advantage was the opportunities for longitudinal pre- and post-treatment psychological assessments. The limitations of cross-sectional studies in this field has been emphasized by Kidson (1973).

Constraints to be described in the succeeding section included the following: -

- (a) a proportion of the patients had received previous anti-hypertensive treatment
- (b) no placebo phase or control group was to be used
- (c) 4 antihypertensive drugs including 3 with known central CNS effects were to be used for 4 different subgroups following diuretic therapy for all subjects
- (d) thoroughly satisfactory assessment of compliance was to be lacking.

Despite these discrepancies between the ideal and the actual clinical research situations, discrepancies familiar not only to the investigators of psychosomatic relationships, it was considered feasible to test the hypotheses stated above, while taking the limitations and constraints into account in interpreting results.

(2)

THE PRESENT STUDY : METHODOLOGY

Methodological aspects are considered as follows:-

- I Selection of patients
- II Baseline assessments of BP levels
- III Baseline and followup psychological assessments
- IV Choice of psychological measures.

I Selection of Patients

A. Selection Criteria

B. Referral Sources.

A. Selection Criteria

The writer took no part in this process, which was determined by the Clinical Pharmacologist and Physicians under whose clinical supervision the drug study took place. The selection criteria were determined by the objectives of the overall drug study, which were initially stated as follows:-

1. To compare the ability of bethanidine, clonidine, methyldopa and oxprenolol to produce clinically effective anti-hypertensive effects, and to carry out long term clinical evaluation of successful responders.
2. Specialized laboratory and clinical procedures to
 - i) investigate changes in sympathoadrenal function following drug therapy.
 - ii) establish the pattern and magnitude of drug induced symptomatology and behavioural change and relate these to the overall therapeutic success.
 - iii) investigate changes in cardiac output, peripheral resistance, renal blood flow, and glomerular filtration following drug therapy.

- iv) provide a comprehensive biochemical screen of plasma to determine changes induced by the 4 drugs.

Objective 2 (ii) above was the stimulus leading to the invitation for psychiatric participation. While the overall strategy was aimed at discovering broadly and in depth the effects of pharmacotherapy, the writer was permitted to enlarge the scope of his investigations beyond those originally envisaged, to include regular assessments of psychological aspects, i.e. personality attributes and situational stress, in addition to clinical assessments of symptoms before and after pharmacotherapy. The aspect of 'drug induced symptomatology' is of interest in its own right but is not within the perspective of this thesis.

The objectives outlined above in large part determined the criteria for inclusion and exclusion which were defined as follows -

1. Criteria for inclusion

- i) essential hypertension
- ii) both sexes
- iii) age 20-60 (this criterion was not followed rigidly, as the age range was in fact 16-62 years)
- iv) DBP > 110 mm Hg on at least 2 occasions either standing or lying, during assessment.

2. Criteria for exclusion

(a) On History

- i) women on oral contraceptives, or women under 30 unless pregnancy was to be precluded, (these criteria were almost certainly mainly responsible for the considerable male preponderance in the study, and thus a major selection bias was introduced).

- ii) angina pectoris; or history of myocardial infarction within preceding 6 months.
- iii) cerebrovascular accident within preceding 6 months, or more than a minimal residual disability from an earlier such incident.
- iv) severe allergic rhinitis, bronchial asthma, chronic obstructive airways disease.
- v) previous adverse reaction to beta adrenergic blockade therapy.
- vi) other concurrent severe disease, e.g. neoplasm, epilepsy, peptic ulcer, alcoholism.
- vii) obviously unstable or unreliable personality, psychosis, or past history of serious psychiatric illness. (This criterion, which as in most such drug studies is necessary to ensure reasonable numbers for followup, introduced another important bias; the research group is psychologically more stable, through clinical screening, than hypertensives in the general population. (The Veterans Administration Studies (1967, 1970) raised considerable controversy regarding this point).
- viii) current treatment with digitalis, anti-arrhythmic therapy, anticoagulants, vasodilators, antidepressants.
- ix) antihypertensive therapy in past 6 months. (This criterion proved too restrictive of numbers: persons otherwise suitable but having received such therapy were included, but were required to omit such therapy for 3 months prior to the baseline phase of investigation).

(b) On Examination

- i) curable hypertension (unilateral renal disease, coarctation of the aorta, phaeochromocytoma, Conn's disease, Cushing's disease).
- ii) malignant hypertension.
- iii) congestive cardiac failure, pulmonary hypertension, aortic stenosis and/or insufficiency, atrioventricular conduction defect.
- iv) diabetes mellitus, autoimmune disease, serum uric acid > 8 mgm %.
- v) biochemical evidence of significant renal or hepatic decompensation.

B. Referral Sources

Patients were referred to the Study from three broad areas

- 1) The Hypertension Clinic, an outpatient clinic taking referrals from other units within the hospital and from general practitioners. (N=27).
- 2) Direct referrals from general practitioners in surrounding suburbs who had been informed by letter about the aim of the study. (N=20).
- 3) Direct referrals from the specialist physicians' private practice (N=28).

The original aim was to study 120 patients but this number proved impossible to achieve over the 3 years of intake, and 75 patients ultimately entered the study, from a total of 166 who were referred for consideration for entry. By far the most common reason for unsuitability was the finding that the BP level fell, during the interval between the point of referral and the trial of baseline

determinations, to a level below the lower level defined for entry. (DBP > 110 mm Hg on at least two occasions, standing or supine, during assessment).

2. Baseline Assessments of BP Levels

On the discovery of BP levels in which the DBP was over 110 mm Hg the patient from whatever source was met by the Nursing Sister who had been specially trained and selected to work in the study. This same Nursing Sister has continued for the duration of the study.

Three consecutive BP readings were made at weekly intervals as the baseline procedure. At each visit, approximately half an hour was spent with the Sister who explained the purpose of these assessments. After the patient had been resting fifteen minutes in the supine position, BP levels were taken in both arms using a London School of Hygiene and Tropical Medicine Sphygmomanometer (Rose, 1964).

This device minimizes the observer bias involved in using the conventional sphygmomanometer, which may lead the user to terminal digit preferences. Using this more sophisticated instrument, the user cannot see the manometer when deciding the systolic and diastolic end-points. Instead, on determining these points a plunger is pressed, and the measure then read. This instrument also incorporates a mechanism ensuring approximate standardization of the rates of inflation and deflation of the cuff. The BP levels were then taken in the standing position after the patient had been walking about in the room for five minutes.

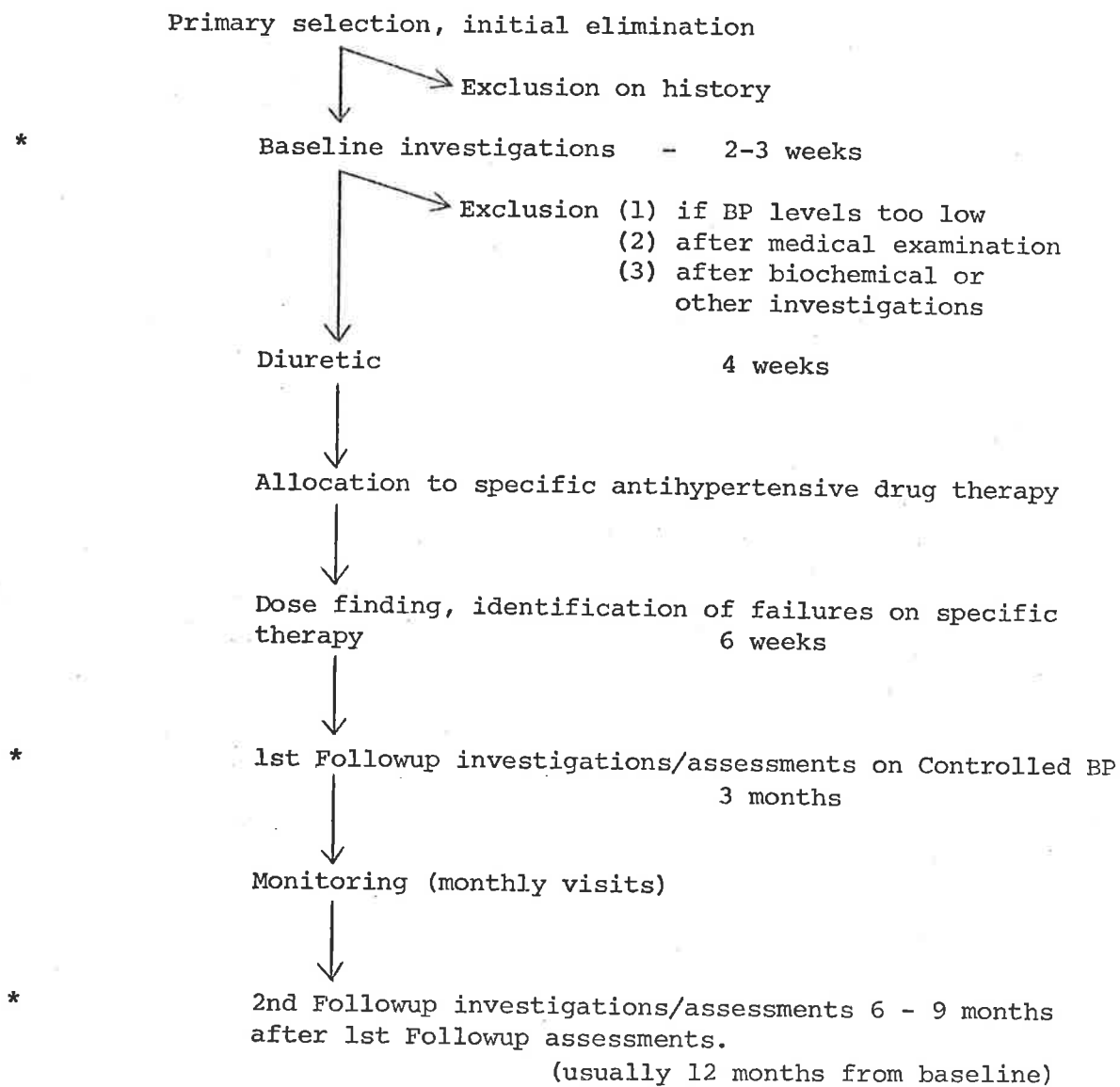
In general it was found that the initial BP levels were a little higher than those on subsequent visits, an example of the

"orienting reflex" reported by all workers in this field. Those patients whose DBP failed to read 110 mm Hg on 2 occasions were excluded from the study. Those patients who were excluded because their BP dropped below the required level were asked to attend whichever doctor referred them. On three occasions in the present study, although the levels fell as mentioned below the minimum for entry as the initial assessment, surveillance of the patients over the following six months led to re-referral, and further baseline measurements, after which the patients were included in the study having then satisfied the entry criteria.

If after these three assessments the patient was suitable regarding BP levels, a full history and examination were carried out by a physician at the Hypertension Clinic, and routine investigations including psychological assessments were undertaken. This assessment provided a further screening procedure, as a minority of patients were excluded on medical grounds as indicated above.

It must be emphasized that the implicit requirement of the drug study of "apparent psychological suitability" played no small part in the selection process. Letters of referral on occasion referred to a "good patient for the project", for example. Such selection seems inevitable, as the demands of the research study necessitated willingness to participate in extensive physiological investigations, agreement to comply with drug treatment, and to cooperate in followup over at least 12 months. The relevance of this to the writer's interest in personality structure in relation to EH is obvious, as such stringent criteria must result in a sample unrepresentative on psychological grounds of EH in the general population.

The time schedule for the study was as follows:-



* Denotes the timing of the three assessments of psychological functioning.

3. Baseline and Follow-up Psychological Assessments

Questionnaires (Kupfer-Detre System (KDS) I and II), (Cattell's 16 Personality Factor Questionnaire Form C) were administered at the conclusion of the Baseline investigations by the Sister, who explained the survey purpose and helped with any difficulties. The structured psychiatric interview with the writer in the Hypertensive Clinic took place on the same day on which the patient was interviewed and examined by the responsible physician, just prior to instigation of diuretic therapy. At this interview, the writer was unaware of (i) BP levels (ii) the questionnaire scores.

At the first followup assessment 3-4 months later the patient again completed the KDS questionnaires (chosen as a measure of current 'state') but not the 16PF questionnaire, and the structured psychiatric interview was repeated. No reference was made at the initial assessment. The interviewer was unaware of: -

- (i) the level of BP
- (ii) whether BP had changed from baseline levels
- (iii) which specific antihypertensive drug had been prescribed
- (iv) questionnaire (KDS and 16PF) scores.

These strategies were intended to reduce bias in assessment as much as possible. After regular monitoring by physicians and more frequent BP recordings by the Sister, at the second followup stage (12-15 months after baseline assessments) the cycle of investigations including psychological assessments were repeated again. At this point the 16PF was completed for the second time, the KDS I and II, for the third time, and the third structured psychiatric interview took place

under the same 'blind' conditions as indicated above for the first followup assessment.

4. Choice of Psychological Measures

The task of attempting to quantify personal psychological characteristics in hypertensive subjects leads to considerations of validity and reliability, acceptability to the subject and feasibility and efficiency in time, for the psychiatrist. The practice of clinical psychiatry teaches one that the accuracy and depth of knowledge of another person's state of mind is a function of at least three interwoven elements, namely the willingness of the person to disclose significant information, the skill and experience of the interviewer in providing a setting conducive to self revelation, and the amount of time spent in mutual interaction. It seemed that a combination of a structured interview together with appropriate questionnaires would be more likely to be fruitful than either method alone, at the very least as a crosscheck from one source of data to another to see whether ratings of mood states such as anxiety, for example were correlated as would be expected.

It seemed useful to differentiate between "state" and "trait" measures of emotion and personality functioning respectively, although the differentiation cannot be too rigidly applied to this complex area. The choice of questionnaires was partly determined by this consideration.

The measures and ratings to be discussed in this section are :

- (1) Cattell's 16 Personality Factor Questionnaire (16PF)
- (2) Kupfer-Detre System (KDS)
- (3) Standardized Psychiatric Interview (SPI)) from structured
- (4) Stated Attitudes to Diagnosis and treatment) psychiatric interview
- (5) Reported Life Stress)

(1) Cattell's 16 Personality Factor Questionnaire (16PF)

In seeking a suitable measure of purportedly enduring personality traits, as opposed to measures of current emotional state, several issues were taken into consideration. In several previous studies, the Eysenck Personality Inventory (E.P.I.) or its predecessor the Maudsley Personality Inventory (MPI) had been used (Sainsbury, 1960; Robinson, 1962; Davies, 1970; Cochrane, 1973). In some American studies, the Minnesota Multiphasic Personality Inventory (MMPI) had been the instrument of choice, (Ostfeld and Lebovits, 1959, Hardyck and Moos, 1966). In Australia, Kidson (1971, 1973) had used the E.P.I. and Cattell's 16PF Form C.

An apparent limitation of the E.P.I. is that scores are restricted to two personality dimensions (introversion-extraversion and stability-neuroticism). The E.P.I. shares with the 16PF the virtue of being generally acceptable by persons who do not necessarily define themselves as emotionally disturbed. However the 16PF would appear able to tap a wider range of dimensions of personality of interest to the psychosomatic investigator (e.g. the bipolar dimensions of submissiveness/dominance, trust/suspicion, group dependency/self-sufficiency). The 16PF second order factor Q1 is said to reflect the dimensions of introversion-extraversion, while neuroticism scores can be derived from First Order Factors, so questions concerning those aspects could still be put if necessary.

The MMPI, which requires responses to a minimum of 399 questions is perhaps of most value with a defined psychiatric population, as many of the dimensions refer to psychiatric diagnostic

groups: it was considered that it would be less suitable for present purposes than the 16PF because of items loaded toward 'mental illness', and because it basically reveals so called "surface traits" rather than "source traits".

The 16PF has been constructed as a result of extensive factor analytic research, and the so called "source traits" derived from these studies are considered to be factors affecting large areas of overt behaviour. "The scales are not arbitrary, a priori concepts but are related to natural personality structures which are unitary, independent and are pragmatically important" (Cattell, Eber and Tatsuoka, 1970). "A simple structure Factor is hypothetically a single influence which operates on and correlates with all the items chosen for the given scale, and which is functionally distinct from all other Factors".

As the test has been developed over the last thirty years, there are sixteen primary Factors, and eight higher order Factors of which four have been more adequately researched & so are included in the present assessment.

There are various Forms of the 16PF, and the Form chosen for the present study was Form C, which consists of 105 items, and requires for the average person, approximately 40-45 minutes to complete. This form is "intended for the average man in the street". There are 6 - 8 items for each first order Factor.

The source traits or Factors are all described in bi-polar terms, and for each Factor there is a technical term, and an accompanying simpler popularly descriptive term. The Factors are

described in the Results Section (Figure 3, p. 155).

The 16PF has been thoroughly studied with regard to measures of consistency, which refers to, (i) reliability - agreement at two different administrations, (ii) homogeneity - agreement of test parts, and (iii) transferability - agreement of what is measured across different populations.

There have also been adequate studies of conceptual or construct validity, both direct and circumstantial, and the statistical basis for the properties is contained in the 16PF Handbook (1970). The scoring for the 16PF is initially in "raw scores", which are then converted to "stens" (standard tens), which provide ten units for the point scale arranged. The mean score therefore becomes 5.5 stens and sten scores of 5 and 6 are within the average range (one standard deviation), whereas sten scores of 4 and 7 indicate some departure from average and scores of 3 and 8, 2 and 9, and 1 and 10 indicate increasingly extreme variation from the mean.

A favourable quality of the 16PF from the perspective of statistical methods is that as it has been developed within a linear model, parametric statistics are generally applicable.

2) Kupfer-Detre System (KDS)

The Kupfer-Detre System of data-gathering and analysis "was developed to meet the needs of psychiatric health personnel in the fields of clinical care, administration and research" - (KDS Systems Inc, 1971). It was devised and developed while the authors were at the Department of Psychiatry, Yale University School of Medicine.

One of the 8 questionnaire modules (KDS-II) is concerned with rating of somatic symptoms, and was initially selected for use in the Study because of the special interest of the Clinical Pharmacologist in the symptoms of hypertensive patients, and the effect of drug treatment on these symptoms. The authors had written of the usefulness of pre-treatment rating of symptoms which might later be attributed to drug therapy in psychiatric patients (Kupfer and Detre, 1971) and there seemed a good case for extending such a use for hypertensive patients. The KDS-II lends itself to repetitive assessment of individual symptoms. This aspect of the Study is peripheral to the theme of the present thesis, and will not be pursued in detail.

The KDS-I (psychological symptoms) schedule of 41 questions and the KDS-II (somatic symptoms) schedule of 40 questions, are scored on single pages separately (see Appendix (p 316 to 317)). Apart from the use of KDS-II alone referred to above, various combinations of scores of psychological (KDS-I) and somatic (KDS-II) symptoms have led to the construction of 5 cluster scales, namely: -

- i) depression
- ii) anxiety
- iii) mania
- iv) psychosis
- v) organicity.

The writer considered that the first two of these scales, namely "depression" and "anxiety", might prove useful as alternative measures of "current emotional state". Correlations would be able to be made with the ratings of "current emotional state" from the Standardised Psychiatric Interview. If the two measures should be discovered to correlate well, this would tend to weight any conclusions based on these measures as far as correlation with BP change is concerned

Concerning the issues of validity, reliability, and sensitivity, the following points may be made. In their final form, the self-rating schedules were based on experience of over 2000 psychiatric evaluations. The questionnaire scores were correlated with clinical interviewers ratings on 200 subjects, and the "anxiety" and "depression" ratings were said to correlate significantly with clinical ratings (Kupfer and Detre, 1971).

The KDS-I scale was shown to discriminate satisfactorily between a sample of clinic patients, and a control group (Kupfer, Detre and Amdur, 1972). A replication study (Wogan, Amdur, Kupfer and Detre, 1973) confirmed the earlier findings, and also included assessments of test-retest reliability. For non psychiatric control subjects, the test-retest reliability coefficient was $r=.64$ for the Anxiety Scale, and $r=.65$ for the Depression Scale. For a global "Degree of Disturbance" Scale the coefficient was somewhat higher ($r=.77$). A clinic sample of 134 subjects showed a significant drop in mean score at retesting, a finding consistent with the expected "placebo response" to the setting of treatment.

The use of the Scales in clinical research settings has been documents in subsequent reports (Himmelhoch, Detre, Kupfer, Swartzburg and Byck, 1972; Kupfer, Detre, Koral and Fajans, 1973).

(3) The Standardized Psychiatric Interview (S.P.I.)

The choice of this particular instrument was influenced by the fact that the writer had thoroughly familiarized himself with its use in the two years preceding this study, in settings involving other patients with medical illness (asthmatics and thyrotoxicos). Interviewer-corerater reliability had been tested and shown to be approximately 0.9. The workers who designed the instrument described a detailed reliability study (Goldberg, Cooper, Eastwood, Kedwood and Shepherd, 1970), in which this degree of reliability had been found among trained psychiatrists.

The S.P.I. appeared to have specific merit for the type of assessment involved in the present study:-

- i) it is known to be acceptable to persons who may not see themselves as psychiatrically disturbed.
- ii) the content is appropriate to the type of psychiatric disturbance seen in the community.
- iii) information is generated about individual symptoms and signs of illness.
- iv) the assessment is economic in time.
- v) the symptom profile, or overall psychiatric state, can be used to measure change over a known time interval.

The core of the S.P.I. is a detailed and systematic inquiry about any psychiatric symptoms which the patient may have experienced in the preceding week. This inquiry concerns 10 symptoms:-

- i) somatic symptoms presumed of psychological origin
- ii) fatigue
- iii) sleep disturbance
- iv) irritability
- v) lack of concentration
- vi) depression
- vii) anxiety
- viii) phobias
- ix) obsessions and compulsions
- x) depersonalization.

Ratings are based on the patient's account of the frequency, duration and intensity of symptoms, and are made on a 5 point scale (0-4). A rating of 0 indicates absence of symptoms; 1 indicates an habitual trait or borderline symptom which does not cause significant distress or require treatment; 2, 3 and 4 indicate respectively mild, moderate and severe degrees of clinical severity of a definitely morbid symptom.

A clinical manual (Institute of Psychiatry: 2nd Edition 1970) provides detailed guidance on the definition of each item and the use of the 5-point scale for that item. Examples concerning "anxiety" and "depression" from (1) the Clinical Schedule on which the item is rated, and (2) the Clinical Manual describing the basis on which the rating is to be made, are included in the Appendix (p 318).

In addition to the symptom inquiry, at the conclusion of the interview ratings are made on a 5-point scale regarding "manifest abnormalities". These refer to abnormalities of behaviour, (1-3) mood, (4-7) perception and cognition, (8-12) as follows:-

- 1) slow, lacking spontaneity
- 2) suspicious, defensive
- 3) histrionic
- 4) depressed
- 5) anxious, tense
- 6) elated, euphoric
- 7) flattened, incongruous
- 8) excessive concern with bodily function
- 9) depressive thought content
- 10) thought disorder, delusions, misinterpretations
- 11) hallucinations
- 12) intellectual impairment

The items on perceptual and cognitive abnormality (8-12) have little relevance to the population in the present study, and it will be noted that questions concerning symptoms of such disturbance are not made routinely in the symptom inquiry.

An overall severity score can be made by summing and weighting the 22 ratings, and the writer has followed the formula proposed by the authors which produced the best agreement with clinical judgement.

$$S = \sum R_i + 2\sum M_i$$

where $R_1, R_2 \dots R_{10}$ = Reported symptom ratings

$M_1, M_2 \dots M_{12}$ = Manifest abnormality ratings

This overall severity score has been termed 'Total Emotional Disturbance' in the present study.

A difficulty arose in deciding whether to rate 'headaches' as a somatic symptom of psychological origin, in this hypertensive group. A decision at the outset of the study to omit this symptom was based on the instruction of the Clinical Manual, "all somatic symptoms which are explicable in organic terms, and all symptoms for which there is no good evidence one way or the other, should not be rated here". At that time the writer was unfamiliar with studies (Stewart, 1953; Al Badran, Weir, and McGuinness, 1970; Lever, 1970:) which had shown that for the mild or moderately severe hypertensive the level of BP is not clearly associated with the presence or absence of headache; although such an association is found with higher levels of BP. The result of this omission is that scores for "Total Emotional Disturbance" will be slightly lower than would otherwise be the case; the majority of patients did acknowledge headache of varying severity at the pre-treatment phase.

(4) Stated Attitudes to Treatment of Hypertension

While responses to simple direct questions would not be expected adequately to tap the complexity of cognitive, affective and motivational components which constitute an "attitude", it was considered worthwhile attempting (in a global manner) to rate conscious attitudes to forthcoming treatment.

The rating was based on the patients' responses to the question, "What do you expect will be the change to your health following drug treatment?"

Responses were ranked as follows: -

Stated Attitudes to Drug Trial

- 0 - Over optimistic
- 1 - Optimistic
- 2 - Positive but guarded
- 3 - Uncertain, doubtful
- 4 - Pessimistic, negative.

A rating of 0 indicates expectation of rapid and sustained improvement with denial of doubt; a rating of 1 indicates solid expectation of definite sustained improvement but acknowledging a little doubt e.g. concerning side effects of drugs; a rating of 2 indicates a balance of positive expectations and reservations with positive attitudes prevailing; a rating of 3 indicates obvious hesitancy, concern with possible side effects, but an acknowledgement of possible benefit; a rating of 4 indicates a basically negative expectation for whatever reason (e.g. previous ill effects, or pervasive pessimism), that ill effects would be likely to outweigh benefit.

Clearly, few patients would be expected to fall into the extreme categories because of selection of 'suitable' persons for participation in the drug study.

It would have been an advantage to have had independent ratings of this attitudinal scale by separate clinicians. These ratings were made at the conclusion of the psychiatric interview by which time it was hoped that full cooperation and frank responses would be expected to be more likely than at the beginning. With the lack of cross-validation, however, reservations must be held about conclusions from this section of the data.

(5) Reported Life Stress

The questionnaire responses and symptom inquiry do not directly reveal data concerning conflicts in specific interpersonal relationships, or concerning perceived situational stress (e.g. work pressure) which may be partly determined by non-personal factors. A typical psychiatric interview regularly shows a progression from symptom description to a discussion of relevant interpersonal conflict, and even a more structured interview as in the present study would be expected to show this pattern. In other words, inquiry concerning the affective disturbance of anxiety or depression in cases where these symptoms were present would lead to discussion of specific interpersonal conflicts, e.g. intra-familial, which were dynamically linked to the symptom.

In those instances where no such associations occurred spontaneously, or where the symptom inquiry revealed an absence of such symptoms, direct specific inquiry could be made after the complete symptom inquiry, into:-

- (1) the nature and quality of the patient's relationships with his or her spouse, if married.
- (2) the nature and quality of the patient's relationships with other next-of-kin, if married or unmarried, (this included parents, children, siblings).
- (3) the nature and quality of the patient's relationship with employees and employers in the work situation, if employed.

Since a simple direct inquiry was thought likely to lead to

an under-reporting of difficulty (by denial or evasion), indirect questioning was to be used, by an inquiry into the patients' characteristic mode of coping with negative emotions, such as hurt feelings, in any of these three areas of interpersonal relationship. "How do you handle such feelings? Do you tend to express such feelings outwardly, or do you tend to bottle them up, or does anything else tend to happen?" Any response to such a question, such as, "it all depends on the situation...." leads naturally to a discussion of whatever situations happened to be disturbing as well as relevant.

While marital and family stress would be expected to be almost exclusively interpersonal, this does not necessarily obtain in the case of perceived work stress where non personal environmental stresses may occur (e.g. time pressure, excessive noise). The criterion used for this inquiry was simply whether such aspects were perceived and reported as stressful, i.e. the subjective rather than objective perspective was sought.

Rather than attempt a quantitative rating score of such perceived stresses, scoring was simply categorical, i.e. 'present', 'absent', and 'not relevant' for the three situational stresses described.

In the setting of the psychiatric interview, the writer considered it important to attempt to influence the patient as little as possible toward an increased preoccupation with the 'stress' aspect of his or her condition, as that too could introduce another potential

bias into subsequent outcome by influencing the patient's behaviour. Such a behaviour change (e.g. toward change of employment, or taking up relaxation training) could theoretically influence BP levels quite considerably. The interviewer, after explaining to the patient that his initial purpose was to ask about symptoms associated with hypertension, and to attempt to understand the influence of drug treatment on these symptoms, sought to avoid adding weight to already existing notions that interpersonal or environmental stress might be of aetiological importance in a particular case. There had to be direct inquiry, however about the presence or absence of significant perceived family, marital and work stresses in an attempt to discover whether such perceived stress had existed before knowledge of the hypertension, or only since its diagnosis, and later whether the reported stress changed during followup.

In the majority of cases there was overt acceptance by the patients of the involvement of the psychiatrist in the study; reasons for the assessments had been carefully explained both by the Sister and the physicians concerned. Defensiveness in response to the structured interview, especially the first, was not infrequent, but in only one case was there an initially overtly hostile response; this did not obviously directly stem from the requirement of the psychiatric interview itself, but was expressed regarding the requirement to make doubtfully relevant statements about personal preferences and attitudes in response to specific questionnaire items.

During the interviews a number of patients wished to use their meeting with the psychiatrist to discuss further details about their

personal lives, for example to seek advice on family problems.

Such patients were carefully reminded that for the present purpose the psychiatric interview was an assessment, and not a therapeutic situation. In those instances where action seemed obviously necessary, a suggestion to seek advice from another source such as the general practitioner was made; for two patients with more severe emotional problems during the progress of the study, psychiatric referral to colleagues was considered necessary.

(3) OPERATIONAL HYPOTHESES

As described in the earlier section on conceptual hypotheses (p 103 to 107), three questions to be considered are:-

- (i) the relationship between specific personality traits (submissiveness, suspiciousness) and drug treatment outcome (BP change).
- (ii) the relationship between the presence or absence of inter-current situational stress, and drug treatment outcome (BP change)
- (iii) the relationship between expectations of drug treatment (attitudes) and outcome (BP change)

Relating these questions to the specific instruments chosen for psychological assessments in this Study, these hypotheses can be re-formulated in operational terms as follows: -

- (1) A negative correlation is predicted between 16PF Factor E- (submissiveness) and BP reduction.
- (2) A negative correlation is predicted between 16PF Factor L+ (suspiciousness) and BP reduction.
- (3) Patients who report significant life stress (marital, family, work) are predicted to show less BP reduction than patients who do not report such life stress.
- (4) A correlation is predicted between the "attitude to drug treatment" rating, and BP change: positive attitudes are expected to be associated with greater BP reduction.

Statistical Methods

For hypotheses (1), (2) and (4) above, the statistic chosen is the Pearson product-moment correlation (r).

For hypothesis (3), comparison of BP changes between the groups who report life stress as present, and the groups who report it as absent, will be carried out using Students "t" test.

For all these analyses, the level of statistical significance chosen is $p < .05$.

The variable "reduction in BP" merits further comment. It has been found (Dixon and Johnson, 1976) that BP reduction is a function of the initial level of BP, whether the reduction occurs via pharmacotherapy or spontaneously. It is therefore more useful to use % change of BP ($\% \Delta SBP$ and $\% \Delta DBP$) as the criterion of change, rather than the absolute reduction of BP in mm Hg, as the latter criterion does not take the initial level into account. The convention of using supine rather than standing BP readings is followed.

Since 4 antihypertensive drugs were to be used after diuretic therapy, it is also necessary to examine the changes in BP for the drug groups separately, as well as considering the changes for the total patient group.

The contribution of the patient's sex and age to any significant findings will be assessed. Sex differences will be examined by performing correlations within each sex alone as well as for the total group. The influence of age on other correlations (e.g. between a personality traits and $\% \Delta BP$) will be assessed by partial correlation analysis.

The personality characteristics of the 'dropout' in relation to those who complete the 12 months course of treatment, will also be assessed. Computer analysis of data was to be performed using the Statistical Package from the Social Sciences (SPSS: Nie, Hull, Jenkins, Steinbrenner and Bent, (1975)).

CHAPTER IVRESULTS

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SECTION I.

BASIC DEMOGRAPHIC DATA AND COMPARISON OF THE STUDY GROUP WITH
ROUTINE HYPERTENSION CLINIC PATIENTS.

These data are arranged as follows:

- (1) Male:Female ratios
- (2) Age
- (3) Marital Status
- (4) Referral source and occupational status
- (5) Known duration of hypertension and previous antihypertensive treatment.
- (6) Other relevant characteristics.

For the variables of sex, age and marital status, comparison with Clinic patients was possible through scrutiny of case notes. For the other variables, data from the latter source was insufficient to permit useful comparisons to be made, so the Study Group figures are presented alone.

(1) Male:Female Ratios.

Table 1 shows that there is a strong selection bias in favour of male patients for entry to the Study Group.

TABLE 1

MALE:FEMALE RATIO

	Study Group (N = 75)	Clinic Patients (N = 284)
Male	54	113
Female	21	171

$$\chi^2 = 24.74$$

$$d.f. = 1$$

$$p < .001$$

The female preponderance in the Clinic patients is itself dissimilar to the sex ratio noted in community studies in Western countries, which reveal a slightly higher prevalence in men in the age range 25 - 60 (Pickering, 1968).

(2) Age.

The two aspects which merit description are

- (i) age at the baseline assessment, and
- (ii) age at which the elevated BP first came to medical attention.

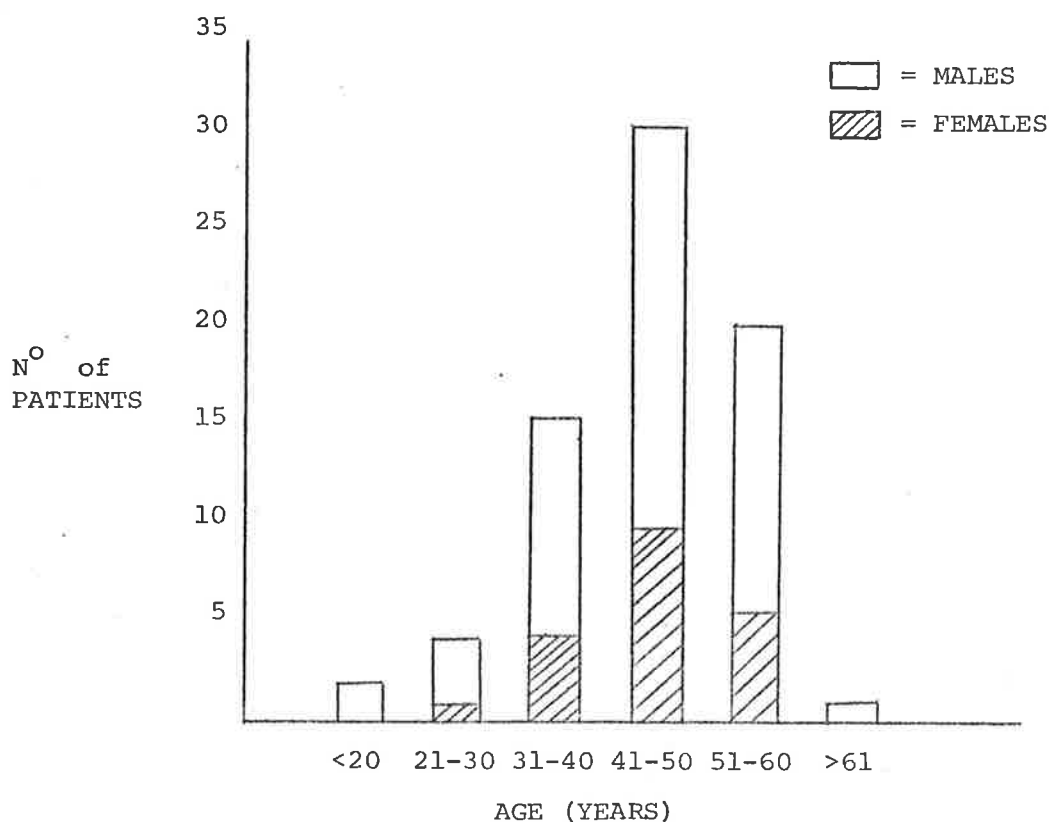
Table 2 reveals no significant sex difference in mean age, while the range is greater in male patients.

