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Elevated Blood Pressure and Self-Reported Symptom Complaints, Daily Hassles, and Defensiveness

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The association between elevated blood pressure and low rates of self-reported problems has been hypothesized to be mediated by defensiveness. In a population screening study in which 1,120 women and 903 men between 20 and 55 years of age participated, multiple resting home blood pressure measurements were performed and questionnaires were administered measuring symptom complaints, daily hassles, and defensiveness. In women, after control for potential confounders, a low number of self-reported symptoms was associated with elevated blood pressure. However, this effect was not mediated by defensiveness, although repressive defensiveness predicted independently elevated blood pressure in women. In men, no significant associations were obtained. Furthermore, no relations emerged between daily hassles and elevated blood pressure. In conclusion, although defensiveness was more prevalent among women with elevated blood pressure, it does not provide a good explanation for the low rates of self-reported symptoms found in these women.

Key words: daily hassles, defensiveness, hypertension, self-reports, symptom complaints

It has been hypothesized that chronic or recurrent exposure to psychosocial stressors is a significant factor in the etiology of essential hypertension (Henry, 1988).

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However, results of studies on the relation between elevated blood pressure and experiencing stressful events and symptoms have been rather inconsistent. Several confounding variables may play a role in the obtained inconsistencies, an important one being hypertension diagnosis. Indeed, in several studies, participants who were treated for hypertension or who were just already aware of having the disorder for some time reported significantly more stressful events (Myers & Miles, 1981), physical symptoms (Müller, Montoya, Schandry, & Hartl, 1994; Zonderman, Leu, & Costa, 1986), and psychological problems (Irvine, Garner, Olmstead, & Logan, 1989) than both normotensives and unaware hypertensives with similar blood pressure levels. In contrast, compared with diagnosed hypertensives and normotensives, individuals who are not aware of elevated blood pressure or just not treated for this condition have been found to have diminished self-report rates of negative life events (Melamed, Kushnir, Strauss, & Vigiser, 1997; Theorell, Svensson, Knox, Waller, & Alvarez, 1986), occupational stress (Jenkins, Hurst, & Rose, 1985; Winkleby, Ragland, & Syme, 1988), physical symptoms, such as headaches and dizziness (Davies, 1970; Kidson, 1973), negative psychological characteristics, such as neuroticism, anxiety, and depression (Soghikian, Fallick-Hunkeler, Ury, & Fisher, 1981), and painfulness of laboratory aversive stimulation (Bruehl, Carlson, & McCubbin, 1992). All these studies strongly suggest a tendency to underreport problems in persons unaware of their elevated blood pressure (see, for a review, Nyklíček, Vingerhoets, & Van Heck, 1996).

Furthermore, defensiveness has been suggested to mediate the inverse associations between blood pressure and self-reported problems (Melamed et al., 1997; Winkleby et al., 1988). In this article, defensiveness is used as a personality characteristic covering a wide range of closely related constructs, such as repression, denial, defensiveness, and emotional inhibition, reflecting the tendency to suppress or deny undesirable aspects of life (Sommers-Flanagan & Greenberg, 1989). Indeed, support has been claimed for associations between some of these constructs (i.e., repression and defensiveness) on the one hand, and underreporting problems (Santonastaso, Canton, Ambrosio, & Zamboni, 1984) and elevated blood pressure (Jorgensen, Johnson, Kolodziej, & Schreer, 1996; Warrenburg et al., 1989) on the other. However, to date, no studies aimed at testing this hypothesis more directly have been conducted.

Therefore, the first goal of this study was to examine the association between elevated blood pressure and self-reported problems, namely the number of symptom complaints and the number and impact of daily hassles in a population screening study. More importantly, the plausibility of defensiveness as a mediator in the inverse associations found was investigated directly using a multivariate approach. Finally, the relations between defensiveness and elevated blood pressure were examined. At the homes of the participants, multiple blood pressures were measured to enhance reliability of the measurements and diminish effects of anxiety in neurotic individuals (Shapiro et al., 1996). In addition,

only participants with elevated blood pressure at the screening who had never been treated for the disorder were included in the elevated blood pressure group. This was done in order to minimize potential biases resulting from hypertension diagnosis (Irvine et al., 1989).

