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BLOOD PRESSURE, SELF-REPORTED SYMPTOMS AND JOB-RELATED PROBLEMS IN SCHOOLTEACHERS

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Abstract—The relationship between blood pressure and self-reports of physical symptoms and job-related problems was investigated in a sample of 262 male and female teachers. The subjects were divided into three groups: treated hypertensives (THT, N=23); untreated hypertensives (UHT, N=101); and normotensives (NT, N=123). After controlling for eight potentially confounding variables, the groups differed significantly with respect to reported physical symptoms, with THT reporting the most and UHT the fewest symptoms. Moreover, after controlling for potential confounders, a multiple regression analysis revealed an inverse association between diastolic blood pressure and the number of reported physical symptoms in untreated subjects. A similar trend for systolic blood pressure did not reach significance. In addition, no significant results with respect to work-related problems were obtained, except for a group×gender interaction on job-related irritation: male THT showed lowest and female THT highest irritation scores. The potential role of altered appraisal, diagnosis, and gender are discussed. © 1997 Elsevier Science Inc.

Keywords: Blood pressure; Treatment; Self-report; Physical symptoms; Job stress; Irritation.

INTRODUCTION

It has been claimed that hypertensives have lower psychological well-being and exhibit more physical symptoms than individuals with blood pressure levels in the normal ranges [1–3]. In most of these studies, hypertensive subjects were either patients who had sought medical help or individuals just aware of their elevated blood pressure. However, it has been demonstrated that being treated for hypertension or being aware of having the disorder can greatly influence self-reports of well-being and experienced stressors [3–5]. For instance, in several studies it has been shown that individuals with elevated blood pressures, who were *not* treated for the condition, or were *un*aware of having elevated blood pressure, reported *fewer* physical symptoms than aware hypertensives [3, 6] and even normotensives [7–9]. In addition, Tibblin and Lindström [9] found an inverse gradient: the higher the systolic blood

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pressure the fewer the physical symptoms reported. It has been proposed that these outcomes may be the result of a diminished appraisal of aversive stimuli or a tendency not to disclose negative information in hypertensives [10].

Also, the inconsistent results from research on the relationship between self-reported stressor exposure and hypertension have pointed at the potentially biasing effects of hypertension treatment and diagnosis. In several studies, treated hypertensives have been found to report more negative life events than normotensives [11, 12]. In contrast, in research based on mainly untreated subjects, hypertensives reported fewer experienced life stressors [5, 13, 14]. The effect of hypertension treatment or diagnosis in studies involving self-reported stress and stressor exposure may be based on phenomena like retrospective "search for meaning," drug therapy effects, or selection bias of neurotic individuals in the hypertensive patient samples [4].

With respect to occupational stressors, the results have been even less clear. On several occasions, job stress, operationalized as high job demands and low decision latitude, has been found to be positively related to blood pressure level [15–17]. In other studies, however, individuals with high blood pressure reported few occupational stressors (e.g., ref. 18) and high job satisfaction [19]. Unfortunately, in most of these studies, the investigators did not mention what proportion of the subjects were aware of having elevated blood pressure, or were treated for hypertension, which makes drawing conclusions concerning the role of these factors impossible.

The purposes of this study were twofold: (1) to examine the potentially moderating role of treatment in the relationship between hypertension and self-reported physical symptoms and job-related complaints in borderline hypertensive and normotensive Dutch school teachers; and (2) to investigate the predictive power of blood pressure level on the frequency of self-reported physical symptoms and job-related complaints when the effect of treatment for hypertension is eliminated.

METHODS

Subjects, instruments and procedure

In 1990 and 1991, the Institute for Research in Social Sciences (IVA; Tilburg, The Netherlands) conducted a study on the relationship between the number of occupational problems and health in a large sample (N=1556) of Dutch schoolteachers. The subjects were employed at primary and secondary schools in the southern parts of The Netherlands. These schools had agreed to participate in a periodic—once per 3 years—medical screening program for their employees. The local Municipal Health Services (GGD) were in charge of the screening program.

