Journal of Human Hypertension (2008) 22, 252–258

www.nature.com/jhh

ORIGINAL ARTICLE

# Prevalence of hypertension-attributed symptoms in routine clinical practice: a general practitioners-based study

M Middeke[1], B Lemmer[2], B Schaaf[3] and L Eckes[4]
[1]*Blood Pressure Institute, Munich, Germany;* [2]*Institute of Experimental and Clinical Pharmacology and Toxicology, Ruprecht-Karls-Universität, Heidelberg, Germany;* [3]*Factum-Company for Statistics, Scientific Information and Communication, Offenbach, Germany and* [4]*Boehringer Ingelheim Pharma, Ingelheim, Germany*

**The objective of the present study was to determine the prevalence of symptoms generally attributed to hypertension and the relationship between symptoms and blood pressure categories. Routine office blood pressure measurement in the morning was obtained and morning symptoms were reported using a standardized questionnaire in a multicenter study from general practitioners in Germany. Dizziness and headaches were significantly ($P<0.001$) more prevalent in 2154 untreated hypertensives (19.6 and 17.0%) as compared with 1399 normotensives (13.6 and 7.4%), whereas tiredness was less in hypertensives (12.0 vs 17.0%, $P<0.01$). In untreated and in 52 469 treated hypertensives, the overall prevalence of symptoms increased constantly with blood pressure levels from 26.1% in untreated male patients with mild hypertension to 54.3% of female patients with severe treated hypertension, with a higher prevalence in women (+7% vs men) and in patients with concomitant diseases (+13% vs patients without concomitant diseases). The prevalence of symptoms in older patients with untreated isolated systolic hypertension was not different from younger normotensives. There was a tight positive correlation between systolic and diastolic blood pressure and dizziness ($R=0.73$ and 0.76) as well as headaches ($R=0.83$ and 0.90) for all blood pressure levels in all patient groups. Typical hypertension-attributed symptoms like dizziness and headaches are more prevalent in hypertensives and they are closely related to blood pressure levels in untreated and treated hypertensives. Morning symptoms in hypertensives may suggest that there is inadequate control of blood pressure. More attention should be paid to perceived symptoms in hypertensives.**
*Journal of Human Hypertension* (2008) **22,** 252–258;
doi:10.1038/sj.jhh.1002305; published online 15 November 2007

**Keywords:** symptoms; clinical practice; blood pressure; hypertensives; normotensives

## Introduction

Hypertension has long been regarded as being symptomless,[1] with subjective symptoms also being reported by healthy individuals.[2] The frequent absence of symptoms or their gradual evolution may provide a partial explanation as to why hypertension is often underdiagnosed and why compliance with therapy is so poor.[3–6] Hypertensive patients are often unaware of clinical problems, and a diagnosis is only made as part of a screening programme or following a consultation for a seemingly unrelated condition.[7,8]

Data on hypertension-attributed symptoms are relatively rare.[2,9–13] There are three potential factors by which deterioration of life quality in hypertensive patients may be explained: increase in blood pressure causing specific symptoms, therapeutic/drug effects and labelling of patients as hypertensives. Patients with known hypertension presented a poorer health-related quality of life.[14,15] This may be explained psychologically, due to the labelling of patients and recognizing that they have 'a disease' that needs treatment, and/or patients' fearing of side effects.

Some patients may only appreciate the benefit of antihypertensive therapy as a result of a reduction in the frequency and intensity of symptoms, such as headache, after treatment has been initiated. In other patients, side effects of antihypertensive medication may negatively impact their overall well-being and quality of life to such an extent that patients are non-compliant.[6] Numerous different classes of antihypertensive agents are now available, some of which are very well tolerated. Such agents are likely to encourage the patient to continue the treatment

Correspondence: Professor M Middeke, Hypertension Center Munich, Blood Pressure Institute, Osterwaldstr. 69, München, Bavaria D-80805, Germany.
E-mail: info@blutdruckinstitut.de
Received 28 June 2007; revised 12 October 2007; accepted 13 October 2007; published online 15 November 2007

and maximize the likelihood of good blood pressure control, thus reducing cardiovascular risk.

No data exist on perceived symptoms related to the level and severity of blood pressure in untreated and treated hypertensives as compared to normotensives.