The main hypotheses were: (a) When controlling for relevant biomedical and life-style variables, elevated blood pressure is associated with low self-report rates of the number of symptom complaints and daily hassles, with low perceived intensity of daily hassles and with high defensiveness; and (b) the inverse associations mentioned in the first hypothesis are mediated by defensiveness. All these relations were expected to be equally valid for men and women.

METHODS

Study Participants and General Procedure

Participants were recruited from three relatively small towns in southern Netherlands. After a campaign in the local media, street by street, every household was contacted for participation by telephone; per household two persons could participate. In the case of refusal, it was requested to pass the telephone to other potential participants of the household. Every person who refused to participate was asked to provide information regarding gender, age, and blood pressure status, in order to be able to compare responders and nonresponders on these variables. If persons agreed to participate, an appointment was made for the measurement of blood pressure at their homes and the delivery of the questionnaire set. One week later, the test booklets were recollected.

A total of 2,095 individuals (69.3% of the individuals contacted by telephone) gave consent and actually participated in the study: 1,120 women, 903 men, and 72 persons who did not indicate their gender. Exclusion criteria for all main analyses were: use of antihypertensive medication, presence of diabetes mellitus, any form of kidney disease, a history of hypertension treatment, myocardial infarction or other cardiovascular disease, and use of any medication that may influence cognitive functioning. This led to the exclusion of 59 female and 69 male participants from all main analyses.

Questionnaires

The Everyday Problems Checklist (EPCL; Vingerhoets & Van Tilburg, 1994) is a Dutch checklist originally consisting of 114 diverse daily hassles that individuals may have experienced in the past 2 months. In addition to checking the items they have experienced, for each marked item the participants have to indicate

"how strongly this did upset" them using a 4-point scale. In this way, the list assesses both the frequency and the impact of daily hassles. In previous research, the EPCL has proven to be reliable (test–retest coefficients of 0.87 for frequency of hassles and 0.76 for impact of hassles) and to have adequate construct validity, as indicated by substantial correlations with questionnaires on life events and psychosomatic symptoms (Vingerhoets & Van Heck, 1990; Vingerhoets & Van Tilburg, 1994).

Given the fact that a conceptual confusion exists in the application of the various defensive constructs (Santonastaso et al., 1984; Tomaka, Blascovich, & Kelsey, 1992), defensiveness was measured in two ways. First, a shortened version (15 items) of the Marlowe–Crowne Social Desirability Scale (SDS; Crowne & Marlowe, 1964) was used, based on the results of an item analysis by Hermans (1971). The scale had a Cronbach α of 0.62 in this sample.

Besides the widely used SDS as a measure of defensiveness (Shapiro, Jamner, & Goldstein, 1993), we also applied the Repressive Defensiveness (RD) subscale of the Weinberger Adjustment Inventory (Weinberger, 1989). In a previous study (Nyklíček, Vingerhoets, Van Heck, & Van Limpt, 1998), this scale has been found to correlate only modestly with the SDS ($r = 0.48$), which suggests that both scales reflect partly distinct aspects of defensiveness. In contrast to the SDS, which emphasizes desirable behaviors, the items of the RD assess extreme restraint and the tendency to deny mildly undesirable behaviors that are likely to be common in the general population. The scale has been shown to have adequate internal consistency (Cronbach α at least 0.76), test–retest reliability (2-week test–retest *r*s in the 0.75–0.88 range), and construct validity (Turvey & Salovey, 1994; Weinberger & Schwartz, 1990). Based on the results of a pilot study, in which two items of the RD—the original Items 8 and 17—showed low corrected item–total correlations ($r < 0.25$), in this investigation use was made of a nine-item version. In this sample, the Cronbach α was 0.76.