TABLE 2.

	Males N = 54 Range 16-62	Females N = 21 Range 28-57	Total N = 75
Mean	43.6	45.6	44.1
SD	10.5	7.6	9.7
SEM	1.42	1.66	1.1

$t = 0.92$ $d.f. = 73$ $n.s.$

FIGURE 1 : AGE DISTRIBUTION



For the comparison of age at which EH first came to medical attention, case notes of a sample of 50 Hypertension Clinic patients were scrutinized. The sample contained 18 Males and 32 Females, approximately the proportion to the total Clinic population (113 Males, 172 Females).

TABLE 3.

AGE AT DISCOVERY OF EH

	MALES		FEMALES	
	Study Group (N=54)	Clinic Patients (N=18)	Study Group (N=21)	Clinic Patients (N=32)
MEAN	41	51	40	44
S.D.	11	10	9	11
S.E.M.	1.5	2.4	1.9	2.1

$t = 3.53$ $d.f. = 70$ $p < .001$ $t = 1.05$ $d.f. = 51$ $n.s.$

It is seen from Table 3 that for male patients, but not females, the Study Group patients were discovered to be hypertensive at an earlier age than Hypertension Clinic patients. The selection bias in this study is therefore an over-representation of male patients, detected as hypertension at a relatively younger age.

It is very likely that the exclusion of younger female patients taking contraceptive pills is the major factor influencing the bias toward younger male patients in the Study.

3. MARITAL STATUS

In this respect the Study Group appears similar to the Clinic patients, with the exception of the category of widowhood in which a significant difference is seen to occur.

TABLE 4
MARITAL STATUS

	STUDY GROUP (N = 75)	CLINIC PATIENTS (N = 50)			
MARRIED	60	37	χ^2	.62	(n.s.)
SINGLE	9	3	χ^2	1.24	(n.s.)
DIVORCED OR SEPARATED	6	4	χ^2	0.00	(n.s.)
WIDOWED	0	6	χ^2	8.42	(.001<p<.01)

Data from the case note survey of Clinic patients is insufficient to permit a valid comparison on the following parameters, so the data for the Study Group is presented alone.

4. REFERRAL SOURCE AND OCCUPATIONAL STATUS

As would be expected, there is a tendency for patients seen in private practice settings to include a greater proportion of those from the upper socio-economic groups, compared with those referred from Clinics within the General Hospital. Since 12 of the 21 females were housewives, they have been allotted the husband's occupational status.

TABLE 5

OCCUPATIONAL STATUS AND REFERRAL SOURCE : STUDY GROUP

OCCUPATIONAL STATUS	REFERRAL SOURCE		
	Hospital Clinics (N = 27)	General Practice (N = 20)	Physicians in Private Practice (N = 28)
Professional, Managerial, own Business or Farm (I & II)	6	5	12
Clerical, Sales, Skilled Craftsmen (III & IV)	3	12	13
Semiskilled and Unskilled (V)	18	3	3

5. KNOWN DURATION OF HYPERTENSION AND PREVIOUS ANTIHYPERTENSIVE TREATMENT.

Table 6 shows that 35 of the 75 patients had been discovered to be hypertensive within the 12 months preceding entry to the Study, the majority of these within 3 months of entry. None of these had received antihypertensive therapy. At the other end of the scale, 19 of the patients had been known to be hypertensive for at least 5 years, and 15 of these had received antihypertensive drugs (which were withdrawn before entry to the baseline assessment phase).

TABLE 6.

KNOWN DURATION OF HYPERTENSION AND PREVIOUS ANTIHYPERTENSIVE TREATMENT IN STUDY GROUP

	KNOWN DURATION			
	Less than 3 months	3 - 12 months	1 - 5 years	More than 5 years
Previous Antihypertensive Drugs (N = 22)	-	-	7	15
No previous Antihypertensive Drugs (N = 53)	31	4	14	4

6. OTHER RELEVANT CHARACTERISTICS

The following table depicts other information which helps to characterize this population of hypertensive patients. Although differentiating trends appear between males and females, with the exception of hospitalization the others are not statistically significant.

TABLE 7
OTHER CLINICAL DATA

	MALE (N = 54)	FEMALE (N = 21)	
HOSPITALIZATION REGARDING HYPERTENSION	14	1	$\chi^2 = 4.23$ (.02 < p < .05)
PSYCHOTROPIC MEDICATION	7	6	$\chi^2 = 2.57$ n.s.
NON PRESCRIBED ANALGESICS	6	5	$\chi^2 = 1.95$ n.s.
SMOKING	17	3	$\chi^2 = 2.29$ n.s.
ALCOHOL - IN EXCESS OF 'SOCIAL DRINKING'	13	1	$\chi^2 = 3.71$ n.s.
STRONG FAMILY HISTORY OF HYPERTENSION (2 > OTHERS)	10	5	$\chi^2 = .26$ n.s.

Section 1: SUMMARY

Patients in the Study Group have been compared with routine Hypertension Clinic patients with regard to sex ratio, age, and marital status.

1. Study Group patients were predominantly male (M:F = 2.7:1), in contrast to Clinic patients (M:F = 0.7:1).

2. The Study Group patients were somewhat younger (mean = 40 years of age) when the knowledge of elevated BP first came to medical attention, compared with a sample of Clinic patients for whom the mean was 47 years of age. The difference applied to male but not to female patients.

3. The Study Group patients were predominantly married (80%) as were the Clinic patients; the only significant difference in civil status between the two groups occurred in the incidence of widowhood (0 for the Study Group, 12% in the Clinic sample).

4. Concerning socio-economic and occupational status, there was approximate stratification across socio-economic levels for the Study Group patients, and this reflected to some extent the referral sources which included the private practice of consulting physicians, the hospital outpatient clinic population, and referral from general practitioners in the surrounding working class suburban areas.

5. The known duration of hypertension varied quite widely, with approximately 40% of the patients having been diagnosed within three months of referral to the study, while at the other end of the spectrum 25% of patients had known of elevated BP for greater than five years. This variation in duration of illness was reflected in the incidence of previous antihypertensive treatment, as most of the patients who had known of elevated BP for greater than twelve months

had been treated previously. As has been noted in an earlier section (p110) other drug treatment was ceased prior to the baseline phase of assessment for the present study.

6. Other relevant clinical data include the fact that only 20% of the patients, predominantly male, had been hospitalized specifically regarding BP elevation. 13% of all patients acknowledged having been treated with psychotropic medication, and a similar proportion of patients reported self medication with analgesics. Only 27% of the patients were smokers, while 20%, predominantly male, acknowledged use of alcohol in excess of social drinking.

7. In 20% of patients, the family history of hypertension revealed two or more near relatives who had been diagnosed as having elevated BP.

SECTION IIBLOOD PRESSURE LEVELSIntroduction

During the assessment phase and at subsequent followup, the BP measures were made under the strictly standardized conditions described in the Methodology Section (p 112).

The question arises whether it is profitable also to include in this presentation of data the BP levels at 'referral', i.e. the measure which prompted the referring clinician to send the patient on to the Research Study. Scrutiny of the figures reveals that for the majority of patients there is a reduction in BP level recorded from 'referral' to 'baseline', but for some patients there is negligible reduction and for a very few there is an increase. This poses the issue whether any psychological measures correlate with this BP change.

The constraint in including this data is that the margin for error in recording is obviously greater than within the Study itself. The relative crudity of measurement will be borne in mind in drawing conclusions from this phase of the study. However such are the every day clinical conditions and settings in which important decisions regarding treatment are made by physicians. To discard this data on grounds that it is not possible to control for observer error may be to lose sight of valuable data regarding changes of BP level in patients entering a treatment study.

The first steps will be to describe the 'Referral' BP data, then the data at the baseline phase. BP levels after diuretic therapy, and at the conclusion of 12 months' combined diuretic and anti-hypertensive drug treatment will then be described.

(1) BP MEASURES AT REFERRAL

In the majority of cases the 'referral BP' was assessed to the nearest 5 mm Hg as is clinical convention. In those cases where BP had been recorded purportedly to the nearest 1 mm Hg, the figures were 'rounded off' to the nearest 5 mm Hg. For example, 197/123 became 195/125. mm Hg.

TABLE 8.BP LEVELS AT REFERRAL, ACCORDING TO SEX

	MALES (N=54)		FEMALES (N=21)		TOTAL (N=75)	
	SBP	DBP	SBP	DBP	SBP	DBP
MEAN	190	120	205	120	195	120
S.D	29	15	31	9	30	14
MEDIAN	190	120	205	120	190	120
RANGE	145-280	95-175	140-260	105-140	140-280	95-175

't' test for differences in mean values between males and females

SBP: 't' = 1.86 d.f = 73 n.s

DBP: 't' = 0.

It is seen that mean values are not significantly different between the sexes, but for DBP there is a wider range of scores in males than in females.

(ii) BASELINE BP LEVELS.

From the time of initial assessment in the Clinic onwards, all BP readings were taken under the strictly standardized conditions described on p.112. The readings shown represent the mean of 4 readings taken during consecutive visits, in the supine position, with the DBP level being that of disappearance of the Korotkoff sounds.

TABLE 9.BASELINE BP LEVELS, ACCORDING TO SEX

	MALES (N=54)		FEMALES (N=21)		TOTAL (N=75)	
	SBP	DBP	SBP	DBP	SBP	DBP
MEAN	174	111	176	113	174	111
S.D	18	9	15	8	18	9
MEDIAN	175	110	176	112	175	111
RANGE	138-207	92-130	147-210	102-130	138-210	92-130

't' test for difference between Males and Females

SBP: 't' = 0.49 d.f. = 73 n.s

DBP: 't' = 0.97 d.f. = 73 n.s

The range of DBP levels for males is seen to be 92-130 mm Hg, which requires some explanation as the criterion for entry to the study included at least 2 DBP levels > 110 mm Hg. The few patients whose mean DBP levels were < 100 mm Hg in the supine position, nonetheless met the criterion as DBP was higher in the standing position.

(iii) POST DIURETIC BP MEASURES

The reasons for the reduction of N from 75 to 71 during this phase will be discussed later (p 212). The following tables are derived from the BP measures taken at the visit at which the antihypertensive drug was about to be prescribed. That decision was made when 2 consecutive readings had shown no further reduction in BP level, so that it was assumed that maximal BP reduction on that standard dosage (1.0 mgms/day) had been achieved. The time interval between the beginning of diuretic therapy and the beginning of the antihypertensive drug was usually 4-6 weeks.

TABLE 10POST DIURETIC BP LEVELS, ACCORDING TO SEX

	MALES (N=51)		FEMALES (N=20)		TOTAL (N=71)	
	SBP	DBP	SBP	DBP	SBP	DBP
MEAN	160	102	165	102	161	102
S.D	20	12	23	14	21	12
MEDIAN	156	103	167	100	158	102
RANGE	125-210	79-126	135-216	75-129	125-216	75-129

't' test for difference between males and females

SBP: $t = 0.87$ d.f. = 69 n.s

DBP: $t = 0$

(iv) BP MEASURES AT 12 MONTHS (DIURETIC AND ANTIHYPERTENSIVE DRUG)

The reduction in N from 71 to 55 will be explained on p 212.

The BP reading made at approximately 12 months from the beginning of treatment is that which coincided with the time of the followup psychological assessment.

TABLE 11.

BP LEVELS AT 12 MONTHS, ACCORDING TO SEX

	MALES (N=40)		FEMALES (N=15)		TOTAL (N=55)	
	SBP	DBP	SBP	DBP	SBP	DBP
MEAN	141	91	142	95	141	92
S.D.	17	11	23	16	18	12
MEDIAN	140	89	141	94	140	90
RANGE	111-205	69-110	116-205	79-135	111-205	69-135

't' test for difference between males and females.

SBP: $t = .15$ d.f. = 53 n.s

DBP: $t = .86$ d.f. = 53 n.s

The similarity of BP reduction for male and female patients noted at earlier phases is seen to persist to this final point in the study.

(v) SUMMARY OF BP CHANGES AT EACH STAGE

Since no sex differences have been discovered at any of the 4 stages described, the patients are considered as a single group in the following tables which summarize the BP findings over the whole study.

TABLE 12.SBP LEVELS OVER THE WHOLE STUDY

	REFERRAL STAGE N=75	BASELINE STAGE N=75	POST DIURETIC STAGE N=71	AFTER 12 MONTHS TREATMENT N=55
MEAN	195	174	161	141
S.D	30	18	21	18
MEDIAN	190	175	158	140
RANGE	140-280	138-210	125-216	111-205

TABLE 13.DBP LEVELS OVER THE WHOLE STUDY

	REFERRAL STAGE N=75	BASELINE STAGE N=75	POST DIURETIC STAGE N=71	AFTER 12 MONTHS TREATMENT N=55
MEAN	120	111	102	92
S.D	14	9	12	12
MEDIAN	120	111	102	90
RANGE	95-175	92-130	75-129	69-135

To assess these changes statistically, paired 't' tests were carried out for the following 3 phases.

- (i) Referral to Baseline (N=75)
- (ii) Baseline to Post-diuretic (N=71)
- (iii) Post-diuretic to 12 months of combined drug treatment (N=55)

Because of the change of N it is not appropriate to perform the 't' tests on the mean figures shown in the previous Tables above, except for the 'Referral to Baseline' phase where N is constant.

TABLE 14.

SBP CHANGES WITHIN EACH PHASE

	N	MEAN	S.D	t	d.f	2 tail probability
(i) Referral	75	195	30	6.3	74	P < .001
(ii) Baseline		174	18			
(i) Baseline	71	174	17	5.7	70	P < .001
(ii) Post Diuretic		161	21			
(i) Post Diuretic	55	160	20	6.3	54	P < .001
(ii) 12 months combined treatment		141	18			

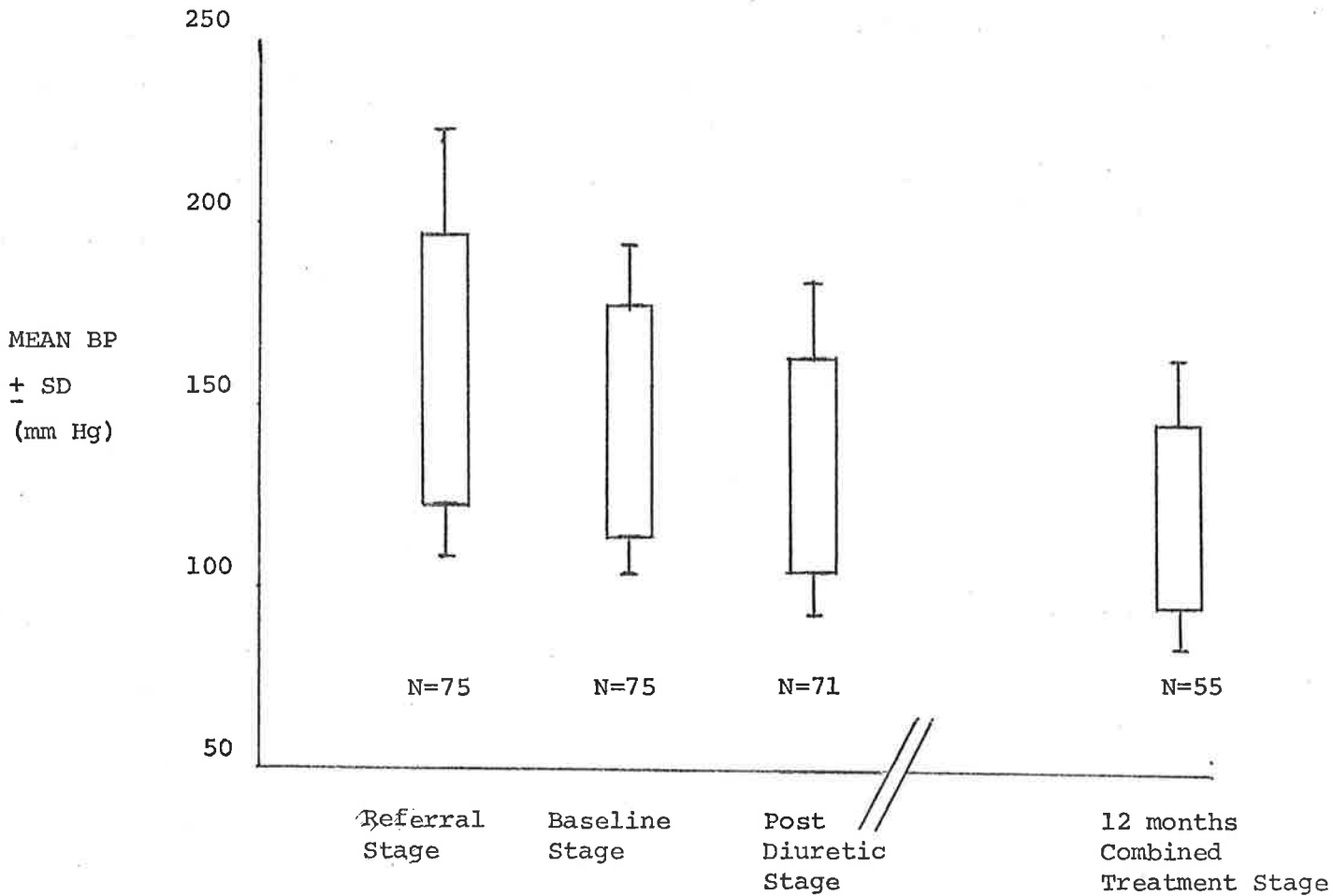
TABLE 15
DBP CHANGES WITHIN EACH PHASE

	N	MEAN	S.D	t	d.f.	2 tail probability
(i) Referral	75	120	14	5.3	74	p < .001
(ii) Baseline		111	9			
(i) Baseline	71	111	9	6.9	70	p < .001
(ii) Post diuretic		102	12			
(i) Post diuretic	55	101	12	4.9	54	p < .001
(ii) 12 months combined treatment		92	12			

Since there has been a reduction of N from 75 (referral and baseline) to 71 (post diuretic) to 55 (12 months) it may be asked whether the latter groups are representative of the initial samples, with regard to BP level. Tables 14 and 15 clearly indicate that the latter groups are representative: for example, Table 14 shows that mean SBP was 174 for N = 75, and was also 174 for N = 71 who went on to complete the diuretic phase. At the end of the diuretic phase Mean SBP was 161 for the N = 71 group, and was 160 for the N = 55 who went on to the 12 months stage. Table 15 shows an identical pattern regarding DBP levels. In other words, the 20 who were unable for a variety of reasons to be assessed at the conclusion of the study, were neither more nor less hypertensive at the baseline and diuretic phases, than those who remained in the study throughout.

The data presented above in tabular form is depicted again in the following Figure.

FIGURE 2: BP CHANGES DURING STUDY



SECTION II: SUMMARY

1. The overall changes in BP are depicted in the figure above.
2. No significant sex differences are found at any phase of the study.
3. The 55 subjects who continued to 12 months followup did not differ in BP levels at Baseline and at the Post-diuretic stage from those who failed for any reason to complete the study.

SECTION III: PSYCHOLOGICAL MEASURES AT BASELINE

Sex differences are described for each of the measures to be reported. A general finding to be revealed is that female patients acknowledge higher levels of current emotional disturbance and life stress ratings, than male patients.

(i) CATTELL'S 16 PERSONALITY FACTOR QUESTIONNAIRE (16PF)(a) ALL PATIENTS

The 'popular' terms are used rather than the technical terms, for the 1st order 16 traits, as the meaning of each trait is thus more easily discerned on inspection.

TABLE 16.1ST and 2ND ORDER (STEN) SCORES.

FACTOR	DESCRIPTION OF BIPOLAR TRAIT	MEAN	S.D.
A	Reserved - Outgoing	4.4	2.1
B	Lower Intelligence - Higher Intelligence	4.9	1.8
C	Ego weakness - Ego strength	4.5	1.8
E	Submissive - Dominant	5.6	1.9
F	Serious - Enthusiastic	4.6	1.7
G	Lower superego strength - higher superego strength	5.4	2.2
H	Timid - Bold	4.9	1.7
I	Tough minded - Sensitive	5.6	2.1
L	Trusting - Suspicious	6.0	2.0
M	Conventional - Imaginative	4.4	1.7
N	Naive - Shrewd	5.9	2.1
O	Untroubled - Guilt prone	6.5	2.2
Q1	Conservative - Radical	5.4	2.2
Q2	Group Dependent - Self sufficient	6.0	2.3
Q3	Lax - controlled	4.6	1.9
Q4	Relaxed - Tense	6.0	2.1
QI	Introversion - Extraversion	4.7	1.2
QII	Adjustment - Anxiety	6.5	1.6
QIII	Emotionalism - Tough poise	5.6	1.9
QIV	Dependence - Independence	5.2	1.6

FIGURE 3 : 16PF TEST PROFILE : MEAN SCORES : ALL PATIENTS (N=75)

FACTOR	LOW SCORE DESCRIPTION	STANDARD TEN SCORE (STEN)										HIGH SCORE DESCRIPTION	
		AVERAGE											
		1	2	3	4	5	6	7	8	9	10		
A	Aloof, Cold .....	.	.	.	.	.	.	.	.	.	.	.	.....Warm, Sociable
B	Dull, Low Capacity .....	.	.	.	.	.	.	.	.	.	.	.	.....Bright, Intelligent
C	Emotional, Unstable .....	.	.	.	.	.	.	.	.	.	.	.	.....Mature, Calm
E	Submissive, Mild .....	.	.	.	.	.	.	.	.	.	.	.	.....Dominant, Aggressive
F	Glum, Silent .....	.	.	.	.	.	.	.	.	.	.	.	.....Enthusiastic, Talkative
G	Casual, Undependable .....	.	.	.	.	.	.	.	.	.	.	.	.....Conscientious, Persistent
H	Timid, Shy .....	.	.	.	.	.	.	.	.	.	.	.	.....Adventurous, "Thick Skinned"
I	Tough, Realistic .....	.	.	.	.	.	.	.	.	.	.	.	.....Sensitive, Effeminate
L	Trustful, Adaptable .....	.	.	.	.	.	.	.	.	.	.	.	.....Suspecting, Jealous
M	Conventional, Practical .....	.	.	.	.	.	.	.	.	.	.	.	.....Bohemian, Unconcerned
N	Simple, Awkward .....	.	.	.	.	.	.	.	.	.	.	.	.....Sophisticated, Polished
O	Confident, Unshakable .....	.	.	.	.	.	.	.	.	.	.	.	.....Insecure, Anxious
Q1	Conservative, Accepting .....	.	.	.	.	.	.	.	.	.	.	.	.....Experimenting, Critical
Q2	Dependent, Imitative .....	.	.	.	.	.	.	.	.	.	.	.	.....Self-Sufficient, Resourceful
Q3	Lax, Unsure .....	.	.	.	.	.	.	.	.	.	.	.	.....Controlled, Exact
Q4	Phlegmatic, Composed .....	.	.	.	.	.	.	.	.	.	.	.	.....Tense, Excitable

Presentation of scores as Sten (Standard-Ten) rather than raw scores means that the range of scores for each Factor is 1-10 and the mean of the Scale is precisely 5.5. Overall, the striking feature is the 'normality' of the scores in the statistical sense.

The 1970 '16PF Handbook' provides sten scores for a variety of clinical groups, and approximate comparisons can be made by the calculation of a 'Profile Similarity Coefficient' between any two scores.

As would be expected, the coefficient (r_p) is moderately high (0.46, $p = .01$) between the present series and that based on theoretical 'average' of 5.5 for each Factor. On the other hand, the coefficients are quite low between the present series and various clinical groups on which data is given. For a 'general neurotic group', $r_p = -.06$; for an 'anxiety reaction' group, $r_p = -.16$; for a 'depressive reaction' group, $r_p = -.08$. It is of interest that for two clinical groups, the profile similarity coefficient does reach statistical significance. For a 'psychosomatic group' comparison, $r_p = 0.37$ ($p < .05$), and for a 'paranoid group' comparison $r_p = .33$ ($p < .05$). Since the age ranges and sex ratio of these comparative groups are not provided, bias cannot be excluded, but it is of interest in the light of other personality studies of hypertensives e.g. (Thaler, Weiner and Reiser, 1957) that 'psychosomatic' and 'paranoid' groups should reveal some apparent affinity with a hypertensive group.

Further, it cannot be argued that the present series is representative of hypertensive subjects generally, since the sample of patients has been selected on the basis of agreement to participate in a drug study; the data simply reflect a selective bias toward personality characteristics considered 'suitable' for effective participation and collaboration.

(b) Sex Differences

TABLE 17.

16PF FACTORS: STEN SCORES: SEX DIFFERENCES

FACTOR	MALES (N=54)		FEMALES (N=21)		t	PROBABILITY (d.f. = 73)
	MEAN	S.D.	MEAN	S.D.		
A	4.5	2.1	4.1	1.8	.81	n.s.
B	4.8	1.9	5.1	1.3	.76	n.s.
C	4.4	1.9	4.7	1.7	.65	n.s.
E	5.6	1.9	5.7	1.9	.20	n.s.
F	4.6	1.7	4.9	1.6	.73	n.s.
G	5.3	2.2	5.7	2.5	.64	n.s.
H	4.8	1.6	5.0	2.0	.60	n.s.
I	5.4	2.0	6.0	2.5	.97	n.s.
L	6.2	2.1	5.6	1.5	1.37	n.s.
M	4.3	1.7	4.5	1.6	.47	n.s.
N	5.9	2.3	6.0	1.7	.21	n.s.
O	6.5	2.2	6.2	2.2	.53	n.s.
Q1	5.3	2.2	5.6	2.0	.56	n.s.
Q2	6.1	2.5	5.6	1.8	.96	n.s.
Q3	4.7	1.9	4.5	1.7	.43	n.s.
Q4	6.0	2.1	6.3	1.8	.60	n.s.
QI	4.6	1.2	4.9	1.2	.96	n.s.
QII	6.5	1.6	6.5	1.5	0	n.s.
QIII	5.5	1.9	5.5	1.6	0	n.s.
QIV	5.1	1.6	5.2	1.2	.28	n.s.

Table 17 reveals that there are no significant sex differences in Sten Scores for First Order or Second Order Factors. This is according to expectation as there is differential weighting of raw scores for males and females. For the general population, mean scores for both sexes is 5.5. The Study Group patients therefore are similar to the General population in sex distribution of 16PF Scores.

(ii) KUPFER-DETRE SYSTEM (KDS) QUESTIONNAIRE SCORES

KDS scores which closely reflect the 'current emotional state' are seen to be significantly higher for females than males regarding measures of 'anxiety' and 'depression'. One female patient did not complete the KDS Questionnaire due to language difficulty.

TABLE 18KDS SCORES: SEX DIFFERENCES (N = 74)

KDS MEASURE	MALES (N=54)		FEMALES (N=20)		t	PROBABILITY d.f. = 72)
	MEAN	S.D.	MEAN	S.D.		
Anxiety	9.0	6.3	14.6	5.0	3.96	$p < .001$
Depression	16.2	8.6	21.5	9.8	2.08	$.02 < p < .05$
Organicity	10.8	7.0	14.8	9.1	1.74	n.s.
Mania	10.1	4.2	11.4	3.6	1.29	n.s.
Psychoticism	5.2	6.4	8.9	7.4	1.94	n.s.

(iii) STANDARDISED PSYCHIATRIC INTERVIEW (SPI) SCORES.(a) EMOTIONAL DISTURBANCE (TOTAL).

The score for "Emotional Disturbance" is obtained using the formula described on p 125. Sex differences are again apparent.

TABLE 19.

SPI EMOTIONAL DISTURBANCE SCORE: SEX DIFFERENCES

	MALES (N=54)	FEMALES (N = 21)
MEAN	13.0	20.1
S.D.	8.5	10.5
S.E.M.	1.2	2.4

t=2.65 d.f.=73 .01<p<.02

(b) SPI SCORES ON SPECIFIC SYMPTOMS

The method of inquiry by which these symptoms are rated on a 5 point scale has been described on p 124. The data are presented here in a frequency distribution format.

TABLE 20.

	FATIGUE	INSOMNIA	IRRITABILITY	IMPAIRED CONCENTRATION	DEPRESSION	ANXIETY
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
ABSENT	39(40)	24(32)	17(17)	36(48)	23(39)	11(15)
MILD	16(21)	19(25)	24(32)	29(27)	26(35)	20(27)
MODERATE	12(16)	22(29)	19(25)	15(20)	14(19)	25(33)
SEVERE	15(20)	10(13)	19(25)	4 (5)	6 (8)	19(25)
VERY SEVERE	2 (3)	0 (0)	0	0	0	0
TOTAL N	75(100)	75(100)	75(100)	75(100)	75(100)	75(100)

Inspection of Table 21 reveals that "anxiety" is recorded as moderate or severe in 46 patients (58%), and "irritability" is recorded as moderate or severe in 38 patients (50%). In contrast, "impaired concentration" is seen to be reported as moderate or severe in only 19 patients (25%), and "depression" in only 20 (27%).

The significant sex differences noted earlier (Table 18) regarding KDS scores of anxiety and depression, also emerge in SPI ratings, as seen in Tables 21 and 22. Whether these consistent findings reflect a true different in affective disturbance between the sexes, or whether they merely indicate a greater readiness on the part of female patients to acknowledge such psychological vulnerabilities, is open to question.

For the analysis of sex differences, the 5-point scale has been collapsed into a 4-point scale which simplified the calculations and presentation, as only 2 subjects achieved the grading of 'very severe', on one symptom (fatigue).

TABLE 21.

SPI SYMPTOM INQUIRY: SEX DIFFERENCES

	FATIGUE		INSOMNIA		IRRITABILITY	
	Male N=54	Female N = 21	Male N=54	Female N = 21	Male N=54	Female N = 21
ABSENT	26	4	19	6	12	2
MILD	10	6	15	3	18	5
MODERATE	9	3	14	7	14	5
SEVERE	9	8	6	5	10	9

$$\chi^2 = 6.93 \text{ n.s.} \quad \chi^2 = 3.21 \text{ n.s.} \quad \chi^2 = 5.31 \text{ n.s.}$$

TABLE 22

SPI SYMPTOM INQUIRY: SEX DIFFERENCES

	IMPAIRED CONCENTRATION		DEPRESSION		ANXIETY	
	Male N=54	Female N = 21	Male N=54	Female N = 21	Male N=54	Female N = 21
ABSENT	29	7	28	1	10	1
MILD	15	5	18	8	16	4
MODERATE	9	6	7	7	21	5
SEVERE	1	3	1	5	7	11

$$\chi^2 = 7.01 \text{ n.s.} \quad \chi^2 = 24.2 \text{ p} < .001 \quad \chi^2 = 8.62 \text{ .02} < \text{p} < .05$$

(iv) STATED ATTITUDES TO DRUG TREATMENTTABLE 23ATTITUDES TO TREATMENT: SEX DIFFERENCES

	MALE (N=54)	FEMALE (N=21)	TOTAL (N=75)
Over optimistic	1	1	2
Optimistic	19	8	27
Positive but guarded	20	4	24
Uncertain, doubtful	12	8	20
Pessimistic, negative	2	0	2

$$\chi^2 = 2.89 \text{ (n.s.)}$$

It is interesting to note that nearly one quarter of the patients were rated as having a prevailing doubtful or negative attitude about the outcome of treatment, particularly in view of the fact that selection for the drug trial had entailed considerable discussion with doctors regarding the proven efficacy of the medication to be used.

(v) LIFE STRESS RATINGS

The method of obtaining information for global judgements (reported present or reported absent) has been described on p 129.

TABLE 24REPORTED LIFE STRESS: SEX DIFFERENCES

	MALE	FEMALE	χ^2	PROBABILITY
(a) REPORTED MARITAL STRESS (N=61)	(N=44) 7	(N=17) 8	6.42	.01 < p < .02
(b) REPORTED FAMILY STRESS (other than marital (N=74))	(N=53) 13	(N=21) 11	5.32	.02 < p < .05
(c) REPORTED WORK STRESS (N=61)	(N=53) 12	(N=8) 3	.83	n.s.

It is seen that 16 of 61 patients reported marital stress, 24 of 74 patients reported interpersonal family stress other than marital, while 16 of 61 patients reported work stress. Females are seen to be more likely to report marital and family stress than males.

Section III: SUMMARY

1. No significant deviation from population measures were seen on the 16PF profile, for either sex.
2. Female patients scored significantly higher than males on KDS Scales of "Anxiety" and "Depression" although not on other KDS Scales.
3. Female patients scored significantly higher than males on SPI ratings of "Anxiety" and "Depression" but not on other symptom ratings.
4. Symptoms rated "moderately severe" and "severe" in order of frequency on SPI ratings were "Anxiety" (58%), "Irritability" (50%), "Insomnia" (42%), "Fatigue" (39%), "Depression" (27%) and "Impaired Concentration" (25%).
5. Approximately one quarter of patients were rated as having a prevailing doubtful or negative attitude regarding treatment outcome.
6. Marital and family stress situations were reported significantly more frequently by females than by males.

SECTION IV RELATIONSHIPS BETWEEN BASELINE PSYCHOLOGICAL MEASURES
AND CHANGES IN BLOOD PRESSURE

Introduction

These relationships will be examined at each of three phases,

- i.e.
- (I) Referral to baseline (N = 75)
 - (II) Baseline to postdiuretic (N = 71)
 - (III) Baseline to 12 months (diuretic and antihypertensive drug) (N = 55).

Phase (III) has been selected as "baseline to 12 months" rather than "post diuretic to 12 months", for the reason that psychological assessments were made at baseline and at 12 months, but not at the end of the diuretic phase.

Regarding sex differences, it has already been found that no significant sex differences are detectable in change of BP scores over the study. (Tables 8, 9, 10 and 11 above). Since sex differences have been found for various "state" measures, in particular KDS and SPI "Anxiety" and "Depression", and also for Reported Marital and Family Stress, it will be necessary to study the inter relationship between BP change and the psychological measures according to sex differences as well as for the group as a whole.

The findings will be presented as follows:

- (1) Predictions
- (2) Other Findings.

(1) Predictions(i) Personality Traits

It was predicted (see p133) that two personality on the 16PF (Factor E- (submissiveness), and Factor L+ (suspiciousness) would be found to be associated with less reduction of BP, i.e. poorer outcome, during the Study.

(a) Factor E

TABLE 25

CORRELATIONS BETWEEN FACTOR E (SUBMISSIVENESS-DOMINANCE) AND % Δ BP

	Referral to Baseline (Phase I)		Baseline to Post Diuretic (Phase II)		Baseline to 12 months continued treatment (Phase III)	
	r	p	r	p	r	p
i) SBP						
Total	.17	n.s.	-.04	n.s.	-.07	n.s.
Males	.18	n.s.	-.08	n.s.	-.15	n.s.
Females	.16	n.s.	.11	n.s.	.16	n.s.
ii) DBP						
Total	.24	.02 (N=75)	.04	n.s.	-.14	n.s.
Males	.26	.03 (N=54)	-.06	n.s.	-.23	n.s.
Females	.18	n.s.	.47	.02 (N=19)	.18	n.s.

It is seen that, of the 18 correlations only 3 are statistically significant at the $p < .05$ level. There is a low positive correlation ($r = .26$) between E+ (dominance), and % Δ DBP in Males in Phase I, and a higher correlation ($r = .47$) in Females in Phase II. These are in the predicted direction, as the E- (submissive) persons showed less reduction of DBP in both instances. The findings are consistent only to a limited extent, therefore, with the hypothesis that persons with "submissive" traits as measured by the 16PF, would reveal greater resistance to change in BP during the Study.

(b) Factor L

TABLE 26

CORRELATIONS BETWEEN FACTOR L (TRUST-SUSPICIOUSNESS) AND %ΔBP

	Referral to Baseline (Phase I)		Baseline to Post Diuretic (Phase II)		Baseline to 12 months continued treatment (Phase III)	
	r	p	r	p	r	p
i) SBP						
Total	.18	n.s.	-.16	n.s.	-.23	.045 (N=75)
Males	.24	.04 (N=54)	-.05	n.s.	-.27	.047 (N=40)
Females	.16	n.s.	-.69	.001 (N=19)	-.06	n.s.
ii) DBP						
Total	.32	.003 (N=75)	-.10	n.s.	-.13	n.s.
Males	.32	.01 (N=54)	.00	n.s.	-.14	n.s.
Females	.29	n.s.	-.51	.01 (N=19)	-.01	n.s.