The aim of this large-scale study was to assess the control of blood pressure in hypertensives treated in general practice and the prevalence of symptoms in patients with hypertension to establish whether the subjective perceived symptoms are associated with poor blood pressure control and severity of blood pressure. In turn, this may help physicians to identify the patients with potentially increased risk of cardiovascular morbidity and mortality as a result of inadequate blood pressure control.

We report the data on the prevalence of hypertension-attributed symptoms.

## Patients and methods

This cross-sectional study has been designed to obtain an insight into the treatment habits and control rates in German primary care settings and to obtain data on the prevalence of typical hypertension-associated symptoms. Between January and October 2001, patients were recruited from a representative nationwide sample of 2934 general practitioners (GP) throughout Germany.

Each GP was provided with copies of a questionnaire on which they were asked to record specific data on adult patients ($\geqslant$18 years of age) whose blood pressure was regularly monitored. The data collected included information on a patient's morning (0600–1200 hours) blood pressure as measured in the GP's office. Systolic and diastolic blood pressure were measured by sphygmomanometry or automated, validated devices. The precise time of the blood pressure measurement was noted. An initial diagnosis (hypertension, coronary heart disease, diabetes mellitus, obesity, sleep apnoea or other concomitant diseases) was recorded, and the gender, age, height, weight and body mass index of each patient were also entered. Before blood pressure measurement, the subjects were asked by their GPs about hypertension-related symptoms. Patients were asked whether they experience symptoms in the morning. When patients reported symptoms, guided questions were related to five items: dizziness/vertigo, headache/tension, angina pectoris/chest pain, dyspnoea or other symptoms in the morning. Dizziness and headache are regarded to be typical hypertension-associated symptoms,[10,16] whereas angina and dyspnoea may be related to concomitant diseases such as coronary heart disease or chronic heart insufficiency.

These symptoms were recorded on a questionnaire. In addition, subjects were asked to provide information on tiredness, which served as a non-specific control symptom. Other information collected by means of the questionnaire included the time of day that the last dose of medication had been taken, the class(es) of antihypertensive drug(s) prescribed and frequency of dosing.

*Study population*

We report on routine patients with or without concomitant diseases, for example, coronary heart disease, diabetes, obesity, sleep apnoea or others for whom morning blood pressure, antihypertensive therapy and dosing practices were recorded. Patients were classified as normotensive or hypertensive, and severity of hypertension was based on the common definitions of national and international hypertension guidelines: hypertension was defined as a systolic blood pressure/diastolic blood pressure $\geqslant$140/90 mm Hg and isolated systolic hypertension as $\geqslant$140/$<$90 mm Hg. Mild hypertension was in the range of 140–159/90–99 mm Hg, moderate 160–179/100–109 mm Hg and severe $\geqslant$180/110 mm Hg.

*Statistical analysis*

Differences between groups were compared with the use of unpaired Student's *t*-test. All reported *P*-values are from two-sided tests, and *P*-values of $<0.05$ were considered to indicate statistical significance.

As a means of estimating the correlation between blood pressure level and the prevalence of morning complaints, Spearman's correlation coefficient was calculated using aggregate blood pressure level data of different blood pressure categories on the one hand and the corresponding prevalence rates of morning complaints (headache, dizziness, tiredness) on the other. Specifically, the mean systolic and diastolic blood levels, respectively, for 10 different blood pressure categories were calculated. In addition to Spearman's correlation coefficients between (aggregate) blood pressure levels and prevalence rates of morning complaints, descriptive *P*-values were calculated.

## Results

Patients enrollment: a total of 64 644 patients were screened in 2934 GP offices.

Five thousand one hundred and ninety-six patients were excluded because of missing blood pressure readings. Of the remaining 59 448 patients, 55 165 had been diagnosed as being hypertensive (hypertensive group) and 4283 patients were characterized by other diagnoses (non-hypertensive group) (Figure 1). Of this group, 1399 patients with normal blood pressure and without antihypertensive medication were selected as the normotensive control group. Demographic data, blood pressure values and symptoms reported from the normotensive group, the 2154 untreated and the 52 569

treated patients of the hypertension population are shown in Table 2.

*Symptoms reporting*

The prevalence of one or more hypertension-attributed symptoms (dizziness, headaches, angina and/or dyspnea) in the morning was 36.4% in treated and 30.6% in untreated hypertensive patients. In normotensives the prevalence of reported symptoms was 19.6% (Table 1).

