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ORIGINAL ARTICLE

Assessing hypertension management in the community: trends of prevalence, detection, treatment, and control of hypertension in the MONICA Project, Augsburg 1984–1995

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***Objective*: To assess trends in prevalence and detection, treatment and control of hypertension in a German population between 1984 and 1995.**
***Setting and participants*: Independent random samples of the population were examined in cross-sectional surveys with identical methods in 1984/85 (age range 25 to 64 years, $n = 4022$ participants), 1989/90 (age range 25 to 74 years, $n = 4940$) and 1994/95 (age range 25 to 74 years, $n = 4856$).**
***Main outcome measures*: Prevalence of hypertension and proportions of hypertensives detected, treated and controlled. Hypertension was defined as blood pressure above 140/90 mm Hg or taking antihypertensive medication.**
***Results*: The prevalence of hypertension did not change significantly over the 10 years (25–64 years, age-standardised 1984/85: 37.8% in men and 24.6% in women; 1994/95: 39.3% and 24.8%, respectively). Rates of detection, treatment and control of hypertension did not change much either. Of all hypertensives in 1994/95, 54% were detected in men and 64% in women, the treatment rates were 23% and 32%, and the proportions of those with controlled hypertension (below 140/90 mm Hg with treatment) were as low as 7% and 13%, respectively. Rates were higher in the older age groups, however, control rates never exceeded 20% at any age.**
***Conclusions*: Despite considerable changes in the pharmacological treatment of hypertension there was a disappointing stagnation with regard to the management of this important risk factor in the community. The reasons for this unfavourable trend need clarification and appropriate public health action.**
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Keywords: antihypertensive treatment; population study; prevalence; detection and control

Introduction

The recognition of high blood pressure (BP) as a major risk factor for cardiovascular diseases has prompted numerous activities.[1] Prevention initiatives involved targeted health education, intensified screening and non-pharmacological as well as drug treatment of hypertensive individuals in the population.[2] Thus, monitoring of the prevalence and detection, treatment and control of hypertension is an important tool for evaluating the management of this condition in a population.

Since the mid 1980s hypertension has been defined as a systolic BP $\geqslant$140 mm Hg and/or a diastolic BP $\geqslant$90 mm Hg.[3–5] There is now wide consensus that the threshold to immediately initiate antihypertensive treatment is a BP consistently above 160/95 mm Hg and that treatment should be aimed to achieve and maintain a target BP below 140/90 mm Hg.[3–6] Treatment at lower levels, that is, at values between 140/90 and 159/94 mm Hg, is recommended in the presence of additional cardiovascular risk factors, target organ damage or a family history of cardiovascular disease.[3,4,7] Even though increasing numbers of epidemiological and clinical trial reports indicate that drug treatment is beneficial in these patients,[8] there remains some debate

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as to whether treatment should be initiated in these patients or not.[9]

In Germany, recent discussions about budgetary restrictions for ambulatory health care have highlighted the prominent economical implications of primary prevention of cardiovascular disease. These arise from the high prevalence of risk factor carriers in the population, from the extension of treatment indications to groups with increasingly lower absolute risk, and thus lower expected individual benefit from therapy, and from the seemingly relentless introduction of costly novel pharmaceutical preparations into a little regulated market.

In the light of these controversial developments we sought to analyse how the management of hypertension has evolved in Germany over a decade. We used data of three large independent population surveys conducted with identical methods between 1984/85 and 1994/95 in the Augsburg study region of the WHO MONICA project.