It is seen that of the 7 statistically significant correlations at p .05 level, only the 4 which occur after drug therapy are in the predicted direction. Females in Phase II, and Males in Phase III (SBP only), show the predicted negative correlation between "suspiciousness" and outcome.

In the pretreatment phase, on the other hand, the L+ (suspicious) males show a greater reduction of BP. Since the L+ is known to contribute to "anxiety", it is possible that through this mechanism the more anxious person may achieve greater reduction of BP in the pretreatment phase, assuming that the "Referral BP" level was higher because of a component related to anxiety.

(ii) Reported Life Stress(a) Marital Stress

TABLE 27

REPORTED MARITAL STRESS AT BASELINE AND %ΔBP (ALL PATIENTS)

		Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
		Present	Absent	Present	Absent	Present	Absent
		(N=15)	(N=46)	(N=14)	(N=45)	(N=10)	(N=36)
<u>SBP</u>	Mean %ΔBP	5.5	8.5	6.0	6.7	15.3	17.6
	S.D.	0.8	1.3	1.1	1.1	13.2	12.2
	t	0.85		.21		.52	
	p	n.s.		n.s.		n.s.	
<u>DBP</u>	Mean %ΔBP	2.3	6.9	9.4	7.3	15.9	15.8
	S.D.	1.0	1.0	1.1	1.0	10.6	12.2
	t	1.44		-.67		-.02	
	p	n.s.		n.s.		n.s.	

For the patient groups as a whole, no significant differences are seen between those who report marital stress and those who do not.

TABLE 28

REPORTED MARITAL STRESS AT BASELINE AND %ΔBP (MALES)

		Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
		Present	Absent	Present	Absent	Present	Absent
		(N= 8)	(N=37)	(N=7)	(N=36)	(N=4)	(N=30)
<u>SBP</u>	Mean %ΔBP	4.0	7.0	1.2	7.2	10.3	18.7
	S.D.	0.9	1.1	1.3	1.1	19.0	11.3
	t	.70		1.31		1.19	
	p	n.s.		n.s.		n.s.	
<u>DBP</u>	Mean %ΔBP	4.4	6.7	7.6	6.3	13.8	16.2
	S.D.	1.3	1.1	1.2	1.0	14.7	12.2
	t	.54		-.30		.35	
	p	n.s.		n.s.		n.s.	

TABLE 29

REPORTED MARITAL STRESS AT BASELINE AND %ΔBP (FEMALE)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present	Absent	Present	Absent	Present	Absent
	N = 7	N = 9	N = 7	N = 9	N = 6	N = 6
<u>SBP</u>						
Mean %ΔBP	7.1	14.7	10.7	4.1	18.7	15.4
S.D	0.8	1.8	0.7	0.9	8.1	17.0
t		1.02		- 1.38		-.42
P		n.s.		n.s.		n.s.
<u>DBP</u>						
Mean %ΔBP	0.0	7.6	11.2	11.6	17.2	14.0
S.D.	0.1	1.0	1.0	0.5	8.2	13.4
t		1.68		.10		-.51
P		n.s.		n.s.		n.s.

The prediction that BP reduction would be less in those who report marital stress is not borne out by these results. A trend is seen in the predicted direction (especially for Phase I - referral to baseline), for those not reporting marital stress to show greater reduction, but this does not reach the $p = .05$ level of significance.

(b) Family Stress

TABLE 30

REPORTED FAMILY STRESS AT BASELINE AND % Δ BP (ALL PATIENTS)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 24	Absent N = 50	Present N = 23	Absent N = 47	Present N = 18	Absent N = 36
<u>SBP</u> Mean % Δ BP	11.6	6.6	5.9	7.1	21.9	16.4
	S.D. 1.0	1.3	1.0	1.1	14.3	10.5
	t	-1.70		.57		-1.60
	p	n.s.		n.s.		n.s.
<u>DBP</u> Mean % Δ BP	6.1	5.9	7.7	8.2	21.5	14.9
	S.D. 0.6	1.2	0.9	1.0	10.4	11.2
	t	-.05		.19		-2.10
	p	n.s.		n.s.		.04

The finding that BP reduction is greater over 12 months in those who report family stress is in the opposite direction to that predicted. The following Tables show that this result does not reach statistical significance however, if the sexes are considered separately.

TABLE 31

REPORTED FAMILY STRESS AT BASELINE AND % Δ BP (MALES)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 13	Absent N = 41	Present N = 13	Absent N = 38	Present N = 10	Absent N = 29
<u>SBP</u> Mean % Δ BP	8.6	6.4	6.7	7.1	23.7	15.8
	S.D. 1.1	1.1	1.0	1.1	13.4	11.1
	t	-.62		.11		-1.83
	p	n.s.		n.s.		n.s.
<u>DBP</u> Mean % Δ BP	7.5	5.9	8.5	6.7	22.7	15.1
	S.D. 0.6	1.2	1.0	1.0	12.7	-1.1
	t	-.44		-.57		-1.80
	p	n.s.		n.s.		n.s.

TABLE 32

REPORTED FAMILY STRESS AT BASELINE AND % Δ BP (FEMALES)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 11	Absent N = 9	Present N = 10	Absent N = 9	Present N = 8	Absent N = 7
<u>SBP</u>						
Mean % Δ BP	15.1	7.4	4.9	8.9	19.7	18.9
S.D.	0.8	1.8	1.0	0.9	16.0	7.0
t		-1.28		.91		-.12
P		n.s.		n.s.		n.s.
<u>DBP</u>						
Mean % Δ BP	4.4	6.1	6.6	14.5	20.1	14.0
S.D.	0.7	1.1	0.7	0.7	7.0	12.7
t		.42		2.27		-1.11
P		n.s.		.04		n.s.

The finding that in females in the Phase II (Diuretic Phase), those who report family stress do less well than those who do not report such stress, is according to prediction.

(c) Work Stress

TABLE 33

REPORTED WORK STRESS AT BASELINE AND %ΔBP (ALL PATIENTS)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 15	Absent N = 46	Present N = 14	Absent N = 43	Present N = 9	Absent N = 36
<u>SBP</u>						
Mean %ΔBP	8.3	7.2	3.0	7.8	9.7	20.1
S.D.	1.2	1.1	1.2	1.0	12.9	10.2
t		-.35		1.43		2.59
p		n.s.		n.s.		0.13
<u>DBP</u>						
Mean %ΔBP	8.0	6.4	5.0	7.6	7.2	19.3
S.D.	1.1	1.0	1.3	0.9	12.0	10.2
t		-.35		.84		3.09
p		n.s.		n.s.		.004

There is a significant difference at 12 months, between those who reported work stress present and those who report it as absent. The findings are in the predicted direction, and occur for SBP and DBP.

TABLE 34

REPORTED WORK STRESS AT BASELINE AND %ΔBP (MALES)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 12	Absent N = 41	Present N = 11	Absent N=39	Post N = 7	Absent N = 33
<u>SBP</u>						
Mean %ΔBP	8.6	6.1	1.5	8.7	7.0	20.1
S.D.	1.3	1.1	1.4	0.9	12.5	10.6
t		-.48		2.0		2.89
p		n.s.		.05		.006
<u>DBP</u>						
Mean %ΔBP	8.8	6.4	3.0	8.0	4.85	19.2
S.D.	1.2	1.1	1.4	0.9	10.4	10.6
t		-.66		1.46		3.26
p		n.s.		n.s.		.002

TABLE 35

REPORTED WORK STRESS AT BASELINE AND % Δ BP (FEMALES)

	Referral to Baseline		Baseline to Post Diuretic		Baseline to 12 months continued treatment	
	Present N = 3	Absent N = 5	Present N = 3	Absent N = 4	Present N = 2	Absent N = 3
<u>SBP</u>						
Mean % Δ BP	7.6	10.8	8.7	-1.9	19.4	19.9
S.D.	1.1	0.8	0.7	0.9	12.0	3.6
t		.49		-1.66		.08
p		n.s.		n.s.		n.s.
<u>DBP</u>						
Mean % Δ BP	4.5	6.0	12.1	2.9	15.4	20.4
S.D.	1.0	0.8	0.7	1.0	17.9	3.3
t		.23		-1.40		.52
p		n.s.		n.s.		n.s.

The improved outcome for those who report work stress as absent is seen to occur in males only. The relationship is mainly seen over Phase III but is also noted in Phase II for % SBP. The N for female patients who are employed is too low for adequate appraisal of this parameter for the female sex.

Summary of Life Stress Findings:-

Marital and Family Stress were not found to be significantly related to BP change, with the minor exceptions regarding Family Stress referred to above. On the other hand, Work Stress appears to be related strongly to outcome, as was hypothesized. The implications of this finding will be considered in the Discussion Section (p 240).

(iii) Attitudes to Drug Treatment

TABLE 36

CORRELATIONS BETWEEN BASELINE "ATTITUDE" SCORES AND % BP

	Referral to Baseline (Phase I)		Baseline to Post Diuretic (Phase II)		Baseline to 12 months continued treatment (Phase III)	
	r	p	r	p	r	p
i) <u>SBP</u>						
Total	-.10	n.s.	-.11	n.s.	.02	n.s.
Males	-.14	n.s.	.01	n.s.	-.14	n.s.
Females	-.28	n.s.	-.46	.02	-.47	.04
ii) <u>DBP</u>						
Total	.17	n.s.	-.03	n.s.	-.02	n.s.
Males	-.09	n.s.	.11	n.s.	-.17	n.s.
Females	-.47	.02	-.47	.02	-.14	n.s.

While no overall correlation occurs between attitudes to treatment and % BP, analysis for the sexes separately reveals that for females at each phase of the Study, significant correlations do occur. These are in line with prediction, whereas for males the prediction that patients with more positive expectations will do better, is not confirmed.

SUMMARY OF FINDINGS FROM PREDICTIONS

1. Referral to Baseline Phase

None of the predicted association occurred for both sexes. However, two significant correlations in the predicted direction were noted.

(i) 16PF Factor E- (Submissiveness) correlated negatively with % Δ DBP in males ($r = -.26$, $p = .03$).

(ii) A positive "Attitude to drug treatment" correlated positively with % Δ DBP in females ($r = .47$, $p = .02$).

One finding was in the opposite direction to that predicted.

(iii) 16PF Factor L+ (Suspiciousness) correlated positively with both % Δ SBP ($r = .24$, $p = .04$) and % Δ DBP ($r = .32$, $p = .01$) in males.

It will be shown in a later Section (Tables 39 and 40) that the dominant association with % Δ BP in this pre-treatment phase is with measures of "Anxiety": it is possible that Factor L+ is also associated with % Δ BP through its known link with the "Anxiety" dimension (for example, Factor L is one of the primaries contributing to the 16PF Second Order Anxiety Factor (QII+)).

2. Baseline to Diuretic Phase

Again, none of the predicted associations occurred for both sexes. However, several statistically significant associations were found, all in the predicted direction.

(i) 16PF Factor E- (Submissiveness) correlated negatively with % Δ DBP in females ($r = -.47$, $p = .02$).

(ii) 16PF Factor L+ (Suspiciousness) correlated negatively with % Δ SBP ($r = -.69$, $p = .001$) and with % Δ DBP ($r = -.51$, $p = .01$) in females.

- (iii) Absence of "Reported Family Stress" was associated with greater %DBP in females ($t = 2.27, p = .04$).
- (iv) Absence of "Reported Work Stress" was associated with greater % Δ SBP in males ($t = 2.0, p = .05$).
- (v) A positive "Attitude to Drug Treatment" correlated positively with % Δ SBP ($r = .46, p = .02$) and with % Δ DBP ($r = .47, p = .02$) in females.

(c) Baseline to 12 Months Combined Treatment

None of the predicted associations occurred for both sexes. The following associations were statistically significant, in the predicted direction.

- (i) 16PF L- (Suspiciousness) correlated negatively with % Δ SBP in males ($r = -.27, p = .05$).
- (ii) Absence of "Reported Work Stress" was associated with better outcome regarding SBP ($t = 2.89, p = .01$) and with % DBP ($t = 3.26, p = .002$) in males.
- (iii) A positive attitude to Drug Treatment was correlated positively with % Δ SBP ($r = -.47, p = .04$) in females.

There was one finding which was in the opposite direction to that predicted.

- (iv) Reported Family Stress was associated with better outcome regarding % Δ DBP for the combined sexes ($t = 2.10, p = .04$). However, when the sexes were considered separately, the association did not reach the $p = .05$ level of significance for either sex alone.

Overall there were 16 statistically significant associations, of which 13 were in the predicted direction, for the selected variables

tested in this way. Few of the associations applied to % SBP and % DBP at the same phase, few applied to both sexes at any phase, and few applied to more than one phase. The most clearcut finding concerned "Attitude to Drug Treatment" in female patients, this association being noted at each phase.

The implications of these findings will be considered in the Discussion Chapter.

(2) Other Findings1. Referral to Baseline Phase(i) 16PF: All patients

TABLE 37

CORRELATIONS BETWEEN BASELINE 16PF SCORES AND %ΔBPFROM REFERRAL TO BASELINE

16PF FACTOR	%ΔSBP		%ΔDBP	
	r (N=75)	p	r (N=75)	p
A	-.02		.07	
B	-.13		-.02	
C	-.10		-.09	
E	.17		.24	
F	.02		.03	
G	.12		.00	
H	-.21	.04	-.29	.006
I	.00		.05	
L	.18		.32	.003
M	.16		.09	
N	.03		.07	
O	-.03		-.11	
Q1	-.15		-.07	
Q2	.08		.07	
Q3	-.23	.02	-.03	
Q4	.08		.10	
QI	-.05		-.07	
QII	.14		.10	
QIII	-.05		-.14	
QIV	.11		.19	

It is seen that only Factor H- (threat-sensitivity, timidity) correlates significantly with %ΔSBP and with %ΔDBP. Two other personality Factors, E+ (dominance) and L+ (suspiciousness) correlates with %ΔDBP but now with %SBP: these Factors have been discussed in the "Predictions" Section (Tables 25 and 26).

Regarding the correlation between Q3- and %ΔSBP, it may

be relevant that the Q3- traits (lack of objectivity, balance and decisiveness) contribute along with Factor H- to the Second Order Anxiety Factor (QII+), so perhaps another component of that dimension is revealed in this association.

(ii) 16PF: Sex Differences

TABLE 38

CORRELATIONS BETWEEN BASELINE 16PF SCORES AND % DBP FROM REFERRAL
TO BASELINE : SEX DIFFERENCES

16PF FACTOR	MALES (N=54)				FEMALES (N=21)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p
A	.08		.18		-.26		-.43	.03
B	-.09		.06		-.34		-.33	
C	-.05		-.05		-.29		-.22	
E	.18		.26	.03	.16		.18	
F	-.04		-.02		.11		.28	
G	.11		-.02		.12		-.09	
H	-.11		-.27	.02	-.42	.03	-.35	
I	.06		.15		-.16		-.21	
L	.24	.04	.32	.009	.16		.29	
M	.14		.10		.17		.08	
N	.06		.08		-.07		.03	
O	-.11		-.18		.20		.14	
Q1	-.19		-.08		-.08		-.04	
Q2	.19		.11		-.18		-.18	
Q3	-.21		.01		-.28		-.20	
Q4	.09		.09		.01		.17	
Q1	-.05		-.06		-.12		-.06	
QII	.09		.05		.27		.27	
QIII	-.07		-.22	.05	.01		.27	
QIV	.15		.24	.04	-.01		-.02	

This table reveals that (i) Factor H- is related to %ΔBP for both sexes, although not for %ΔSBP in male patients (ii) the 'Independence' Factor QIV and its related primaries (E+ and L+) are linked with %ΔDBP for Male patients but not Females.

(iii) a new Factor emerges as related to % Δ DBP in females, namely Factor A- ($r = -.43$, $p = .03$). This Factor (Sizothymia) reflects reserve and emotional restraint as opposed to 'outgoingness' and warmth.

(iii) KDS and SPI: All Patients

TABLE 39

CORRELATIONS BETWEEN BASELINE 'STATE' MEASURES AND % Δ BP
FROM REFERRAL TO BASELINE

'STATE' MEASURES	% Δ SBP		% Δ DBP	
	r (N=75)	p	r (N=75)	p
KDS Anxiety	.25	.02	-.08	
KDS Depression	.34	.001	.16	
SPI Anxiety	.32	.002	.00	
SPI Depression	.31	.003	-.07	
SPI Total Emotional Disturbance	.29	.006	.00	

It is evident that % Δ SBP is significantly correlated with each measure of emotional state, whereas % Δ DBP is not. It would appear that changes in SBP may more readily reflect 'arousal' related to affective states such as anxiety, than do changes in DBP.

Clinicians have long been aware of the sensitivity of SBP to the 'arousal' state evoked in the setting of the office examination, in both normotensive and hypertensive persons, and the findings in Table 38 confirm this clinical experience in the research group.

(iv) KDS and SPI: Sex DifferencesTABLE 40CORRELATIONS BETWEEN BASELINE 'STATE' MEASURES AND % Δ BP
FROM REFERRAL TO BASELINE: SEX DIFFERENCES

'STATE' MEASURE	MALES (N=54)				FEMALES (N=21)			
	% Δ SBP		% Δ DBP		% Δ SBP		% Δ DBP	
	r	p	r	p	r	p	r	p
KDS Anxiety	.15		-.11		.42	.04	.29	
KDS Depression	.30	.01	.15		.36		.34	
SPI Anxiety	.14		-.10		.63	.001	.47	.02
SPI Depression	.28	.02	.12		.23		-.18	
SPI Total Emotional Disturbance	.16		-.04		.43	.03	.22	

It is of interest that in males, 'depression' scores correlate significantly with % Δ SBP whereas 'anxiety' scores do not; in females, on the other hand, 'anxiety' scores correlate more highly with % Δ BP than 'depression' scores.

Summary of Additional Findings in Referral to Baseline Phase

1. 16PF: Apart from the correlation with Factor E referred to in the previous section, the primary Factors which correlate with % Δ BP mainly have an association with Anxiety (Factor H-, L+ and Q3-).
2. KDS and SPI:
There is a clear correlation overall between measures of 'Anxiety and Depression' % change in SBP. Sex differences are noted, the association being stronger regarding 'Depression' in males and 'Anxiety' in females.
3. The overall finding, therefore, is that those patients indicating greater levels of 'emotional disturbance' at baseline, will have had a greater reduction of BP, especially SBP, from referral to baseline, than patients indicating lesser degrees of 'emotional disturbance'.

2. Baseline to Diuretic Phase

It has been shown (p 173) that several correlations consistent with predictions occurred in this Phase.

Additional findings are: -

(i) 16PF: All patients.

TABLE 41

CORRELATION BETWEEN 16PF SCORES AT BASELINE AND % Δ DBP

FROM BASELINE TO DIURETIC

16PF FACTOR	% Δ SBP (N=71)		% Δ DBP (N=71)	
	r	p	r	p
A	-.11		-.26	.01
B	-.09		-.09	
C	.08		-.02	
E	-.04		.04	
F	-.20	.05	-.12	
G	-.26	.02	-.18	
H	-.15		.13	
I	-.14		-.29	.008
L	-.16		-.11	
M	.09		.06	
N	.11		.15	
O	.19		.05	
Q1	.03		.12	
Q2	.00		-.06	
Q3	.09		.00	
Q4	.04		.00	
QI	-.27	.01	-.07	
QII	.02		-.04	
QIII	-.06		.26	.02
QIV	-.05		.04	

Regarding SBP, the finding that Introverted (QI-) patients do somewhat better may be related to a compliance factor, as the primary Factor F- (seriousness) is a component of QI. However, the rather curious finding that G- (less conscientious) patients also do better is not readily explained, as it is the opposite of what would be expected if compliance is the mediating variable.

Regarding DBP, Factor I- (tough minded) is reflected also in the second order Factor QIII (tough poise), and together with A- (reserve, restraint) point to a dimension of realism as opposed to emotionalism and sensitivity, as favourably linked with good outcome.

(ii) 16PF: Sex Differences

TABLE 42

CORRELATION BETWEEN BASELINE 16PF and %ΔBP FROMBASELINE TO DIURETIC PHASE: SEX DIFFERENCES

16PF FACTOR	MALES (N=52)				FEMALES (N=19)			
	SBP		DBP		SBP		DBP	
	r	p	r	p	r	p	r	p
A	-.13		-.36	.004	-.06		.16	
B	-.14		-.16		.14		.17	
C	.01		-.10		.35		.20	
E	-.08		-.06		.11		.47	.02
F	-.12		-.14		-.48	.02	-.11	
G	-.40	.002	-.22		.12		-.15	
H	-.07		.11		-.34		.14	
I	-.03		-.23	.05	-.42	.04	-.53	.01
L	-.05		-.00		-.69	.001	-.51	.01
M	.07		.06		.15		.03	
N	.18		.12		-.20		.29	
O	.26	.03	.10		-.04		-.08	
Q1	.08		.13		-.12		.07	
Q2	-.06		-.13		.31		.34	
Q3	.11		.00		.00		.01	
Q4	.02		.04		.09		-.21	
QI	-.22		-.10		-.43	.03	-.02	
QII	.06		.06		-.16		-.36	
QIII	.01		.30	.02	-.37		-.04	
QIV	-.05		.00		.10		.14	

The finding of a striking sex difference concerning Factor L (Trust-Suspicion) has been noted in the Section on 'Predictions'. In both sexes, but particularly in females, Factor I- (Tough mindedness as opposed to Sensitivity) correlates with good outcome. The associations noted in Table 41 are seen to be limited to females in some instances (Factor F and QI) and to males in others (Factor G). Factor A- (reserve) which has already been found to correlate with better outcome in Phase I in females (Table 38), is now noted also to correlate with better outcome in males for %ΔDBP.

(iii) KDS and SPI: All Patients

TABLE 43

CORRELATION BETWEEN 'STATE' MEASURES AT BASELINE AND
%ΔDBP FROM BASELINE TO DIURETIC PHASE

'STATE' MEASURES	%ΔSBP (N=71)		%ΔDBP (N=71)	
	r	p	r	p
KDS Anxiety	-.12		-.05	
KDS Depression	.13		.04	
SPI Anxiety	.01		.07	
SPI Depression	-.20	.05	-.06	
SPI Total				
Emotional Disturbance	-.03		-.02	

Correlations with %ΔSBP are seen to be virtually absent, whereas in (Table 39) all 5 measures of 'emotional state' correlated significantly with %ΔSBP in the pretreatment phase.

(iv) KDS and SPI: Sex Differences

TABLE 44

CORRELATION BETWEEN 'STATE' MEASURES AND %ΔBP IN DIURETIC
PHASE: SEX DIFFERENCES

'STATE' MEASURES	MALES (N=52)				FEMALES (N=19)			
	SBP		DBP		SBP		DBP	
	r	p	r	p	r	p	r	p
KDS Anxiety	-.11		-.02		-.14		-.48	.02
KDS Depression	.11		.06		.25		-.19	
SPI Anxiety	-.02		.01		.15		.04	
SPI Depression	-.30	.02	-.19		-.06		-.16	
SPI Total								
Emotional Disturbance	-.04		-.01		.00		.27	

It is of interest that the only significant correlations are now in the opposite direction from that seen in Phase I: females scoring lower on KDS Anxiety, and males rated lower on SPI Depression, do better regarding $\% \Delta \text{DBP}$ and $\% \Delta \text{SBP}$ respectively. The overall picture remains that of a lack of correlation between baseline 'emotional state' measures and $\% \Delta \text{BP}$.

Summary of Additional Findings in Diuretic Phase

1. 16PF: There are few strong associations between specific traits and $\% \Delta \text{BP}$ in this Phase: the most obvious is that concerning Factor I (Tough mindedness/Sensitivity): patients with the former characteristic tending to do better.

2. SPI and KDS:

The strong associations noted in Phase I between these scores and $\% \Delta \text{BP}$ no longer evident; correlations which do occur show an opposite sign: anxious and depressed patients, if anything, do a little worse during diuretic therapy. It may be surmised that the 'peak' of BP elevation related to 'emotional arousal' at referral has virtually disappeared by the baseline stage, so little further reduction can occur on this basis.

(iii) Baseline to 12 months combined treatment.

In Phase III, associations between 16PF L and % Δ SBP, and Work Stress and % Δ BP have been noted in male patients, while attitude to treatment was seen to be related to % Δ SBP in females (p174).

Additional findings are: -

(1) 16PF: ALL PATIENTS

TABLE 45

CORRELATION BETWEEN 16PF SCORES AT BASELINE AND % Δ BP FROM
BASELINE TO 12 MONTHS

16PF FACTORS	SBP (N=55)		DBP (N=55)	
	r	p	r	p
A	-.45	.001	-.47	.001
B	-.13		-.04	
C	.16		.07	
E	-.07		-.14	
F	.02		-.08	
G	-.01		-.07	
H	.10		.06	
I	-.07		.00	
L	-.23	.045	-.12	
M	-.08		.01	
N	.02		-.06	
O	.12		.08	
Q1	-.16		-.11	
Q2	-.01		-.31	.01
Q3	.11		.02	
Q4	-.13		-.12	
QI	-.11		-.07	
QII	-.12		-.06	
QIII	.25	.04	.22	
QIV	-.15		-.19	

It is seen that the unpredicted correlation concerning Factor A- (Sizothymia = reserve, restraint) appears again: Factor A- is significantly correlated with outcome for both SBP and DBP. Possible explanation of this important association will be considered in the Discussion Chapter.

The finding concerning Q2 (group dependence/self sufficiency) is of interest. 'Self sufficient' persons do less well: conceivably, this relationship could be mediated through compliance behaviour.

(ii) 16PF: SEX DIFFERENCESTABLE 46CORRELATION BETWEEN 16PF SCORES AT BASELINE AND %ΔBPFROM BASELINE TO 12 MONTHS: SEX DIFFERENCES

16PF FACTOR	MALES (N=40)				FEMALES (N=15)			
	SBP		DBP		SBP		DBP	
	r	p	r	p	r	p	r	p
A	-.40	.005	-.50	.001	-.60	.01	-.39	
B	-.07		-.04		-.38		-.08	
C	.28	.04	.18		-.24		-.38	
E	-.15		-.23		.16		.18	
F	.03		-.13		-.02		.16	
G	-.07		-.08		.10		-.05	
H	.15		.02		-.01		.15	
I	-.01		.02		-.30		-.06	
L	-.27	.047	-.14		-.06		-.01	
M	-.21		-.13		.33		.58	.01
N	.04		-.06		-.06		-.07	
O	.14		.12		.13		-.03	
Q1	-.17		-.18		-.15		.10	
Q2	-.11		-.44	.002	.36		.26	
Q3	.22		.09		-.18		-.20	
Q4	-.15		-.07		-.06		-.33	
QI	-.03		-.04		-.34		-.17	
QII	-.15		-.04		.02		-.16	
QIII	.26		.24		.33		.14	
QIV	-.24		-.35	.01	.14		.47	.04

Several findings are of interest

- (i) Factor A- is clearly associated with good outcome for both sexes.
- (ii) The primary Factor Q2+ (self sufficiency) is negatively associated with outcome only in males.
- (iii) Correlations with 'Independence' (QIV) have opposite signs for males and females. More 'Independent' males do less well, more 'Independent' females do better, than their 'Dependent' counterparts.
- (iv) Factor C+ (ego strength) is associated with good outcome in males.
- (v) Factor M+ (imaginativeness) is associated with good outcome in females.

(iii) KDS and SPI: All PatientsTABLE 47

CORRELATIONS BETWEEN BASELINE 'STATE' MEASURES AND
% Δ BP FROM BASELINE TO 12 MONTHS

'STATE' MEASURES	% Δ SBP r (N=55) p		% Δ DBP r (N=55) p	
	KDS Anxiety	-.01		-.02
KDS Anxiety	-.09		-.09	
SPI Anxiety	-.06		-.06	
SPI Depression	-.00		-.02	
SPI Total Emotional Disturbance	-.05		-.05	

It is clear that the baseline 'state' measures do not correlate with outcome at 12 months. This may be contrasted with the finding in Table 39 above depicting the high correlation with % Δ SBP from the referral to baseline phase.

(iv) KDS and SPI: Sex differencesTABLE 48

CORRELATION BETWEEN BASELINE 'STATE' MEASURES AND % Δ BP
FROM BASELINE TO 12 MONTHS: SEX DIFFERENCES

STATE MEASURES	MALES (N=40)				FEMALES (N=15)			
	SBP		DBP		SBP		DBP	
	r	p	r	p	r	p	r	p
KDS Anxiety	-.11		-.13		.26		.47	.04
KDS Depression	-.13		-.17		-.03		.12	
SPI Anxiety	-.17		-.08		.14		.26	
SPI Depression	-.16		-.01		-.06		.07	
SPI Total Emotional Disturbance	-.11		-.10		.01		.05	

It is seen that the only significant correlation is between KDS Anxiety and % Δ DBP in females; more anxious females do better. Since the correlation regarding SPI anxiety is not significantly high, although in the same direction, no firm conclusion can be drawn about the single finding.

Summary of Additional Findings from Baseline to 12 Months

1. 16PF: Factor A- ('Reserve') emerges as a strong correlate of % Δ BP. This Factor has already appeared in earlier Phases, but less consistently.
 - : Factor Q2 (Self sufficiency) correlates negatively with % Δ DBP in males, but not females.
 - : Factor M (Imaginativeness) correlates positively with % Δ DBP in females, but not males.
 - : The Second Order Factor QIV (Dependence-Independence) reveals a striking Sex difference. More 'Independent' females have better outcome, while the reverse applies to males.
2. KDS and SPI: Baseline measures on these parameters do not correlate with outcome at 12 months.

For a detailed Summary of all associations at $P < .05$ from both predicted variables and additional factors, see Appendix (p 328 to 331). There are 72 such associations. In choosing $p < .05$ as the level of statistical significance, an apparently significant finding would occur 1 in 20 times by chance alone (i.e. 3 or 4 correlations).

The following summarizing Tables are therefore considered only for those findings significant at the $p < .02$ level. The pattern of association is shown clearly in this tabular presentation, in particular the fact that quite different associations are evident at each Phase.

The SPI item 'T.E.D' represents 'Total Emotional Disturbance'. Bracketed 16PF Factors (e.g. QI-) are Second Order Factors.

TABLE 49

REFERRAL TO BASELINE PHASE: BASELINE PSYCHOLOGICAL MEASURES
CORRELATING SIGNIFICANTLY ($p < .02$) WITH % Δ BP

	16PF	KDS	SPI	Attitudes	Reported Life Stress
<u>SBP</u>					
<u>Total</u>	Q3	Anxiety Depression	Anxiety Depression T.E.D	-	-
<u>Males</u>	-	Depression	Depression	-	-
<u>Females</u>	-	-	Anxiety T.E.D	-	-
<u>DBP</u>					
<u>Total</u>	E H-	-	-	-	-
<u>Males</u>	L H-	-	-	-	-
<u>Females</u>	L	-	Anxiety	Attitude to Drug Treatment	-

TABLE 50

BASELINE TO DIURETIC PHASE: BASELINE PSYCHOLOGICAL MEASURES
CORRELATING SIGNIFICANTLY ($p < .02$) WITH % Δ BP

	16PF	KDS	SPI	Attitudes	Reported Life Stress
<u>SBP</u>					
<u>Total</u>	G- (QI-)	-	-	-	-
<u>Males</u>	G-	-	Depression	-	-
<u>Females</u>	F- L (QI-)	-	-	Attitude to Drug Treatment	-
<u>DBP</u>					
<u>Total</u>	A- I- (QIII)	-	-	-	-
<u>Males</u>	A- (QIII)	-	-	-	-
<u>Females</u>	E I L	Anxiety	-	Attitude to Drug Treatment	-

TABLE 51

BASELINE TO 12 MONTHS: BASELINE PSYCHOLOGICAL MEASURES ASSOCIATED

SIGNIFICANTLY ($p < .02$) with Δ BP

	16PF	KDS	SPI	Attitudes	Reported Life Stress
<u>SBP</u>					
<u>Total</u>	A-	-	-	-	Work Stress
<u>Males</u>	A-	-	-	-	Work Stress
<u>Females</u>	A-	-	-	-	-
<u>DBP</u>					
<u>Total</u>	A- Q2-	-	-	-	Work Stress
<u>Males</u>	A- Q2- (QIV-)	-	-	-	Work Stress
<u>Females</u>	M	-	-	-	-

Summary of Associations between Baseline Psychological Measures and % Δ BP1. Predictions(i) 16PF Factor E (Submissiveness-Dominance).

There is little support for the hypothesis that E- (submissive) patients would do less well regarding % Δ BP. Two correlations, one concerning males in the pretreatment phase, and the other concerning females in the diuretic phase, are consistent with the hypothesis.

(ii) 16PF Factor L (Trust-Suspicious)

There is some evidence that once drug treatment has been undertaken, those patients with L+ (suspiciousness) traits will do less well regarding % Δ BP. Females in the diuretic phase, males in Phase III (for SBP) show the expected correlation between Factor L and % Δ BP. In the pretreatment Phase, however, a correlation in the opposite direction to that predicted is noted: this may reflect the association between this Factor and Anxiety Measures.

(iii) Life Stress(a) Reported Marital Stress

No support is provided for the prediction that patients reporting such stress will have a poorer outcome.

(b) Reported Family Stress

The only support for the prediction regarding Family Stress comes from the Diuretic Phase for female patients. However, in Phase III a correlation in the reverse direction to that predicted is noted for the combined sexes. Overall, therefore, the hypothesis is not supported.

(c) Reported Work Stress

The prediction regarding Work Stress is supported for male patients, particularly in Phase III. Numbers of employed females is too low to allow adequate evaluation of this dimension in females.

(iv) Attitude to Drug Treatment

In females, but not in males, the prediction that outcome would correlate with 'Attitude to Treatment' is confirmed, for each phase of the Study.

2. Other Findings

(i) The 16PF Factor which correlates most significantly with % Δ BP is Factor A (A- = reserved, A+ = outgoing): A- patients fare better than A+ patients. This trend is evident throughout the Study, more so on Phase III than earlier.

(ii) Other 16PF Factors in which significant correlation may be relevant for particular Phases are -

(a) Factor I (Tough-Sensitive) in the diuretic phase.

(b) Factor M (Practical-Imaginative) in Phase III in females.

(c) Factor Q2 (Dependence-Selfsufficiency) in Phase III in males.

(iii) 'Emotional State' measures (KDS, SPI) correlate strongly with % Δ BP in Phase I, but few consistent patterns appear in the post-treatment Phases (II and III). The correlations are consistently greater with SBP than DBP, and with females rather than males.

SECTION V: OTHER FINDINGS RELEVANT TO RESULTS IN SECTION II

Before interpreting further the results obtained so far, it is necessary to undertake further steps to consider the following factors -

- (1) Whether the psychological measures can be considered independent (predictor) variables.
- (2) Intercorrelation among psychological variables.
- (3) The possible influence of age.
- (4) Differences in BP response between the 4 antihypertensive drugs.
- (5) Characteristics of 'dropouts' during the Study.

1. Stability of Psychological Measures

Since such striking sex differences have been demonstrated at each Phase, the findings will be presented according to sex.

(a) Change in 16PF Measures

In the following 2 Tables, only those measures which have been shown to correlate significantly with Δ BP at the $p < .02$ level of significance at any Phase of the Study, will be considered.

(i) Males

TABLE 52

CHANGES IN 16PF SCORES: BASELINE TO 12 MONTHS: MALES

16PF Factor	Baseline		12 months		t	p (2 tailed) d.f = 39
	Mean	SD	Mean	SD		
A	4.3	2.0	4.6	2.0	-1.01	n.s
G	5.3	2.2	5.2	2.2	.22	n.s
H	4.9	1.5	4.8	1.9	.30	n.s
L	5.9	1.9	5.9	1.8	0	n.s
Q2	5.8	2.5	5.8	2.5	-.06	n.s
QIII	5.7	1.8	5.5	1.9	.79	n.s
QIV	4.9	1.7	5.0	1.7	-.62	n.s

All these factors can be considered independent variables, as none showed significant change during the Study. It is of interest that of the 13 Factors not listed above, (because of lack of significant correlation with % Δ BP at any Phase) only Factor B (Intelligence), shows a significant change ($t = 2.47$, $p = .02$).