A separate questionnaire was employed for assessing the number of symptom complaints. Most of the 18 items were derived from a list that is commonly used by the Dutch Municipal Health Services (Nyklíček et al., 1997). The items reflect various present symptoms ranging from migraine, back pain, and varicose veins to concentration problems, diminished appetite, and feeling depressed. The participants checked the frequency of occurrence of each symptom on a 4-point scale: 1 (*seldom or never*) 2 (*sometimes*), 3 (*often*), and 4 (*very often*). In this sample, the Cronbach α of this total scale was 0.79. In this study, we used the number of symptoms reported to occur at least "sometimes."

Finally, a questionnaire was employed for assessing various control variables, such as gender, age, years of education, smoking, coffee and alcohol consumption, weekly physical exercise, (family) history of hypertension, and use of (antihypertensive) medication.

Biomedical Measurements

Blood pressure data were collected in the evening, at the participants' home using a Philips HP 5330 automatic digital device, based on the oscillometric method. This device proved to be a valid instrument in a pilot study, in which blood pressures measured using both a standard mercury sphygmomanometer and the Philips device were compared in 34 healthy volunteers. Mean blood pressures and variances did not differ between the two devices, $t(66) < 1.0$. In addition, correlations between the single readings of the two devices were 0.87 for systolic blood pressure (SBP) and 0.72 for diastolic blood pressure (DBP). In this study, four consecutive blood pressure measurements were taken while the participants were sitting in a quiet environment, with 2-min intervals. The sphygmomanometers were programmed in such a way that, at random, 50% of the participants could see their blood pressures on the screen and the other 50% could not. Participants who could not see the blood pressures were told that they would obtain the data when the study was completed. The participants who did see the levels were informed that, in general, systolic levels above 140 mmHg and diastolic levels above 90 mmHg were considered to be indicative of elevated blood pressure. This manipulation was performed in order to be able to examine whether perception of having elevated blood pressure would influence the self-reports of stress(ors) and, if appropriate, to account for these effects in the statistical analyses.

Statistical Analysis

All analyses were performed using SPSS software. First, responders and nonresponders were compared with respect to age, gender, and blood pressure status by means of *t* tests. For responders, mean SBP and DBP were computed, being the mean of at least three valid measurements after levels that deviated more than 20% from the mean of the other values were discarded as being erroneous (0.8% of the SBP and 0.3% of the DBP). Subsequently, multiple logistic regression analyses were performed in which elevated mean blood pressure (defined as a mean SBP of at least 140 mmHg, or a mean DBP of at least 90 mmHg, while not using any antihypertensive medication) was the outcome variable (Winkleby et al., 1988). In the first logistic regression analysis, variables reflecting the number of symptom complaints, exposure to daily hassles, and defensiveness operated as predictors after control (at Step 1) for potential confounders. For interpretational purposes, the defensiveness scores in this analysis were dichotomized using a median-split procedure. Several of the following potential confounders could enter the analysis at the first step: age, body mass index (BMI: weight/[length^2]), education, marital status, employment status, smoking, alcohol and coffee consumption, using a low-fat or low-salt diet, use of oral contraceptives, physical exercise, presence of a

hypertensive mother or hypertensive father, practicing relaxation techniques such as yoga, and whether the blood pressure device screen was on or disabled during measurement. The on/off position of the blood pressure screen was used only as one of the control predictors, because in a preanalysis it was found to have no effect on any of the self-reports of stress(ors).

In order to examine the mediation of defensiveness in associations found between elevated blood pressure and self-reported problems, a second logistic regression analysis was performed. The predictors in this analysis were residuals resulting from a linear regression of each of the symptom complaints and daily hassles variables on scores of the SDS and RD scales, thereby removing variance explained by defensiveness. Another possible strategy to realize this would be to enter the continuous defensiveness scores before the original self-reported hassles and symptoms scores. These analyses were also performed, but the results did not differ from the analyses based on the residualized scores reported in this article.