Together with the invitation for their periodic medical examination, the subjects received the following self-report questionnaires.

1. *Health status.* On a 20-item checklist the subjects indicated for which diseases they were treated in the past 5 years (ranging from sleeplessness to diabetes mellitus, hypertension, and heart disease).
2. *Perceived physical symptoms.* Thirty dichotomous items regarding various present symptoms such as fatigue, migraine, back pain, and varicose veins were checked. The list is commonly used by the Dutch Municipal Health Services (GGD).
3. *Job-related stressors.* This list consisted of 74 items belonging to nine classes of difficulties regarding: authority, colleagues, time pressure, students, parents, future perspective, physical environment, teaching itself, and additional duties. Examples of items are "lack of time to prepare classes," "students' aggressive behavior," "lack of support from colleagues," and "few promotion possibilities." The items were scored on five-point scales indicating the extent to which the subjects felt burdened by each of these problems. The questionnaire is based partly on the results of the study by Kyriacou and Sutcliffe [20] and partly on the Teacher Occupational Stress Factor Questionnaire (TOSFQ) [21]. Derived from a principal component analysis, the nine classes have demonstrated

adequate internal consistencies: Cronbach's α ranging between 0.78 and 0.94 [22]. Support for the questionnaire's validity has also been reported, based on substantial and meaningful correlations between relevant classes of job stressors and measures of work-related sickness, sickness absenteeism, work-related psychological complaints, etc. [22].

4. *Job-related psychological symptoms.* These were assessed by means of two checklists. The first list consisted of 10 vague psychological complaints, such as having difficulty concentrating, not feeling in the mood for anything, etc., which were, according to the subjects, related to the job. These items have been derived from studies by Lefebvre and Sandfort [23] and Needle et al. [24], which together yielded a homogeneous scale (Cronbach's α=0.87 [22]). The second checklist was a 19-item list of adjectives, containing three subscales: Anxiety, Depression, and Irritation (Cronbach's α being 0.82, 0.83, and 0.87). The subjects were asked how frequently they felt this way on their jobs. In both checklists, the frequency of occurrence was scored on four-point scales.
5. *General questions.* These focused on biographical factors such as age and gender, and also on lifestyle variables, such as smoking, alcohol consumption, and physical exercise.

For their medical check-up, the subjects visited one of the local Municipal Health Services (GGD) in the morning. Among other things the following data were collected: systolic and diastolic blood pressure (SBP and DBP), serum cholesterol level, height, and weight.

Blood pressure data and blood samples were collected while the subjects were sitting. Blood pressure level was measured once using a standard mercury sphygmomanometer by a nurse certified in blood pressure assessment. The nurse was dressed in casual clothes, instead of a white uniform. Within 3 minutes after the capillary blood sample was taken, serum cholesterol level was determined by the enzymatic color method using Reflotron (Boehringer Mannheim, Amsterdam).

Because at that time the relationship between blood pressure and the scores on the self-reports were not of primary interest to the IVA researchers, the data were not combined: the medical data were stored at the GGD, whereas the questionnaire scores were stored and analyzed separately at IVA. In March 1994, our research group initiated a cooperative, retrospective study with the IVA and the local Tilburg GGD to be able to integrate and study those two data sets. The subjects, who had their medical examinations done at the GGD of Tilburg, were asked for permission to use the combined data for scientific purposes. The subjects (N=358) were sent a letter which contained their medical data and the request to grant us permission by just sending the letter back in a postage-free envelope. Two hundred sixty-two subjects (73.2%) returned the letter, the data of which were analyzed. This group consisted of 162 males and 100 females with a mean age of 42.0 years (SD=5.55).

Statistical analyses

The subjects were divided into three groups according to their blood pressure level and their answer to the question "Have you been treated for hypertension in the past 5 years?" Hypertension was defined as having a SBP of ≥140 mmHg or a DBP of ≥90 mmHg. This procedure resulted in the following groups: treated hypertensives (THT: N=23), untreated hypertensives (UHT: N=101), and normotensives (NT: N=123).