(ii) Females

TABLE 53

CHANGES IN 16PF SCORES: BASELINE TO 12 MONTHS: FEMALES

16PF Factor	Baseline		12 months		t	p (2 tailed) d.f = 39
	Mean	SD	Mean	SD		
A	4.3	1.7	4.6	2.1	-.54	n.s
E	5.3	1.9	5.7	2.0	-.64	n.s
F	4.5	1.2	5.1	2.0	-1.17	n.s
I	5.7	2.0	5.9	1.8	-.75	n.s
L	5.1	1.2	5.9	1.3	-1.67	n.s
M	4.4	1.4	4.7	1.8	-.96	n.s
Q1	4.9	1.2	4.8	1.2	.45	n.s

None of these 7 16PF Factors shows a significant change over the 12 months. Of the 13 other Factors not listed above, only QIV (Independence) showed significant change.

Female patients scored higher on 'Independence' at the 12 month stage. ($t = 2.53$, $p = .02$).

In summary, all 16PF measures which correlate significantly ($p < .02$) at any phase with % Δ BP show stability over 12 months. They may be considered as independent variables, or predictors, of % Δ BP.

(b) Changes in KDS and SPI Measures

It is evident from the following tables that unlike 16PF scores, KDS and SPI scores change significantly during the study, and cannot therefore be considered as independent variables.

(i) Males

TABLE 54

CHANGES IN KDS AND SPI SCORES FROM BASELINE TO 12 MONTHS: MALES

	Baseline		12 Months		t	p (2 tailed) d.f. = 39
	Mean	SD	Mean	SD		
KDS Anxiety	8.5	6.1	6.2	6.1	3.26	.001 < p < .002
KDS Depression	16.1	8.9	13.8	9.0	2.08	.05 < p < .02
SPI Anxiety	1.45	.99	.80	.96	4.33	.001 < p < .01
SPI Depression	0.53	0.75	0.53	0.78	0	n.s.
SPI T.E.D.	12.6	8.9	8.0	7.8	4.0	p < .001

The overall trend is toward lower scores and ratings, i.e. improvement in psychological functioning.

It is of interest that the only variable of this group which does not follow the pattern of change in the direction of improvement is SPI Depression. Tables 40 and 44 shows that this item does correlate with % Δ SBP in Phase I and II. It could therefore be considered as an independent variable. However, because the purportedly complementary questionnaire measure (KDS Depression Score) in males does change during the study, little weight can be attached to the significance of this single exception to the general pattern.

(ii) Females

TABLE 55

CHANGES IN KDS SCORES AND SPI SCORES FROM BASELINE TO 12 MONTHS: FEMALES

	Baseline		12 months		t	p (2 tailed) d.f. = 14
	Mean	SD	Mean	SD		
KDS Anxiety	13.8	4.0	8.6	4.4	5.43	p<.001
KDS Depression	21.7	9.5	18.5	11.3	1.52	n.s.
SPI Anxiety	2.27	.88	1.80	1.20	1.00	n.s.
SPI Depression	1.93	.80	1.33	.90	2.2	p<.05
SPI T.E.D.	20.0	10.0	15.1	7.8	1.8	n.s.

Comparison of this Table with Table 54 reveals that the trend toward reduced levels of emotional 'State' as measured by these instruments is less evident in females than in males. In Table 44 it was seen that KDS Anxiety correlated significantly with Δ DBP in Phase II (diuretic phase), but since the KDS Anxiety Score itself is now seen to change significantly during the study, it cannot be considered an independent (predictor) variable of BP change. The fact that patients were not assessed psychologically at the end of the diuretic phase limits the extent to which the correlation can be interpreted further.

(c) Changes in 'Attitude to Drug Treatment' Ratings

TABLE 56

CHANGES IN 'ATTITUDE TO DRUG TREATMENT' RATINGS FROM BASELINE TO 12 MONTHS

	<u>BASELINE</u>		<u>12 MONTHS</u>		t	d.f. p (2 tailed)	
	MEAN	S.D.	MEAN	S.D.			
All patients (N=55)	1.84	.86	1.56	.98	1.79	54	n.s.
Males (N=40)	1.85	.80	1.70	1.1	0.85	39	n.s.
Females (N=15)	1.80	1.01	1.20	.41	2.07	14	n.s.

It is seen that statistically significant changes in 'attitude' ratings have not occurred between baseline and 12 months: 'Attitude to Drug Treatment' may therefore be considered an independent variable.

(d) Changes in Reported Work Stress Scores

TABLE 57

CHANGES IN REPORTED WORK STRESS SCORES FROM BASELINETO 12 MONTHS

	<u>BASELINE</u>		<u>12 MONTHS</u>		χ^2	d.f.	p
	PRESENT	ABSENT	PRESENT	ABSENT			
All patients (N=45)	9	36	10	35	2.51	1	n.s.
Males (N=40)	7	33	8	32	1.94	1	n.s.
Females (N= 5)	2	3	3	2	Fisher's exact test = .70 n.s.		

It is evident that Reported Work Stress ratings do not vary significantly in the course of the study, and Reported Work Stress may therefore be considered an independent variable in further analysis.

(e) Summary of 'Stability of Psychological Measures'

Independent variables have been defined as those which do not show a statistically significant change ($p .02$) from baseline to 12 months. By this criterion the following variables have been revealed:-

- PHASE I: 1) Males: SBP:SPI Depression
DBP:16PF H, 16PF L
- 2) Females: SBP: SPI Anxiety, SPI T.E.D.
DBP: SPI Anxiety, Attitudes to Drug Treatment
- PHASE II: 1) Males : SBP: 16PF G, SPI Depression
DBP: 16PF A, 16PF QIII
- 2) Females: SBP:16PF F, 16PF L, 16PF QI, Attitude to
Drug Treatment
DBP: 16PF E, 16PF I, 16PF L, Attitude to
Drug Treatment
- PHASE III: 1) Males : SBP: 16PF A, Reported Work Stress
DBP: 16PF A, 16PF Q2, 16PF QIV,
Reported Work Stress
- 2) Females: SBP: 16PF A.
DBP: 16PF M.

2. Intercorrelation among psychological variables

For present purposes, only the associations concerning the "independent variables" listed above, will be considered.

(a) Males

TABLE 58

CORRELATIONS AMONG SIGNIFICANT PSYCHOLOGICAL MEASURES: MALES

	PHASE I		PHASE II		PHASE III	
	r	p	r	p	r	p
SBP 16PFG/SPI Depression 16PFA/Rep. Work Stress			.24	.04	.23	.05
DBP 16PFL/16PFH 16PFA/16PFQIII 16PFA/16PF Q2 16PFA/16PF QIV 16PFQ2/16PF QIV 16PFQ2/and Rep. Work Stress 16PF QIV and Rep. Work Stress	-.41	.001	-.57	.001	.14 .16 .48 .04 .09	.001

The association between 16PFL and 16PFH ($r = -.41$, $p = .001$) is of particular interest because scores on these 2 Factors show zero correlation in the general population (16PF Handbook, 1970). It will be necessary to consider that H- ("threat sensitivity" and L+ (suspiciousness) are more closely related in this hypertensive group than in the general population, and the scales may represent overlapping expressions of a basic psychological influence.

The fairly high correlations between 16PF and 16PF QIII, and between 16PF Q2 and 16PF QII, are to be expected as these First Order Factors are known to contribute significantly with others to the Second Order QIII and QIV Factors respectively. There is probably little to be gained

from considering the Second Order Factors separately from this point, since they reflect a dominant contribution from the clearly defined Primary Factors A and Q2 respectively.

The weakly positive correlation between Factor A and Reported Work Stress is an indication that A+ (outgoing) persons report more work stress than A- (reserved) persons, but the association is not strong enough to consider them as a single influence.

The same deduction applies for the observed association between 16PF Factor G and SPI Depression.

(b) Females

TABLE 59

CORRELATIONS AMONG SIGNIFICANT PSYCHOLOGICAL MEASURES: FEMALES

	PHASE I		PHASE II		PHASE III	
	r	p	r	p	r	p
SBP						
SPI/Anxiety/SPI T.E.D	.70	.001				
16PFF/16PFL			.72	.001		
16PFF/16PF QI			.60	.003		
16PFF/16PF QI			.26			
16PFF/Attitude			.09			
16PFL/Attitude			.10			
16PF QI/Attitude			.29			(16PFA alone)
DBP						
SPI Anxiety/Attitude	-.18					
16PFE/16PFI			-.31			
16PFE/16PFL			-.32			
16PFI/16PFL			-.19			
16PFE/Attitude			-.34			
16PFI/Attitude			.40	.04		
16PFL/Attitude			.10			(16PFM alone)

The high intercorrelation between SPI Anxiety and SPI T.E.D. ($r=.70$, $p=.001$) means that in further analysis either measure may be used.

Since Factor F contributes strongly to Factor QI, little may be gained from considering the Second Order Factor separately. The high correlation

($r = .72$, $p = .001$) between Factors F and L will need to be considered in further analyses. None of the correlations between 16PF Factors and 'Attitude' scores appear high enough to warrant excluding the latter variable, although the correlation between 'Attitude' and Factor I is noteworthy ($r = .40$, $p = .04$).

(c) Summary of Intercorrelation among Psychological Measures.

(i) Males: Factors A, G, and Q2 may be considered as separate independent variables.

: Factors H and L are moderately correlated ($r = -.41$)

: SPI Depression)
Reported Work Stress) are not highly correlated with any other variable.

(ii) Females: Factors A, I and M may be considered as separate influences.

: Factors F and L are fairly highly correlated ($r = .72$, $p = .001$)

: Factor I is the only 16PF Factor correlating with 'Attitude' scores ($r = .40$, $p = .04$)

: SPI Anxiety and SPI T.E.D. are highly interrelated ($r = .70$, $p = .001$).

(3) Age

In the following Tables, the association between age and each of the other relevant variables is described.

(a) Age and %ΔBP

TABLE 60

CORRELATION BETWEEN AGE AND %ΔBP AT EACH PHASE

	Referral to Baseline		Baseline to Diuretic		Baseline to 12 months Combined Treatment	
	r	p	r	p	r	p
SBP						
Males	-.08		.13		.15	
Females	.21		-.02		-.10	
DBP						
Males	-.21		.01		.29	.03
Females	.08		.16		-.15	

It is seen that the only correlation approaching significance is that in males between age and %ΔDBP at Phase III. It is therefore necessary to carry out partial correlational analysis for the observed relationships between relevant psychological variables and %ΔDBP in Phase III (See Table 46). These variables are Factors A, and Q2. The correlations of Factors A and Q2 with age in males are .09 and -.06 respectively (see Table 61).

$$\text{Using the formula } r_{j.k} = \frac{r_{i.j} - (r_{i.k})(r_{j.k})}{\sqrt{1-r_{i.k}^2} \sqrt{1-r_{j.k}^2}}$$

where i = the independent variable (e.g. Factor A), j = the dependent variable (%ΔDBP) and k = the control variable (age); the partial correlation coefficient r may be determined.

- (i) From Table 46, $r = -.50$ ($p = .001$) for 16PFA and %ΔDBP. After allowing for age by the formula above, $r = .58$ ($p = .001$).

(ii) From Table 46, $r = -.44$ ($p = .001$) for 16PF Q2 and % Δ BP.

After allowing for age by the formula above, $r = -.48$ ($p = .001$).

Therefore, in both instances the effect of allowing for the age factor has been to enhance the association between 16PF variables and % Δ BP. (See Table 46).

(b) Psychological Measures

Only those psychological measures which have been found to correlate significantly at any Phase are depicted in the following tables.

(i) 16PF and Age

TABLE 61

CORRELATION BETWEEN AGE AND BASELINE 16PF SCORES

16PF Factor	Males (N=54)		Females (N=21)	
	r	p	r	p
A	.09		-.07	
E			.05	
F			-.28	
G	.30	.01		
H	.21			
I			-.11	
L	-.32	.01	-.11	
M			-.20	
Q2	-.06			

Since there are significant correlations regarding Factors G and L, in males, it will also be necessary to study the partial correlation coefficients to determine whether the apparent significant correlations regarding % Δ BP (in Phases II and I respectively, see Tables 42 and 38 respectively) remain thus after taking the age factor into account.

The partial correlation coefficients have been calculated according to the formula shown on p 202. The results are shown in the following table.

TABLE 62

COMPARISON OF CORRELATION COEFFICIENTS BETWEEN 16PF FACTORS AND % Δ BP BEFORE AND AFTER AGE CORRECTION.

	r	p	r	p
			partial	
<u>Phase I</u>				
Males: 16PF L and % Δ DBP	.32	.01	.27	.01 < p < .02
<u>Phase II</u>				
Males: 16PF G and % Δ SBP	-.40	.002	-.46	p < .005
<u>Phase III</u>				
Males: 16PF A and % Δ DBP	-.50	.001	.58	.001
16PF Q2 and % Δ DBP	-.44	.001	-.48	.001

It can be seen that, as a result of calculating partial correlation coefficients, the correlations remain statistically significant at $p < .02$ for Factors L (Phase I), Factor G (Phase II), and Factors A and Q2 (Phase III).

(c) KDS, SPI, ATTITUDE TO DRUG TREATMENT, and AGE

TABLE 63

CORRELATION BETWEEN AGE AND BASELINE KDS and SPI SCORES

	Males (N=54)		Females (N=21)	
	r	p	r	p
KDS Depression	.09			
SPI Anxiety			.36	
SPI Depression	.10			
SPI T.E.D			.36	
Attitude to Drug Treatment			-.26	

None of these is statistically significant .

(d) Reported Work Stress and AgeTABLE 64RELATIONSHIP BETWEEN AGE AND REPORTED WORK STRESS: MALES

REPORTED WORK STRESS					
Present (N=11)		Absent (N=43)		t	d.f p(2 tailed)
Mean Age	SD	Mean Age	SD		
38.3	11.8	45.0	9.8	1.90	52 .02<p<.05

A significant association is seen to exist between age and reported work stress in male patients, with a higher incidence in younger patients.

(e) Summary

- (1) For male patients, correcting for age by partial correlation analysis makes no significant change in correlations between specific scales and % Δ BP. Reported Work Stress is however related to age.
- (2) For females, no significant association with age are seen for BP or psychological variables.

4. Differences in BP response between the 4 antihypertensive drug groups.

The following Table indicates that the Bethanidine group showed less % Δ BP than the other 3 groups. The greatest difference is seen to occur between Bethanidine and Methyldopa (12.6% \pm 3.7 compared with 22.6% \pm 3.2) for SBP. However, even this apparent difference does not reach statistical significance at the $p < .05$ level ($t = 2.04$, d.f. = 23, $p > .05$). No other significant differences occur.

TABLE 65

COMPARISON OF BP RESPONSE BETWEEN THE 4 DRUG GROUPS: BASELINE TO 12 MONTHS

	Bethanidine Group N=11		Clonidine Group N=13		Methyldopa Group N=14		Oxprenolol Group N=17	
	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.
% Δ SBP	12.6	3.7	18.1	4.2	22.6	3.2	18.3	1.9
% Δ DBP	14.7	3.9	15.4	3.5	18.6	3.0	17.9	2.5

The trend toward less reduction of SBP in the Bethanidine group may be partly explained by the fact that in this analysis the supine BP level rather than the standing BP level has been used. Of the 4 drugs, Bethanidine is the only one known to induce significant orthostatic postural changes (because of the postganglionic blocking action); the supine level is characteristically higher than the standing level, which dictates the extent to which dosage can be increased as symptoms related to postural hypotension begin to occur.

It may be concluded that for purposes of the present study it is legitimate to consider the 4 groups as a whole, as has been done in this section. There are certain differences in psychological correlates of % Δ BP between the 4 drug groups, but analysis of these differences is not central to the theme of this study.

Regarding the dosage levels of the antihypertensive drugs which were prescribed, there was little departure from routine clinical practice in this study. The dosage level was gradually increased according to response until a satisfactory BP level was obtained, or until such increase was prevented by the occurrence of unacceptable side effects. Thus, some patients showed a satisfactory therapeutic response on small dosage; others showed a satisfactory therapeutic response only when the dosage was increased; a minority failed to show satisfactory therapeutic response even when dosage levels were much greater than the mean for the group. The occurrence of unacceptable side effects also showed great inter-patient variability, and was not simply related to drug dosage. In a few instances where satisfactory response was not obtained but side effects were unacceptable, the patient was dropped from the study, as the methodological requirement precluded the use of an extra drug (e.g. a vasodilator as in 'triple therapy') during the 12 months assessment period.

An account of the various reasons for 'dropouts' is provided in the next segment.

5. Withdrawals and Losses

Case vignettes of the 20 patients who were not available for 12 month follow-up are provided in the Appendix (p 296). The reasons are diverse but some categorization is possible as follows:-

1. 2 patients: no antihypertensive therapy except diuretic therapy required (Numbers 61, 73).
2. 1 patient : preferred alternative (private) supervision of treatment (No. 31).
3. 1 patient : 12 month assessment time not reached when data analysis performed (No. 72).
4. 5 patients: "non-compliant":- failed to continue follow-up.
(Nos. 13, 43, 58, 65, 68)
: All 5 drugs were involved, with a single case each.
: Younger males are over-represented - all 3 males under 25 (Nos. 13, 65, 68) dropped out of regular follow-up.
5. 7 patients: "Side effect failures" (Nos. 1, 7, 66, 69, 70, 71, 74).
: Drugs implicated were cyclopenthiazide (2), methyldopa (4), bethanidine (1).
6. 1 patient : "treatment failure" (No. 36): drug was methyldopa.
7. 1 patient : toxic psychosis (No. 34): drug was bethanidine (interacting with a tricyclic antidepressant).
8. 2 patients: fatal cardiovascular complications (Nos. 35, 75).
Drugs used in these 2 cases were bethanidine and clonidine respectively.

The question arises whether these non-completers are representative of the patient group as a whole, on psychosocial characteristics. It has already been shown (Tables 14 and 15, p 151 and 152) that as far as mean BP levels at the baseline and postdiuretic stages were concerned, the reduction of the total did not result in significant changes: those who were lost to follow-up were neither more nor less hypertensive than those who remained. It is useful to consider the baseline psychological characteristics of the 16 patients who encountered significant difficulties (categories 4 to 8 above - Cases 13, 43, 58, 65, 68, 1, 7, 66, 69, 70, 71, 74, 36, 34, 35, 75) in relation to the total group scores.

The 4 patients (31, 61, 72, 73) in the "non-problem" category are not included in the following analysis. Statistical analysis is based on scores tabulated in pages 303 to 314 of the Appendix.

- (1) Sex ratio: Females accounted for 4 of the 16 noncompleters (25%) and a similar proportion, 15 of 55 completers (27%).
- (2) Age: The noncompleters were younger (38.5 ± 12.6 yrs) than the completers (45.6 ± 8.4 yrs). The differences were significant at $p < .05$ ($t = 2.10$, $d.f = 69$).
- (3) 16PF Factors: Of the 9 First Order Factors also shown to correlate significantly with $\% \Delta BP$ at at least 1 Phase of the study, only Factor L (trust-suspicion) shows a clear difference between completers and noncompleters. For completers, mean $L = 5.7 \pm 1.8$ and for noncompleters $L = 7.6 \pm 1.7$ ($t = 3.85$, $d.f = 69$, $p < .001$ for a 1 tailed test). Differences regarding Factor Q2 (dependence-selfsufficiency) are just outside the .05 level: for completers $Q2 = 5.7 \pm 2.5$, for noncompleters $L = 6.5 \pm 1.9$, ($t = 1.39$, $.05 < p < .10$).

- (4) Emotional 'State' scores: No KDS or SPI score differentiates the two groups, although all are higher for the noncompleters.
- (5) Attitude ratings: In view of the significant findings concerning Factor L, it is of particular interest that the conscious attitude to treatment is no different between the 2 groups.
- (6) Work Stress ratings: 7 of 45 completers reported work stress, as did 5 of 13 noncompleters. While there is a clear trend for noncompleters to have an increased incidence, this does not quite reach the $p = .05$ level of significance ($\chi^2 = 3.23$, d.f. = 1, $.05 < p < .10$).
- (7) Drug Group: 5 noncompleters were in the Methyldopa group, 4 in the Bethanidine Group, and 2 each in the Clonidine and Oxprenolol Group. The differences are not significant statistically.

Summary of findings regarding losses and withdrawals

Patients failing to complete the course were younger, and showed a clearly higher level of 'suspiciousness' as measured by 16PF Factor L. There were trends toward an increased incidence of reported work stress, and to higher scores on selfsufficiency (Q2+) for the noncompleters.

Therefore, those remaining in the study and who are the subject on which all the correlational analyses have been carried out, are not entirely representative of the original cohort of 75 patients. Those with traits of suspiciousness, and possibly also of selfsufficiency, were less likely to remain in the study, especially if they were younger patients.

Apart from the variable of age, the findings concerning Factors L+ and Q2+ and Work Stress were all consistent with those depicted in Section IV regarding correlations with Δ BP. The presence of these items reduced the likelihood of satisfactory outcome at 12 months, either by failure to complete the course on the one hand, and by other less obvious mechanisms in those who remain in the study.

6. Summary of "Other findings relevant to results in Section IV"

(1) Stability of Psychological Measures

- (i) The 16PF primary Factors which have been shown to correlate at $p < .02$ with BP change at any Phase (A,E,G,H,I,L,M,Q2) do not themselves change significantly over the 12 month period.
- (ii) Certain SPI ratings (Depression in Males, Anxiety in Females) do not show significant change (e.g. K.D.S scores).
- (iii) Ratings of Attitude to Drug Treatment, and of Reported Work Stress, are also basically stable over the 12 months period of followup.

All these variables may therefore be considered independent (predictor) variables of Δ BP.

(2) Intercorrelations among Psychological Measures

Of the variables mentioned in (1) above, significant correlations occur between Factors H and L in males, and between Factors F and L in females. Factor I also correlates with 'Attitude' ratings in females.

(3) Age

The only significant relationship between age and any variables indicated above is between Work Stress and age in males. Younger male patients have a higher incidence of Work Stress.

(4) Difference in BP response between the 4 antihypertensive drug groups

The BP changes for the 4 groups do not differ significantly; the widest difference is between Bethanidine and Methyldopa for $\% \Delta$ SBP, but this difference does not reach the 5% level of significance.

(5) Withdrawals and Losses

Regarding the 20 patients failing to receive 12 month assessment followup, in 6 cases the 'dropout' was due to diverse problems and complications which arose. The noncompleters were not different from "completers" regarding initial BP levels, but there were differences on other parameters, particularly age and 16PF Factor L. Younger more suspicious patients were over-represented among noncompleters.

SECTION VI: SUMMARY

This section represents a further distillation of the summaries of the 5 Sections, which have been described on pages 143-44, 153, 162, 191-92, and 211 respectively.

1. The Sample.

The Study sample of patients (N=75) were predominantly male (N=54) and married, (80%) with a mean age of 44 years. Compared with the Clinic population, females were underrepresented. Known duration of hypertension varied widely, and only a minority had required hospitalization related to the hypertension.

2. BP levels.

Supine BP levels varied from a mean of 195/120 mm Hg at referral, to a mean of 174/111 mm Hg at baseline clinic assessment. For the 71 patients who completed diuretic therapy above (cyclopentiazide), mean BP level dropped to 161/102 mm Hg. For the 55 patients who went on to complete 12 months combined treatment with one of the four antihypertensive drugs (Bethanidine, Clonidine, Methyldopa or Oxprenolol), mean BP dropped further to 141/92 mm Hg. No differences between the sexes were found regarding BP reduction, and mean BP levels for the 20 who failed to complete the study did not differ at baseline from those who did complete the full course.

3. Psychological Measures at Baseline

In contrast to baseline BP levels which were similar for both sexes, there were clear sex differences on many psychological measures. Both the self report (KDS) and Interview Schedule (SPI) ratings revealed higher scores for Anxiety and Depression in females, while marital and family stresses were also reported significantly more frequently by females than by males. There was a range of positive

to negative attitudes to forthcoming drug treatment, with one quarter of the sample having prevailing doubtful or negative views about outcome.

4. Associations between Baseline Psychological Measures and Change of Blood Pressure.

No psychological variable correlated at all three phases (pre treatment, diuretic, combined drug treatment) for both $\% \Delta$ SBP and $\% \Delta$ DBP, for both sexes. Rather, certain variables correlated clearly at one phase but not another, or for one sex but not for the other.

- (1) Predictions: The prediction that E-(submissive) persons would do less well was fulfilled only to limited extent, with two correlations at a significant level.

The prediction that L+ (suspicion) persons would do less well was clearly borne out for females in the diuretic phase, but not elsewhere. Indeed, in Phase I L+ persons tended to show a greater reduction of blood pressure than L+ persons.

The prediction that Reported Life Stress would be associated with poorer outcome was clearly seen for male patients regarding Work Stress over the 12 month Phase, but findings regarding Marital Stress and Family Stress in general did not support the prediction.

The prediction that 'Attitude to Drug Treatment' would correlate with poorer outcome was fulfilled for females at each Phase, but not for males.

(2) Other Findings

The personality trait most closely associated with $\% \Delta$ BP was Factor A (A- = reserved, A+ = outgoing): A- patients fare better than A+ patients. This association is present at each Phase, usually for both sexes, and is stronger for

Phase III.

Other 16PF Factors (I, M, Q2) show significant correlation at specific Phases, for one or other but not both sexes.

Phase I (Pretreatment) is the only Phase at which measures of emotional state (KDS, SPI) are clearly associated with Δ BP; the relationship is particularly evident for Δ SBP, in females.

5. Other Findings relevant to positive associations described above

The 16PF Factors are stable over 12 months, and can be regarded as independent (predictor) variables. Ratings of Attitude to Drug Treatment, and Life Stress ratings, are also basically stable during the study. However, KDS and SPI scores tend to show change (improvement) and cannot therefore be regarded as independent variables.

Intercorrelation among the relevant psychological variables is generally low, exceptions being 16PF Factors H & L in males, and F & L in females.

Regarding age, the only significant influence is that regarding Reported Work Stress, this tending to occur in younger male patients. Differences in BP response between the 4 drug groups were small, with a trend to slightly less SBP reduction in the Bethanidine Group, but this did not reach statistical significance so the 4 groups could be considered together regarding psychological variables.

Regarding withdrawals and losses for diverse reasons 20 patients could not be followed up over 12 months. There was a clear trend for the 'dropout' group to show personality differences regarding Factor L (Trust-Suspicion) with L+ patients following prediction in

having less satisfactory outcome. The other correlation concerned age, younger patients tending to drop out to a greater extent.

The implications and meanings of these results, in the light of related studies, are considered in the next Chapter.

CHAPTER VDISCUSSION

This Chapter is arranged as follows: -

1. Introduction
2. Methodology
3. Pre-treatment data and comparison with data from other studies
4. BP Changes and comparison with data from other studies
5. Predictions
6. Other positive findings.

1. INTRODUCTION.

The basic aim of this study has been to delineate specific psychological characteristics of 75 hypertensive patients using questionnaire and interview methods, and then to see whether the progress of the patient in treatment as far as BP change is concerned, is related to these psychological characteristics

The present study differs fundamentally from the majority of previous studies linking personality with BP levels.

Most studies which have attempted systematically to correlate psychological attributes with BP levels have been of the 'between groups' type, using a comparison group of nonhypertensives subjects as controls. Such studies include those of Hamilton (1942), Sainsbury (1964), Robinson (1962), Davies (1970) and Kidson (1971). Some of these studies have also included a 'within-group' analysis, for example, in Kidson's study, correlation between the level of BP and personality characteristics were examined for the hypertensive subjects. A study which consisted solely of a 'within group' analysis was that of Pilowsky, Spalding, Shaw and Korner (1973), in which selected psychological characteristics were correlated with a variety of physiological parameters in EH patients.

These studies were all basically 'cross-sectional'; BP and personality data were obtained at one point in time, and correlational analysis was then carried out. The present study differs from all of these in that it has a longitudinal perspective, and is of a 'within-group' type, with no control group for comparison. A control group would have needed to have been a non-treatment group: on ethical grounds this was not considered feasible, in the light of studies demonstrating the efficacy of antihypertensive treatment for patients with moderate essential hypertension (e.g. the Report of the Veterans Administration Study Group, 1970).

A study from the era before effective pharmacotherapy in which an attempt was made to describe the influence of psychological factors on onset, symptoms, course and complications of the condition was that of Reiser, Brust, Shapiro, Ferris, Baker and Ranschoff (1951). Data concerning 250 patients over a 5 year period were assessed retrospectively: the psychological appraisal varied from a superficial psychiatric assessment to intensive psychotherapy in a minority of patients. The degree of correlations between meaningful life situations and the course of the condition was considered to be a function of the depth of knowledge of the patient's personality: in 19 patients receiving insight psychotherapy, 100% "correlation" was noted!

In a review of psychosomatic aspects of essential hypertension, Leigh (1971) cautioned against drawing conclusions from studies in which groups of patients were unselected, where the influence of drugs given for the patients psychological state were not considered, and where psychosocial variables were not quantified. Acknowledging the difficulties inherent in achieving the latter goal, he also emphasised the virtues of the longitudinal approach "the most promising lines of research involve long term investigations of psychosocial changes occurring in the life of the individual".

2. METHODOLOGY

Several methodological issues have been considered in Chapter III. Differences between the ideal research setting and the real clinical situation in which the writer found himself have been summarized on p106. In this section there will be further consideration of some of these issues.

(i) BP levels

Since fluctuations in BP level during daily life are known to be considerable (in some instances as great as the overall fall during the study), even the most careful indirect method used in the present study (see p 112) could not altogether remove the effect of transient emotional states on the BP level recorded in the Clinic. The incidence of bias and variation were undoubtedly higher for the 'Referral BP' levels, whereas the Clinic readings were carried out in a highly standardized routine by a single person. Variation was also noted between the right arm and the left arm, and between supine and standing levels. Throughout the analysis of results, the supine level in the right arm has been selected as in clinical convention.

(ii) Questionnaire data

(a) 16PF

Criticism can be made of questionnaire data at a general level, and also with regard to the specific test. While the 16PF is relatively comprehensive in its coverage of personality dimensions compared with many personality questionnaires, and has the virtue of being oriented to functional measurement of natural personality structures, the information obtained from it is nonetheless restricted and selective. The specific form used (Form C), while deemed the most appropriate at the

beginning of the study, is not the final product of its creator. Cattell (1973) indicates that for the future, the adult personality questionnaire will draw on 23 primary factors and 12 secondary factors instead of 16 and 4 respectively as at present.

Another constraint is that the theme of 'suppressed hostility' running through the psychological literature on essential hypertension is not specifically depicted by any First Order or Second Order Factor. The dimensions of Factors E (Dominance/Submissiveness), H (Timidity/Boldness) and L (Trust/Suspicion) may nonetheless be taken to reflect relevant aspects of disposition of aggression.

Behaviour in the testing situation and attitudes toward testing are known to be important; cooperativeness, and an adequate educational level are necessary. The balance of factors between educational level, predicted fatigue in testing, and the fostering of a cooperative attitude led to the choice of Form C rather than the longer Form A or B in the present study. Form C does include a Motivational Distortion score which enables one to assess the "motivational role distortion in which either consciously or unconsciously the subject gives a picture of himself distorted by the prism of his own personality in the given testing role" - Cattell, Eber and Tatsuoka (1970). Bearing in mind the constraints in interpretation imposed by motivational distortion, Cattell (1970) advises "the best way to reduce distortion effects is probably in the test administration itself, by taking time to get rapport and to convince the individual that if he is taking the trouble to take a test, his own best interests in the long run are served by avoiding misrepresentation". While this advice may be more obviously pertinent in testing for job selection, for example, than in a clinical study where personality testing was but one part of a comprehensive workup, close attention was paid to the matter of cooperative involvement in the present study.

The nursing Sister who administered the 16PF had met the patients on at least 3 occasions before the test was given, and had spent considerable time and effort explaining and preparing for the various physical and psychological assessments. She was on hand to check any problems in completion of the tests. All 75 patients completed the test, and all 55 who remained in the study for 12 months completed it a second time; this 100% retrieval was mainly due to her efforts in facilitating a positive attitude to the assessments. The physicians in the study, and the psychiatrist who interviewed the patients, also attempted to reinforce this attitude toward completion of all questionnaire material with frankness and honesty. It is recognized that even with these attempts at maximizing cooperation, there are still limitations imposed by lack of self awareness and 'social desirability' responses.

(b) KDS

This questionnaire in comparison to the 16PF is as an infant is to an adult, with remaining uncertainties regarding future status. The primary use of this instrument was to tap repetitively the 'current state' with particular regard to symptoms which might be considered drug-related, a purpose outside the frame of reference of this thesis. It has been retained in this analysis because two interesting points emerged (i) in the pre-treatment phase the change in SBP appeared related to various apparent 'arousal' measures including KDS Anxiety and Depression scores following drug treatment, the 'emotional state' as measured by KDS scores, is not predictor of change, but rather is another dependent variable (in contrast to 16PF scores).

(iii) Interview Data

Clearly, only a fragmentary knowledge of another person's state of mind is obtainable by a brief structured interview. The SPI is a "screening" assessment rather than a comprehensive appraisal of subtleties of personality functioning. The author had familiarized himself with it in another study (involving asthmatics), and high interrater reliability had been found (about 0.90). It would have been an advantage to have repeated a reliability assessment using hypertensive patients, as hypertensives may pose special problems in attempts to elicit meaningful self disclosure, particularly in matters of emotional significance to the patient (Handkins and Munz, 1978). The ratings of 'Attitude to Drug Treatment' would also ideally have been made by 2 raters independently, at least on a sample of patients with essential hypertension. These conditions were not practicable at the time the writer was embarking on the assessments for the study. Regarding 'Reported Life Stress', the problem of emotional denial could not be overcome altogether in the interview situation, although steps were taken to reduce that source of bias as much as possible (see p 130). At the conclusion of the Study 30 spouses were interviewed, and in general a higher degree of life stress was reported by the spouse. The writer was also able to interview a number of patients in depth after the 12 months stage, an option he was reluctant to take during the 12 months because of the potential confounding through another influence on treatment outcome.

3. PRE-TREATMENT DATA AND COMPARISON WITH DATA FROM OTHER STUDIES.

1. Sex Ratio

The male/female ratio for the study group patients was 2.7:1, as compared with a ratio of 0.7:1 for Clinic patients (Table 1 , p 136.). The sex ratio is approximately equal in population surveys of essential hypertension. The difference is probably largely explained by the fact that one of the criteria for exclusion was the concurrent use of oral contraceptive medication in females. This was deemed necessary in view of the known influence of the hormones on the renin-angiotension-aldosterone system, and on the incidence of high BP readings in women taking these agents.

The detection of hypertension was also found to be earlier in males than females in the present study, and this probably reflects this selection bias with relative exclusion of the younger female hypertensive. In view of the selection bias, one option would have been to exclude the female patients from the statistical analyses altogether. However, much valuable data has been derived from a study of male/female differences on a variety of psychological measures, and these differences are not simply age dependent.

2. Severity of Hypertension

The mean BP levels at baseline were essentially determined by the criteria set to permit entry to the study, and the mean of 174/111 mm Hg indicates that the hypertension was overall of moderate severity.

The criterion of exclusion for persons with significant target organ damage is another indicator of the level of severity of hypertensive disease in these patients.

Since the criterion for entry was two DBP readings >110 mm Hg in the standing or supine position, a number of patients whose mean supine DBP on four readings was <110 mm Hg did enter the study, and some of these would have been 'labile' or 'borderline' hypertensives, although the majority of such patients had been excluded following assessment at the baseline phase.

3. Psychological Correlates

(i) 16PF Profile: "Neuroticism" and Essential Hypertension: Comparison with other Studies.