RESULTS

In comparing the group means between responders and nonresponders, the degrees of freedom have been corrected for inequality of variances. Responders appeared to be somewhat older than individuals who were not willing or able to participate in the study: 39.4 (8.8) versus 37.8 (9.4), respectively; $t(1082) = 3.84$, $p < .001$. Among the responders, a larger proportion of individuals reported elevated blood pressure compared with nonresponders: 9.0% versus 6.0%; $\chi^2\,(1) = 5.24$, $p < .05$. Both genders were equally represented in both groups: 56.1% women in the group of nonresponders and 55.6% among the participants; $\chi^2\,(1) = 0.05$, $p > .10$. The sample characteristics of the responders are shown in Table 1.

In both women and men, both defensiveness variables were negatively correlated with self-reported number of daily hassles and symptom complaints (r ranging from –0.18 between SDS and the number of symptoms in men to –0.33 between RD and the frequency of daily hassles for women). For the impact of daily hassles, the correlations with defensiveness were substantially lower, the correlation with RD even being not significant in men (Table 2).

Women

Due to missing values on the self-report variables, the logistic regression analysis was based on 65 women with elevated blood pressure and 809 normotensive women. The following biomedical and life-style variables appeared to be significant predictors of elevated blood pressure in women at Step 1: BMI, age, having a hypertensive father, using oral contraceptives, blood pressure screen being on, and physical exercise, with all except the last showing positive associations (see Table 3). At Step 2, the number of self-reported symptom complaints appeared to be a sig-

TABLE 1
Sample Characteristics

	Normotensive				*Elevated Blood Pressure*				
	Women[a]		*Men*[b]		*Women*[c]		*Men*[d]		
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*[e]
SBP	112.7	10.4	120.1	9.6	142.8	14.3	144.9	11.7	1323.1***
DBP	72.16	7.72	74.52	7.40	94.68	7.97	91.55	7.59	1196.2***
Age	37.96	8.66	39.09	8.44	41.40	8.50	43.70	7.60	46.11***
BMI	23.36	3.63	24.59	2.77	25.97	4.89	26.73	3.49	96.23***
Partner[f]	90.2%		88.7%		89.3%		88.1%		NS
Education[g]	10.27	2.75	10.87	3.08	9.81	2.56	10.42	3.02	NS
Employment[h]	56.0%		94.4%		50.0%		88.1%		NS
Smoking[i]	35.0%		40.3%		25.0%		50.0%		NS
Coffee[j]	3.93	2.76	5.14	3.05	4.06	2.78	5.62	2.72	6.48*
Alcohol[k]	3.79	5.34	9.11	8.27	3.49	5.96	12.15	9.70	24.51***
Low fat/salt[l]	4.6%		4.3%		9.6%		5.9%		3.50†
Physical exercise[m]	1.61	1.84	2.04	2.40	0.99	1.35	1.56	2.13	8.71**

Note. NS = nonsignificant.

[a]$n \geq 903$. [b]$n \geq 639$. [c]$n \geq 81$. [d]$n \geq 113$. [e]Test for the main effect of blood pressure status (for the purpose of clarity, percentages are displayed for dichotomous variables). [f]Percent married or living together. [g]Years of education. [h]Percent employed. [i]Percent smoker. [j]Cups per day. [k]Glasses per week. [l]Using a low-fat or low-salt diet. [m]Hours per week.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. †$p = 0.062$.

TABLE 2
Correlations Between the Self-Report Variables for Women and Men

	DH–F	*DH–I*	*Symptoms*	*RD*	*SDS*
DH–F	1.00	0.29	0.35	–0.33	–0.31
DH–I	0.19	1.00	0.23	–0.11	– 0.08*
Symptoms	0.32	0.23	1.00	–0.23	–0.19
RD	–0.23	–0.04**	–0.21	1.00	0.50
SDS	–0.24	–0.07*	–0.18	0.51	1.00

Note. Correlations are based on at least 1,045 women (above diagonal) and 830 men (below diagonal). Except were indicated, all correlations are significant at $p < 0.001$. DH–F = frequency of daily hassles, DH–I = mean impact of daily hassles, RD = Repressive Defensiveness, SDS = Social Desirability Scale.