Because of missing data, 15 subjects could not be classified into one of the three groups. Body mass index (BMI) was computed [weight/(height^2)] to be included as a covariate in the analyses. The following statistical analyses were performed using SPSS software. First, Pearson product-moment correlations were computed between blood pressure and the control variables and one-way analyses of variance (ANOVAs) were performed to examine whether the groups differed on these variables. Second, 3 (group)×2(gender) covariance analyses were performed to compare the groups on the amount of their self-reported physical symptoms and job-related stress. Relevant control variables were entered as covariates. Finally, stepwise multiple linear regression analyses were used to examine the relationship between both SBP and DBP, on the one hand, and self-reported physical symptoms and job-related difficulties, on the other hand, in those individuals not treated for hypertension. In these regression analyses, relevant covariates were entered first into the equation.

RESULTS

Systolic blood pressure correlated significantly with BMI (Pearson's r=0.27, p<0.05), and cholesterol level (r=0.26, p<0.05). DBP correlated significantly with BMI (r=0.30, p<0.05), and cholesterol (r=0.22, p<0.05). Furthermore, gender was important: males exhibited higher blood pressures than females: SBP 136.4 vs. 132.4 [$F(1, 260)$=4.90, p<0.05], DBP 85.3 vs. 81.6 [$F(1, 260)$=10.68, p<0.01]. Smoking and alcohol intake did not correlate with blood pressure. However, smoking did

Table I.—Means and standard deviations for the control variables

Variable	Group*			F	p
	THT	UHT	NT		
Gender†	0.70 (0.47)	0.72 (0.45)	0.50 (0.50)	6.67	0.0015
Age	44.02 (3.51)	43.34 (4.07)	42.42 (4.39)	2.19	NS
BMI	25.50 (2.60)	24.47 (2.68)	23.53 (2.30)	7.96	0.0005
Cholesterol	5.90 (1.09)	5.60 (1.16)	5.26 (1.02)	6.14	0.0025
Smoking‡	4.55 (5.54)	9.06 (9.13)	8.46 (8.35)	2.57	0.0787
Alcohol§	11.85 (12.44)	12.45 (9.07)	10.47 (9.60)	1.19	NS
Exercise‖	0.78 (0.42)	0.74 (0.44)	0.76 (0.43)	0.09	NS
Type of School¶	1.39 (0.50)	1.45 (0.50)	1.36 (0.48)	0.89	NS

* THT = treated hypertensive; UHT = untreated hypertensive; NT = normotensive, NS = not significant.
† Coding: 0 = female; 1 = male.
‡ Number of cigarettes per day.
§ Number of glasses per week.
‖ Coding: 0 = no physical exercise at work or in free time; 1 = some physical exercise at work or in free time.
¶ Coding: 1 = primary school; 2 = secondary school.

correlate with BMI (r=0.26, p<0.05). One-way ANOVAs revealed significant differences between the groups with respect to gender [$F(2, 244)$=6.67, p<0.01], BMI [$F(2, 243)$=7.96, p<0.001], and serum cholesterol level [$F(2, 237)$=6.14, p<0.01]. The differences were in the expected direction; the THT group showed the highest; the NT group the lowest; and the UHT group intermediate levels of BMI and cholesterol, the hypertensive group consisting of more males than the normotensive group (Table I). No differences were found on any other control variable.

Self-reported physical symptoms

Analyses of covariance revealed that, after controlling for BMI, cholesterol, age, gender, self-reported smoking, alcohol intake, exercise, and type of school the groups differed significantly with respect to reported physical symptoms [$F(2, 217)$=3.45, p<0.05], with THT reporting most and UHT fewest symptoms (Fig. 1). The main effect of gender was also significant [$F(1, 217)$=11.44, p=0.001]; women reported more symptoms than men. There was no group×gender interaction [$F(2, 217)$<1.0], indicating that the group main effect was similar for male and female subjects. The group effect was not due to differences in blood pressure level, which was demonstrated by an analysis with SBP and DBP as additional covariates. The group main effect remained significant [$F(2, 215)$=3.82, p<0.05].