The comparison of the 16PF profile in these patients with those provided in the 16PF Handbook (1970) for normal subjects, general neurotics, anxiety neurotics, obsessive-compulsive neurotics, inadequate personalities, and psychosomatic patients reveals similarities at a statistically significant level (see page 156), only with the profiles for (i) normal subjects and (ii) psychosomatic patients and (iii) paranoid patients.

While the characteristics of the patient populations making up the majority of the clinical subgroups are not fully specified in the 16PF Handbook, (e.g. regarding age or sex ratio) the finding that the hypertensive subjects in the present study do not have a 'neuroticism' profile is of considerable interest in the light of previous studies in which neuroticism scores in hypertensive subjects were examined.

In most other studies, the Eysenck Personality Inventory (EPI) Neuroticism Score has been used as the measure of neuroticism, rather than the Neuroticism score of the 16PF, which is derived from a number of first order Factors. Comparisons between EPI Neuroticism ratings and the 16PF profiles are therefore indirect and approximate, but not without value. In the earliest study, Sainsbury (1960) had found that hypertensives scored higher on the Neuroticism scale of the Maudsley Personality Inventory (from which the SPI was derived) than a control group of medical outpatients, and concluded that hypertensives, together with other 'psychosomatic' patients, appeared to be intrinsically more neurotic than non psychosomatic patients.

Robinson (1964) confirmed Sainsbury's findings for outpatient hypertensives, but found that hypertensives in a random sample of the population did not score differently from non hypertensives on Neuroticism measures. This suggested that it was not the high BP itself which was associated with neurotic personality traits, but some factor possibly related to selection for hospital treatment, either because of symptomatology or through selection at the general practice level.

This line of thinking was further investigated by Cochrane (1969) who found in general practice populations no difference in EPI Neuroticism scores between hypertensives, normotensives, and persons who attended doctors but in whom BP levels were not recorded. He suggested that the higher scores found by the two previous workers in outpatient populations, might be attributable to side-effects of drugs which may have been reported as symptoms by the patients who

completed the Neuroticism scales.

Cochrane's conclusions could also partly explain Kidson's (1971) finding that male hypertensives were significantly more neurotic on the EPI Scale than non patient subjects. Kidson also studied a non hypertensive group and found no differences on EPI scores between those with low and those with high BP.

Davies (1970), had used the EPI to survey 128 male factory workers, and found an inverse relationship, namely that those with the highest BP levels had lower Neuroticism scores than those with the lowest BP levels. This latter finding was taken to be consistent with the theory that an inability to express feelings directly, or indirectly via neurotic symptoms, was associated with the tendency to develop high blood pressure, as had been postulated by the earlier psychoanalytic writers, (Saul, 1939, and Alexander, 1939).

The finding in the present study of a lack of correlation with the general neurotic profile on the 16PF (profile similarity co-efficient $r_p = .06$) lends support to the conclusions of Robinson, Cochrane and Kidson, that in an untreated population no correlation will be found between neuroticism and high blood pressure.

(ii) Measures of "Current Emotional State" : Comparisons with other studies.

It is of interest to compare the findings in the present study with some other studies in which these aspects have been systematically examined. The comparisons in most cases must again be indirect and approximate as different measures of anxiety and depression have been used, with few exceptions. For example, no studies have been discovered in which the KDS scales have been used in hypertensive subjects.

The Standardised Psychiatric Interview (SPI) has been used in a study by Mann (1977), who provided psychiatric assessment in a British Medical Research Council multicentre trial of treatment for mild to moderate essential hypertension. Data on individual symptoms is not described, as it has been in the present study (Table 20, p159), and the author used the total interview score (derived as shown on page 125) to designated groupings of patients as neurotic (scores of 17 and above), dysthymic (8 to 16), and non neurotic (less than 8). He interviewed 108 subjects, 55 of whom were hypertensive and 53 normotensive, matched for age and sex.

The proportion of cases in each category, in the 55 persons designated hypertensive was:-

neurotic	16	(29%)
dysthymic	10	(18%)
non neurotic	29	(53%)

This may be compared with findings in the present study of 75 patients when scores are categorized in the same way:-

neurotic	32	(43%)
dysthymic	21	(28%)
non neurotic	22	(29%)

While there is seen to be an apparently higher proportion of 'neurotic' cases in the present series, the two series of subjects are not directly comparable in other respects. For example, regarding level of BP, the designation 'hypertensive' in Mann's series was made if there were two DBP readings > 90 mmHg, whereas a cut-off point of 110 mmHg was used in the present study. There may also be sex differences between the two groups; the male/female ratio is not specified in Mann's series so comparisons of scores of females and males separately cannot be made. In the present series females were found to score significantly higher than males (see Table 21 p160).

In the present study, no significant correlations were found between BP level at baseline and measures of 'current emotional state' (KDS and SPI). In another segment of Mann's study, the General Health Questionnaire (GHQ) (Goldberg, 1970) was used to assess 12,700 persons in general practice, and no differences were detected between those with hypertension and those with normal pressure. Whether the patients were aware of their BP level or not made no difference to this finding, which supports those studies which have failed to show a direct positive correlation between neurotic symptomatology and BP level in untreated persons.

The incidence of anxiety symptoms in hypertensive persons has been examined by Wheatley and Hordern (1977) in a study of the General Practitioner Research Group in Britain. These workers found a high incidence of anxiety symptoms, i.e. 185 (91%) of 204 hypertensive patients in the study. In 45 of these, complete records for three separate anxiety measures (physician rating, a symptom checklist, and global rating) were available, and 37 cases (82%) were found to have anxiety symptoms. Most of these were of mild to moderate severity. The figures are very similar to those found using the SPI ratings in the present series (64 of 75 patients, 85%: see Table 20 , p 159).

Concerning sex differences in measures of psychological symptoms, there is support for the finding from the present study of clear differences between scores in male and female hypertensives. Wheatley, Balfour, Levine, Lipman, Bauer and Bonato, (1975) had also found that females scores higher than males on most psychological symptoms. They assessed 87 new hypertensives in a general practice setting, and found self-ratings on anxiety to be higher in females than males.

These authors also compared the frequency of the clinician ratings of three psychological states, (i) anxiety, (ii) depression and (iii) anger/hostility. These three measures may be considered approximately comparable to the ratings made in the present study of anxiety, depression and irritability, using the SPI scales. Anxiety was noted to occur significantly more frequently than the other two states, whereas in the present study, anxiety and irritability were scored as occurring approximately equally frequently: (see Table 20, p 159).

(iii) Attitudes to Treatment and Reported Life Stress

No direct comparisons with other studies regarding pretreatment assessments of these factors is possible: in Sections 4 (predictions) and 5 (Other Positive Findings) later in this Chapter, these issues are pursued in more detail.

- SUMMARY: (1) Sex incidence: in relation to that of the general population, a selection bias against younger female hypertensives occurred in this study.
- (2) Pretreatment 16PF profile did not match a "neuroticism" profile: the conclusions of Robinson, Cochrane and Kidson are supported in this respect.
- (3) Compared with a British general practice series of mild hypertensives (Mann, 1977), on SPI scales the present series contains a higher proportion of 'neurotic' patients.
- (4) The high incidence of anxiety symptoms (85%) on SPI ratings is very similar to the 82% incidence described in a British series by Wheatley and Hordern (1977).

4. BP CHANGES, AND COMPARISON WITH DATA FROM OTHER STUDIES

Before going on to discuss the findings regarding psychological correlates of BP change, it is useful to compare the findings regarding BP change in relation to drug treatment in the present series with a sample of recent studies in which the same drugs have been used. Such a comparison enables one to assess approximately whether the present group of patients is 'typical' or not in response to drug treatment.

Mean BP changes on diuretic treatment alone were 13/9 mm Hg from a baseline of 174/111 mm Hg for the total group. This may be compared with an average decrease of 21/10 mm Hg in 453 patients pooled from 16 studies in which thiazides were used alone (McMahon, 1978). The apparently lesser response in the present series may simply be related to the fact that the changeover to combined treatment with an antihypertensive drug occurred usually within 4-6 weeks as soon as 2 consecutive readings of similar BP were found, on a standardized dosage of cyclopentiazide.

After 12 months combined diuretic and antihypertensive drug treatment the mean BP level for the 55 patients who remained in the study was 141/92. For the latter patients, therefore, there had been an overall mean reduction of 33/19 mm Hg during drug therapy (see Tables 12 and 13, p 150). It was also found that there were no significant differences between the BP levels achieved at 3 months after antihypertensive treatment began, and the levels observed at the 12 month followup stage. In other words, increments of dosage during that latter part of the study for all the

antihypertensive drugs had no significant effect on the BP level achieved.

It has also been found that there was no statistically significant difference regarding the reduction of BP achieved between the four drug groups. The bethanidine group did not fare quite as well, (see Table 65, p 206): one of the problems in assessing the efficacy of the latter drug is that while the others do not induce significant orthostatic postural hypotension, the changes between supine and standing BP levels are much more striking in patients receiving bethanidine. Throughout the present analysis, the measure used as the dependent variable has been the supine BP level, as this convention permits comparability with most other studies.

(i) CLONIDINE: A review of 13 studies to 1978 by McMahon revealed that in most, a 20-25% decline in both SBP and DBP occurred as a result of combination Clonidine and diuretic therapy, in groups of mild/moderate hypertensives (DBP 90-115 mm Hg). The figures of 18% reduction in SBP and 15% reduction in DBP in the present series is comparable.

(ii) METHYLDOPA: Findings from 9 studies (McMahon, 1978) in which Methyldopa was combined with a thiazide diuretic revealed that BP level is lowered by approximately 35/20 mm Hg in hypertensives with DBP < 114 mm Hg. The figure of 40/21 mm Hg in the present series for the 14 patients who completed the 12 months course, is seen to be very similar.

A study in which methyldopa was combined with cyclopentiazide, was reported by Hansen, Hansen and Lindholm, (1977). The subjects were new hypertensives, with a mean age of 50 years; 14 who began treatment with the combination of drugs showed a mean BP reduction from 190/118 mm Hg to 148/85 mm Hg. In another group of 14 patients who had already been treated with a beta blocking agent and hydralazine, a washout period was followed by treatment with

methyl dopa and cyclopentiazide. The mean BP level at the beginning of the latter treatment in this group of 14 patients was 175/103 mm Hg, and the BP level fell to a mean of 149/95 after treatment. Overall, 65% of patients achieved good control of BP without side effects. The SBP reduction appears to be somewhat less in that study (175→159 mm Hg), than in the present study (170→141 mm Hg).

- (iii) OXPRENOLOL: Barritt and Marshall (1977) reported a detailed study of 40 patients treated with oxprenolol alone; these were new hypertensives, in whom the mean BP at the outset was 175/111 mm Hg. The authors report a gradation of response, with approximately 25% of the patients having BP reduction of 0-10, 10-20, 20-30 and 30-40 mm Hg respectively. The percentage reduction was thus from 0-32%, and the group could not be divided conveniently into 'responders' and 'non-responders'. The reduction in mean BP was not related to the initial level, and there were no differences between the sexes although there was a correlation between age and BP reduction. It is noteworthy that there is a significant number of poor responders, a finding which occurs regularly in comparable studies, but is usually left unexplained.
- (iv) OXPRENOLOL and METHYLDOPA: A comparison of Oxprenolol and Methyl dopa was carried out by Barritt, Marshall and Heaton (1976), 24 patients completing a period of treatment with each drug, separated by a washout period. BP falls were similar with each drug. Increasing the dosage in those who did not respond adequately to moderate doses had no consistent pressure lowering effect for either drug. The mean supine BP level at the beginning of the study were 174/106 mm Hg, and BP reduction to a mean of 157/96 mm Hg was achieved.

These patients did not receive a diuretic agent in addition, and this is the most likely explanation for the somewhat higher levels following treatment than in the present study group.

- (v) BETHANIDINE: A study in which the efficacy of Bethanidine was assessed, was one in which the drug was compared with guanethidine; this was carried out by the Veterans' Administration Cooperative Study Group of Antihypertensive Agents (1977) and the data concerning Bethanidine are of some interest. Fifty-two patients completed a 6 month followup. The mean BP at the outset of treatment was 154/107 mm Hg and the mean age of the patients was 50 years. Mean reduction in sitting BP in the Bethanidine group was 15/14 mm Hg, 45% achieving a DBP < 90 mm Hg. In that study, Bethanidine was found to be inferior to guanethidine. In another study, the problem of orthostatic postural hypotension was strikingly illustrated in a small group of ambulant patients in whom direct arterial measures were made (Goldberg, 1976). The 6 patients receiving Bethanidine had mean supine BP levels of 221/108 mm Hg and mean standing BP levels of 96/54 mm Hg. The mean differences between readings taken in the supine and the readings taken in the standing position was thus a staggering 125/54 mm Hg!

SUMMARY: The purpose in reporting these other studies has been to illustrate that the changes in BP observed in the present series is approximately of the same order as that achieved in other groups of patients with similar BP levels at the beginning of treatment. Every treatment group includes a significant minority of non responders and poor responders even under research study conditions carried out over

short periods of time where such factors as compliance and satisfactory dose finding are carefully monitored. The variance in response is seldom explained and while pharmacokinetic and biological factors may account for some of this variance, the possible contribution of non pharmacological factors including psychological influences, is regularly neglected in these studies.

5. PREDICTIONS

The predictions made in Chapter III (Operational Hypotheses, p 133) concerned personality traits, life stress, and attitudes to drug treatment. In this section, a more detailed analysis of the findings reported in Chapter IV will be carried out, with regard to these specific variables.

- (1) "A negative correlation is predicted between 16PF Factor E- (submissiveness) and BP reduction".

Factor E is taken to assess the 'Submissiveness-Dominance' dimension of personality. Correlations at the $p < .05$ level of significance were noted in two phases of the study, both with regard to Δ DBP. The first was in males in Phase I, ($r = .26$, $p = .03$), and the second in females in Phase II, ($r = .4$, $p = .02$). In both instances the 'submissiveness' pole (E-) was associated with less satisfactory outcome: the prediction was thus partly confirmed by these findings.

The source trait Factor E has been defined as 'the extent to which the individual has the confidence and need to pit himself against social and material opposition'. (Cattell, 1973). This trait is considered to have moderately low heritability (approximately 0.25), and men typically score significantly higher than women. Factor E is typically lower in neurotic patients and in the chronically ill.

The 'submissiveness' characteristics refer to such qualities as being obedient, mild, easily led, docile, accommodating, dependent, considerate, and humble. The 'dominance' characteristics refer to such qualities as being assertive, competitive, independent-

minded, rebellious, and headstrong.

The inhibition of assertiveness is clearly evident when individual items making up the Factor E Scale are examined with regard to high and low scorers on this Factor.

(a) In male patients, 3 of the 6 questions making up the Scale particularly discriminate high and low scorers. Those which discriminate best ($p = .02$) are: -

(i) I can look anyone in the eye and tell a lie with a straight face (if for a right end)

(ii) I would rather do without something than put a waiter or waitress to a lot of extra trouble.

A third question also discriminated ($p = .05$) between high and low scorers.

(iii) People say that I like to have things done my own way.

(b) Among female patients, only the first of these three questions discriminated between high and low scorers, ($p = .01$).

The psychoanalytic formulation of the 'hypertensive personality' particularly emphasized the trait of submissiveness (Alexander (1939) and Saul (1939)): the suppression of aggressive impulses revealed by overly compliant behaviour was hypothesized as a pathogenic factor in the development of essential hypertension. Pilowsky, Spalding, Shaw and Korner (1973) had found a correlation between the 'abasement' scale derived from the Edwards Personal Preference Schedule, and BP levels in 12 male hypertensive subjects.

While there are obvious shortcomings in assessing a basic behavioural trait simply by questionnaire response, rather than carrying out 'objective' testing in actual interpersonal situations, it is relevant that Factor E has been described by Cattell (1973) to correlate well with behavioural ratings.

- (2) "A negative correlation is predicted between 16PF Factor L+ (suspiciousness) and BP reduction".

Factor L is concerned with the "Trust-Suspicion" aspect of personality functioning. The associations with % Δ BP are of special interest, because in Phase I there is a correlation ($r = .24$, $p = .04$) between L+ and % Δ DBP in males (See Table 26, p 165), while in Phase II there is a strong correlation between L- and % Δ BP in females (For % Δ SBP, $r = .69$, $p = .001$; for % Δ DBP, $r = .51$, $p = .01$: See Table 26, p 165).

The L- person is described as trusting, accepting, compliant, tolerant and conciliatory. The L+ person is described as suspicious, jealous, dogmatic, easily frustrated, irritable, seeking fault in others. There are typically sex differences, with lower scores in females.

The trait has moderately high heritability (about 0.55). Psychologically, the L+ trait is strongly associated with the systematic use of projection in perceptual situations. The L+ person expresses individuality, the L- person accepts a socially low expression of individuality. This Factor is an important component of the QII Anxiety Second Order Factor (L+ loading high Anxiety), and in women but not men it also contributes to the QIII+ (Tough Poise) Factor. The Factor has been found, along with Q2+ (self sufficiency) to be prominent in the coronary-prone person, L+ being considered to

contribute to the 'inner tension' which has been described in such persons.

Responses to individual questions reveals that -

- (a) In males four of the six questions discriminated between high and low scorers.
- (i) I think many foreign countries are actually more friendly than we suppose ($p = .025$).
- (ii) I suspect that people who act friendly to me can be disloyal behind my back ($p = .025$).
- (iii) If a neighbour cheats me over small things, I would rather humour him than show him up ($p = .05$).
- (iv) I think most witnesses tell the truth even if it becomes embarrassing ($p = .05$).

- (b) None of the individual questions discriminate significantly between high and low scorers among the female patients.

With regard to the present findings, the apparent contradiction that L+ is associated with better outcome in Phase I, and with less satisfactory outcome in females in Phase II, is resolved to some extent if the characteristics pertaining to anxiety are noted.

The main finding in Phase I is that Anxiety and some personality traits associated with anxiety (H-, L+, Q3-), correlates with $\% \Delta BP$. The "suspiciousness" component of anxiety, more evident in males, may have been associated with greater reduction of BP possibly because the anxiety associated with that doubt and suspiciousness was relayed somewhat by reassurance from those involved in treatment, and acceptance by the patient of entry to the study.

However, once medication taking became necessary as in Phase II, a trusting rather than a suspicious attitude would be more conducive both to a placebo effect and to optimal compliance. Such characteristics were more evident in females than males, according to expectation, and the positive 'attitude to drug treatment' correlations found at this phase (see Table 36, p 172) also suggest contributions from the mechanisms of placebo reaction and good compliance.

(3) "Patients who report significant life stress (marital, family, work) are predicted to show less BP reduction than patients who do not report such life stress".

(a) Report of Work Stress is associated with less satisfactory outcome in Phase III (See Table 34 , p 170) in male patients. The method of enquiry by which this item was rated either 'present' or 'absent' has been described in the Methodology Section (p 129). No attempt is made to use an external criterion to establish the presence of 'work stress', but rather the individual's conscious perception of his or her work situation as a source of conflict and strain is accepted. It is likely that by this means the incidence is under reported, for the following reasons.

Firstly, there is a group who need to deny stress which actually does exist, and interviews with spouses of 30 patients as carried out at the conclusion of the study suggested that there had been some under reporting of stressful experience by a number of patients. Defensiveness regarding self disclosure of intimate material has been found to be greater in hypertensives than nonhypertensives (Handkins and Munz, 1978). Secondly, the

interview itself was relatively brief, directive, and was a 'screening procedure' rather than a full psychiatric interview. Experience with clinical interviewing teaches one that the extent of the data able to be elicited is at least partly a function of the depth and length of the interview as well as the interviewer's experience and skill. In those instances where the interviewer suspected some denial of stressful personal experience, it was not thought appropriate to challenge strongly such defences.

The interviewer was basically seeking to identify the occurrence of chronic rather than acute, time-limited stress, perceived by the patient as frustrating and difficult to master or to modify. The emphasis was on interpersonal rather than nonpersonal stress, although a few patients reported the latter rather than the former and were included among the group who rated 'work stress' as present.

The following case vignettes are selected to illustrate the concept of 'work stress' as used in the study. The first three cases are illustrative of chronic persistent work stress, while the next two illustrate a change from a stressful to a less stressful or non stressful work experience prior to the onset of treatment in the study.

- *
1. Mr. A. was a 56 year old married man, known to have been hypertensive for 8 years prior to the study, and who had received intermittent antihypertensive treatment for this, but who had received no drug therapy in the 3 months prior to entry to the study. His BP at referral was 191/118 and the mean baseline BP was 184/113 mm Hg. He had worked for an overseas based company as an electronics technician for many years after migrating from Great Britain, and considered himself basically conscientious, dependable and competent at his work. He had accepted promotion to a more demanding position, as technical officer a year before entry

(* Patient No. 28, Appendix p 304)

to the study, which position required mastery of new developments in electronics as well as an increase in authority in a small group. Increasingly, he came to feel that he was given insufficient support by management, that he was being "used by the system" and that he was being asked to function at a level outside his own capabilities. He became increasingly frustrated and resentful, and his work efficiency suffered. He felt quite unable to modify his work environment to suit his own needs, and these daily tensions were present for the duration of his treatment in the study.

His physician referred to "paranoid traits" in his personality, so striking was his hostility about his work situation. His wife amply confirmed the account given by the patient concerning work stress; she added such information as the fact that he had smashed a door pane in frustration one one occasion and had physically attacked a fellow employee on another. This was in contrast to his previous tendency to bottle up tensions and now he seemed not to be able to control them. No resolution of these conflicts occurred during his involvement in the study, and he was later retired prematurely from work on medical grounds.

2. Mr. B.* was a 52 year old scientific officer who had worked in an academic environment for several years since migrating from Europe and described severe interpersonal and intrapersonal conflict regarding his work situation. Tension between himself and his immediate supervisor had been unremitting over some years, and from the patient's point of view his work was insufficiently valued and appreciated, and his efforts to gain promotion had been thwarted. He believed that his supervisor had unfairly gained credit for research work carried out by himself. Suppressed bitterness eventually surfaced, and an outburst of temper led to a change of supervisor, but the problem did not disappear altogether: the patient considered that
- * (Patient No. 67: Appendix p 305).

he was not discriminated against as a European migrant in his efforts at achieving recognition in an Australian University. He had a deep sense of futility about his work and his future and an overseas visit to his own northern European University and contact with erstwhile colleagues left him feeling more inferior in relation to men of his own age in his profession. He had been treated for hypertension on and off for three years prior to entry to the study, and the level at referral was 205/120 mm Hg, while the baseline levels were 188/113 mm Hg. His wife, when interviewed later, gave a clear picture of his obsessive preoccupation with his grievances at work, describing him as "married to his work" to the detriment of family life and his own health, and she actively sought psychotherapeutic help for him to help to come to terms with his conflicts, which she felt helpless to modify despite considerable effort on her part. The patient did seek counselling at the end of the study period concerning his work conflicts, which had not modified significantly during the 12 months of the study itself.

3. Mr. C.* was a 36 year old married plasterer. He had sustained a fractured femur in a vehicular accident one year before entry to the study, was unemployed for some months, and his BP elevation was discovered during that time. Previously he had been compulsively overworking, regularly working evenings and weekends, and worrying excessively at meeting deadlines. During his enforced absence from his occupation, his wife sought employment for economic reasons, and he became abusive toward her, pathologically jealous about her contact with male employees, and his alcohol intake increased considerably. The marriage was severely jeopardized and this situation only improved slightly when he took up his employment again on recovery from his illness.

* (Patient No. 40: Appendix p 304).

His BP levels at referral to the study were 180/130 mm Hg, and the mean levels at the baseline stage were 148/107 mm Hg. During the period of the study Mr. C. was again employed continuously, sub-contracting with one partner which he found less conflicting than working for a boss, but he remained highly anxious about his work situation nonetheless. He expressed fears of falling from scaffolding and sustaining further injury and unemployment, he still worried excessively about not meeting deadlines, to the extent that there were disturbed sleep regularly with frequent dreams depicting his non coping with work requirements. While these 'work stresses' cannot be attributed to the work environment itself, as they appear mainly to be a reflection of his personality configuration, nonetheless their expression in the work situation constitutes the 'work stress' from his point of view, on which the rating is based.

In all three cases mentioned above, the 'reported work stress' was chronic, and the person showed little capacity adaptively to influence the environmental requirements to a more agreeable and congenial level. In contrast, the following two cases illustrate a quite different situation, where recognition of maladaptive functioning had led to employment changes with satisfactory subjective results, by the time the patient participated in the study.

4. Mr. D.* was a 40 year old man at the time of referral to the study by his general practitioner whom he had consulted because of persistent headaches. The hypertension had been detected only six months prior to entry to the study, and the mean level at point of referral to the study was 160/120 mm Hg, while the baseline levels a few weeks later were 172/120 mm Hg. Both

* (Patient No. 52: Appendix p 305).

patient and general practitioner believed that 'work stress' had contributed to the development of his hypertension, and on medical advice he changed his occupation shortly before entry to the study.

For several years he had worked as a country traveller for a statewide meat firm, thus spending part of each week away from home, and there were dissatisfactions and frustrations within his family on this account. His wife reported "I virtually had to bring the four boys up on my own". Both patient and his wife agreed that being on "continuous telephone call" when he was at home was highly stressful for him. She described him as "conscientious, a tidiness fanatic, punctual, wanting to be in control".

The change of employment was to a much less demanding position as a buyer in a large chain store, with remuneration equal to his previous position, but no after hours work and no travelling away from the city. The increased participation in family life and adoption of leisure pursuits was subjectively beneficial, and he was rated as having absent work stress for the duration of the study.

5. Mr. E.,* was a 49 year old married man who had been treated on and off for episodes of elevated BP over several years before referral to the study. His BP levels at referral to the study were 165/105, and the mean baseline levels were 168/107 mm hg. For several years prior to entry to the study he had been State Manager for a multinational tyre company, which involved

* (Patient No. 2: Appendix p 303).

not only considerable interstate travel but was adversely effected for him by what he called a "severe personality clash" with an interstate manager senior to him. His wife described a steady decline in his health and in his enjoyment of life, as his responsibilities and commitments had increased in the years prior to his treatment.

At the time of entry to the study, he had made a personal decision to give up this employment, and to find a much less demanding one as a buyer for a local paper firm, and he remained in this position for the duration of the study. It was rather boring and insufficiently satisfying so he changed again following the completion of the study to a position of supervisor of Ancillary Staff in a government department and remained contented with that position over a further year.

His employment during the year of the study involved no competitive striving as he had no intention of seeking promotions; he had also turned to fostering leisure pursuits during that year. Work stress was rated as absent at each assessment visit.

From these vignettes it is evident that it is difficult to separate out 'work stress' from 'personality conflicts' as the latter tend to be expressed through the former. In each of the five cases described above, the wife was convinced that a stressful work situation had contributed to the hypertension, at least by aggravation of the condition. In all cases except that of Mr. D., the wife also had no doubt that the patients personality problems had contributed to the stress load in the work situation. There is doubtless some tendency

for patient, spouse and perhaps doctor to rationalize the importance of "work stress", as it is outside the interpersonal nexus of the marriage, and may conveniently allow avoidance of concurrent marital problems by both parties. The wives of the first four patients described above all felt they had been required to bear the brunt of their husband's dissatisfaction of work over long periods of time.

With regard to the research finding that the presence of "work stress" was associated with less satisfactory outcome, there is little evidence from the literature against which a direct comparison can be made. The longitudinal study by Kasl and Cobb is relevant, as BP levels were examined during a period of anticipation of job loss, during unemployment and during probationally reemployment, in a large cohort of men. In each of these phases, BP levels were higher than during later periods of stability in new jobs, and were significantly higher than in a control group of men who remained in stable employment for a comparable period of time. The changes in BP level were greater in those with the personality trait of "lower ego resilience", which was derived from MMPI scores. (Kasl and Cobb, 1970).

The epidemiological survey carried out by Kahn, Medalie, Newfeld, Riss and Goldbourt in Israel (1972), has also presented data which are germane to the present issue. Ten thousand male civil service workers were studied on three separate occasions over a five year period, and incidence of hypertension was significantly associated with two psychological variables "feeling hurt by superior but brooding", "feeling hurt by superior but restraining retaliation". The authors also adopted the procedure of asking the patient whether there were serious problems in a number of life situations, without trying to differentiate

the effects of personality and the sociocultural situation.

Reviewing the aspect of "work stress" especially with regard to compensation problems and essential hypertension, Mustacchi (1976) concluded that "it is as yet unproven that hypertension develops after exposure for long hours over a period of several years to the exasperations, frustrations, pressures, strains and stresses of work". He quoted a study in Iran of 379 silo workers exposed to high noise levels, which study revealed that the frequency of hypertension in those over 55 years was related to the length of exposure to excessive noise, rather than to age. This association was not apparent for those aged between 40 and 55 years.

Regarding reported marital and reported family stress, no such clearcut finding occurred as was the case with work stress in males. The lack of confirmation of a predicted relationship between such stress and change in BP may reflect the fact that no such relationship does exist, or it may indicate that the methodology was inadequate for this assessment. The interviews with 30 spouses subsequent to the 12 months study did tend to show that there was a greater discrepancy between the patient's report and the spouse's account regarding marital and family stress, than regarding work stress. In other words there appeared greater defensiveness regarding stress in the home than at work. In view of this variability in selfdisclosure, the question of the actual relationship between family/marital stress and change in blood pressure must remain open.

- (4) "A correlation is predicted between the "attitude to drug treatment" rating, and BP change: positive attitudes are expected to be associated with greater BP reduction".

Significant findings were found (Table 36) in female patients in Phase I, regarding $\% \Delta \text{DBP}$ ($r = -.47$, $p = .02$) and in Phase II regarding $\% \Delta \text{SBP}$ ($r = -.46$, $p = .02$) and $\% \Delta \text{DBP}$ ($r = -.47$, $p = .02$).

In Phase III the correlation with $\% \Delta \text{SBP}$ is again moderately high ($r = -.47$), and this is significant at the $p = .04$ level. No significant correlations were seen in male patients. The findings concerning female patients are according to prediction, and would appear to reveal a component of a 'placebo effect' which is not discernible however in male patients.

The postulated 'placebo effect' suggested by these findings is likely to be more complex than simply an effect of taking medication, since a correlation of $r = -.47$ ($p = .02$) was found in the pre treatment phase. It would appear that there may be a nonspecific 'study effect', which later is coupled with a medication effect. The literature to be quoted lends support to this interpretation of the findings.

Quantification of the medication 'placebo effect' is not possible without the use of a placebo control group. Reasons for the lack of inclusion of such a group have been explained (p 215). It is of interest therefore to consider some other studies involving patients with approximately similar initial BP levels to those in the present study, in which a placebo against active drug treatment design has been used. It can reasonably be deduced that changes of a similar order would have been likely to have occurred in the present study group.

The Report of the Medical Research Council Working Party on Mild to Moderate Hypertension (1977), carried out in Britain, involved men and women between ages 35-64. There were 440 male patients,

whose average BP level at entry to the study was 158/98 mm Hg, while for the 310 females, the average level was 165/101 mm Hg. Approximately half of each group received an active drug, either bendrofluazide or propranolol, while half received placebo. For males who required an active drug, the mean reduction at 3 months was 23 mm Hg for SBP, and 12 mm Hg for DBP. By contrast, the placebo group showed reductions of 14 mm Hg & 7 mm Hg respectively. By 12 months, both groups had shown a slight rise in BP, but not up to the baseline level. A similar pattern occurred in the female group, with reduction of 15 mm Hg for SBP and 7 mm Hg for DBP on placebo. The authors comment that the magnitude and prolongation of the placebo effect was greater than expected, and it was attributed to habituation to the clinic environment and "regression to the norm".

Another study of relevance is that by Bengtsson (1974). The beta blocking agent Alprenolol was compared with placebo in 26 females with EH, aged 38-60 years. The mean reduction of supine SBP up to 3 months was 19 mm Hg from a baseline of 184 mm Hg for SBP, and 5 mm Hg from a baseline of 106 mm Hg for DBP. Subsequently, patients on the active drug showed mean reduction of 17 mm Hg from a baseline of 165 mm Hg for SBP, and 8 mm Hg for a baseline of 101 mm Hg for DBP. This study did not incorporate any psychological measures, and is quoted simply to indicate the approximate magnitude of the "placebo drug effect".

From the evidence of this small sample of studies, it appears that a reduction of at least 10 mm Hg in SBP, and about 5 mm Hg in DBP, is likely to occur due to non pharmacological reasons in any study involving drugs.

In the present study, an attempt was made to assess the aspect of expectations of benefit from drug treatment, by rating a 5 point scale according to the patients' consciously stated attitudes. (See p 127). It is of interest that even within this group, carefully selected for participation in a research study, a significant number expressed doubts or

uncertainties about the outcome of treatment (8 of 21 women, (38%)
14 of 54 men (26%)).

The fact that the attitude score at baseline correlated with % Δ DBP before any drug treatment was given ("Reported" to "Baseline" phase), suggests that psychological effects indicated by a positive attitude, having to do with entry to the treatment environment itself, were operating before the drug phase, and conceivably could have continued on during the drug phase to some extent.

The changes in BP from the time of referral to the point of beginning drug therapy must be considered in psychophysiological terms. Furthermore, it has been demonstrated that in response to diuretic therapy, a proportion of the variance in response in female patients can be explained as related to expectations and certain personality traits, as revealed by 16PF measures. There was a positive correlation not only between the psychiatrist's ratings of expectation of benefit from treatment, and outcome, but also between Factors F- (seriousness) and particularly Factor L- (trust), and outcome of treatment. It does seem that even though a placebo agent was not used in this study, a "placebo effect" is being demonstrated. A definition of the placebo effect was attempted by Shapiro (1961), "any therapeutic procedure (or that component of any therapeutic procedure) which is given deliberately to have an effect, or unknowingly has an effect on a patient, symptom, syndrome, or disease, but which is objectively without specific activity for the condition being treated. The therapeutic procedure may be given with or without conscious knowledge that the procedure is a placebo, maybe an active (non inert) or non active (inert) procedure, and includes therefore all medical procedures no matter how specific".

A later definition by Shapiro is quoted by Adler and Hammett (1973), "the psychological, physiological or psychophysiological effect of any medication or procedure given with therapeutic intent, which is independent of, or minimally related to the pharmacological effect of the

medication, or to the specific effects of the procedure, and which operates through a psychological mechanism".

Several authors have drawn attention to the relevance of the placebo effect in medical practice, although the same authors consider the matter to be under-estimated in most clinical research and patient care. Thus Benson and Epstein (1975) consider that, 'the placebo effect is a neglected and berated aspect of patient care'. They consider that "disdain of the placebo effect is the prevalent attitude in medicine today". The work of Beecher (1955), is quoted with favour; in fifteen studies with a variety of medical conditions, in a total of 1082 patients, 35.2 percent of persons benefited from the placebo drug used in the study. Benson and Epstein reflect on the fact that over the centuries, the placebo effect was the most powerful influence of the measures available to the physician; from the time of incorporation of placebo drugs in controlled studies of the efficacy of active drugs from the early 1950's. the total placebo effect of a procedure has tended to be neglected. Attention has been focussed on the difference between an active and an inactive chemical, rather than on the total setting. Most investigations have failed to incorporate non treatment controls, assuming that by incorporating a placebo drug that sufficiently caters for the placebo effect.

Scrutiny of the components of the placebo effect in more detail leads to a consideration of variables within the patient, variables within the doctor, and most importantly of the relationship between them. The placebo effect may commence before the administration of any medication. An increased level of stress and discomfort is known to increase the placebo effect.

Other authors have also examined the placebo effect by considering the doctor/patient relationship. Adler and Hammett (1973) considered that the necessary and sufficient components of the placebo effect could be

conceptualized as being two elements, (1) participation in a shared cognitive system that made otherwise chaotic symptoms understandable, in other words, an agreement of how things "hang together" and (2) access to a relationship with a culturally sanctioned parental figure. They refer to the first element as "system formation" and the second as "group formation", referring to these two elements as basic needs of human personality functioning.

The neglect of the overall placebo effect has been considered analogous to the neglect by microbiologists of the penicillium mold - it was long considered a "bothersome bacteriostatic contaminant, which spoiled cultural growths", rather than as a powerfully effective treatment in its own right. (Adler and Hammett, 1973).