*$p < 0.05$. **Nonsignificant.

TABLE 3
Multiple Logistic Regression, Predicting Elevated Blood Pressure in Women by Biomedical and Life-Style Variables, Symptom Complaints and Repressive Defensiveness

Predictor	*Logistic coefficient*	*SD*	*Odds Ratio*	*95% Confidence Interval*	*p Value*
Hypertensive father	0.85	0.35	2.34	1.18–4.64	0.015
Age	0.07	0.02	1.07	1.03–1.11	0.001
Body mass index	0.15	0.03	1.16	1.09–1.22	0.001
Oral contraceptives	0.90	0.32	2.45	1.31–4.59	0.005
Screen on	0.62	0.27	1.86	1.10–3.14	0.020
Physical exercise	–0.20	0.09	0.82	0.68–0.98	0.033
Symptom complaints	–0.11	0.04	0.89	0.82–0.97	0.007
Repressive defensiveness	0.54	0.27	1.71	1.01–2.91	0.047

Note. The variables are dichotomous except age (in years), body mass index (in kg/m^2), physical exercise (in hours per week), and the number of symptom complaints, which are continuous; the analysis was based on 65 women with elevated blood pressure and 809 normotensive women.

nificant predictor of elevated blood pressure, in an inverse manner (odds ratio = 0.89, $p < .01$, 95% confidence interval 0.82–0.97). The other stressor and distress variables failed to enter the equation ($p > .10$). Also, the dichotomized RD scores were significantly and positively associated with elevated blood pressure (odds ratio = 1.71, $p < .05$, 95% confidence interval 1.01–2.91). SDS failed to predict elevated blood pressure ($p > .10$).

When the residualized scores of the number of reported symptom complaints were used—after being regressed on SDS and RD—this modified symptom complaints variable still predicted the presence of elevated blood pressure after entering the biomedical and life-style variables first (odds ratio = 0.90, $p < .02$, 95% confidence interval 0.82–0.98).

Men

After controlling for the significant biomedical and life-style variables, namely age, BMI, and alcohol consumption (all positively associated with elevated blood pressure) in the male sample, no single daily hassles, symptom complaints, or defensiveness variable could predict elevated blood pressure ($ps > .10$). An analysis without the potential confounders did not change this outcome.

DISCUSSION

The main aims of this study were: (a) to examine the associations between elevated blood pressure and self-reported measures of stressor exposure and distress, and (b) to scrutinize the potentially mediating role of defensiveness in the associations found. The data from this study support the hypotheses partially and only in women. Regarding the first hypothesis, only in female participants, a *low* number of self-reported symptom complaints was associated with elevated blood pressure. This inverse association has been reported earlier, but in all studies the results were based on predominantly male, middle-aged participants (Davies, 1970; Kidson, 1973; Nyklíček et al., 1997). The reason why the inverse association in this study was found only in women remains unclear. Of the variables measured, only employment rate differed between our male and female participants: more than 90% of the men were employed whereas nearly 50% of the women did not have a job. To examine the possibility that (un)employment in some way played a role in the obtained gender differences, separate ad hoc analyses were performed for employed and unemployed men and women. If employment would be a key factor, then it was expected we would find a negative association between elevated blood pressure and symptom complaints only in unemployed women. However, the reverse outcome was found: no significant association emerged for unemployed women, whereas the negative relation did hold for employed female participants. Also reporting tendencies with regard to symptom complaints cannot explain the differences: although women reported more symptoms than men, even after correction for age, BMI, and education, the genders did not differ with respect to the variances or other distribution characteristics of the symptom scores.