Dizziness was the most prevalent of such symptoms. The prevalence was higher in untreated and treated hypertensive patients (19.6 and 22.2%) than in normotensive patients (13.7%). Other symptoms that are attributed to hypertension—headache, angina pectoris and dyspnea—were also more prevalent among hypertensives.

However, the prevalence of tiredness was highest in normotensives (17.01%) as compared with untreated (12.0%) and treated hypertensives (15.8%).

The prevalence range of reported hypertension-attributed symptoms was from 23.2% in normotensive

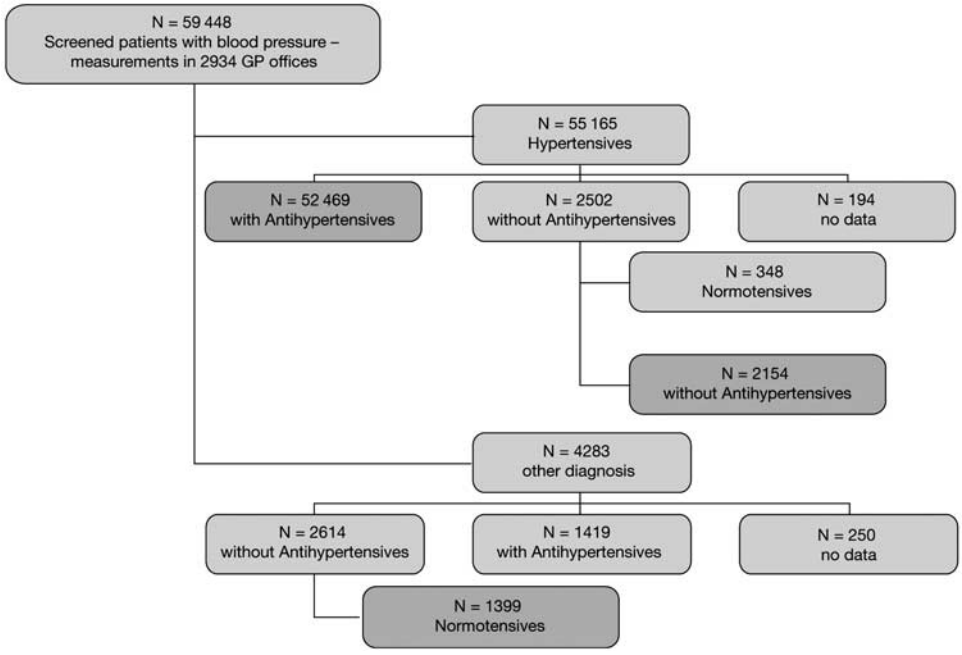


**Figure 1** Enrollment of study population. GP, general practitioner.

**Table 1** Prevalence of hypertension-attributed symptoms (dizziness, headaches, angina and dyspnea) and nonspecific symptoms (tiredness) in the morning reported in normotensives and in untreated and treated hypertensives

| | *Normotensives* N = *1399* | | *Hypertensives untreated* N = *2154* | | *Hypertensives treated* N = *52 469* | |
|---|---|---|---|---|---|---|
| | N | *% (range)* | N | *% (range)* | N | *% (range)* |
| Dizziness | 191 | 13.65 (11.9–15.6) | 421 | 19.55 (17.9–21.3) | 11 643 | 22.19 (21.8–22.5) |
| Headaches | 104 | 7.43 (6.1–8.9) | 366 | 16.99 (15.4–18.6) | 9966 | 18.99 (18.7–19.3) |
| Angina | 11 | 0.79 (0.4–1.4) | 52 | 2.41 (1.8–3.2) | 2704 | 5.15 (5.0–5.3) |
| Dyspnea | 34 | 2.43 (1.7–3.4) | 67 | 3.11 (2.4–3.9) | 3154 | 6.01 (5.8–6.2) |
| Total | 274 | 19.59 (17.5–21.8) | 660 | 30.64 (28.7–32.6) | 19 076 | 36.36 (35.9–36.8) |
| Tiredness | 238 | 17.01 (15.1–19.1) | 259 | 12.02 (10.7–13.5) | 8267 | 15.76 (15.4–16.1) |

men to 56.7% in hypertensives with concomitant diseases (Table 2). The prevalence of symptoms was higher in female as compared to male normotensive subjects and hypertensive patients, and in patients with concomitant diseases (Table 2).