The element of a patient's expectation and conviction of efficacy was considered by Liberman (1962) who referred to the "vast potential of the emotional relationship between the omnipotent physician and the needs of the patient". The important role of the milieu itself was emphasized and attention drawn with the "Hawthorne effect", in which the efficiency of workers in a factory increased with the attention that followed an investigation of their work pattern.

Some confirmation of this "Hawthorne effect" came from a study which summarized a series of clinical trials in which the placebo effect was discerned. Lowinger and Dobie (1969), discovered estimates of placebo effects as 24%, 35%, 74% and 76% in four consecutive studies of psychotropic drugs. They attempted to discover what factors had contributed to the higher placebo effects. Two elements were discerned. Those studies in which intensive testing by psychological means occurred, had higher placebo effects. The differences were very striking - a 24% placebo effect occurred in a drug study comparing a mildly potent agent

with placebo, and 74% effect was observed in a comparable study but in which there was intensive research into psychological factors. The authors considered that the investigatory process extended the emotional experience for the participants, by providing additional support and identification with the therapeutic team from the research personnel. The tester was identified with the therapeutic endeavour. The relevance of this finding to the present study is quite apparent.

The second element was the matter of dosage levels within the study. It was discovered that increments to larger doses of drugs increased the placebo effect. This was attributed to a greater level of enthusiasm by doctors, alertness to toxicity factors, and attention to detail of effects which were conveyed to the patient. Thus, increased placebo effects were found with higher doses compared with mild doses, even if the study was double blind. These factors may also be highly relevant in the present study in which an antihypertension drug was added to a diuretic, then gradually stepped up with meticulous monitoring of effects.

Examination of the variable of 'expectations' was carried out specifically in a study by Nash and Zimring (1969). Ratings by a psychologist of expectations, based on the response to eight questions on a 3 point scale, were made on 99 elderly subjects (with a mean age of 82 years!) who were given either a placebo or a possibly active drug (phenytoin or procainamide), and were told that improvement in short term memory would be likely to occur as a result of the medication. The patients were able to be sub-grouped into those with high, moderate or low expectancy respectively, and a highly significant difference was found in the predicted direction. Another psychological variable, 'openness to new experience' was also measured using responses to the

Thematic Apperception Test cards, and this variable was not found to correlate with response to the procedure. No differences were discovered between the placebo and the active agent, as far as memory function was concerned. Those with higher expectations did better with either treatment!

In summary there would seem to be substantial evidence from these studies that the setting of the present study was highly conducive to a variety of placebo effects. The patients were selected from clinical practices, and referred to a research study. They were informed that they would be entering a study which required extensive investigation, and that a comparison between drugs of proven efficacy would be made. Their anxieties and concern about procedures and the therapeutic plan of action, were able to be discussed by a sympathetic, diligent, and enthusiastic nursing Sister. The patients were reassured at the end of the physical investigations, concerning the lack of evidence of other bodily disease or of end organ damage where this was the case, as in the vast majority of cases. The psychological assessments which took place, although relatively brief in duration, may have contributed to conveying to the patient a totality of care and not just attendance to the level of blood pressure itself. To the psychiatrist, the reassuring effect of the total research design was quite evident in the comments of many patients and was spontaneously referred to by some. It would be expected that persons with anxious and obsessional traits, would feel increased security at the structure and security of the total treatment design. Several patients compared the treatment favourably with what would have happened if they had continued with routine treatment through their family doctor, or even with a specialist physician alone. Some of the patients' spouses when interviewed separately referred specifically to this point.

It has been indicated that the decision not to incorporate a period of placebo medication before the administration of the diuretic agent, has made it impossible to quantify the placebo effect in terms of degree of reduction of BP level. Evaluation of the specific effect of the diuretic agent, or of the antihypertensive drugs subsequently, is accordingly more difficult and interpretations of efficacy must be made with great caution. The evidence from the literature quoted above would suggest that it is very unlikely that the placebo drug effect had dissipated by the time the specific antihypertensive drugs were used, and indeed the correlation between positive expectations about treatment and the outcome at the 12 month stage, at least for DBP, tends to confirm this conclusions, at least for female patients.

It may be argued that the placebo effect would be expected to be approximately equally distributed among the 4 groups of patients, in which allocation to specific drug groups was randomised. However, the sex differences between the groups is quite striking - for group 1 (bethanidine), there were 6 male patients and 7 female patients, whereas for group 4 (oxprenolol) there were 14 male patients and 3 female patients. It has been discovered in this study that female patients showed significant correlations between expectation of treatment and outcome, whereas male patients did not. The female patients have shown higher anxiety levels, and this is also known to increase the placebo effect. Females were noted by the psychiatrist to be much more ready to perceive the interviewer as a helper rather than simply an assessor, another ingredient considered by the authors quoted above to be a powerful influence.

The question of spontaneous reduction of blood pressure is relevant, in addition to the consideration of the general placebo effect to the treatment situation, and the specific placebo effect of medication as described above. It is likely that in the present series, a spontaneous reduction would have occurred in a proportion of patients.

Support for this contention comes from such studies as that of Stewart (1971), who followed up 53 men, aged 18 - 50, referred on account of an isolated finding of raised BP, usually as a result of an assessment for life insurance. His initial finding was that the 'pick up' BP (equivalent to the Referral BP in the present study), was significantly greater than the 'established BP' which represented the mean of 3 readings over a 3 month period. For example, in a sub sample of 9 patients, the mean DBP fell from 116 mmHg to 103 mmHg during this 'assessment phase'. This is parallel to the finding in the present study.

40 of the 53 men were considered to have established hypertension, and of these 40, there were 12 in whom the DBP fell without treatment from a level of 105 mmHg to 88 mmHg over an average of 6.7 years. These hypertensives were considered to have 'lapsed hypertension'. Seeking to identify factors which might distinguish the 'lapsed hypertensives' from those who went on to require treatment, the data indicated that a relatively high age of onset, professional rather than labouring employment, involvement in competitive mental stress, and family history of close relatives effected by premature arterial vascular disease were all associated with a persistently rising pressure. There was no attempt to quantify the 'competitive mental stress', and the examples given in the article refer to instances of interpersonal aggression in work situations.

Looking to the time when a trial of mild hypertensives would take place, the author cautioned 'any such trial if it is to be of practical value, must contrive to identify in advance that substantial minority who will do as well without treatment'.

The finding that approximately 30% of Stewart's, 'established hypertensives' showed spontaneous reduction of BP was approximately matched by a 3 year follow-up study of middle aged men with borderline BP by Hedstrand and Aberg (1975). They reviewed 98 men aged 50, who while failing to fill the criteria for antihypertensive treatment, (supine DBP greater than 105 mmHg), but did fulfill the criteria for borderline hypertension (supine 160 - 170/100 mmHg and/or > 160/100 in sitting or standing positions. SBP had decreased by > 5 mmHg in 23%, DBP in 46%, and both pressures in 15%, by the time of the 3 year followup. Those who in contrast, went on to develop hypertension, had a higher SBP at the initial examination, and a family history of hypertension was more common in this group.

The spontaneous reduction in BP in these untreated patients was described as reflecting the statistical phenomenon of 'regression toward the mean'. The authors found no correlation with assessment of 'stress experience' but do not provide information concerning the method of assessment of that parameter. Their conclusion is, 'it is of great practical importance to be aware that in some subjects an elevated BP may decrease over a period'.

Overall, the two studies serve as reminders of the caution which must be exercised in attributing change of BP over an extended period of time, to pharmacological or even psychological 'placebo' effects. The inference for the present study is that a significant minority of the patients could have had a reduction in BP over the 12 month period, even in the absence of pharmacological treatment.

6. OTHER POSITIVE FINDINGS(i) Factor A

This Factor has been found to correlate significantly with % Δ BP especially in later phases of the study. Throughout the study, the correlations between Factor A and % Δ BP are seen to be in a negative direction; that is, between the A- pole and greater BP reduction, and between the A+ pole and less BP reduction.

In Phase I, the correlation with % Δ DBP in females just fails to reach statistical significance at the $p = .02$ level ($r = -.43$, $p = .03$). In Phase II, for all patients for % Δ DBP, $r = -.26$ ($p = .01$), and this relationship is more evident in males ($r = -.36$, $p = .004$) than in females. In Phase III, the correlation is seen to occur for SBP as well as for DBP. For the combined sexes, $r = -.45$ ($p = .001$) for % Δ SBP and $r = -.47$ ($p = .001$) for % Δ DBP. For males, % Δ SBP $r = .40$ ($p = .005$) and for % Δ DBP $r = -.50$ ($p = .001$). For females $r = .60$ ($p = .01$) for % Δ SBP, and $r = -.39$ for % Δ DBP.

It is clear that Factor A should be examined closely to see what it is purported to measure. It was designated Factor 'A' because of all personality factors derived from a series of factor analytic studies, this Factor accounted for the greater variance between individuals (Cattell, 1973). The A- person (previously termed schizothymic) is described as critical, standing by his own ideas, cool and aloof, precise and objective, distrustful and sceptical, rigid, cold, and prone to sulk. By contrast, the A+ person (affectothymic) is described as warm hearted, outgoing, easygoing, participating, cooperative, attentive to people.

The 'sizothymia-affectothymia' dimension is considered to be very similar to Kretschmer's (1936) designation of 'schizothymia-cyclothymia' as the temperamental dimension in nonpsychotic people which parallels the dichotomy of 'schizophrenia-affective psychosis' in the clinical sphere. Females typically score significantly higher than males. Above the age of 30 an individual's level remains steady throughout life. The trait is considered to have a moderately high heritability of approximately 0.50, and thus to a larger extent than most other 16PF Factors is considered to be significantly genetically determined. Environmental influences are considered to contribute by inducing frustrations in early life associated with betrayal of emotional expression, leading to subsequent inhibition of such expression of emotion.

Since there are highly significant correlations with % BP in both sexes, it is of interest to examine the individual questions to obtain more concrete information than is available from abstracted Factor descriptions. Those questions which most clearly discriminate between high and low scores can thus be identified.

Statistical evaluation of the degree of difference between the high and low scores for each question has been made using the Fisher Extract Probability Test. The six questions comprising Factor A are described in the Appendix. (p 315).

(a) For male patients, the two questions which best discriminate high and low scorers ($p = .01$) are:-

(i) I could be happy in a job that required me to listen to unpleasant comments all day from employees and customers.

(ii) In a factory I would rather be in charge of:

(a) machinery or keeping records

(b) talking to and hiring new people.

In response to both these questions, the A- person clearly expresses a preference for lack of interpersonal involvement, and for avoidance of interpersonal tension.

(b) For female patients, the question which best discriminates ($p = .05$) is:-

(i) I would rather be:

(a) In a business office organizing and seeing people

(b) an architect, drawing plans in the back room.

Again, the A- person prefers the non personal routine, so there is some similarity with the 'non involvement' preferred by the male A- patients.

It would seem that patients who prefer avoidance of interpersonal involvement do better regarding BP reduction than patients who become more involved. Comparison of characteristics of high and low scores reveals no differences regarding sex, age, marital status, known duration of elevated blood pressure, incidence of reported life stress, and KDS and SPI anxiety and depression scores.

The 16PF provides a 'Motivational Distortion Scale' to assess a tendency to score according to perceived social expectancy. It is of interest that high scorers tend to score more highly on the Motivational Distortion Scale, than do low scorers ($t = 2.01$, d.f. 15, $.025 < p < .05$) This may betray conflict over traits of 'noninvolvement' perceived as socially undesirable or unacceptable in A+ individuals.

Since no other paper has been found in which the 16PF was used in a longitudinal study, a direct comparison with other findings of other workers is not possible. There have been two other studies in which

BP and 16PF correlations were made, in cross sectional studies, but the groups were not clinically comparable with the present group. Harburg, Julius, McGinn, McLeod and Hoobler (1964) reported a study in which the 16PF was administered to 74 college students, of mean age 21 years, none of whom was known to be hypertensive. A positive correlation ($r = .32$) was found between height of BP and Factor A, indicating that the "involved" group in that series tended to have higher BP levels than the "uninvolved" group. Kidson's (1973) study used males only - 40 known hypertensives and 110 non hypertensive controls. In neither group was there a significant correlation between height of BP and Factor A.

It is pertinent to consider other personality studies than these two in which the 16PF was used, in which the dimension of "involvement" appeared relevant. Hamilton's (1942) study of 5470 college students aged between 16 and 23 was the first to draw attention to this aspect of personality.

No evidence was found to support the contention that those with elevated BP were neurotic or unstable. However, trait rating scales indicated that those with higher BP scores did tend to reveal physical and social non participation compared with those with normal BP levels.

The series of studies begun by Thaler, Weiner and Reiser, (1957), were summarised by Singer (1973) in her Presidential Address to the American Psychosomatic Society. The concept of "engagement-involvement" was derived from these studies, and came to be regarded as of special relevance in the study of hypertensive subjects. In contrived interview situations, hypertensive subjects showed steeper rises in BP than normotensives, when interacting intensely with the interviewer. Williams and McKegney (1969) showed that this interpersonal factor was of greater importance than the novelty of the situation, or the content of the interview. The conclusion of this series of studies is that the

hypertensive person appears to need to 'insulate' himself from such physiological reactions by the development of defensive personality characteristics, and the A- pattern described above would seem very similar indeed to this 'insulated' defensive personality configuration. In the present study, treated hypertensives lacking these characteristics fare less well over time. It is noteworthy that not only Factor A+, but also perceived Work Stress was correlated with less successful outcome, by the end of Phase III as far as BP reduction in male patients was concerned. The patient's defensive strategies and coping mechanisms could be conceived as having been outstripped in these circumstances.

So far the A- trait has been considered as a personality characteristic which may help to protect the patient from an over-responsive pressor system. The work of the Laceys (1970) may lead to an alternative explanation: they have reasoned that the state of reduced 'involvement' might reflect a psychological state which is a direct consequence of BP elevation. (see p 64). In both animal and human experiments, reduced cerebral reactivity to stimuli, both external and internal, was seen to be a consequence of artificially elevated BP. It may therefore be deemed psychologically advantageous to the organism to have an elevated BP level, as that appears to promote the restraint of emotions by subtle changes in cerebral reactivity. The Factor A- pattern revealed by the 16PF questionnaire could then be conceptualized as a consequence of elevated BP, not simply an incidentally discovered trait.

It is conceivable that A- persons are over-represented in this study because of a need for suitable 'research' patients. The aloofness

and preferences for precision, if observable clinically, might well have been deemed more fitting traits for participation in a research study, than those of the more 'easygoing' A+ temperament.

This question of interpretation of results in which such personality differences might influence selection and thus compliance behaviour, is a most important one seldom addressed adequately in drug studies. The present study is deficient in its lack of assessment of the compliance factor once drugs had been prescribed, by any truly objective means. Direct questions were asked, "side effects" were sought, and for a subsample of patients the next of kin was interviewed, but all these methods are very approximate. This area is one which clearly requires closer scrutiny. Attention has been drawn to the biostatistical problem arising when a "compliance sample" of patients is chosen, in Sackett and Haynes' (1976) book on "Compliance with Therapeutic Regimens". It is pointed out that the risk in screening out patients with doubtful compliance behaviour is that results of trials can be seriously distorted if the excluded group represents a sizeable proportion of eligible cases. If compliance and therapeutic responsiveness are interrelated, the findings may only be pertinent for compliant patients, and not for other patients with the same medical condition. The much quoted Veterans Administration Cooperative Study (1967 and 1970) is cited as an example of a study which is based on a "compliance-confounded cohort".

It would appear that the present series may be criticized on somewhat similar grounds. Despite the search for qualities of apparent willingness to cooperate over 12 months, a significant loss (27%) did occur before that time. Interestingly, the "noncompleters" did not differ significantly from "completers" on 16PF Factor A, but they did

differ on Factor L, and to a lesser extent on Factor Q2 (p 209).

Although in the crude sense of "dropping out", the noncompliant patients were no different from "completers" regarding Factor A, in the more subtle sense of apparent participation but noncompliance regarding medication, the possible influence of this personality characteristic cannot be excluded: nor can it be determined accurately with the available data. If Factor A+ patients were more highly represented in those who overtly comply but covertly are noncompliant, a positive correlation between Factor A- and change of blood pressure could occur on these grounds alone. It has been stated above (p 261) that A+ individuals scored higher on the Motivational Distortion Scale, which lends support to the notion that A+ persons may also be less accurate in reporting drug taking, than A- persons.

Another facet regarding Factor A which merits further study, in the relationship to baseline blood pressure levels. Factor A is the only Factor correlating significantly with height of blood pressure before treatment. (for SBP, $r = .47(p < .001)$, and for DBP, $r = .49(p < .001)$). Dixon and Johnson (1976) have commented on the relationship between pretreatment height of blood pressure, and changes in blood pressure occurring through whatever means. The precise role of the personality variable Factor A in these relationships awaits full explanation.

FACTOR F

This Factor is termed 'Desurgency-Surgency', and is found to correlate significantly with % Δ SBP. (See Table 42, p 182). The F- characteristic is associated with better outcome in the diuretic phase ($r = .48, p = .02$).

Persons at the F- pole (Desurgency) are described as prudent, sober, taciturn, serious, introspective, concerned and cautious, in contrast to those at the F+ pole who are described as enthusiastic, heedless, and happy-go-lucky. The trait is an important component of the second order introversion-extraversion Factor (QI). It is considered to have a relatively high heritability (0.60). Cultural differences are quite marked - for example, the trait is typically high in Australian compared with Orientals. The F- trait is considered to reflect the 'disciplinary weight of experience', the 'effect of a general severity of the economic, socio-ethical, and physical world, in terms of care and forethought required'.

Regarding responses to individual questions, item analysis reveals that best discriminator in females is the question, 'I feel a bit awkward in company and do not show quite so well as I should'.

Thus, whilst Factor F traits are concerned overall with 'seriousness-enthusiasm', the 'seriousness' among these female patients appears related to shyness, inhibition, and social anxiety.

The finding described above was not predicted, but it is consistent with the 'involvement' hypothesis described above, that the more introspective F- person should fare better. Compliance would also be more likely to be adequate in the 'prudent' than the 'heedless' person.

(v) FACTOR H.

This factor is designated, 'Timidity-Boldness' and correlations occur with $\% \Delta BP$ only in Phase I. In males, for $\% \Delta SBP$ $r = -.11$, $p = n.s.$, and for $\% \Delta DBP$, $r = -.27$, $p = .02$. In females, for SBP $r = -.42$, and $p = .03$, and for DBP $r = -.35$, $p = n.s.$

The H- trait is thus associated with greater reduction of BP in this phase.

The H- person is described as shy, timid, restrained, threat sensitive, and retiring; the H+ person is described as adventurous, socially bold, thick skinned and actively interested in the opposite sex.

This factor is considered to have the closest association with physiological disturbance, in particular sympathetic over reactivity, as shown for example by reactions to the cold pressor test. Heritability is considered to be about 0.40, and females typically score significantly lower than males.

Examination of responses to individual questions reveals that:

- (a) In male patients, there are three questions which discriminated high and low scorers:
 - (i) Some things make me so angry that I find it best not to speak ($p = .01$).
 - (ii) I am shy, and careful, about making friendships with new people ($p = .025$).
 - (iii) When I make a just complaint I always get matters adjusted to my satisfaction ($p = .05$).

(b) In female patients, the second of these questions is the strongest discriminator, at the $p = .025$ level.

The two elements which emerge from these responses appear to be inhibition of aggressive feelings on the one hand, and anxiety about involvement with new people on the other.

The inhibition of emotional expression and assertiveness of H- males appears at first glance rather similar to the 'submissiveness' of E- males. However, whereas the E- male did less well in Phase I, the H- person showed a greater reduction of BP. A possible explanation of the discrepancy can perhaps be found by considering the specific connection with physiological sympathetic over-reactivity referred to above. H- persons appear to show an 'arousal' pattern of anxiety to a greater extent than E- persons. The H- trait is an important component of the second order Anxiety Factor (QII) whereas the E- trait is not.

The association with other anxiety measures (KDS and SPI) is clearly evident in Phase I, as these 'state' measures also are associated with greater reduction of BP. The H- person would appear to have more labile BP associated with anxiety.

It would appear that participation in the study was itself anxiety reducing for such 'threat-sensitive' H- persons, so there was a greater reduction in BP in both sexes in such persons than in the less anxious patients. In other words, there would seem to have been some dissipation of the 'head' of BP related to arousal before drug treatment was undertaken. The fact that no correlations with H- occur in later stages is consistent with that explanation.

(iv) FACTOR G:

This Factor refers to 'Superego Strength'. A single significant correlation was found, namely in relation to %ASBP in males, in Phase II ($r = -.40, p = .002$: See Table 42 p 182). The G- trait is associated with better outcome on diuretic treatment. At the G- pole (low superego strength) are persons who tend to disregard rules, and who are expedient, frivolous and fickle. The G+ pole (high superego strength) harbours persons who are conscientious, persistent and moralistic, and emotionally disciplined.

The trait is considered to have an appreciable heritability about 0.40), to increase moderately with age, and is typically slightly higher in women than men. High scorers are usually high achievers occupationally. The unitary structure 'G', closely matches the psychoanalytic construct of the superego.

Responses to individual questions in male patients reveals that the questions which discriminate high and low scorers are -

- (i) "If my income were more than enough for ordinary daily needs, I would feel I should give the rest to a church or other worthwhile cause" ($p = .005$).
- (ii) "I feel that
 - (a) some jobs just do not need doing so carefully as others
 - (b) any job should be done thoroughly if you do it at all"
 ($p = .025$) .

Persons responding affirmatively to (i) and to (b) in (ii) would seem to be experiencing superego pressure to a considerable degree.

While it might have been assumed that compliance would be greater in such G+ individuals, and therefore a better response to drug treatment might have been expected, it would seem that reduction of SBP was more likely in those with less harsh and punitive superego structures. In other words, the person suffering excessive superego tension appears somewhat less liable to early reduction of BP. As the study progressed the trend is not apparent, perhaps because the compliance problem results in an opposite trend.

(vi) FACTOR I:

This Factor is said to measure the "Tough minded-Tender minded" dimension of personality. It is found to correlate with % Δ DBP ($r = -.53$ $p = .01$ in females in Phase II, and to a slightly lesser extent with % Δ SBP in females ($r = -.42$ $p = .04$) and % Δ DBP in males ($r = -.23$ $p = .05$) also in Phase II. (See Tables 41 and 42, p 180 and 182). Persons of I- traits fare better than those of I+ traits during diuretic treatment.

At the I- pole (Toughmindedness), the evident traits are lack of sentiment, self reliance, "hardness" and practicality; at the opposite I+ pole (Tender mindedness) are traits of sensitivity, dependency, "overprotection", insecurity, intuition, and hypochondriacal preoccupation. Typically there are sex differences, women tending to the I+ pole. Heritability on this trait is considered to be quite high (0.60). The association of the I+ trait with poor health, chronic illness, low performance, and neuroticism may be relevant to the present study. The I+ person lives more by feeling and intuition than by logic and fact.

Responses to individual questions are as follows: -

- (a) For male patients, the two questions which discriminated high and low scorers were:
- (i) I would rather be (a) a construction engineer
(b) a teacher of social ideas
and manners ($p = .005$)
 - (ii) I would rather exercise by (a) fencing and dancing
(b) wrestling and baseball
($p = .025$).

The responses indicate the expected preference for masculine and practical pursuits in I+ persons.

(b) Among female patients, the two questions which discriminated high and low scorers, both at the $p=.05$ level were:

(i) I can do hard physical work without feeling worn out as soon as most people.

(ii) I think that what people say on poetry could be put just as exactly in plain prose.

In female patients, the non-nonsense, practical, independent aspect is evident from these responses. The better response to diuretic treatment may reflect a more straightforward, less conflicted adaptation to the treatment programme. This conclusion is supported by the finding (See Table 59, p 200) that Factor I is the only 16PF Factor which correlates significantly with the conscious "Attitude to Drug Treatment" rating.

(viii) FACTOR M:

This Factor purports to assess the 'Practical vs imaginative' aspect of personality. There is a single finding of statistical significance, namely that females in Phase III showed a correlation between M+ and % Δ BP ($r = .58$, $p = .01$); see Table 46, p 186.

At the M- pole are persons described as practical, conventional, prosaic and steady. The M+ pole reveals persons who are described as imaginative, bohemian, and fanciful.

The source trait has a moderate heritability of approximately 0.40, and scores are typically higher in women.

Persons of M- traits tend toward concrete, non-subjective occupations, while M+ traits are evident in more creative roles as in artists, and psychologists.

Cattell (1973) suggests that "psychosomatic and stress illnesses" are associated with the M- trait. It is of interest that in Kidson's (1973) study, scores on Factor M were found to be significantly lower ($p = .01$) in 40 male outpatient hypertensives, than in 110 non hypertensive controls. The mean sten scores were 4.2 and 5.2 respectively for the two groups.

With regard to responses to individual questions, in the present study, the question which discriminates best between high and low scorers in female patients is -

- (i) I would rather see
 - (a) a good movie of hardy pioneering days
 - (b) a clever movie, farce or skit on the society of tomorrow.

It remains somewhat difficult to explain adequately the finding that females revealing such a preference as indicated by a (b) response to this question, should do better regarding BP reduction. Perhaps it reflects a less careworn, more playful attitude, that life need not be taken quite so seriously all the time; the converse traits were emphasized in Moschowitz's 1919 description as characteristic of persons with essential hypertension (see p 15). It should be added that Factor M has somewhat lower concept validity ratings (direct and circumstantial) than most of the 16PF Factors, so the relevance of the finding should not be too highly stressed.

(ix) FACTOR Q2:

This Factor is termed 'Group Dependency vs Self Sufficiency'. This Factor is seen to correlate with Δ DBP in Phase III, in male patients ($r = -.44$ $p = .002$); see Table 46 p 186. Persons at the Q2+ pole (selfsufficient, resourceful, preferring own decisions) do less well than those at the Q2- pole (socially group dependent, "sound followers").

The trait has low heritability (0.25), and sex differences are negligible. Q2 is one of the major Factors contributing to the second order Introversion factor (Q1). As mentioned earlier (p 233), Q2+ has been associated together with L+ with proneness to coronary artery disease.

Regarding individual items, it is found that in male patients, three of the questions are highly discriminating between high and low scorers:

- (i) When I plan something I like to do so quite alone, without any outside help ($p = .001$).
- (ii) To vote well on a social issue I would read:
 - (a) a widely recommended novel about it.
 - (b) a text-book listing statistical and other facts ($p = .001$).
- (iii) I sometimes hesitate to use my own ideas, for fear they might be impractical ($p = .01$).

The wish for independence, and rejection of dependence is clearly apparent in the response to the first question. The third question appears to be concerned with belief in one's self sufficiency.

Those patients with Q2+ traits would be expected to have much greater conflict in accepting a passive, dependent, patient role than Q2- individuals. Having complied with the invitation for participation in the study, it would be expected that the expression of such tendencies could lead to diminished compliance in taking medication, and perhaps in long term participation in the study as a whole. Whether the significant mediating mechanism is mainly poor compliance, or is related to psychological conflict over dependency which is intense enough to exert pressor effects (as the Alexand/Saul theory would predict, is not able to be determined from the information available.

It is consistent with the abovementioned conclusions that among the withdrawals and losses Factor A2+ persons showed a greater trend to withdraw from the study than Q2- persons.

CONCLUSIONS

Exploration of personality traits and situational factors in a consecutive series of 75 hypertensive patients has tended to confirm the statements made over two decades ago by A.P. Shapiro (see p 92 to 94) concerning the potential for multiple nonpharmacological influences in drug treatment for essential hypertension. Shapiro had drawn attention to the need to study such sources of variance as the establishment of adequate "baseline" measures, the effect of the individual physician's capacity for reassurance, the specific meaning of a new drug to a patient, the influence of environmental stresses, the effect of "suggestion", and the subtle interplay of psychodynamic forces in the experimental situation. He referred also to the complex effects of hospitalization itself, effects outside those at play in the present series.

The very complexity of the field, and the real difficulty in isolating one factor from another, so that the influence of any one of them can be adequately delineated, may be major reasons why this area of research has been so neglected, relative to the number of drug studies in essential hypertension. While systematic appraisal of personality traits by questionnaire, and assessments of life stress and current emotional state have been attempted this study may be criticized on the grounds that subtleties of the clinician-patient relationship were not explored systematically. However, a typical clinician's role did not obtain, because a great deal of emotional support and guidance was provided by the Nursing Sister who participated throughout and beyond the study itself. While routine Clinic patients also had the benefit of her involvement in ongoing treatment, the

investment was much greater in the Study group than for routine patients. Such factors as these were not able to be expressed quantitatively, and yet might have been responsible for effects at least as telling as some of the variables which were studied. A future study which incorporated a measure of the perceived helpfulness of staff members to the patient, would have obvious advantages in that respect.

While a great deal of useful information accrued from the use of the 16PF, the fact that "hostility" traits could only be very indirectly inferred was a limitation, and an additional psychological measure such as a verbal sampling technique, the Thematic Apperception Test, or the use of a questionnaire such as Foulds' Hostility and Direction of Hostility Questionnaire (HDHQ) might have permitted more adequate testing of the hypothesis derived from psychoanalytic investigation, than Factors E, H and L of the 16PF. However, the demands of the overall hypertension Study placed limits on the amount of testing in which patients could reasonably be involved.

For the reasons outlined in the Methodology Section (p 131) the writer did not carry out an indepth psychiatric examination including details of family history and relationships and personal developmental history, during the collection of data over the 12 month period. It is entirely possible that themes highly relevant to satisfactory attachment to a doctor, such as authority conflicts or unmet dependency needs with parents, might have been uncovered and found to be related to outcome. In the time since the conclusion of routine data collection the writer has interviewed a significant minority of the patients in much greater depth, as well as interviewing spouses where possible, and it was obvious

in interviews with younger noncompliant patients in particular that transference problems arising from damaged parental relationships played no small part in the difficulties of the doctor-patient relationship and subsequent unsuccessful treatment.

For example, patients No. 43, 68 and 70 were all admitted for cerebrovascular complications within a year of the concussion of the study. Their ages were 37, 21 and 33 years respectively; all had been noncompliant, and all had a history of severely disturbed paternal relationships with early pseudo-independence and subsequent conflicts with authority figures.

Evidence gleaned from these post-study interviews has also persuaded the writer that the simple ratings of "Marital Stress" and "Family Stress" were inadequate, and certainly these stresses were under-reported. The discrepancy between in-study data and subsequent interview data appeared much greater for these two life stress areas, than for work stress. Patients appeared less reluctant to bring out problems related to the latter at a screening interview, perhaps because work stress may be able to be perceived as something "outside the self", compared with marital or family stress about which defensiveness was so evident.

Among the study's compensatory virtues was the fact that the writer was 'blind' to the BP levels and changes, drug group, and previous psychological data, at the time of the assessments: it was hoped that this would considerably reduce bias in interview ratings. The participation of a psychiatrist in the study appeared to do no harm, and while the attempt was made to be neutral rather than helpful therapeutically, it appears from post-study interviews that a rapport had been established in most cases, which made subsequent involvement

easier than would otherwise have been the case. For example, the writer has been involved in marital therapy, family therapy and individual supportive psychotherapy with certain patients where a clear need arose for these treatment approaches as time passed. He has also been asked to assist in the management of "problem patients" who had been noncompliant, such as the three mentioned above who had already suffered cerebrovascular complications.

As far as personality theory and essential hypertension is concerned, it does appear that it would be most useful to pursue the dimension revealed by the Factor A correlation with outcome. Apart from its possible relation to compliance behaviour, the 'reserved-outgoing' trait may be closely related to the dimension Singer (1974) referred to as 'engagement-involvement'. It is conceivable that this aspect of personality is not separate from but is functionally connected with the classic conflict over disposition of hostility, representing defensiveness and avoidance as a coping style for fear of intrusion of aggressive feelings in close relationships, and such a speculation would need to be tested by careful study of hypertensives and non hypertensives regarding these conflicts and coping strategies. In particular, a study of young early hypertensives would promise to be most profitable. Thus Harburg's (1964) college students showed a positive correlation between Factor A and height of blood pressure; and the present series showed a clear negative correlation in the pre treatment phase. This raises the question whether the A- trait is partly a function of the interplay between life stress and a hyperreactive pressor system, consolidated over years. On this basis, the avoidance behaviour of the A- person may be biologically adaptive.

Pursuing this issue further, one returns to the intriguing hypothesis advanced by the Lacey's (1970) that raised BP may itself play a part in psychological adaptation, by an 'inhibitory' effect on CNS excitation via central afferents of baroreceptor connections. By this mechanism, a change in interactive style and degree of "involvement" may not be a psychological choice but a biological imperative. Similarly, Schwartz (1976) has proposed a "dysregulation" theory, that the brain can learn to "disconnect itself" regarding purely physiological homeostasis for the purpose of achieving psychological equilibrium for the organism, but at the price of disrupted cardiovascular regulation.

This theory is at a frontier of thinking which links psychology and cerebrovascular physiology, and clearly at present the theorizing may be somewhat ahead of hard evidence. The writer is attracted to the thought that pharmacology may help to provide answers to such questions; For example, certain modern antihypertensives namely α blockers, and vasodilators and diuretics, do not alter CNS function directly but exert effects peripherally, and so the effects of reducing BP level on psychological functioning should be able to be studied. In addition, certain drugs (such as methyldopa and clonidine) have clear CNS depressant effects along with hypotensive effects of comparable degree, so that studies of behavioural and psychological changes in patients taking these agents, in comparison with those taking drugs with no direct CNS effects, may shed further light in this area. If raised BP is actually "dampening" CNS responsivity as the Lacey's and Schwartz suggest, drugs such as bethanidine, α blockers and diuretics should lead to a detectable increase in CNS excitation in some form. Anecdotal information from a few patients taking bethanidine in the present study suggested that this did sometimes

happen. For example, patient No. 68 ascribed his noncompliance on bethanidine mainly to the disagreeable effects of uncontrolled aggression after taking the drug. It will be possible to investigate this aspect to some extent from data available from the present study, but additional study of initially untreated patients will obviously also be necessary.

The repeated findings from personality studies that untreated hypertensives do not have a 'neurotic profile', (Robinson 1964, Cochrane 1968, Kidson 1973) is not at variance with the abovementioned 'dysregulation' hypothesis, in fact an absent or negative correlation would be predicted from that theory. Alexander (1950) also conceptualized essential hypertension as an alternative to a neurotic state, rather than simply a consequence or manifestation of it, but tended to regard genetically determined predisposition to vascular overreactivity as explaining the 'choice' of which organ system suffered the consequences of the suppressed pent up aggressive drive. The modern theory places a more fundamental role on receptive brain mechanisms and afferent cardiovascular connections, than on discharge of cerebral excitation via efferent autonomic connections as in the earlier theory.

The psychiatrist venturing into the less familiar domain of cerebral physiology and regulation of cardiovascular functioning, may well be intrigued by the possibilities for research in this area offered by the practice of clinical psychiatry. What happens to BP level and other cardiovascular regulation in psychotic decompensation? Is the efficacy of antipsychotic drugs and antidepressant drugs in any way related to blood pressure-reducing properties? Is it coincidental that reserpine is an antipsychotic as well as antihypertensive drug? While some areas of this interface between psychiatry and essential hypertension have already been studied (e.g. Heine, Sainsbury and Chynoweth 1969) the field is ripe for further development and imaginative research at the present time.

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APPENDIXCASE HISTORIES

Vignettes of five patients have been provided in the Discussion Section (pp 241 to 246) regarding the specific issue of "work stress". In a later section of the Appendix (pp 296 to 302), brief reports are provided for all patients who failed to complete the 12 month followup.

The following two case histories, one of each sex, are chosen from the majority of patients who were "successful" in terms of satisfactory blood pressure reduction. Both had a positive attitude toward the treatment programme in the Research Study, and both were fully compliant with medication, according to information from spouses. Their histories illustrate such aspects as reactions to diagnosis, coping strategies with current environmental stresses, and the typical sex difference in degree of defensiveness in reporting certain stress situations.