A stepwise multiple regression analysis revealed that, after controlling for potential confounders, DBP predicted significantly the number of reported physical symptoms [β=−0.17, $t(203)$=−2.49, p<0.05] in subjects not treated for hyperten-

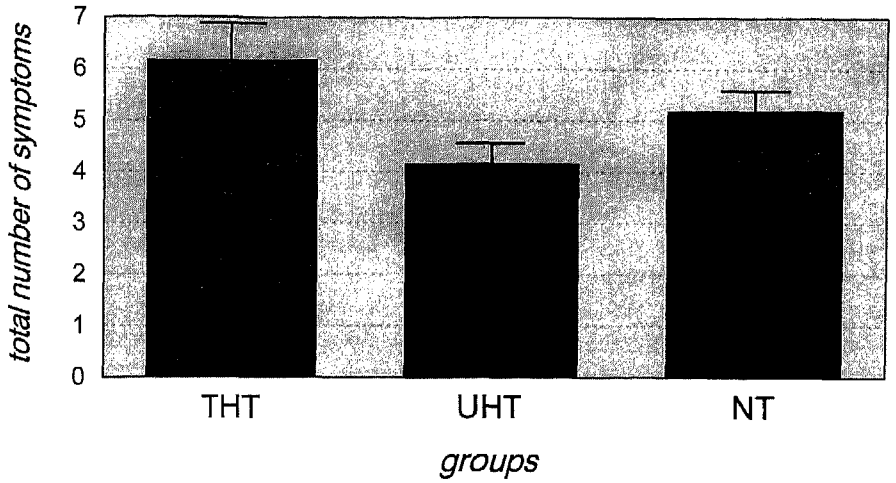

Fig. 1. Means and standard errors of the total number of physical symptoms reported by treated hypertensives (THT), untreated hypertensives (UHT), and normotensives (NT).

sion (Table II). The model, including gender, age, BMI, smoking, and DBP explained 18% of the variance [$F(5, 203)=8.90, p<0.0001$]. Without correction for the control variables, the correlation between DBP and the number of symptoms was -0.22 ($p<0.01$), which was as high as the simple correlation between DBP and serum cholesterol level.

After controlling for age and gender, SBP showed a trend for a similar association with the number of physical symptoms [$\beta=-0.12, t(206)=-1.73, p=0.08$], but this trend disappeared when BMI and smoking entered the analysis first [$\beta=-0.09, t(203)=-1.37, p>0.10$].

Job-related stress

Analyses of covariance showed that the groups did not differ with respect to self-reported job-related stressors, with means and standard deviations for the THT, UHT, and NT groups being 271.5 (33.1), 270.3 (37.0), and 272.8 (35.1), respectively [$F(2, 217)<1.0$]. The groups did not differ on any of the job-related psychological symptoms scales [$F(2, 229)<1.36, p>0.10$]. However, a group×gender interaction

Table II.—*Final regression model of the total number of physical symptoms*

Step no.	Variable	*B*	β	*t*	*p*
1	Gender	1.44	0.19	−2.92	0.0038
	Age	1.12	0.26	3.98	0.0001
	BMI	−0.31	−0.21	−3.06	0.0025
	Smoking	0.64	0.18	2.73	0.0069
2	DBP	−0.07	−0.17	−2.49	0.0134

Because of having no significant contribution to the model in step 1 ($p > 0.10$), cholesterol, alcohol, exercise, and type of school were not included in the equation.

was found for the Irritation subscale [$F(2, 229)=3.13$, $p<0.05$], with the male THT subjects exhibiting the lowest and female THT individuals the highest Irritation scores, whereas the scores of the other groups were in between.

Neither of the multiple linear regression analyses showed a significant predictive power of SBP or DBP with respect to job-related complaints. In fact, no simple correlation between these variables exceeded 0.10. Given the group×gender interaction, found for Irritation in the covariance analysis, additional simple correlations were computed for this variable for males and females separately. However, again, the correlations did not exceed 0.10.