The prevalence of all hypertension-attributed symptoms experienced in the morning increased with the severity of blood pressure in untreated and treated hypertensives (Figures 2 and 3). In patients with isolated systolic hypertension on the day of

**Table 2** Characteristics of study population (age, gender, CD[a], blood pressure, body mass index) and reported symptoms (headache, dizziness, dyspnoea and angina) in male and female participants, and in patients with (+) and without (−) CD

| | *Normotensives* | *Hypertensives (untreated)* | | | | *Hypertensives (treated)* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *Blood pressure categories* | | | | *Blood pressure categories* | | | | |
| | | *Mild* | *Moderate* | *Severe* | *Isolated systolic* | *Normalized* | *Mild* | *Moderate* | *Severe* | *Isolated systolic* |
| *N*= | 1399 | 512 | 759 | 267 | 616 | 12 359 | 9228 | 8956 | 3894 | 17 996 |
| % | 100 | 23.8 | 35.2 | 12.4 | 28.6 | 23.6 | 17.6 | 17.1 | 7.4 | 34.3 |
| *Age* | | | | | | | | | | |
| Years | 49.5 | 54.3 | 55.5 | 56.2 | 62.0 | 61.8 | 61.1 | 62.4 | 64.2 | 65.6 |
| s.d. | 17.1 | 13.3 | 13.6 | 13.9 | 14.3 | 13.1 | 12.3 | 12.2 | 12.2 | 11.9 |
| Female (%) | 60.8 | 53.9 | 45.3 | 46.1 | 53.1 | 52.9 | 50.9 | 52.3 | 56.6 | 54.3 |
| CD (%) | 36.8 | 44.7 | 41.6 | 53.9 | 53.9 | 82.2 | 88.4 | 99.3 | 99.8 | 96.0 |
| *SBP* | | | | | | | | | | |
| mm Hg | 119.9 | 144.6 | 160.3 | 181.7 | 153.4 | 126.8 | 144.3 | 161.3 | 185.0 | 150.5 |
| s.d. | 10.9 | 8.0 | 9.8 | 17.3 | 12.1 | 7.7 | 8.2 | 8.9 | 15.7 | 11.9 |
| *DBP* | | | | | | | | | | |
| mm Hg | 74.5 | 91.9 | 97.2 | 106.0 | 80.0 | 77.2 | 91.3 | 96.0 | 103.2 | 79.8 |
| s.d. | 7.8 | 2.5 | 4.9 | 10.6 | 5.4 | 6.4 | 2.3 | 5.1 | 10.0 | 5.2 |
| *BMI* | | | | | | | | | | |
| $kg\,m^{-2}$ | 25.2 | 27.3 | 27.0 | 27.8 | 26.9 | 27.2 | 28.0 | 28.6 | 29.2 | 27.8 |
| s.d. | 4.1 | 4.6 | 4.0 | 4.5 | 4.0 | 4.3 | 4.5 | 4.7 | 5.2 | 4.4 |
| *Symptoms* | | | | | | | | | | |
| Female (%) | 34.8 | 39.9 | 42.2 | 52.9 | 31.2 | 38.4 | 47.3 | 54.9 | 54.3 | 43.5 |
| Male (%) | 23.2 | 26.1 | 36.7 | 46.9 | 26.3 | 31.3 | 39.1 | 49.1 | 48.5 | 35.5 |
| *Symptoms* | | | | | | | | | | |
| CD+ (%) | 33.8 | 40.3 | 44.5 | 51.7 | 33.2 | 40.5 | 48.9 | 56.7 | 54.6 | 44.7 |
| CD− (%) | 25.7 | 27.1 | 35.1 | 47.5 | 24.0 | 25.0 | 31.3 | 40.1 | 43.3 | 28.3 |

Abbreviations: CD, concomitant diseases; BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure.
[a]Mainly cardiovascular diseases, diabetes and overweight/obesity.