CASE HISTORY 1 (FEMALE)

The patient (Research No. 10), was a 57 year old married housewife who had been referred by her general practitioner for treatment of hypertension in the Research Study. Elevated blood pressure had first been detected 3 years earlier (levels around $220/120$ mm Hg), at which time her complaints were of palpitations, throbbing sensations in her head, and impairment of memory. Investigations carried out at that time to exclude renal or other causes for her hypertension were

negative, and the physician recorded "essential hypertension - possibly nervous factors are predominant". She had failed to respond to a combination of a daily dosage of bethanidine 20 mgms and amylobarbitone 90 mgms from her general practitioner, but did have a moderately satisfactory response to methyldopa 750 mgms per day combined with diazepam 6 mgms daily at the Hypertension Clinic. However, she did not maintain her followup and at the time of re-referral for treatment in the Research Study blood pressure levels were again $220/120$ mm Hg.

At the baseline assessments her mean levels were $177/104$ mm Hg, and after diuretic therapy the level was $167/89$ mm Hg. After 12 months of combined diuretic therapy and methyldopa, which was started at a dosage of 500 mgms per day initially, increasing to 625 mgms at 3 months and reducing to 375 mgms per day by 12 months, the levels were fairly satisfactory at $147/87$ mm Hg.

There was a family history of hypertension in two close relatives, and the patient was a regular smoker of 10-15 cigarettes, and a non drinker. She was on no other medication at the time of the baseline assessment.

At the standardised psychiatric interview at the baseline stage, she reported moderately severe fatigue, irritability, impaired concentration, depression and anxiety, with some phobic avoidance of travelling alone or leaving the house unaccompanied, and there was a mild sleep disturbance. There was also evidence of obsessional behaviour and thinking, with checking rituals and intrusion of

unwanted anxiety-provoking thoughts. Her "total emotional disturbance" score on the SPI was 36, well above the mean of 20 for the 21 female patients (see Table 19, p 159), and well above the cut-off point of 17 designating neurotic disturbance (Mann, 1977). KDS Anxiety Score was 16 (mean = 15 for female patients), and the KDS Depression Score was 21 (mean = 21 for female patients). The greatest deviation from the mean score on the 16PF occurred for Factors G, M and O (sten score = 2) and Factor N (sten score = 9). The patient did not acknowledge significant anxiety about the implications of essential hypertension for her future health, and was optimistic about the response to treatment from medication (rating 1 on the 0 - 4 point scale). There was no report of marital or family disturbance, and she was a housewife so work stress was irrelevant. There was a report of environmental stress concerning troublesome and aggressive neighbours in the area in which they were living, but this was not rated on the interview schedule.

At the clinical level, the combination of symptoms described above amounted to a moderately severe anxiety neurosis with some phobic and obsessional features. The patient did not seek any psychiatric assistance for these symptoms during the study. Over the 12 months period there was improvement on some of these symptoms, but the "total emotional disturbance" score was still 22 at the 12 months stage. The KDS Anxiety Score had dropped from 16 to 9, while the KDS Depression Score had increased from 21 to 27.

PERSONAL HISTORY

The patient had spent her first 53 years in Suffolk, England, migrating to South Australia just one year before her hypertension was diagnosed. She was the 6th of 9 children, 3 of whom had died in recent years. The patient's father, who had worked as a trimmer in a foundry, died at 79 of bowel cancer, and her mother died at 74 of cardiac problems. The patient was close to both parents, had nursed both of them in the later years of their lives and appeared to have resolved her grief reaction adequately after their deaths.

The patient had no significant illness as a child, and described herself as shy and inhibited socially during her developing years. After leaving school in her mid teens she worked as a machinist until her marriage, and had subsequently worked as a supervisor of cleaners in a large firm before migrating to Australia.

She was married in her mid 20's, and there was one daughter to the marriage, which was described in very positive terms. The sexual relationship had been good for most of their married life until her more recent illness. Her husband had worked as a supervisor in an engineering firm in Britain, and was persuaded by the patient somewhat against his will to migrate to Australia following the earlier migration of their only daughter after her marriage. Since that time, two other sisters had also migrated to South Australia, and one of them subsequently required inpatient psychiatric treatment for a depressive illness.

INTERVIEW WITH HUSBAND

It became evident from this interview that problems of separation anxiety loomed large in his wife's case. There had been a high level of interdependence among her family members, and she had little social interaction outside the family circle during their years in England. She had tolerated badly the separation brought about by her daughter's migration to Australia, but her own emigration was followed by difficulties in adapting to the loss of her other family attachments in England. Her anxieties had increased when one of her other sisters decompensated psychiatrically not long after migrating to Australia and required inpatient treatment.

At the time of referral for treatment in the Research Study, the patient had become increasingly housebound, and was reluctant to go shopping alone or travel on public transport. The husband confirmed that she had been quite disturbed over the violent behaviour of some near neighbours who were aborigines. She had always been a person who had wanted to shield herself from aggression. He thought that this combination of problems contributed to the deterioration in her health and to the onset of her elevated blood pressure levels, which had not been evident at the medical screening prior to her leaving for Australia.

The patient had been quite meticulous about compliance with medication, and had few side-effects from her medication except a possible further reduction of libido. She had co-operated positively in the treatment followup programme at the hospital.

CONCLUSION.

The patient was a middle age woman in whom there was clear evidence of an anxiety neurosis with some phobic features, at the time of detection of elevated blood pressure levels. Hypertension was predominantly systolic, and it is quite possible that the 'arousal' state associated with chronic anxiety neurosis was a significant factor in the blood pressure elevation. Satisfactory modification of the latter occurred with regular antihypertensive treatment, but there was only partial modification of her anxiety symptoms during the 12 months of treatment. Her personality configuration included inhibition of assertiveness, fear of aggression, and marked anxiety at disruption of attachment bonds. There were obsessional traits, and adaptation to a new environment provided difficult and may have contributed to her illness. During treatment her attachment to the Hypertension Unit staff would seem to have helped provide needed security and care, as well as appropriate medication.

Postscript - the patient remained well as far as her blood pressure levels were concerned, but subsequently required admission to the Psychiatric Unit at the general hospital when depressive symptoms worsened and her level of agitation became intolerable when she was alone. The anxiety symptoms failed to respond to the use of high dosage of benzodiazepines. A moderate improvement occurred with the addition of tricyclic antidepressants, and a change in anti-hypertensive therapy from methyldopa to a beta blocking agent, this change having been made because of the possibility that methyldopa might have contributed to the depressive state.

APPENDIXCASE HISTORY 2. (MALE)

The patient (Research No. 59), was a 36 year old married clerk, whose blood pressure elevation was detected at the time of a medical examination related to an adoption procedure. He was asymptomatic at the time, although the blood pressure level on referral was $210/140$ mm Hg. He was not aware of any previous readings of elevated blood pressure; the most recent reading had been four years previously.

During the baseline assessment phase, the four blood pressure readings varied between 152-180 systolic and 111-128 diastolic, with a mean of $169/124$ mm Hg. After a month of diuretic therapy, there was some reduction of systolic pressure to 159 mm Hg, while the diastolic was still 120 mm Hg. Clonidine was added in an initial daily dosage of 150 microgrammes, and this was increased to 375 microgrammes per day by the 12 months followup stage, at which time his blood pressure level was $120/90$ mm Hg.

There was no family history of hypertension; the patient had taken considerable pains to enquire from all possible family members about this aspect. He had not been taking any other medication, and was a non-smoker who drank only occasionally.

The patient's reaction to the diagnosis of hypertension was one of considerable anxiety. He read widely concerning the implications of elevated blood pressure, and was fully conscious of the increased risk of cerebrovascular injury at the time of the first assessment, i.e. there was no evidence of denial, and he appeared highly motivated to cooperate in treatment.

The interview schedule ratings at the baseline assessment indicated symptoms of moderate sleep disturbance, irritability, and anxiety and acknowledgement of occasional spells of depression. KDS anxiety and depression scores were 12 and 7 respectively, (mean scores for N=55 males were 9 and 16 respectively - see Table 18, p 158) The SPI "total emotional disturbance" scores was 11, indicating a mild to moderate level of emotional disturbance (mean score for N=55 males was 13 - see Table 19 p 159). The greatest deviance from the mean on the 16PF at baseline was a sten score of 2 for Factor Q3 (low self sentiment integration), while a score of 3 was obtained on Factors A, M and Q2, and a score of 8 on Factors B and C. His attitude to the forthcoming drug trial was one of optimism (rating 1 on the 0-4 point scale).

Regarding life stress ratings, he did not acknowledge significant marital or work disturbance, but there was definite disturbance within the family environment. His wife's 15 year old brother, severely disabled with dystrophia myotonica, was living with the patient and his wife, and this caused him intense frustration, as he resented both the intrusion, and the displacement of responsibility from inlaws onto himself and his wife. He had tended to bottle up his feelings about this problem but eventually had given vent to his anger, with no change in the situation. By the time of the 12 month assessment, the "family stress" had been reduced considerably as the brother-in-law had been away from the home for several months staying with relatives.

At the conclusion of the study a more detailed personal history was obtained, and his wife was interviewed.

PERSONAL HISTORY:

The patient was the third child and eldest son of ten siblings, and spent the first 20 years of his life in Guyana. His parents were English born, and his father worked as a salesman in a retail store for most of his life. The father was described as exceedingly strict, with a penchant for physical punishment for minor misdemeanours until the patient was in his mid teens.

It is relevant that the patient did not complain of his father's behaviour in describing it, rationalizing it as necessary because of the size of the family, but admitted to his bitterness at discovery years later that his father was much more lenient with younger siblings than had been the case with himself. There was a close and affectionate relationship between the patient and his mother, and toward most of his elder female siblings.

He was enuretic until the age of 6, was always shy and retiring in relationships with peer groups and with authority figures in his school going years. He also described harsh discipline with physical punishment at his school in Guyana.

From the age of 16-20 the patient was an overseer on a plantation, and his diffidence and shyness were a problem as he was expected to be a disciplinarian himself in relation to the black labourers on the estate. He coped moderately well, but left at age 20 for the United Kingdom accompanying his sister; he did clerical work in the South-west of England for another 4 years before migrating to Australia. His family have subsequently moved from Guyana back to England, while one other sister is in Australia at the present time.

In the 12 years since coming to South Australia he had remained with one firm and work relationships were described as generally congenial, but he had little ambition to advance himself beyond his present clerical position. He expressed a clear preference for working in relative isolation from colleagues. He had a series of short-term relationships with members of the opposite sex, before marrying at 35 a woman 15 years his junior. The issue of adoption of children rather than having their own arose because of the family history of dystrophia myotonica, and this appeared to perturb him less than it did his wife, from his account. The couple were informed that adoption could not be considered until his wife was 25 years of age. They had a good sexual relationship, and the few conflicts which occurred were all centred around the problem of his wife's divided loyalty with regard to other sick family members, whom she tended to feel obliged to look after when necessary.

Enquiry about his means of handling frustration and resentment indicated that he preferred to avoid aggressive interchange whenever possible "I have a real hatred of arguing."

INTERVIEW WITH WIFE

The interview with his wife at the conclusion of the study confirmed most of the relevant points made above but there was emphasis on important matters. She said that he had an extreme reaction to the diagnosis of hypertension, being unable to sleep adequately for at least a few weeks. After an initial flurry of searching for information about the condition he dismissed it from conversation and "hates anyone to say anything about it now".

Her description of his character indicated distinct obsessional traits. He was highly conscientious, perfectionistic in attitudes at

home or at work tending to expect much of others as well as himself. In her opinion he had never been able to relax properly, and was particularly tense in social situations; she could readily detect anticipatory anxiety in him, for example at the time of his visits to hospital for physiological studies (cardiac output). She thought he was sensitive about his Guyanese accent, believing people might be disparaging him, while she believed no such attitudes were evident.

His wife emphasized the importance of the conflict over her family's hereditary condition. There was a 50% chance that her children would develop the condition, but she had not discussed this with her husband fully until two weeks before their marriage. She was greatly concerned that if she became pregnant herself, her husband would remain anxious for years, hence her wish to seek adoption, although one of her sisters had decided that the risk was worth taking and had become pregnant at the time of the interview.

The patient's wife also agreed with her husband that the imposition by her family members on herself had greatly contributed to the strain at home, as her husband resented the presence of a third person, but was unable to reject her brother sensing his need for support. Her statement of his reactions was "he couldn't talk about it, because if he did he would want to shout and yell".

While the patient had reported that there was no stress in his work situation, she thought he had considerable conflict with authority and gave examples concerning his immediate superior in the work situation. She had encouraged him to ventilate his frustrations rather than bottle his feelings up as was his habitual pattern.

She added that she could always tell when her husband's blood pressure would be elevated at the time of his visits to hospital,

because it would reflect the state of mind concerning his conflicts over his brothers or his problems with his work. Since the medication she thought he had been sleeping better but was more tired, and that he was more able to speak of his feelings than previously.

CONCLUSION:

It is a matter of speculation whether the considerable life stress related to his wife's family, and the implications for their marriage of the hereditary neurological condition, were pathogenic factors related to the timing of development of elevated blood pressure in the mid 30's in his case. His personality traits appear very similar to those of the classical "hypertensive personality" with a tendency to be overtly submissive and compliant while inwardly experiencing considerable frustration and resentment. It is quite possible that the necessary involvement with others of his wife's family after his marriage stimulated unresolved conflicts arising from his early life especially regarding siblings. There was also a tendency to deny the presence of conflict with authority figures at work, which were reported clearly by his wife rather than by himself. Defensiveness in this area is likely to be linked with that concerning paternal aggression in his developing years.

His adaptation to treatment had appeared exemplary in terms of compliance with medication and regular medical followup. By the time of the 12 months followup stage there was a significant change in the stress situation in his family. The extent to which his improvement can be attributable to pharmacological treatment, or release from major psychological stress resists precise definition.

Appendix

Losses and Withdrawals

1. Patient No. 1: A 58 year old married Minister of religion: BP levels at referral and baseline stage were $^{210}/_{120}$ and $^{189}/_{112}$ mm Hg respectively. Questionnaire and interview scales showed very low scores on measures of affective disturbance. Within 2 weeks of starting medication he developed severe muscle aches and pains, with a pyrexia, and at his request was withdrawn from medication and the Study, later to receive alternative medication.
2. Patient No. 7: A 49 year old married bank officers: BP levels at referral, baseline, and diuretic stage were $^{190}/_{110}$, $^{151}/_{104}$, and $^{156}/_{104}$ mm respectively, i.e. no improvement occurred on cyclo-pentiazide alone. The addition of methyldopa in dosage 750 - 1000 mgm/day was followed by complaints of fatigue, somnolence, and sexual dysfunction which were unacceptable to him, so alternative treatment was arranged.
3. Patient No. 13: A 19 year old single male apprentice cook: BP levels at referral and baseline stage were $^{260}/_{140}$ and $^{191}/_{130}$ mm Hg respectively. He dropped out within a month, and it was thought that geographical factors (he lived 120 Km from the city, on an island) and family pressures (his father was a 53 year old hypertensive who rejected drug treatment) contributed to his non cooperation.
4. Patient No. 31: A 39 year old married housewife; Bp levels at referral, baseline and diuretic stage were $^{168}/_{96}$, $^{170}/_{109}$, and $^{164}/_{93}$ mm Hg respectively. Psychological assessments reveals some negative expectation from medication, and she scored the maximum rating in 16PF Q2 (Selfsufficiency). Within a few weeks of beginning Methyl-dopa at 750 mgm/day she opted out of follow-up in the Study, and returned to the care of a private practitioner.

5. Patient No. 34: A 49 year old married housewife; BP levels at referral, baseline and diuretic stage were $^{120}/_{120}$, $^{167}/_{113}$, and $^{136}/_{104}$ mm respectively. There was evidence of severe affective disturbance, and she reported marital and family stresses. She was commenced on Bethanidine 20 mgm/day, and 2 weeks later consulted her local doctor regarding insomnia for which she was prescribed nitrazepam. 3 weeks later Mutabon D (Amitryptline and Perphenazine) was prescribed in addition, Bethanidine was stopped, and she developed an acute toxic confusional psychosis necessitating admission to the general hospital psychiatric unit. A good recovery occurred but she did not re-enter the Study. Adverse drug interaction almost certainly played a significant role in the psychiatric decompensation.
6. Patient No. 35: A 50 year old divorced waitress; BP levels at referral, baseline and diuretic stage were $^{235}/_{130}$, $^{196}/_{117}$, and $^{216}/_{129}$ respectively, i.e. she was one of the more severe hypertensives whose BP level worsened on diuretic therapy alone. Scores on psychological disturbance were also among the highest in the Study. There were family stresses, and a doubtful attitude to treatment. Nonetheless, after 3 months of Bethanidine in dosage up to 150 mgm/day, BP levels were $^{178}/_{108}$ and she had improved psychologically. At the 3 month psychiatric interview she reported that a close female friend had died suddenly from cerebral haemorrhage. One week later she suffered the same fate.
7. Patient No. 36: A 32 year old married toolmaker: BP levels at referral baseline and diuretic stage were $^{180}/_{120}$, $^{192}/_{119}$ and $^{207}/_{126}$ mm Hg respectively. His BP levels increased on diuretic therapy alone. Minimal overt psychological disturbance was evident at

the baseline assessment. Methyldopa was commenced at 750 mgm/day and at a dosage level of 3000 mgm/day after 3 months, BP levels were still $^{181}/_{115}$ mm Hg; he was considered a treatment failure and withdrawn from the Study at that point, for alternative therapy at the Hypertension Clinic. There had been a slight worsening in psychological scores over the 3 months.

8. Patient No. 43: A 37 year old married storeman: BP levels at referral, baseline and diuretic stage were $^{175}/_{115}$, $^{184}/_{122}$ and $^{185}/_{112}$ mm Hg respectively, i.e. minimal benefit had occurred with diuretic therapy alone. A rather high level of emotional disturbance was found at baseline, there was a report of disturbance in marital and work relationships, and he had quite negative expectations from medication. He was a compulsive gambler, lived 200 km from Adelaide, and failed to continue follow-up shortly after starting Clonidine 150 μ g/day. Non compliance with medication continued to be a problem in further intermittent treatment by his general practitioner. An opportunity to reassess him psychologically during an admission following a slight cerebrovascular episode later provided strong evidence of a major authority conflict, this being confirmed by his wife.
9. Patient No. 58: A 46 year old single unemployed male: BP levels at referral, baseline and diuretic stage were $^{210}/_{110}$, $^{175}/_{103}$, and $^{178}/_{107}$ respectively, i.e. no benefit had been obtained from diuretic therapy alone. There was a past history of alcohol addiction and psychological assessment at baseline revealed a considerable degree of affective disturbance. Methyldopa was used in dosage from 500 mgm/day to 1250 mgm/day by 3 months,

at which time a satisfactory BP level of $^{127}/87$ mm Hg was achieved, and there was a reduction in his level of emotional disturbance. He failed to return for further follow-up appointments.

10. Patient No. 61: A 41 year old married foreman: BP levels at referral, baseline and diuretic stage were $^{180}/110$, $^{168}/107$ and $^{125}/91$ mm Hg respectively, i.e. during diuretic therapy BP levels were brought into the normotensive range. Low levels of anxiety were described, and no significant life stresses were acknowledged. No antihypertensive drug was required in his case, and he did not participate in the further research phases of the Study.
11. Patient No. 65: A 16 year old single male sales assistant: BP levels at referral, baseline and diuretic stage were $^{210}/140$, $^{177}/119$ and $^{167}/109$ mm Hg respectively. Low levels of anxiety were recorded at baseline assessment. He began specific treatment with Oxprenolol 40 mgm/day but was soon lost to the Study as he failed to return for follow-up.
12. Patient No. 66: A 43 year old married housewife, BP level at referral $^{220}/120$, mm Hg, mean baseline level $^{159}/110$ mm Hg. There was a moderate degree of anxiety. She was troubled by the cardiac output studies in the Human Studies Laboratory - "I felt like a guinea pig" had rather negative attitudes to drug treatment. A few weeks after commencing Methyldopa 750 mgm/day, she complained of side effects (drowsiness, lethargy) and withdrew from the Study at that point.
13. Patient No. 68: A 21 year old labourer, married but separated from his wife shortly prior to referral to the Study: BP levels at referral, baseline and diuretic stage were $^{210}/150$, $^{177}/115$

and $^{165}/_{96}$ mm Hg respectively. There were high levels on scores of affective disturbance at baseline assessment. He received Bethanidine in dosage between 20 - 50 mgm/day and remained in the Study for the 3 month assessment, by which time BP levels were $^{153}/_{92}$ mm Hg with no significant change in affective disturbance. He failed to return for further appointments, and later suffered a subarachnoid haemorrhage from a ruptured intracranial aneurysm.

14. Patient No. 69: A 38 year old married male works supervisor; BP levels at referral, baseline and diuretic stage were $^{200}/_{140}$, $^{149}/_{108}$ and $^{155}/_{116}$ mm Hg respectively, i.e. no significant improvement occurred on diuretic therapy alone. There were moderately high levels of overt emotional disturbance, and interestingly his scores were high on the two 16PF Factors (A+ and L+) which were most closely associated with less satisfactory outcome. He was prescribed Bethanidine in dosage between 20 - 70 mgm/day over 3 months, by which time BP levels were still high at $^{148}/_{112}$, and his psychological measures had worsened slightly. Higher dosage of Bethanidine was not achieved as he complained of side-effects including impotence. He was therefore taken out of the Study as a side effect failure, to receive alternative medication.
15. Patient No. 70: A 33 year old single man who worked in charge of a transport depot: BP levels at referral, baseline and diuretic stage were $^{150}/_{120}$, $^{167}/_{110}$, and $^{159}/_{105}$ mm Hg respectively. Relatively high levels of affective disturbance were recorded at baseline assessments, and he expressed considerable pessimism about forthcoming medication. Methyldopa was prescribed and

at 1000 mgm/day after 3 months BP levels were reasonably satisfactory at $^{142}/_{99}$ mm Hg, and there were no significant changes in scores of emotional state. He complained of tiredness, drowsiness and impaired libido, and further increase of dosage level was not achieved. BP levels increased again and he was withdrawn from the Study as a side-effect failure to receive alternative treatment. He did not persist long with Clinic follow-up, stopped medication, and was admitted within a year severely brain damaged from a cerebral haemorrhage.

16. Patient No. 71: A 44 year old married female office cleaner: BP levels at referral, baseline and diuretic stage were $^{190}/_{120}$, $^{167}/_{110}$, and $^{159}/_{105}$ mm Hg respectively. She had low levels of overt affective disturbance, and reported no significant life stress. She started 80 mgm daily of Oxprenolol but was withdrawn from the Study by the physician shortly afterwards because of side effects probably related to the cyclopentiazide rather than the Oxprenolol.
17. Patient No. 72: A 53 year old married housewife: BP levels at referral, baseline and diuretic stage were $^{260}/_{140}$, $^{210}/_{118}$, and $^{175}/_{96}$ mm Hg respectively. High levels of emotional disturbance were recorded at baseline assessment. She received Methyldopa 750 mgm/day and at 3 months BP levels were satisfactory at $^{149}/_{87}$ mm Hg. When the combined data was analysed she had not completed 12 months follow-up, and she subsequently was missed for the interview schedule.
18. Patient No. 73: A 50 year old married man who worked on an assembly line at a large factory: BP levels at referral, baseline and diuretic stage respectively were $^{160}/_{110}$, $^{165}/_{99}$, and $^{128}/_{89}$

mm Hg respectively. Low levels of anxiety were noted at the baseline assessment. His BP remained satisfactorily controlled on diuretic therapy alone, so that specific anti-hypertensive thereapy was not required at that stage.

20. Patient No. 75: A 51 year old married manager of a retail store, whose BP levels at referral, baseline and diuretic stage were 190/120, 161/94 and 151/105 mm Hg respectively, i.e. there had been little benefit from diuretic therapy alone. Emotional disturbance was at an average level, and work stress and pressures were described. He began Clonidine in dosage of 150 g/day, and died suddenly after a myocardial infarction 2 months later.

Subject	Sex	Age	Marital Status	Reported BP	Mean Baseline BP	Post Diuretic BP	12 Months Combined Treatment BP
1	M	58	M	210/120	189/121	-	-
2	M	49	M	165/105	168/107	141/92	148/96
3	F	53	M	175/106	165/111	158/105	147/108
4	M	41	M	170/100	172/105	152/92	152/69
5	M	35	M	160/120	146/106	152/103	140/104
6	M	57	M	190/106	184/106	194/103	170/102
7	M	49	M	190/110	151/104	156/104	-
8	M	62	M - W	215/130	193/125	204/120	147/86
9	M	57	M	220/120	176/115	166/101	135/81
10	F	57	M	220/120	177/104	167/89	147/87
11	M	43	M	180/130	184/123	174/118	122/95
12	M	43	M	240/140	169/98	177/109	161/106
13	M	19	S	260/140	191/130	-	-
14	M	52	M	170/100	193/121	190/120	118/73
15	M	23	S	170/110	150/103	134/79	124/78
16	F	42	M	170/110	166/116	145/104	148/99
17	M	41	M	148/104	150/104	168/110	146/106
18	M	46	M	184/124	157/108	140/93	148/99
19	F	53	M	240/120	188/114	187/100	121/83
20	M	41	S	220/140	200/130	170/111	131/88
21	M	44	S	195/125	185/118	149/101	135/85
22	F	43	M	197/119	170/117	173/107	142/91
23	F	36	Div	205/125	174/109	138/96	116/87
24	M	34	M	150/100	153/107	155/118	149/102
25	M	49	M	190/105	175/118	131/91	131/95

Subject	Sex	Age	Marital Status	Reported BP	Mean Baseline BP	Post Diuretic BP	12 Months Combined Treatment BP
26	M	46	M	190/120	142/93	149/99	149/95
27	M	52	S	170/110	154/111	148/103	135/97
28	M	56	M	191/118	184/113	141/85	133/90
29	F	39	Sep	210/15	166/104	148/96	126/80
30	M	44	M	145/115	154/103	140/86	135/82
31	F	39	M	168/96	170/109	164/93	-
32	F	49	M	210/130	181/127	190/127	205/120
33	M	34	M	160/120	147/99	133/83	128/85
34	F	49	M	210/120	167/113	136/104	-
35	F	50	Div	235/130	196/117	216/129	-
36	M	32	M	180/120	192/119	207/126	-
37	M	56	M	210/135	202/128	210/122	148/98
38	M	49	M	180/120	183/114	151/92	121/78
39	F	28	S - M	186/117	190/114	180/100	137/82
40	M	36	M	180/130	148/107	174/112	167/108
41	M	32	Div	250/175	176/114	140/106	158/99
42	F	46	M	260/140	162/108	135/94	116/85
43	M	37	M	175/115	184/122	185/112	-
44	F	56	M	220/115	191/107	178/93	129/79
45	M	51	M	200/100	204/108	161/99	154/97
46	M	51	M	190/110	178/111	179/100	153/104
47	M	41	M	145/105	138/104	156/106	117/86
48	F	43	M	190/120	189/130	182/128	155/102
49	M	46	Sep	150/110	169/112	146/109	125/92
50	F	36	M	160/110	147/102	135/94	121/85

Subject	Sex	Age	Marital Status	Reported BP	Mean Baseline BP	Post Diuretic BP	12 Months Combined Treatment BP
51	M	35	M	190/120	199/117	180/123	170/100
52	M	40	M	160/120	172/120	149/95	111/79
53	M	55	M	190/110	177/104	162/89	119/82
54	F	44	M	140/110	180/124	160/106	165/135
55	M	55	M	220/120	207/98	192/102	153/72
56	M	48	M	180/120	184/101	152/86	137/80
57	M	58	M	185/120	150/92	146/99	127/88
58	M	46	S	210/110	175/103	178/107	-
59	M	36	M	210/140	169/124	159/120	120/90
60	F	55	M	180/110	181/111	143/75	141/87
61	M	41	M	180/110	168/107	125/91	-
62	M	51	M	230/120	190/111	150/86	166/93
63	M	46	M	157/111	156/108	146/103	138/81
64	M	46	M	280/150	207/110	162/108	152/98
65	M	16	S	210/140	177/119	167/109	-
66	F	43	M	220/120	159/110	-	-
67	M	52	M	205/120	188/113	142/85	172/110
68	M	21	Sep	210/150	177/115	165/96	-
69	M	38	M	200/140	149/108	155/116	-
70	M	33	S	150/120	167/110	159/105	-
71	F	44	M	190/120	175/106	191/93	-
72	F	53	M	260/140	210/118	175/96	-
73	M	50	M	160/110	165/99	128/89	-
74	M	29	M	190/130	202/114	-	-
75	M	51	M	190/120	161/94	151/105	-

16PF STEN SCORES (BASELINE - 12 MONTHS)

Subject	A	B	C	E	F	G	H	I	L	M
1	9-	4-	7-	3-	4-	8-	7-	7-	7-	6-
2	8-7	6-7	5-3	5-7	6-6	8-4	4-5	6-10	6-6	3-2
3	6-8	3-5	4-1	6-7	4-5	6-5	4-5	4-7	5-5	2-2
4	4-4	3-4	5-7	4-5	4-6	3-7	4-7	5-5	9-4	6-4
5	2-4	6-7	1-3	5-7	6-7	6-6	5-4	4-4	6-4	5-7
6	2-3	4-4	3-5	5-6	4-5	3-6	4-7	3-4	7-9	2-2
7	4-	4-	4-	7-	7-	8-	7-	7-	6-	5-
8	2-5	4-3	6-5	4-5	5-7	8-5	7-10	6-4	6-2	4-4
9	2-2	3-7	3-1	4-4	3-1	7-7	6-3	7-7	4-4	2-4
10	6-4	7-5	6-7	6-9	5-3	2-6	6-4	7-7	5-8	2-3
11	2-	6-	9-	3-	6-	7-	6-	3-	2-	2-
12	10-10	3-4	8-8	8-6	7-8	5-5	7-8	7-8	5-4	4-4
13	1-	7-	3-	6-	4-	8-	4-	9-	7-	4-
14	2-2	3-4	6-4	5-5	2-3	7-3	4-4	5-6	2-7	4-8
15	2-5	6-8	7-8	8-9	4-5	1-1	5-5	3-4	6-5	4-5
16	4-3	6-4	6-6	5-7	5-7	8-5	5-6	9-7	5-7	4-3
17	8-4	6-8	3-7	3-6	4-4	8-6	7-7	4-4	8-7	3-5
18	4-6	8-8	4-4	8-6	6-4	8-8	6-7	5-9	6-8	6-6
19	2-2	4-5	3-2	7-7	5-5	9-7	5-6	6-7	6-7	6-7
20	4-3	2-3	7-5	5-5	6-6	5-7	5-3	4-6	6-4	2-3
21	4-5	2-7	2-3	5-6	4-4	3-1	3-3	6-6	9-8	5-6
22	7-5	6-5	5-9	3-7	6-8	6-5	8-8	7-7	7-5	5-4
23	2-4	4-4	3-3	4-4	5-3	8-4	1-1	4-5	6-7	6-6
24	7-8	7-3	4-4	7-6	7-4	3-3	3-3	8-8	5-6	9-5
25	4-7	4-4	3-3	5-5	4-4	4-6	7-7	3-5	5-7	6-10

Subject	A	B	C	E	F	G	H	I	L	M
26	6-6	3-6	4-3	8-9	4-6	8-8	4-7	3-3	7-4	4-6
27	2-2	3-3	5-4	4-5	2-1	4-1	3-4	7-7	5-7	5-7
28	4-3	6-8	4-3	5-7	4-3	7-4	3-2	7-7	7-8	3-3
29	4-4	4-4	2-4	10-9	5-4	6-3	3-6	9-9	5-6	5-5
30	6-6	6-4	1-4	6-6	4-4	3-3	6-4	3-3	4-5	4-4
31	6-	5-	4-	5-	3-	4-	6-	4-	6-	5-
32	5-6	6-5	4-4	4-5	5-7	7-3	3-4	8-7	6-6	5-4
33	6-6	4-4	7-7	3-5	6-7	1-7	6-7	3-3	8-4	4-4
34	2-	5-	6-	6-	3-	5-	3-	3-	5-	4-
35	2-	4-	2-	4-	5-	7-	3-	10-	8-	4-
36	2-	7-	6-	8-	4-	8-	4-	6-	6-	4-
37	2-2	6-6	3-3	8-6	4-4	8-9	4-3	6-5	7-6	4-4
38	3-6	4-4	3-4	8-7	4-3	5-6	5-4	5-6	5-6	8-8
39	4-5	6-7	7-8	5-7	7-7	2-1	9-7	6-7	5-4	6-6
40	5-5	4-2	3-4	9-5	1-4	7-5	4-2	7-5	6-7	5-3
41	3-2	3-6	3-5	4-5	1-4	4-5	2-3	7-7	6-6	5-4
42	2-3	5-4	6-6	4-3	3-7	7-6	3-4	4-7	4-4	3-1
43	6-	3-	4-	6-	6-	7-	7-	7-	8-	4-
44	2-3	3-5	4-6	3-4	4-3	9-8	5-3	8-6	6-6	5-6
45	3-3	1-4	5-6	5-4	6-5	5-6	5-3	3-5	6-4	6-7
46	4-1	6-4	1-1	5-9	6-6	7-6	5-6	3-5	5-5	4-3
47	6-6	3-7	7-1	4-3	10-7	8-8	7-5	4-4	2-4	1-2
48	5-2	7-8	5-8	5-4	3-3	2-3	7-6	6-5	4-4	6-6
49	2-2	6-6	6-8	5-3	6-7	1-1	7-6	7-7	2-5	1-1
50	5-8	7-6	5-6	6-4	5-5	9-8	7-5	10-8	6-6	4-6

Subject	A	B	C	E	F	G	H	I	L	M
51	6-6	6-6	4-6	3-5	3-3	3-1	3-4	5-7	8-8	4-2
52	4-6	7-3	3-3	5-5	4-6	7-5	6-6	7-1	2-4	2-2
53	6-6	3-6	5-7	9-6	4-4	3-3	8-7	2-4	7-6	4-4
54	5-8	6-7	8-6	4-4	4-7	6-6	6-4	7-5	5-6	3-6
55	4-4	6-7	4-4	3-3	4-4	8-8	3-4	6-6	5-5	6-2
56	4-8	3-7	4-4	8-6	4-3	5-5	3-3	9-3	10-10	4-4
57	7-1	6-4	4-3	10-10	6-6	7-7	3-5	9-7	5-6	5-6
58	7-	2-	3-	3-	3-	5-	3-	6-	9-	7-
59	3-4	8-8	8-5	4-5	4-4	5-3	4-3	4-8	6-6	3-1
60	6-4	7-6	3-4	8-4	2-2	4-6	5-5	3-5	2-8-	4-6
61	7-	8-	8-	9-	6-	3-	6-	5-	5-	3-
62	2-4	3-4	1-2	7-5	4-4	5-8	4-3	3-4	6-7	5-3
63	5-4	7-6	3-3	5-5	5-4	5-5	5-3	8-8	9-9	4-5
64	5-6	4-6	4-7	7-7	5-6	2-5	6-5	8-6	7-8	5-7
65	4-	8-	6-	5-	7-	3-	3-	3-	10-	6-
66	7-	5-	6-	7-	7-	2-	6-	4-	6-	6-
67	4-4	3-6	3-1	3-5	1-3	7-8	4-4	4-5	6-6	5-6
68	2-	3-	5-	6-	6-	4-	3-	7-	10-	9-
69	8-	7-	3-	6-	4-	8-	3-	5-	10-	3-
70	4-	7-	4-	7-	5-	5-	2-	10-	9-	4-
71	2-	4-	3-	8-	8-	3-	7-	3-	9-	2-
72	4-	4-	6-	8-	7-	6-	4-	2-	6-	8-
73	6-	2-	7-	5-	6-	5-	6-	5-	2-	2-
74	6-	5-	4-	5-	3-	4-	6-	4-	6-	5-
75	7-	7-	4-	6-	4-	3-	5-	4-	6-	2-