DISCUSSION

The data regarding self-reported physical symptoms replicate previous findings [6–9], demonstrating an inverse association between blood pressure and self-reported physical symptoms. Several possible explanations may be postulated. First, elevated blood pressure may be accompanied by an altered perception or appraisal of threatening proprioceptive stimuli. This may have a psychological basis, such as a repressive/defensive tendency in persons with elevated blood pressure. In several studies, including some recent ones, this association has been demonstrated [25–27]. Altered appraisal in hypertensives has also been proposed to be a consequence of a physiological mechanism, involving baroreceptor stimulation-mediated CNS inhibition [28]. It has been suggested that this mechanism may even play an important role in the etiology of some forms of hypertension [28, 29]. Alternatively, instead of having a perceptual basis, the phenomenon may be a result of a tendency to avoid disclosing one's problems and worries. Indeed, such a preference for non-disclosure has been demonstrated in hypertensives [30, 31]. Finally, it has been suggested that low blood pressure may be accompanied by more symptoms [32]. In our sample, however, no subject had a blood pressure below 100/60 mmHg. In addition, we performed a regression analysis without individuals who had a SBP below 115 or a DBP below 70, which can be considered a very liberal criterion for low blood pressure. The results yielded a still significant inverse association between blood pressure and self-reported physical symptoms [$\beta=-0.14$, $t(190)=-2.00$, $p<0.05$]. This demonstrates that the inverse relationship also holds for a subpopulation, in which hypotensive subjects are left out. The correctness of the first three, more plausible, explanations for this phenomenon will have to be addressed in future research.

A second conclusion is that being treated for hypertension moderates the relationship between blood pressure and self-reported symptoms. In contrast with the fact that (diastolic) blood pressure level was *inversely* related to the number of self-reported symptoms, the subjects treated for hypertension reported *more* symptoms than normotensives and untreated hypertensives. This effect was not related to actual blood pressure level. This result seems to suggest a negative effect of hypertension treatment or just hypertension diagnosis on self-reported well-being. However, an alternative explanation may be that these findings are the consequence of help-seeking behavior on the part of individuals who are inclined to complain. Such persons would have a relatively greater chance of having their blood pressure measured and, hence, a higher probability of detection of hypertension. Thus, not treatment or diagnosis per se, but a dispositional characteristic, like neuroticism, may be confounded

with hypertension diagnosis. This explanation is in line with the results of two studies [33, 34], in which hypertension diagnosis was not confounded with help-seeking behavior. The aware hypertensive groups consisted of individuals who were detected and labeled hypertensive during a population screening. No differences in well-being were found between hypertensives and normotensives in those studies. Finally, although the symptoms described in the checklist used in the present study do not reflect typical side-effects of antihypertensive treatment, the potential effect of drugs cannot be ruled out as an explanation for the higher symptom rates in treated hypertensives in the present study [35]. Therefore, this finding should be treated with caution. Irrespective of the question whether the results obtained are due to treatment or diagnosis itself, self-selection of individuals with neurotic tendencies, or some other variable, the treatment and diagnosis status should always be included in research on associations between hypertension and variables assessed by self-reports.

Given the inconsistent results of previous research [15–19], the failure to find significant results on the relationship between blood pressure and both job-related stressor exposure and job-related psychological problems was not entirely unexpected. The results of research on the relationship between blood pressure and self-reported job-related stressors have been suggested to be dependent on the objectivity–subjectivity balance of the measuring instrument and on heterogeneity of the sample [36]. When job stressors are assessed relatively objectively, and when the population sample is rather heterogeneous, positive associations between blood pressure and job-related stressor exposure are likely to be found. The assumption underlying this relation is that job stressors contribute to elevations of tonic blood pressure [10, 36]. In contrast, when job stressors are measured by means of more subjective instruments, and when the sample is homogeneous, null or reverse findings may be expected [18]. These observations are in line with a recent study conducted by Fox et al. [37], in which stressor exposure has been assessed in both ways. In a sample of 136 nurses, these investigators found that the objective measure of stressor exposure—the head nurse's ratings of individual nurses' workload—was positively associated with blood pressure level, whereas the subjective measure of workload did not correlate with blood pressure. The highly subjective self-reported number of stressful events at work even correlated negatively with DBP. The present results are not in disagreement with these outcomes. The potential mechanisms that could be responsible for the null and reverse findings may be the same as the ones possibly involved in the diminished self-reports of physical symptoms by hypertensives, for instance, altered appraisal or nondisclosure.