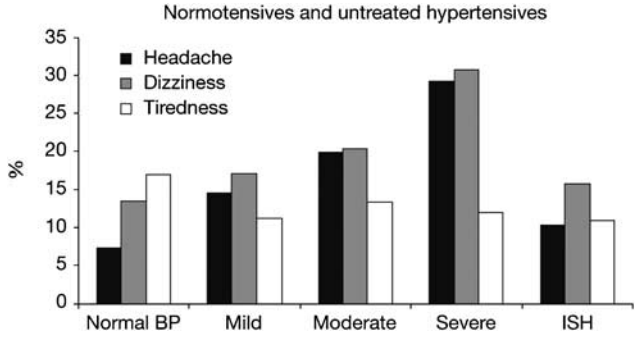


**Figure 2** Percent (%) of hypertension-attributed symptoms (headache and dizziness) and tiredness in $N=1399$ normotensives (normal BP) and in $N=2154$ untreated hypertensives with mild, moderate, severe and isolated systolic hypertension (ISH). Significance: normal BP vs all other categories and all symptoms significant ($P<0.0001$), between hypertensive groups all are significant except mild vs moderate hypertension and mild vs ISH for headache, and none for tiredness. BP, blood pressure.

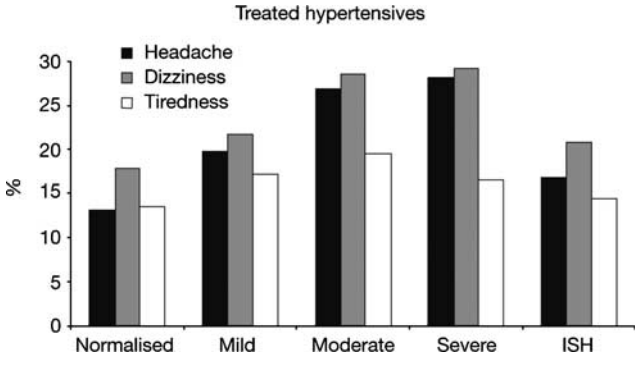


**Figure 3** Percent (%) of hypertension-attributed symptoms (headache and dizziness) and tiredness in $N=52\,469$ treated hypertensives with normalized blood pressure (<140/90 mm Hg) and with mild, moderate, severe and isolated systolic hypertension (ISH). Significance: all categories are significantly different, except mild vs ISH and moderate vs severe hypertension for dizziness, moderate vs severe hypertension for headache, and mild vs severe hypertension for tiredness.

examination, the frequencies of symptoms were similar to those recorded in those with mild hypertension. Treated hypertensives without concomitant diseases and with normalized blood pressure had a similar prevalence of symptoms to normotensives: 25.0 and 25.7% (Table 2).

There was a significant positive correlation between the typical hypertension-attributed symptoms (dizziness and headache) and systolic and diastolic blood pressure in all blood pressure categories of normotensive subjects and hypertensive patients (Figure 4a–f). However, no correlation was found between tiredness and blood pressure (Figure 4e–f).

There was no obvious difference in the overall incidence of morning symptoms according to the class of antihypertensive monotherapy. Similarly, there was no significant correlation between the most commonly used combination therapies and the incidence of hypertension-attributed symptoms.

## Discussion

In the past, hypertension has been described as the 'silent killer'.[17] Our study has shown that this is a misnomer and that symptoms may occur. Incidence of hypertension-attributed symptoms in the morning was reported by up to 52.9% of untreated hypertensive patients with severe hypertension and up to 56.7% of treated hypertensives in this large-scale study conducted throughout German GPs' offices. The authors acknowledge that the definition of subjective symptoms is difficult and that asking direct questions about specific symptoms may result in over-reporting. However, the inclusion of information on tiredness, which is usually not regarded as a symptom of hypertension rather than as lower blood pressure, introduced a control element into the current study.

A high incidence of symptoms in hypertensives is not uncommon. It has previously been reported that