Subject	16PF Sten Scores (Baseline - 12 Months)						KDS Scores		Attitude to Drug Treatment	Drug Group
	N	O	Q1	Q2	Q3	Q4	Anxiety	Depression		
1	3-	6-	3-	5-	4-	2-	0-	9-	1-	M
2	2-5	8-9	5-5	3-5	6-5	6-7	12-11	23-32	2-1	O
3	7-5	9-4	5-4	6-8	5-5	7-10	9-6	22-27	1-1	C
4	6-5	9-10	6-8	1-5	5-5	7-5	6-0	19-9	2-0	B
5	8-6	7-8	6-7	9-9	6-5	8-8	16-27	17-25	3-3	M
6	9-9	6-6	1-4	5-10	3-4	4-7	13-9	6-10	0-0	B
7	4-	6-	4-	6-	5-	5-	10-	23-	2-	M
8	2-4	10-10	4-3	6-5	5-3	6-2	4-1	14-9	1-1	O
9	3-3	8-7	6-7	5-6	4-4	10-7	20-18	28-33	3-3	O
10	9-7	2-8	5-3	5-8	5-5	7-7	16-9	21-27	1-1	M
11	2-	6-	3-	8-	4-	3-	2-3	5-6	2-4	M
12	8-8	7-5	3-3	10-6	7-4	5-4	0-1	7-3	3-0	O
13	5-	5-	6-	8-	2-	7-	20-	24-	2-	-
14	6-3	10-8	3-2	4-3	3-5	7-10	18-11	9-9	2-1	M
15	4-5	3-3	4-8	5-8	2-4	3-2	4-0	5-2	1-1	O
16	7-5	4-4	5-5	9-6	3-7	6-3	17-9	24-32	2-2	B
17	5-8	5-8	6-4	8-9	4-6	9-6	12-5	14-9	3-4	C
18	6-6	3-9	4-8	8-8	5-2	3-3	1-1	19-8	1-1	M
19	5-6	7-10	3-3	6-6	3-4	4-9	21-16	17-21	1-1	M
20	5-9	8-4	3-3	8-8	4-4	5-4	8-5	10-11	2-4	C
21	9-5	5-8	6-6	2-3	3-6	5-9	13-3	23-10	1-3	B
22	7-9	5-7	7-7	4-8	7-5	7-2	14-6	18-5	3-1	C
23	5-2	4-5	5-6	6-9	4-6	7-8	17-15	38-34	0-1	O
24	2-2	9-9	9-9	5-3	2-2	7-7	9-5	15-19	1-2	B
25	0-7	10-7	4-7	8-5	5-4	7-4	12-6	20-17	3-3	C

Subject	16PF Sten Scores (Baseline - 12 Months)						KDS Scores		Attitude to Drug Treatment	Drug Group
	N	O	Q1	Q2	Q3	Q4	Anxiety	Depression		
26	6-8	7-7	6-4	10-8	6-10	2-5	2-1	8-9	2-1	C
27	5-1	5-5	7-4	5-6	2-2	7-7	9-2	26-25	2-2	M
28	9-7	8-6	8-8	4-9	5-5	6-8	9-4	33-31	3-1	O
29	6-6	5-3	8-7	2-6	3-9	9-7	17-11	31-34	2-1	M
30	1-1	7-5	4-4	1-8	5-7	3-7	0-0	7-3	2-1	O
31	6-1	8-1	9-	10-	7-	8-	11-	18-	3-	M
32	5-7	5-5	7-7	2-4	5-3	5-8	13-7	28-21	3-1	B
33	8-9	5-6	8-4	4-3	4-6	7-2	3-0	4-7	3-2	O
34	5-	8-	6-	6-	4-	6-	20-	23-	2-	B
35	4-	10-	6-	5-	2-	10-	27-	37-	3-	B
36	8-	6-	0-	8-	8-	3-	3-	8-	1-	M
37	3-2	9-8	5-6	3-1	7-6	4-5	12-12	22-18	2-1	O
38	8-5	5-6	9-9	9-8	8-7	7-10	1-3	12-12	1-4	C
39	7-8	4-6	8-8	5-7	5-5	5-5	12-0	16-3	3-1	B
40	5-7	3-6	5-3	5-4	2-4	7-5	15-8	22-8	2-1	C
41	6-4	6-1	2-3	5-5	2-5	9-7	18-9	30-6	1-1	O
42	4-7	6-7	2-3	5-7	3-3	7-5	11-13	28-25	1-1	B
43	6-	1-	6-	8-	4-	6-	13-	13-	4-	C
44	7-4	8-5	7-5	8-8	7-5	5-6	10-11	3-7	2-2	M
45	7-3	7-10	4-5	9-6	6-4	5-7	10-6	22-11	3-2	C
46	4-6	9-6	8-5	8-8	5-1	10-10	22-22	32-31	2-1	O
47	8-10	2-7	3-6	4-6	4-7	5-7	6-9	9-18	2-2	M
48	4-4	4-2	5-6	7-5	4-4	3-2	13-9	15-6	3-1	O
49	4-4	5-3	6-1	3-3	4-2	3-3	8-2	16-10	1-1	M
50	3-7	8-4	1-8	6-4	9-6	9-6	19-10	28-18	1-2	C

Subject	16PF Sten Scores (Baseline - 12 Months)						KDS Scores		Attitude to Drug Treatment	Drug Group
	N	O	Q1	Q2	Q3	Q4	Anxiety	Depression		
51	8-4	9-7	3-6	8-5	4-4	7-8	9-4	14-12	2-2	B
52	6-4	7-9	1-3	3-3	7-10	5-3	5-4	4-5	1-1	M
53	9-7	2-5	5-8	8-8	5-6	3-3	0-1	5-10	3-1	C
54	6-7	5-5	5-10	4-7	6-6	8-5	7-3	6-5	3-1	B
55	4-3	5-7	3-2	5-3	8-2	7-7	0-3	27-14	1-1	O
56	10-10	9-9	8-8	9-1	7-6	10-7	3-3	14-6	3-1	C
57	4-6	7-8	9-7	4-3	3-3	8-9	6-9	23-16	2-2	O
58	6-	7-	4-	8-	5-	5-	21-	21-	1-	M
59	6-7	5-3	4-4	3-3	2-4	4-5	12-3	7-8	1-1	C
60	5-4	8-5	6-5	8-2	3-4	6-6	11-4	31-13	1-1	O
61	6-	9-	9-	5-	7-	4-	0-	3-	3-	-
62	7-10	10-10	6-5	5-9	2-3	10-7	9-14	19-17	1-1	B
63	9-7	5-5	6-6	5-6	5-5	7-5	4-9	5-14	1-1	O
64	5-4	7-5	3-4	9-8	4-4	5-3	9-1	15-11	2-2	M
65	8-	3-	6-	8-	5-	7-	10-	18-	2-	O
66	7-	8-	6-	5-	4-	5-	14-	15-	3-	-
67	8-10	8-7	9-9	10-8	5-5	8-6	19-12	34-37	2-3	M
68	5-	7-	4-	3-	4-	6-	17-	30-	1-	B
69	8-	7-	6-	8-	2-	8-	10-	25-	3-	B
70	4-	7-	8-	4-	1-	7-	18-	20-	4-	M
71	9-	6-	6-	7-	3-	4-	9-	8-	1-	O
72	7-	9-	9-	5-	4-	6-	-	-	1-	M
73	4-	6-	4-	6-	6-	3-	5-	4-	1-	-
74	6-	8-	0-	10-	7-	8-	3-	11-	3-	-
75	8-	6-	4-	5-	10-	7-	11-	22-	1-	C

SPI SCORES

Subject	Fatigue	Sleep Disturbance	Irritability	Impaired Concentration	Depression	Anxiety	Total Emotional Disturbance	Reported Family Stress	Reported Marital Stress	Reported Work Stress
1	0-	0-	0-	0-	0-	0-	0-	0-	0-	0-
2	0-1	1-2	1-0	1-0	0-0	1-0	6-3	0-1	0-0	0-0
3	3-2	0-2	3-2	2-1	2-3	2-3	26-28	0-0	1-1	1-1
4	2-1	0-0	1-0	0-0	0-0	1-0	9-2	0-0	0-0	0-0
5	3-1	3-1	3-1	1-0	0-1	2-1	25-10	1-1	0-0	0-1
6	0-0	0-1	2-1	6-0	0-0	2-1	12-7	0-0	0-0	0-0
7	3-	2-	3-	2-	2-	2-	23-	1-	0-	0-
8	0-0	0-0	0-0	0-0	1-0	1-1	2-1	0-0	1-2	0-0
9	3-3	2-3	1-2	2-2	2-2	2-2	29-31	1-1	0-0	0-0
10	3-2	1-0	3-2	3-1	3-2	3-2	36-22	0-0	0-0	2-2
11	0-1	0-1	0-2	0-0	0-1	0-1	1-13	0-0	0-0	0-0
12	0-0	0-0	0-0	0-0	0-0	1-0	3-0	0-0	0-0	0-0
13	0-	3-	2-	2-	2-	2-	20-	0-	2-	1-
14	0-1	2-2	0-1	2-1	0-1	2-2	15-18	0-0	0-0	0-0
15	0-0	0-0	1-0	0-0	0-0	0-0	1-0	0-0	2-0	0-0
16	3-3	2-0	2-1	1-1	2-2	1-3	23-18	1-1	1-1	2-2
17	0-0	1-1	2-2	1-0	0-1	2-0	15-13	0-0	0-0	0-0
18	1-1	0-1	2-0	1-0	0-0	0-0	6-2	0-0	0-0	0-0
19	1-2	2-3	3-3	3-1	3-1	3-3	30-24	1-1	0-0	2-2
20	0-2	1-0	1-1	1-0	0-1	2-1	13-11	1-1	2-2	0-1
21	1-0	1-0	2-1	1-0	1-1	3-3	21-12	1-0	2-2	0-0
22	1-0	1-1	3-1	1-0	2-1	3-1	23-9	1-1	0-0	2-2
23	4-1	3-0	3-0	3-1	3-1	3-1	38-11	1-1	2-2	2-2
24	2-0	1-1	3-3	2-1	1-0	3-3	23-22	0-0	1-1	1-1
25	3-3	2-3	2-2	2-0	0-2	3-2	27-27	0-0	0-0	0-0

SPI SCORES

Subject	Fatigue	Sleep Disturbance	Irritability	Impaired Concentration	Depression	Anxiety	Total Emotional Disturbance	Reported Family Stress	Reported Marital Stress	Reported Work Stress
26	0-0	2-2	1-1	0-0	1-0	1-0	12-7	1-0	0-0	0-0
27	3-3	3-2	1-0	1-2	3-2	2-3	24-27	0-0	2-2	0-0
28	2-2	0-1	1-2	2-1	0-2	3-2	25-10	1-1	1-1	1-1
29	3-3	3-0	3-0	2-2	2-1	3-2	22-16	1-0	2-2	0-0
30	2-0	0-0	1-0	0-0	1-0	1-0	7-2	0-0	0-0	0-0
31	2-	2-	1-	2-	1-	2-	20-	0-	1-	2-
32	2-1	2-1	2-0	2-0	3-1	3-1	25-10	1-0	0-0	2-2
33	1-0	0-0	1-1	0-0	1-0	0-0	5-1	0-0	0-0	0-0
34	1-	3-	1-	1-	1-	2-	19-	1-	1-	2-
35	4-	3-	3-	2-	3-	3-	36-	1-	2-	0-
36	0-	1-	0-	0-	1-	1-	5-	0-	0-	0-
37	3-0	1-1	1-1	0-0	2-0	2-1	17-9	1-1	0-0	0-0
38	0-2	2-1	3-0	0-0	0-1	2-0	14-10	1-1	0-0	0-0
39	1-0	0-0	1-0	0-0	1-0	1-0	6-0	0-0	2-0	1-0
40	0-0	2-1	3-1	0-0	1-1	2-0	20-7	0-0	1-0	1-0
41	3-0	3-3	3-1	2-0	0-0	3-0	27-4	0-1	2-2	0-0
42	0-2	0-1	1-0	2-3	1-0	3-0	13-9	0-0	0-0	2-2
43	3-	1-	1-	0-	1-	2-	22-	0-	1-	1-
44	0-1	2-1	0-0	0-0	2-2	2-0	13-10	1-0	1-1	2-2
45	0-0	2-3	0-1	1-0	0-0	1-0	9-4	0-0	0-0	0-0
46	1-2	2-1	2-3	1-0	0-0	2-1	14-15	0-0	0-0	0-0
47	0-3	0-0	0-1	0-1	1-0	2-1	5-10	0-0	0-0	1-0
48	3-0	2-0	2-1	1-0	1-0	1-3	14-8	1-1	1-1	0-1
49	1-1	1-0	0-0	0-0	0-0	0-0	10-3	0-0	2-2	0-0
50	2-1	1-1	2-3	0-1	1-2	2-3	9-16	0-0	1-1	0-0

SPI SCORES

Subject	Fatigue	Sleep Disturbance	Irritability	Impaired Concentration	Depression	Anxiety	Total Emotional Disturbance	Reported Family Stress	Reported Marital Stress	Reported Work Stress
51	1-1	1-0	1-0	0-1	0-0	1-1	6-5	0-0	0-0	0-0
52	0-1	1-0	3-2	0-0	0-1	0-0	4-4	1-1	0-0	0-0
53	0-0	0-1	2-0	0-1	0-0	0-0	2-2	0-0	0-0	0-0
54	0-2	0-2	1-2	0-1	1-2	1-3	7-24	0-1	0-1	2-2
55	1-2	1-2	0-1	0-0	1-0	1-1	10-6	0-0	0-0	0-0
56	0-0	2-0	1-2	0-0	0-0	0-0	19-10	0-0	0-0	0-0
57	2-2	2-1	2-1	1-1	2-0	1-0	13-10	2-2	0-0	0-0
58	3-	3-	3-	3-	1-	3-	34-	1-	2-	2-
59	0-0	2-3	2-1	0-0	1-1	1-2	11-11	1-1	0-0	0-0
60	1-3	0-1	3-3	0-0	2-2	3-3	15-21	0-0	1-1	2-2
61	1-	0-	1-	0-	1-	1-	6-	0-	0-	0-
62	0-1	1-0	2-1	1-0	0-0	3-0	12-4	0-0	0-0	0-0
63	0-0	1-0	1-1	0-0	1-0	2-0	7-1	0-0	0-0	0-0
64	2-1	1-0	1-1	2-0	0-0	1-1	11-25	0-0	0-0	0-1
65	0-	0-	0-	0-	0-	0-	0-	0-	2-	0-
66	1-	2-	3-	0-	1-	3-	22-	1-	0-	2-
67	2-3	2-2	2-3	1-1	1-3	2-2	28-28	0-0	0-0	1-1
68	0-	0-	3-	0-	2-	3-	14-	0-	1-	1-
69	2-	2-	3-	0-	2-	2-	22-	0-	0-	0-
70	1-	2-	2-	1-	0-	2-	18-	1-	2-	1-
71	0-	0-	0-	0-	0-	0-	0-	0-	0-	0-
72	3-	3-	2-	1-	2-	3-	25-	0-	0-	1-
73	2-	0-	2-	0-	1-	2-	7-	0-	0-	0-
74	1-	1-	1-	1-	1-	1-	17-	0-	1-	0-
75	0-	0-	1-	0-	0-	1-	4-	0-	0-	1-

APPENDIX16PF Factor A.

(Sizothymia-Affectothymia)

<u>Question No.</u>		<u>Response for Low Score: ()</u>		
2	I could happily live alone, far from anyone, like a hermit.	(Yes)	Occasionally	No
19	I would be happy in a job that required me to listen to unpleasant complaints all day from employees and customers.	Yes	In between	(No)
36	In a factory I would rather be in charge of: (a) Machinery or keeping records. (b) Talking to and hiring new people.	(a)	In between	b
53	I would rather be: (a) In a business office, organising and seeing People. (b) An architect, drawing plans in the back room.	a	In between	(b)
70	I am happy to oblige people by making appoint- ments at times they like, even if a bit inconvenient to me.	Yes	Sometimes	(No)
87	I am more restrained than most people in saying what my feelings are.	(Yes)	Sometimes	No

APPENDIX

KDS Coding Scores 1 - 2

ANXIETY

SCORE	KDS-1
2	I feel restless and I cannot keep still
2	I am dreaming now more than I usually do
3	Nowadays when I get anxious, my heart starts to beat fast
2	Last night I had trouble getting to sleep
	KDS-2
2	Shortness of breath
3	Tremors of "shakes"
2	Difficulty in swallowing
2	Restlessness, inability to be still
1	Headache
3	Nervousness
1	Nausea or vomiting
2	Diarrhoea
1	Dry mouth and throat
3	Nightmares
2	Frequent urge to urinate
2	Increased sweating
2	Rapid or pounding heart beat

APPENDIX

KDS Coding Scores

DEPRESSION

SCORE	KDS-1
3	I feel downhearted and blue
2	I simply don't have the energy to do things the way I used to
3	I am enjoying my food (no)
3	When I meet people I feel I have nothing to say
3	I find that my thinking has slowed down recently
3	I find it increasingly difficult to make decisions
1	I am dreaming now more than I usually do (no)
1	I feel that things are looking up and that I can accomplish great things (no)
3	I feel that others would be better off if I were dead
1	I now have more sexual desires than I have had for some time (no)
2	I recently have had more trouble expressing my thoughts or saying what I want to say
1	I feel like talking with people, even if it's necessary to phone them long distance (no)
2	I have been waking up earlier than I need to
3	I am sleeping more than I used to
3	Nowadays I feel worse in the morning
2	My memory is not as sharp as it used to be
1	My evenings and nights are my best times
2	I am napping more than I used to
1	Last night I had trouble getting to sleep
1	Last night I woke up more than once

KDS-2

1	Drowsiness
2	Poor memory
2	Difficulty getting or maintaining an erection
2	Difficulty in ejaculating
3	Constipation
2	Decreased appetite
3	Lack of energy
2	Difficulty maintaining sexual excitement
2	Difficulty in reaching orgasm

APPENDIXSTANDARDIZED PSYCHIATRIC INTERVIEW (S.P.I.)

The method of rating the symptom ANXIETY is as follows:-

1. Questions (from Clinical Schedule)

Would you say that you are a highly strung or nervous person?

Do you every find that you get anxious or frightened for no good reason?

Do you worry a lot about things?

If the patient's replies indicate anxiety and worrying go on as follows:-

What sort of things do you chiefly worry about?

Have you always been like this, or is it something that has only started recently?

Do you worry all the time, or only now and then?

Do you find yourself worrying more than you need to about little things?

Have you been very upset by worries in the past week?

ANXIETY	4	3	2	1	0
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APPENDIX2. Criteria for Rating (from Manual for Standardized Psychiatric Interview, 1970).ANXIETY

The term is intended to include all forms of anxiety except phobic anxiety, which is dealt with in the next rating key. It is, therefore, intended to include both anxiety which is accompanied by definite physical concomitants and anxiety which is confined to anxious thought content. In assessing a patient's "worry", attention must be paid to how much distress it has caused him in the previous week. "Hypochondriacal anxiety" (i.e. worry about bodily functions) can be rated both here and in Section II under "Excessive Concern with Bodily Functions", as appropriate in each particular case.

Rating '0' Absent:

Negative answers to the mandatory questions.

Rating '1' Mild:

Although the patient reports that he is highly strung or nervous, he has been his usual self in the past week and his anxiety has not caused significant distress.

Rating '2' Moderate:

Anxiety to cause significant distress has occurred occasionally in the past week.

Rating '3' Marked:

Anxiety sufficient to cause significant distress has occurred frequently in the past week,

OR

anxiety has caused extreme distress for the individual concerned occasionally in the past week.

Rating '4' Severe:

Anxiety has caused extreme distress for the individual concerned frequently in the past week.

APPENDIXSTANDARDIZED PSYCHIATRIC INTERVIEW (S.P.I.)

The method of rating the symptom DEPRESSION is as follows:-

1. Questions (from Clinical Schedule)

How have you been feeling in your spirits in the past week?

Have you had spells of feeling sad or miserable?

If the patient's replies indicate despondency or sadness, go on as follows:-

Have you felt low the whole time, or just occasionally?

Does it seem connected with anything that happens?

How hard does it get?

Do you every get weepy?

Can you snap out of it?

Do you sometimes feel hopeless?

Have you felt like making an end to it all?

DEPRESSION 4 3 2 1 0

APPENDIX2. Criteria for Rating (from Manual for Standardized Psychiatric Interview, 1970).DEPRESSION

The term is intended to cover all moods of gloominess, despondency and sadness which the patient has experienced during the past week.

The psychiatrist may suspect that the patient is concealing a morbid depression of mood. If so, he should employ any additional questions designed to elicit this fact, in order to arrive at an accurate rating. He should not, however, allow his clinical impression that the patient is depressed to justify a morbid rating on this key if the patient firmly denies despondency. He has an opportunity to make a morbid rating based purely on clinical judgment in Section II.

Depressive Thought Content is rated separately from Depression of Mood; questions dealing with depressive thought content will be found at the bottom of the same page. They should always be asked if there is any reason to suspect a depressive condition.

Patients who report suicidal thoughts or impulses will usually be rated '3' or '4' depending on the frequency and strength of the impulses. A patient who describes such thoughts in an unconvincing or histrionic manner may, however, be rated '2' on this symptom.

Rating '0' Absent: Negative answers to the mandatory questions

Rating '1' Mild: Occasional feelings of gloominess which do not cause significant distress and are looked upon by the patient as habitual; lack of zest reported but no actual depressive phenomena.

Rating '2' Moderate: Occasional depressed feelings which either cause significant distress or are looked upon by the patient as a significant departure from his usual self, in the past week.

Rating '3' Marked: Frequent depressed feelings as described in '2' in the past week,

OR

occasional extreme distress caused by depression or occasional occurrence of major depressive phenomena (e.g. suicidal ideas, ideas of worthlessness, nihilistic delusions, etc).

Rating '4' Severe: Depression has caused extreme distress frequently in the past week.

APPENDIX
CORRELATION COEFFICIENTS - TOTAL

	Referral - Baseline (N=75)				Baseline - Diuretic (N=71)				Baseline - 12 months (N=55)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor A	-.02	.43	.07	.27	-.11	.18	-.26	.01	-.45	.001	-.47	.001
B	-.12	.14	-.01	.46	-.09	.23	-.09	.24	-.13	.18	-.04	.38
C	-.10	.20	-.09	.22	.08	.26	-.02	.43	.16	.12	.07	.31
E	.17	.08	.24	.02	-.04	.39	.04	.38	-.07	.31	-.14	.16
F	.16	.45	.03	.39	-.20	.05	-.12	.17	-.02	.43	-.08	.28
G	.12	.15	-.00	.50	-.26	.02	-.18	.06	-.01	.48	-.06	.31
H	-.21	.04	-.29	.006	-.14	.12	.13	.14	.10	.24	.06	.33
I	.00	.49	.05	.34	-.14	.12	-.29	.01	.00	.50	.04	.38
L	.18	.06	.32	.003	-.16	.09	-.10	.19	-.23	.05	-.13	.19
M	.16	.09	.09	.22	.09	.23	.06	.30	-.08	.28	-.14	.46
N	.03	.40	.07	.26	.11	.18	.15	.11	.02	.46	-.06	.33
O	-.03	.41	-.11	.18	-.19	.06	.05	.34	.12	.40	.08	.27
Q1	-.15	.11	-.07	.26	.03	.39	.12	.15	-.16	.12	-.11	.20
Q2	.08	.25	.07	.27	.00	.49	-.06	.30	-.01	.48	-.31	.01
Q3	-.23	.02	-.03	.40	.09	.23	-.00	.49	.11	.22	.02	.45
Q4	-.08	.26	.10	.20	.04	.38	-.00	.49	-.13	.18	-.12	.19

APPENDIX
CORRELATION COEFFICIENTS - TOTAL

	Referral - Baseline (N=75)				Baseline - Diuretic (N=71)				Baseline - 12 months (N=55)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor QI	-.05	.32	-.07	.28	-.27	.01	-.07	.29	-.11	.22	-.07	.30
QII	.14	.12	.10	.21	.02	.44	-.04	.38	-.12	.20	-.06	.33
QIII	.05	.35	-.14	.12	-.06	.30	.26	.02	.25	.04	.22	.06
QIV	.11	.17	.19	.05	-.05	.34	.04	.37	-.15	.14	-.19	.08
KDS												
Anxiety	.25	.02	-.07	.26	-.12	.17	-.05	.35	-.01	.46	-.02	.45
Depression	.34	.001	.16	.09	.13	.13	.04	.39	-.09	.27	-.09	.26
SPI												
Anxiety	.32	.002	.00	.49	.02	.44	.07	.29	.07	.32	.00	.50
Depression	.31	.003	.06	.29	-.20	.05	-.06	.31	-.06	.33	.02	.45
Total Emotional Disturbance	.29	.006	.00	.49	-.03	.41	-.02	.43	-.02	.43	-.05	.37
Attitude to Drug Treatment	-.19	.05	-.17	.07	-.11	.18	-.03	.39	-.14	.16	-.17	.11

APPENDIX

CORRELATION COEFFICIENTS - MALES

	Referral - Baseline (N=54)				Baseline - Diuretic (N=52)				Baseline - 12 months (N=40)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor A	.08	.27	.18	.09	-.13	.18	-.36	.004	-.40	.005	-.50	.001
B	-.09	.26	.06	.34	-.14	.17	-.16	.12	-.07	.33	-.04	.41
C	-.05	.37	-.05	.35	.01	.47	-.10	.24	.28	.04	.18	.13
E	.18	.10	.26	.03	-.07	.30	-.06	.33	-.15	.18	-.23	.08
F	-.04	.38	-.02	.43	-.12	.20	-.14	.17	-.03	.42	-.13	.21
G	.11	.22	-.02	.43	-.40	.002	-.22	.06	-.07	.34	-.08	.31
H	-.11	.22	-.27	.02	-.07	.31	.11	.22	.15	.18	.02	.45
I	.06	.33	.15	.16	-.03	.42	-.23	.05	-.01	.48	.02	.46
L	.24	.04	.32	.009	-.04	.37	-.00	.49	-.27	.05	-.14	.19
M	.14	.15	.11	.24	.07	.30	.06	.34	-.21	.09	-.13	.20
N	.06	.33	.08	.27	.18	.10	.12	.19	.04	.41	-.06	.36
O	-.11	.21	-.18	.09	.26	.03	.10	.24	.14	.20	.12	.22
Q1	-.19	.08	-.08	.29	.08	.30	.13	.18	-.17	.15	-.18	.14
Q2	.19	.09	.11	.20	-.06	.34	-.13	.18	-.11	.24	-.44	.002
Q3	.21	.06	.01	.47	.11	.21	.00	.50	.22	.09	.08	.30
Q4	.09	.26	.09	.26	.02	.43	.04	.39	-.15	.17	-.07	.33

APPENDIX
CORRELATION COEFFICIENTS - MALES

	Referral - Baseline (N=54)				Baseline-Diuretic (N=52)				Baseline - 12 months (N=40)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor QI	-.05	.35	-.06	.32	-.22	.06	-.10	.25	-.03	.42	-.04	.39
QII	.09	.26	.05	.36	.07	.32	.06	.34	-.15	.17	-.04	.41
QIII	-.07	.31	-.22	.05	.01	.46	.30	.02	.26	.05	.24	.07
QIV	.15	.14	.24	.04	-.05	.36	-.00	.50	-.24	.07	-.35	.01
KDS												
Anxiety	.15	.13	-.11	.20	-.11	.23	-.02	.44	-.11	.24	-.13	.21
Depression	.30	.01	.15	.14	.11	.21	.06	.33	-.13	.21	-.17	.14
SPI												
Anxiety	.14	.16	-.10	.24	-.02	.44	.01	.47	-.17	.15	-.08	.30
Depression	.28	.02	.12	.19	-.30	.02	-.19	.09	-.16	.17	-.01	.47
Total Emotional Disturbance	.17	.11	-.04	.38	-.04	.38	-.02	.46	-.12	.24	-.09	.28
Attitude to Drug Treatment	-.14	.16	-.09	.26	.01	.47	.11	.20	.02	.44	-.16	.16

APPENDIX

CORRELATION COEFFICIENTS - FEMALES

	Referral - Baseline (N=21)				Baseline - Diuretic (N=19)				Baseline - 12 months (N=15)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor A	-.26	.14	-.43	.03	-.06	.40	.16	.25	-.60	.01	-.39	.08
B	-.34	.07	-.33	.08	.14	.29	.17	.24	-.38	.08	-.08	.38
C	-.29	.11	-.22	.17	.35	.07	.20	.20	-.24	.19	-.38	.08
E	.15	.26	.18	.22	.11	.32	.47	.02	.16	.29	.18	.26
F	.11	.32	.28	.11	-.48	.02	-.11	.33	-.16	.48	.16	.29
G	.12	.31	.00	.35	.13	.31	-.15	.27	.10	.36	-.05	.43
H	-.41	.03	-.35	.06	-.34	.08	.14	.28	-.01	.49	.15	.30
I	-.16	.25	-.21	.08	-.42	.04	-.53	.01	-.30	.14	-.06	.42
L	.16	.25	.29	.11	-.69	.001	-.51	.01	-.06	.41	-.01	.49
M	.17	.23	.08	.37	.15	.27	.04	.44	.33	.11	.58	.01
N	-.07	.38	.03	.44	-.20	.20	.29	.12	-.06	.41	-.07	.40
O	.20	.20	.14	.28	-.04	.43	-.08	.37	.13	.32	-.03	.46
Q1	-.08	.37	-.04	.43	-.12	.31	.07	.39	-.15	.29	.10	.36
Q2	-.18	.23	-.18	.23	.31	.10	.34	.08	.36	.09	.26	.18
Q3	-.28	.11	-.20	.19	-.00	.50	-.01	.49	-.18	.26	-.20	.24
Q4	.01	.48	.17	.23	.09	.35	-.21	.19	-.07	.40	-.33	.12

APPENDIX
CORRELATION COEFFICIENTS - FEMALES

	Referral - Baseline (N=21)				Baseline - Diuretic (N=19)				Baseline - 12 months (N=15)			
	%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP		%ΔSBP		%ΔDBP	
	r	p	r	p	r	p	r	p	r	p	r	p
16PF Factor QI	-.12	.30	-.06	-.40	-.43	.03	-.02	.47	-.34	.10	-.17	.27
QII	.27	.12	.27	.12	-.16	.26	-.36	.07	.02	.47	-.16	.28
QIII	.01	.48	.27	.13	-.37	.06	.10	.34	.33	.12	.14	.31
QIV	-.01	.49	-.02	.47	-.04	.43	.26	.14	.14	.32	.47	.04
KDS												
Anxiety	.42	.04	.29	.11	-.15	.28	-.48	.02	.26	.17	.47	.04
Depression	.36	.07	.34	.08	.24	.16	-.19	.23	-.04	.45	.12	.33
SPI												
Anxiety	.63	.001	.47	.02	.15	.27	.05	.42	.14	.31	.26	.17
Depression	.23	.17	.10	.33	.06	.40	-.16	.25	-.06	.42	.07	.41
Total Emotional Disturbance	.42	.03	.22	.17	-.01	.49	-.27	.13	.01	.49	.05	.43
Attitude to Drug Treatment	-.28	.11	-.47	.02	-.46	.02	-.47	.02	-.47	.04	-.18	.26

APPENDIX

Associations between baseline psychological measures and % change in BP at each phase.

There are 72 associations significant at $p < .05$. The Pearson product-moment correlation coefficient (r) is the index of correlation for all measures except the 'Life Stress' measures, where a 't' test is used to compare the 'positive' with the 'negative'.

1. Referral to baseline phase(a) All patients

(i) <u>%ΔSBP:</u>	16PF Factor H	($r = -.21, p = .04$)
	16PF Factor Q3	($r = -.23, p = .02$)
	KDS Anxiety	($r = .25, p = .02$)
	KDS Depression	($r = .34, p = .001$)
	SPI Anxiety	($r = .32, p = .002$)
	SPI Depression	($r = .31, p = .003$)
	SPI TOTAL	
	Emotional	
	Disturbance	($r = .29, p = .006$)
(ii) <u>%ΔDBP:</u>	16PF Factor E	($r = .24, p = .02$)
	16PF Factor H	($r = -.29, p = .006$)
	16PF Factor L	($r = .32, p = .003$)
	16PF Factor QIV	($r = .19, p = .05$)

(b) Males

(i) <u>%ΔSBP:</u>	16PF Factor L	($r = .24, p = .04$)
	KDS Depression	($r = .30, p = .01$)
	SPI Depression	($r = .28, p = .02$)
(ii) <u>%ΔDBP:</u>	16PF Factor E	($r = .26, p = .03$)
	16PF Factor H	($r = -.27, p = .02$)
	16PF Factor L	($r = .32, p = .009$)
	16PF Factor QIII	($r = -.22, p = .05$)
	16PF Factor QIV	($r = .24, p = .04$)

(c) Females(i) % Δ SBP

16PF Factor H	(r = -.42, p = .04)
KDS Anxiety	(r = .42, p = .04)
SPI Anxiety	(r = .63, p = .001)
SPI Total Emotional Disturbance	(r = .43, p = .03)

(ii) % Δ DBP

16PF Factor A	(r = -.43, p = .03)
SPI Anxiety	(r = .47, p = .02)
Attitude to Drug Trial	(r = -.47, p = .02)

2. Baseline to Diuretic Phase(a) All patients(i) % Δ SBP

16PF Factor F	(r = -.20, p = .05)
16PF Factor G	(r = -.26, p = .02)
16PF Factor AI	(r = -.27, p = .01)
SPI Depression	(r = -.20, p = .05)

(ii) % Δ DBP

16PF Factor A	(r = -.26, p = .01)
16PF Factor I	(r = -.29, p = .008)
16PF Factor QIII	(r = .26, p = .02)

(b) Males(i) % Δ SBP

16PF Factor G (r = -.40, p = .002)

16PF Factor O (r = .26, p = .03)

SPI Depression (r = .30, p = .02)

Reported work
Stress (t = 2.0, p = .05)(ii) % Δ DBP

16PF Factor A (r = -.36, p = .004)

16PF Factor I (r = -.23, p = .05)

16PF Factor QIII (r = .30, p = .02)

(c) Females(i) % Δ SBP

16PF Factor F (r = -.48, p = .02)

16PF Factor I (r = -.42, p = .04)

16PF Factor L (r = -.69, p = .001)

16PF Factor QI (r = -.43, p = .03)

Attitude to
Drugs (r = -.46, p = .02)(ii) % Δ DBP

16PF Factor E (r = .47, p = .02)

16PF Factor I (r = -.53, p = .01)

16PF Factor L (r = -.51, p = .01)

KDS Anxiety (r = -.48, p = .02)

Attitude to
Drugs (r = -.47, p = .02)Reported Family
Stress (t = 2.27, p = .04)

3. Baseline to 12 month phase(a) All patients

(i) <u>%ΔSBP:</u>	16PF Factor A	(r = -.45, p = .001)
	16PF Factor L	(r = -.23, p = .05)
	16PF Factor QIII	(r = .25, p = .04)
	Reported Work Stress	(t = 2.59, p = .013)
(ii) <u>%ΔDBP:</u>	16PF Factor A	(r = -.47, p = .001)
	16PF Factor Q2	(r = -.31, p = .01)
	Reported Family Stress	(t = -2.10 p = .04)
	Reported Work Stress	(t = 3.09, p = .004)

(b) Males

(i) <u>%ΔSBP:</u>	16PF Factor A	(r = -.40, p = .005)
	16PF Factor C	(r = .28, p = .04)
	16PF Factor L	(r = -.27, p = .05)
	Reported Work Stress	(t = 2.89, p = .006)
(ii) <u>%ΔDBP:</u>	16PF Factor A	(r = -.50, p = .001)
	16PF Factor Q2	(r = -.44, p = .002)
	16PF Factor QIV	(r = -.35, p = .013)
	Reported Work Stress	(t = 3.26, p = .002)

(c) Females

(i) <u>%ΔSBP:</u>	16PF Factor A	(r = -.60, p = .009)
	Attitude to Treatment	(r = -.47, p = .04)
(ii) <u>% DBP:</u>	16PF Factor M	(r = .58, p = .01)
	16PF Factor QIV	(r = .47, p = .04)
	KDS Anxiety	(r = .47, p = .04)

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