Methods

Study design and population

The collaborative WHO-MONICA Project was initiated in the early 1980s to monitor trends and determinants in cardiovascular disease morbidity and mortality in men and women from 27 countries over a period of 10 years.[10] The present investigation is based on data from the MONICA Augsburg Project in Southern Germany. In the city of Augsburg and the two surrounding counties, three independent, randomly selected, representative samples of the population were examined in 1984/85 (S1), in 1989/90 (S2) and 1994/95 (S3). All three surveys comprised the age groups 25 to 64 years, and S2 and S3, in addition, the age group 65 to 74 years. Overall participation reached 79.3% in S1 ($n = 4022$), 76.9% in S2 ($n = 4940$) and 74.9% in S3 ($n = 4856$). Participation was also stable in the restricted age group 25 to 64 years (S2: $n = 3966$; S3 $n = 3916$). In each survey, the participants were interviewed and examined in an identical manner by intensively trained observers using highly standardised methods.[11]

Interview questions comprised information on medical history and lifestyle factors such as smoking, alcohol consumption, physical activity and dietary patterns. All medications taken during the week prior to the interview were assessed identically in S1, S2 and S3. The participants were asked to bring all their drug packages to the interview. Drug names, dosages and the route of administration were recorded. Antihypertensive drugs were defined as any preparation containing diuretics, beta-blockers, calcium channel blockers, ACE-inhibitors, aldosterone antagonists, and peripherally or centrally acting vasodilators as well as different combinations and reserpine. These categories were chosen according to the pertinent guidelines for antihypertensive therapy of the German Hypertension League.[3] The pharmacological compounds of all preparations were identified using the 'Rote Liste', an official German listing of drugs, and a local drug database.

Blood pressure was measured with identical methods in all three surveys.[12] Three auscultatory blood pressure recordings were taken with a Hawksley random-zero sphygmomanometer from each individual after being at rest in a sitting position for an average of 30 min. A constant cuff deflation rate was applied and the first and the fifth phase Korotkoff sounds were recorded to the nearest even digit. Appropriate cuff sizes were selected for differing upper arm circumferences. The individual blood pressure of a participant in this report is based on the arithmetic mean of the second and third blood pressure measurement.

Hypertension was defined as present in a study participant if the systolic BP was equal to or greater than 140 mm Hg and/or the diastolic BP was equal to or greater than 90 mm Hg and/or antihypertensive treatment was taken. We defined participants reporting a prior diagnosis of hypertension as detected hypertensives. Treated hypertensives were participants reporting the current use of at least one antihypertensive drug. To reduce misclassification due to participants taking agents with BP lowering effect for other conditions, eg, beta-blockers after a previous myocardial infarction, calcium antagonists for angina, etc, a positive antihypertensive treatment status was assigned only if a participant was a detected hypertensive. Treated hypertensives with BP values below the target BP of 140/90 mm Hg were considered as controlled hypertensives.

We also employed the formerly common definition of hypertension as systolic BP $\geqslant$160 mm Hg and/or the diastolic BP $\geqslant$95 mm Hg and/or antihypertensive treatment.[10] This old definition was used for comparative purposes and because it was still in wide use when the study started in 1984/85. For this definition treated hypertensives with BP values below the target BP of 160/95 mm Hg were considered as controlled hypertensives. Definitions comply with previous reports from our study[13] and others.[14–16]

Statistical analyses

Prevalence estimates were directly standardised to the age distribution of the West German population as of 31 December, 1980, and represent population values. They are reported separately for men and women in each survey. The weights for age-standardisation in the subgroup of hypertensives are based on the prevalence of hypertensives in Survey 1984/85 and the age-standardisation weights according to the FRG age distribution on 3 December, 1980. The weights were calculated for both cut-off points for hypertension (160/95 mm Hg and 140/90 mm Hg) separately.

For the comparisons between surveys we calculated the percentage differences and report their

95% confidence intervals in the text. This approach emphasises the purpose of our study as an exercise to estimate trends rather than present *P*-values which refer to statistical hypothesis testing. For the sake of conciseness we report only intervals of major interest in the text. The figures display the 95% confidence intervals of the prevalence estimates and proportions. Statistical analyses were performed with the PC version of the Statistical Analysis System (SAS 6.11) and MEDCALC, version 4.03.

Results

Trends in the prevalence of hypertension

The age-standardised prevalence of hypertension in participants aged 25 to 64 years rose slightly from S1 to S3 (men, +1.5%, 95% confidence interval (–1.5%; 4.5%); women, +0.2% (–2.5%; 2.9%)). Inclusion of those aged 65 to 74 years in S2 and S3 confirmed the slight rises in hypertension prevalence (Table 1). Through the years, hypertension was much more prevalent in men than in women.