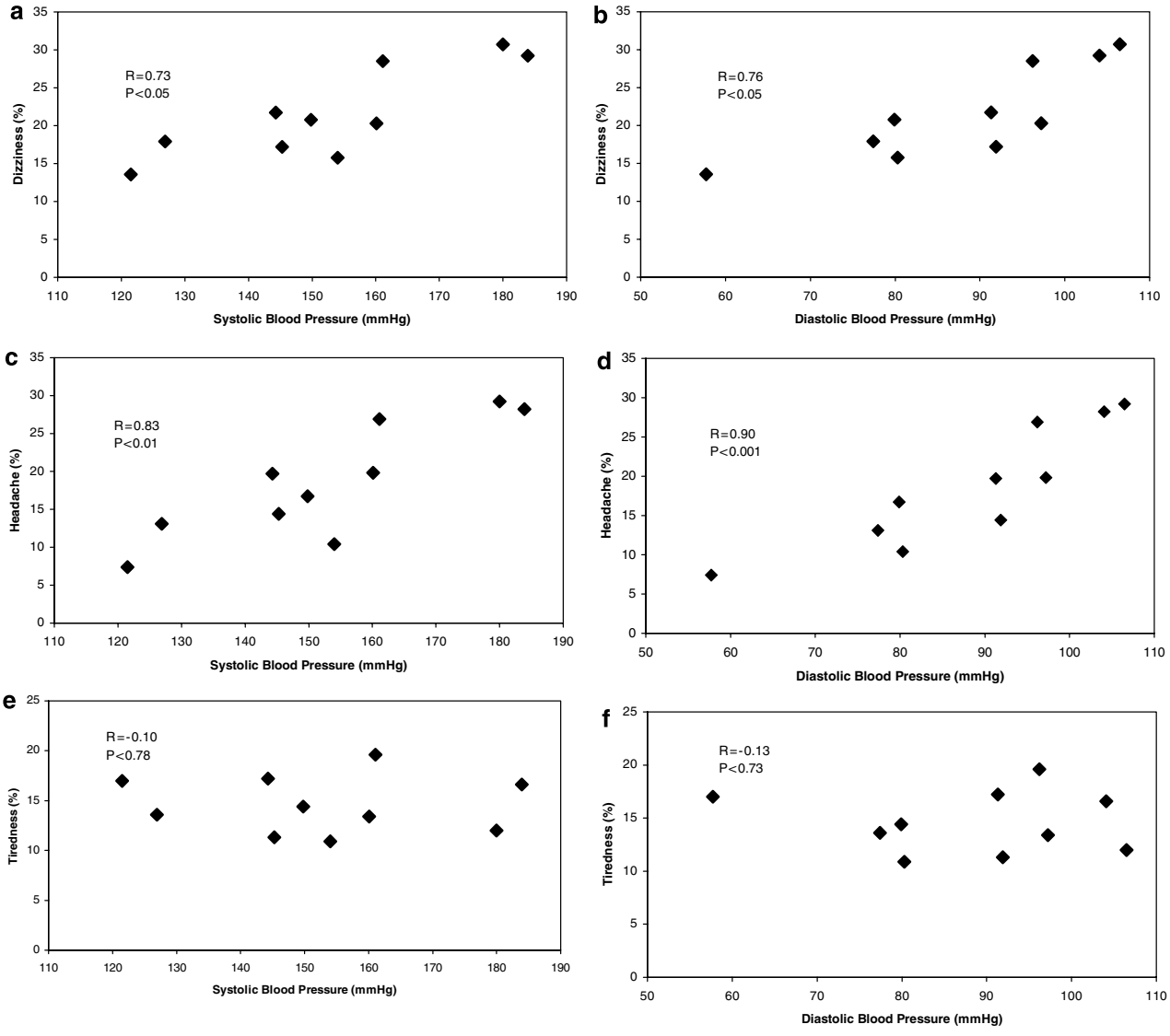


**Figure 4** (**a–f**) Spearman's correlation coefficients for systolic and diastolic blood pressure in 10 blood pressure categories of normotensives ($N=1399$), patients with untreated mild, moderate, severe and isolated systolic hypertension ($N=2154$), in treated hypertension ($N=52\,469$) with normalized, mild, moderate, severe and the prevalence (%) of dizziness, headache and tiredness.

hypertensive patients receiving medication tend to report more symptoms than those who are not.[18] This may be psychologically, due to the labelling of patients and recognizing that they have 'a disease' that needs treatment, and/or patients' fearing of side effects.

However, we found a strong correlation between the severity of blood pressure and reported symptoms. These were higher in women and in patients with concomitant diseases. No relation between age and symptoms was found. In older patients with isolated systolic hypertension, the incidence of reported symptoms was as low as in younger normotensives. Isolated systolic hypertension is a very special form of hypertension, which is in many respects not comparable with other hypertension forms in younger and middle-aged patients.[19]

Symptoms reported by the patients while undergoing antihypertensive treatment could be explained by the adverse events related to the medication, inadequate blood pressure control and the consequent emergence of symptoms of hypertension, or due to interactions with concomitant treatment.[18] The nature of the symptoms and their increasing incidence with the severity of hypertension in this study suggest that these symptoms were the result of inadequate blood pressure control rather than side effects of the medication. No differences were found between different medications.