The daily hassles measures failed to show any relation with elevated blood pressure in both men and women. Together with similar results of another recent study of ours (Nyklíček et al., 1997), this outcome is in discordance with some earlier research on elevated blood pressure and self-reported negative life events and occupational stress, which in undiagnosed participants showed inverse associations (Theorell et al., 1986; Winkleby et al., 1988). This discrepancy may be due to differences in heterogeneity of the samples studied. As Theorell and coworkers stated (Theorell et al., 1991), in the case of heterogenous samples, such as the ones

in our studies, it is more likely that the outcomes show more positive associations. This is the result of a relatively larger variance of objective frequency of exposure to stressors, which has been demonstrated to show more positive correlations with blood pressure than investigations in homogenous samples based on rather subjective self-report measures (Nyklíček et al., 1996; Theorell et al., 1991; Winkleby et al., 1988).

Also, the association between defensiveness and elevated blood pressure was found only in female participants: among high-RD women there was a larger proportion of women with elevated blood pressure than among low-RD scorers. Defensiveness has been found in previous studies to be associated with hypertension or elevated tonic blood pressure in samples of both women and men (Cottington, Brock, House, & Hawthorne, 1985; Jorgensen et al., 1996; Warrenburg et al., 1989). In addition, repeatedly associations have been obtained between defensiveness and cardiovascular reactivity to laboratory stressors (Tomaka et al., 1992; Warrenburg et al., 1989). In this sample, the differential gender outcomes may somehow be associated with differences in employment rate. Ad hoc logistic regression analyses revealed that among 41 unemployed women with elevated blood pressure and their 401 normotensive counterparts, RD scores significantly predicted elevated blood pressure (odds ratio = 2.10, $p < .04$), which was not the case among employed women. More importantly, although based on only a limited number of participants (14 with elevated blood pressure and 30 normotensives), among unemployed men the same association was found (odds ratio = 8.56, $p < .01$). In contrast, among working men the relation again was nonexistent.

The fact that defensiveness measured by SDS, in contrast with the results based on RD, did not predict elevated blood pressure was not anticipated. However, most of the studies finding a positive main effect of SDS on blood pressure were reactivity studies or studies conducted in a medical setting (Nyklíček et al., 1998; Warrenburg et al., 1989), suggesting that the Marlowe–Crowne SDS may be more sensitive to revealing differences in blood pressure containing a reactivity or anxiety component, whereas the RD scale may be more likely to reveal effects with respect to truly resting blood pressures, obtained in a tranquil setting familiar to the participant, like in this study. The rather low Cronbach α of the short version of SDS does not seem likely to account for the nonsignificant result, given the fact that in the study finding significant effects of SDS but not RD (Nyklíček et al., 1998), the same versions of the questionnaires were used as in this investigation.

No support has been obtained for the hypothesis that defensiveness mediates the low self-report rates of problems in hypertensives. The inverse association found in this study—concerning symptom complaints in women—remained significantly negative after variance accounted for by defensiveness was partialled out statistically. This suggests that defensiveness is not the crucial mediator in this particular relation. Another potentially mediating mechanism may provide an explanation for the inverse associations reported here and in the literature: a physio-

logically-based altered appraisal of aversive stimuli, for instance, brought about by baroreceptor mediated central nervous system inhibition (Dworkin, Filewich, Miller, Craigmyle, & Pickering, 1979; Ghione, 1996). In short, in this hypothesis, baroreceptor stimulation, as a result of blood pressure elevations, has central inhibitory effects, causing a variety of unpleasant sensations and events to be appraised as less aversive or even not aversive at all (Dworkin et al., 1979; Randich & Maixner, 1984). Future research should focus on this mechanism, the more that recent evidence suggests a role of this mechanism in the etiology of essential hypertension: the appraisal effects of baroreceptor stimulation have been found to predict long-term blood pressure elevations (Elbert et al., 1994).

In conclusion, elevated blood pressure was inversely-related to the number of self-reported symptom complaints in women. This association was not mediated by defensiveness, although repressive defensiveness independently predicted elevated blood pressure in women. No effects were found in men. Future research should focus on baroreceptor stimulation effects as a potential alternative explanation for the inverse associations between blood pressure level and self-reported stress and on gender differences in these relations.

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