Obviously, more research is needed on the potential mechanisms explaining these results. In general, a major drawback of the use of the self-report in this kind of research is the fact that it contains both an objective component of the environment and a subjective appraisal by the individual. The proportion of both aspects depends on the exact formulation of the questionnaire items and the individual characteristics of the subject, which makes interpretation rather difficult. Therefore, in future research, serious attempts should be made to disentangle these two components of stressor exposure and to assess them simultaneously [10].

There are a number of limitations of the present study, which should be taken into account when interpreting the between-group results. First, it should be noted that

treatment for hypertension has been assessed, not diagnosis or awareness of the condition. Given the estimates that 29.4% (females) to 44.2% (males) of diagnosed borderline hypertensives do not actually receive medical treatment [38], a subgroup of the untreated hypertensives were probably aware of their elevated blood pressure. If it is rather awareness of having the condition or self-selection bias of help-seekers rather than treatment per se, which account for the elevated self-report rates of symptoms, stressors, and distress, then the outcomes of the present research would be confounded, being too conservative. The aware subgroup of the untreated hypertensives would probably have enlarged the self-report rates of symptoms, and perhaps also of other complaints, in the untreated group. This would result in a reduced chance of finding the present outcomes. Therefore, in future research, diagnosis/awareness and treatment of hypertension should be kept apart carefully. Another limitation concerns the categorization of subjects as hypertensive or normotensive. This was based on a single blood pressure measurement, which may result in an exaggerated proportion of subjects classified as hypertensive [38]. This is due to the fact that the present investigation is based on already available data, which were collected for other purposes. However, this limitation would also result in an overestimation of the number of symptoms in the untreated hypertensive group, diminishing the probability of finding the present between-group differences.

The results concerning job-related irritation should be viewed with caution, given the small sample size of the male and female treated hypertensive subgroups. Nevertheless, the outcomes support the notion that there is some link between being treated for hypertension and hostility. Moreover, the link depends on gender: treated female hypertensives exhibited the highest scores; treated male hypertensives the lowest scores on Irritation. Untreated hypertensives, whether males or females, did not differ from normotensives on Irritation. The results suggest a differential gender effect of treatment on hostility. Treatment in female hypertensives may be associated with enhanced irritability, and in male hypertensives with repressed feelings of irritation, the latter finding being in agreement with the results of several other studies conducted in male subjects [39–41]. In addition, Durel et al. [42] found more or less corresponding gender differences: females showed positive correlations between ambulatory blood pressures—both systolic and diastolic—and hostility, whereas in males this personality feature was associated negatively with systolic blood pressure. On the other hand, in some studies, no gender differences on hostility were obtained in patients [43] and unselected samples [44]. Although overall, the results in this area of study certainly suggest a link between hypertension and aspects of hostility, the inconsistencies sometimes found also indicate that multiple factors are involved, which may moderate the relationships found. These factors include type of instrument measuring hostility, accuracy, and context of blood pressure measurement and sample characteristics such as gender and diagnosis status [45]. Needless to say that the effects of these factors should be taken into account.

Future research should aim at examining the distress and stressor report rates in various well-defined blood pressure groups simultaneously with estimates of the potentially explanatory mechanisms of defensiveness, nondisclosure, and baroreceptor-mediated CNS inhibition mentioned earlier. Finally, prospective research, aiming at elucidating the question of causality, should be encouraged.