Headache was a frequently reported symptom in the present study. This is consistent with previous findings of a smaller scale study.[10] Other investigators, however, have reported that the incidence of headache was lower in treated hypertensive patients.[18] A Swedish study conducted in middle-aged women showed that dizziness, in particular, was more prevalent in women who started taking antihypertensive therapy.[16] Another finding of the same study was that headache was more common in patients with the highest quintile of hypertension who did not receive antihypertensives.[16]

Further evidence that headache and dizziness reported in the present study were due to hypertension, as a result of inadequate blood pressure control, is provided by the absence of a marked severity-related increase in the incidence of tiredness. In contrast to headache and dizziness, the incidence of tiredness was markedly lower in patients with severe hypertension as compared with normotensives.

Also, the nature of the antihypertensive monotherapy in the present study did not have any marked impact on the incidence of hypertension-attributed symptoms. Among the different classes of antihypertensive agents, the ARB (angiotensin receptor blockers) are generally regarded as the most tolerated, having a placebo-like tolerability profile. As a consequence, more patients continue to take ARBs than any of the other leading classes of antihypertensives.[20] This suggests, once again, that the symptoms reported were not side effects of the antihypertensive medication, but rather the emergence of the symptoms of hypertension as a result of poor blood pressure control.

This is in contrast to a small-scale study that was reported in 1979. In young subjects, no significant correlation was established between a number of different symptoms, including headache and blood pressure level.[21] The patient population in the present study was predominantly middle aged or elderly. The age of the patients studied may have an impact on symptoms, with older patients being more susceptible. However, although hypertensive patients have been shown to have more physical and psychological complaints than normotensive subjects, the age of the patient does not appear to have any effect.[22] In our study, we found no influence of age on the prevalence of symptoms.

The findings of this study suggest that the emergence of such symptoms as headache, dizziness, angina or dyspnoea in the morning may serve as a warning that there is inadequate control of blood pressure. If the patient is not totally compliant, the emergence of symptoms in the morning may encourage the patient to adhere more rigidly to the dosing regimen. Primary care physicians should also be aware that the presence of these symptoms suggests the persistence of hypertension and that the patient's present medication may not be providing adequate blood pressure control.

The Hypertension Optimal Treatment (HOT) trial showed that intensive antihypertensive treatment can result in an improvement in the patient's well-being, with, most notably, reductions in cardiac symptoms and dizziness even under combination therapy.[23] Without being alarmed, patient education on the benefits of effective antihypertensive therapy in terms of reduced cardiovascular risk in the long term, as well as enhanced quality of life in the short term, should form part of the patient management programme.

*What is known about the topic*

- Data on hypertension-attributed symptoms are rare—hypertension is commonly regarded as a silent/symptomless killer.

*What this study adds*

- Hypertension is not symptomless in all hypertensive patients.
- The prevalence of headache and dizziness is up to 56.7%.
- Both headache and dizziness correlate very tightly with the blood pressure level in normotensives, untreated and treated hypertensives.

## Acknowledgements

Parts of these data were presented at the 21st Scientific Meeting of the International Society of Hypertension, 2006, Fukuoka, Japan (ref. 24). This work was supported by Boehringer Ingelheim Pharma, Germany.