In age-specific analyses, there was no indication that prevalence trends were markedly different between age groups (Figure 1). It appeared, though, that rises of hypertension prevalence were confined mostly to the older age groups. It became also evident that hypertension affected around 70% of the population aged 65 to 74 years.

Employing the definition of hypertension as ⩾160/95 mm Hg, the observed trends were similar. This definition considerably reduced the differences of the prevalence of hypertension between men and women, and the size of the public health problem in terms of the proportion of the population affected (Figure 1).

Trends in the prevalence of antihypertensive drug use

The prevalence of antihypertensive drug use rose over the decade. Thus, the proportion of all subjects in the population taking antihypertensive drugs increased from 5.5% to 8.3% in men (+2.8%, (0.3; 5.3)) and from 7.3% to 9.0% (+1.7%, (–1.5; 4.9)) in women (Table 2).

Trends in the detection, treatment and control of hypertension

There was little improvement in the detection rate of hypertension defined at 140/90 mm Hg over the 10 years in 25 to 64 year old hypertensives (Figure 2). The age-standardised detection rates in men persisted at approximately 50%, in women at approximately 60%. The proportion of hypertensives with drug treatment increased between 1984/85 and 1989/90, and it rose by 7.9% (4.0; 11.8) in men and by 4.1% (–1.4; 9.6) in women. However, there was no further increase until 1994/95. Thus, only 22.9% of all men and 32.9% of all women with hypertension were actually treated with antihypertensive drugs in 1994/95. Moreover, the proportion of hypertensives reaching the target BP below 140/90 mm Hg remained low and amounted to only 6.6% in men and to 13.1% in women in 1994/95.

For hypertension defined at 160/95 mm Hg the overall situation appeared generally more favourable. The detection rate in 1994/95 was 72.8% in men and 80% in women (Figure 2), the treatment rate went up to 41.1% and 54.7%, respectively, and the proportion of controlled hypertensives (reaching below 160/95 mm Hg) was 25.1% in men and 36.8% in women.

Table 1 Numbers and age-standardised prevalence (%) of hypertension (defined at 140/90 mm Hg or at 160/95 mm Hg) in men and women, aged 25 to 74 years

	Survey I 1984/85		*Survey II 1989/90*		*Survey III 1994/95*	
	No.	*Prevalence[a] (%)*	*No.*	*Prevalence[a] (%)*	*No.*	*Prevalence[a] (%)*
Hypertension ⩾140/90 mm Hg						
Men						
25–64 years	808	37.8	779	37.7	803	39.3
25–74 years			1138	42.7	1141	44.0
Women						
25–64 years	545	24.6	523	23.5	559	24.8
25–74 years			819	30.2	880	32.2
Hypertension ⩾160/95 mm Hg						
Men						
25–64 years	403	18.6	432	20.2	432	20.2
25–74 years			653	23.7	663	24.5
Women						
25–64 years	309	13.7	312	13.7	353	15.4
25–74 years			530	19.2	570	20.6

[a]Standardised to the F.R.G. population as of 31 December 1980.