REFERENCES

1. Monk M. Psychological status and hypertension. Am J Epidemiol 1980;112:200–208.
2. Müller A, Montoya P, Schandry R, Hartl L. Changes in physical symptoms, blood pressure and quality of life over 30 days. Behav Res Ther 1994;32:593–603.
3. Zonderman AB, Leu VL, Costa PT Jr. Effects of age, hypertension history, and neuroticism on health perceptions. Exp Gerontol 1986;21:449–458.
4. Irvine MJ, Garner DM, Olmstead MP, Logan AG. Personality differences between hypertensive and normotensive individuals: influence of knowledge of hypertension status. Psychosom Med 1989;51:537–549.
5. Theorell T, Svensson J, Knox S, Waller D, Alvarez M. Young men with high blood pressure report few recent life events. J Psychosom Res 1986;30:243–249.
6. Goldberg EL, Comstock GW, Graves CG. Psychosocial factors and blood pressure. Psychol Med 1980;10:243–255.
7. Davies M. Blood pressure and personality. J Psychosom Res 1970;14:89–104.
8. Kidson MA. Personality and hypertension. J Psychosom Res 1973;17:35–41.
9. Tibblin G, Lindström B. Complaints in subjects with angina pectoris and hypertension. In: Zanchetti A, ed. Neural and psychological mechanisms in cardiovascular disease. Milano: Casa Editrice "Il Ponte" 1972:135–139.
10. Nyklíček I, Vingerhoets AJJM, Van Heck GL. Hypertension and objective and self-reported stressor exposure: a review. J Psychosom Res 1996;40:585–601.
11. Lal N, Ahuja RC, Madhukar. Life events in hypertensive patients. J Psychosom Res 1982;26: 441–445.
12. Myers HF, Miles RE. Life events stress, subjective appraisal and somatization in hypertension: a pilot study. J Human Stress 1981;7:17–27.
13. Linden W, Feuerstein M. Essential hypertension and social coping behavior: experimental findings. J Human Stress 1983;9:22–31.
14. Svensson J, Theorell T. Life events and elevated blood pressure in young men. J Psychosom Res 1983;27:445–456.
15. Schnall PL, Pieper C, Schwartz JE, Karasek RA, Schlussel Y, Devereux RB, Ganau A, Alderman M, Warren K, Pickering TG. The relationship between "job strain," workplace diastolic blood pressure, and left ventricular mass index. JAMA 1990;263:1929–1935.
16. Theorell T, Ahlberg-Hulten G, Jodko M, Sigala F, De la Torre B. Influence of job strain and emotion on blood pressure in female hospital personnel during workhours. Scan J Work Environ Health 1993;19:313–318.
17. Van Egeren LF. The relationship between job strain and blood pressure at work, at home, and during sleep. Psychosom Med 1992;54:337–343.
18. Winkleby MA, Ragland DR, Syme L. Self-reported stressors and hypertension: evidence of an inverse association. Am J Epidemiol 1988;127:124–134.
19. Jenkins CD, Hurst MW, Rose RM. Biomedical and psychosocial predictors of hypertension in air traffic controllers. In: Spielberger CD, Sarason IG, eds. Stress and anxiety, vol. 9. Washington, DC: Hemisphere Publishing Corp 1985:231–238.
20. Kyriacou C, Sutcliffe J. A model of teacher stress. Educ Studies 1978;4:1–6.
21. Clark EH. An analysis of occupational stress factors as perceived by public school teachers. Auburn, Alabama: University Press 1980.
22. Van Poppel J, Kamphuis P. Gezondheid, Werk en Werkomstandigheden van Onderwijzend Personeel in het Schooljaar 1990–1991 [Health, Work, and Work Situation of Teaching Personnel in Years 1990–1991]. Unpublished report, Institute for Research in the Social Sciences IVA, Tilburg University, 1992.
23. Lefebvre RC, Sandfort SL. A multi-modal questionnaire for stress. J Human Stress 1985;11:69–75.
24. Needle RH, Griffin T, Svendsen R. Occupational stress, coping and health problems of teachers. J School Health 1981;51:175–181.
25. Cottington EM, Brock BM, House JS, Hawthorne VM. Psychosocial factors and blood pressure in the Michigan statewide blood pressure survey. Am J Epidemiol 1985;121:515–529.
26. King AC, Taylor CB, Albright CA, Haskell WL. The relationship between repressive and defensive coping styles and blood pressure responses in healthy, middle-aged men and women. J Psychosom Res 1990;34:461–471.
27. Warrenburg S, Levine J, Schwartz GE, Fontana AF, Kerns RD, Delaney R, Mattson R. Defensive coping and blood pressure reactivity in medical patients. J Behav Med 1989;12:407–424.
28. Dworkin BR, Filewich R, Miller N, Craigmyle N, Pickering T. Baroreceptor activation reduces reactivity to noxious stimulation: implications for hypertension. Science 1979;205:1299–1301.
29. Randich A, Maixner W. Interactions between cardiovascular and pain regulatory systems. Neurosci Biobehav Rev 1984;8:343–369.