## References

1 Page IH. Hypertension: a symptomless but dangerous disease. *N Engl J Med* 1972; **287**: 665–666.
2 Kullman S, Svardsudd K. Differences in perceived symptoms/quality of life in untreated hypertensive and normotensive men. *Scand J Prim Health Care* 1990; **1**(Suppl): 47–53.
3 Marques-Vidal P, Tuomilehto J. Hypertension awareness, treatment and control in the community: is the 'rule of halves' still valid? *J Hum Hypertens* 1997; **11**: 213–220.
4 Gasse C, Hense HW, Stieber J, Doring A, Liese AD, Keil U. Assessing hypertension management in the community: trends of prevalence, detection, treatment, and control of hypertension in the MONICA Project, Augsburg 1984–1995. *J Hum Hypertens* 2001; **15**: 27–36.
5 Wolf-Maier K, Cooper R, Banegas JR, Giampaoli S, Hense HW, Joffres M *et al.* Hypertension prevalence and blood pressure levels in 6 European countries, Canada, and the United States. *JAMA* 2003; **289**: 2363–2369.
6 Nunes MI. The relationship between quality of life and adherence to treatment. *Curr Hypertens Rep* 2001; **3**: 462–465.
7 Mamon J, Green L, Levine DM, Gibson G, Gurley HT. Using the emergency department as a screening site for high blood pressure. A method for improving hypertension detection and appropriate referral. *Med Care* 1987; **25**: 770–780.
8 Angard N, Chez RA, Young C. Personal health among midlife women hospital employees. *J Womens Health* 1998; **7**: 1289–1293.
9 Williams GH. Beyond blood pressure control. Effect of antihypertensive therapy on quality of life. *Am J Hypertens* 1988; **1**(Suppl): 363S–365S.
10 Di Tullio M, Alli C, Avanzini F, Bettelli G, Colombo F, Devoto MA *et al.* Prevalence of symptoms generally attributed to hypertension or its treatment: study on blood pressure in elderly outpatients (SPAA). *J Hypertens* 1988; **6**(Suppl 1): S87–S90.
11 Kjellgren KI, Ahlner J, Dahlof B, Gill H, Hedner T, Saljo R. Perceived symptoms amongst hypertensive patients in routine clinical practice—a population-based study. *J Intern Med* 1998; **244**: 325–332.
12 Erickson SR, Williams BC, Gruppen LD. Perceived symptoms and health-related quality of life reported by uncomplicated hypertensive patients compared to normal controls. *J Hum Hypertens* 2001; **15**: 539–548.
13 Dimenas ES, Wiklund IK, Dahlöf CG, Lindvall KG, Olofsson BK, De Faire UH. Differences in the subjective well-being and symptoms of normotensives, borderline hypertensives and hypertensives. *J Hypertens* 1989; **7**(11): 885–890.
14 MacDonald LA, Sackett DL, Haynes RB, Taylor DW. Labelling in hypertension: a review of the behavioural and psychological consequences. *J Chronic Dis* 1984; **37**(12): 933–942.
15 Mena-Martin FJ, Martin-Escudero JC, Simal-Blanco F, Carretero-Ares JL, Arzua-Mouronte D, Herreros-fernandez V. Health-related quality of subjects with known and unknown hypertension: results from the population-based Hortega study. *J Hypertens* 2003; **21**: 1283–1289.
16 Sigurdsson JA, Bengtsson C. Symptoms and signs in relation to blood pressure and antihypertensive treatment. A cross-sectional and longitudinal population study of middle-aged Swedish women. *Acta Med Scand* 1983; **213**: 183–190.
17 Hoel D, Howard RB. Hypertension: stalking the silent killer. *Postgrad Med* 1997; **101**: 116–121.
18 Vandenburg MJ, Evans SJ, Kelly BJ, Bradshaw F, Currie WJ, Cooper WD. Factors affecting the reporting of symptoms by hypertensive patients. *Br J Clin Pharmacol* 1984; **18**(Suppl 2): 189S–195S.
19 Franklin SS, Pio JR, Wong ND, Larson MG, Leip EP, Vasan RS, Levy D. Predictors of new-onset diastolic and systolic hypertension: the Framingham Heart Study. *Circulation* 2005; **111**: 1121–1127.
20 Bloom BS. Continuation of initial antihypertensive medication after 1 year of therapy. *Clin Ther* 1998; **20**: 671–681.
21 Kottke TE, Tuomilehto J, Puska P, Salonen JT. The relationship of symptoms and blood pressure in a population sample. *Int J Epidemiol* 1979; **8**: 355–359.
22 Wood WG, Elias MF, Schultz NR, Pentz III CA. Symptoms reported on the Cornell Medical Index in relationship to hypertension and age. *Exp Aging Res* 1978; **4**: 421–431.
23 Wiklund I, Halling K, Ryden-Bergsten T, Fletcher A. Does lowering the blood pressure improve the mood? Quality-of-life results from the Hypertension Optimal Treatment (HOT) study. *Blood Press* 1997; **6**: 357–364.
24 Middeke M, Lemmer B, Schaaf B, Eckes L. Prevalence of hypertension attributed symptoms: results of a large-scale, primary-care study conducted in Germany. *Int Soc Hypertens* 2006, 64 abstr.