30. Cumes-Rayner DP, Price J. Understanding hypertensives' behaviour: I. Preference not to disclose. J Psychosom Res 1989;33:63–74.
31. Handkins RE, Munz DC. Essential hypertension and self-disclosure. J Clin Psychol 1978;34:870–875.
32. Pilgrim JA. Psychological aspects of high and low blood pressure. Psychol Med 1994;24:9–14.
33. Mann A. Hypertension: psychological aspects and diagnostic impact in a clinical trial. Psychol Med 1984;5:1–35.
34. Moum T, Naess S, Sorensen T, Tambs K, Holmen J. Hypertension labelling, life events, and psychological well-being. Psychol Med 1990;20:635–646.
35. Bolli P, Fernandez PG, Bühler FR. Beta-blockers in the treatment of hypertension. In: Laragh JH, Brenner BM, eds. Hypertension: pathophysiology, diagnosis, and management. New York: Raven Press 1990:2181–2208.
36. Theorell T, Faire UDE, Johnson J, Hall E, Perski A, Stewart W. Job strain and ambulatory blood pressure profiles. Scan J Work Environ Health 1991;17:380–385.
37. Fox ML, Dwyer DJ, Ganster DC. Effects of stressful job demands and control on physiological and attitudinal outcomes in a hospital setting. Acad Manag J 1993;36:289–318.
38. Lew EA. Hypertension and longevity. In: Laragh JH, Brenner BM, eds. Hypertension: pathophysiology, diagnosis, and management. New York: Raven Press 1990:175–190.
39. Cottington EM, Matthews KA, Talbott E, Kuller LH. Occupational stress, suppressed anger, and hypertension. Psychosom Med 1986;48:249–260.
40. Harburg E, Erfurt JC, Chape C, Hauenstein LS, Schull WJ, Schork MA. Socioecological stressor areas and black–white blood pressure: Detroit. J Chronic Dis 1973;26:595–611.
41. Netter P, Neuhäuser-Metternich S. Types of aggressiveness and catecholamine response in essential hypertensives and healthy controls. J Psychosom Res 1991;35:409–419.
42. Durel LA, Carver CS, Spitzer SB, Llabre MM. Associations of blood pressure with self-report measures of anger and hostility among black and white men and women. Race, reactivity, and blood pressure regulation. Health Psychol (Special Issue) 1989;8:557–575.
43. Boutelle RC, Epstein S, Ruddy MC. The relation of essential hypertension to feelings of anxiety, depression and anger. Psychiatry 1987;50:206–217.
44. Somova LI, Diarra K, Jacobs TQ. Psychophysiological study of hypertension in black, Indian and white African students. Stress Med 1995;11:105–111.
45. Suls J, Wan CK, Costa PT. Relationship of trait anger to resting blood pressure: a meta-analysis. Health Psychol 1995;14:444–456.