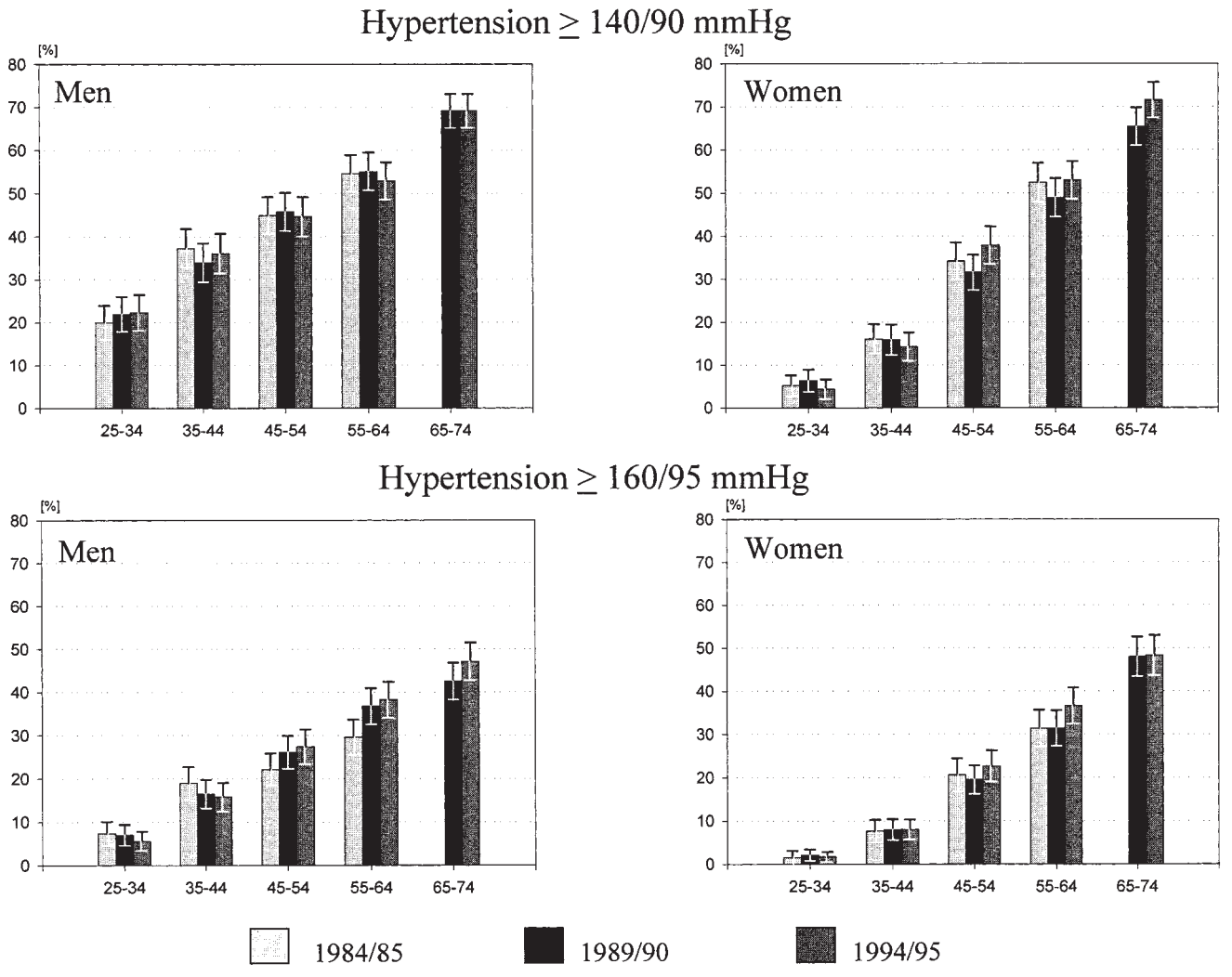

Figure 1 Prevalence of hypertension (in %) by two definitions, by gender, 10-year age groups, and survey.

Table 2 Numbers and age-standardised prevalence (%) of antihypertensive drug treatment (defined as antihypertensive drug use by detected hypertensives) in men and women, aged 25 to 74 years

	Survey I 1984/85		*Survey II 1989/90*		*Survey III 1994/95*	
	No.	*Prevalence[a] (%)*	*No.*	*Prevalence[a] (%)*	*No.*	*Prevalence[a] (%)*
Antihypertensive treatment						
Men						
25–64 years	128	5.5	187	8.1	193	8.3
25–74 years			330	11.2	346	12.0
Women						
25–64 years	171	7.3	188	8.0	213	9.0
25–74 years			344	12.2	381	13.5

[a]Standardised to the F.R.G. population as of 31 December 1980.

Trends of detection, treatment and control of hypertension among hypertensive men (Table 3) and hypertensive women (Table 4) are presented separately for each 10-year age group for both definitions of hypertension. Detection, treatment and control of hypertension increased with age in men and women and irrespective of the cut-off point at which hypertension was defined. However, treatment and con-

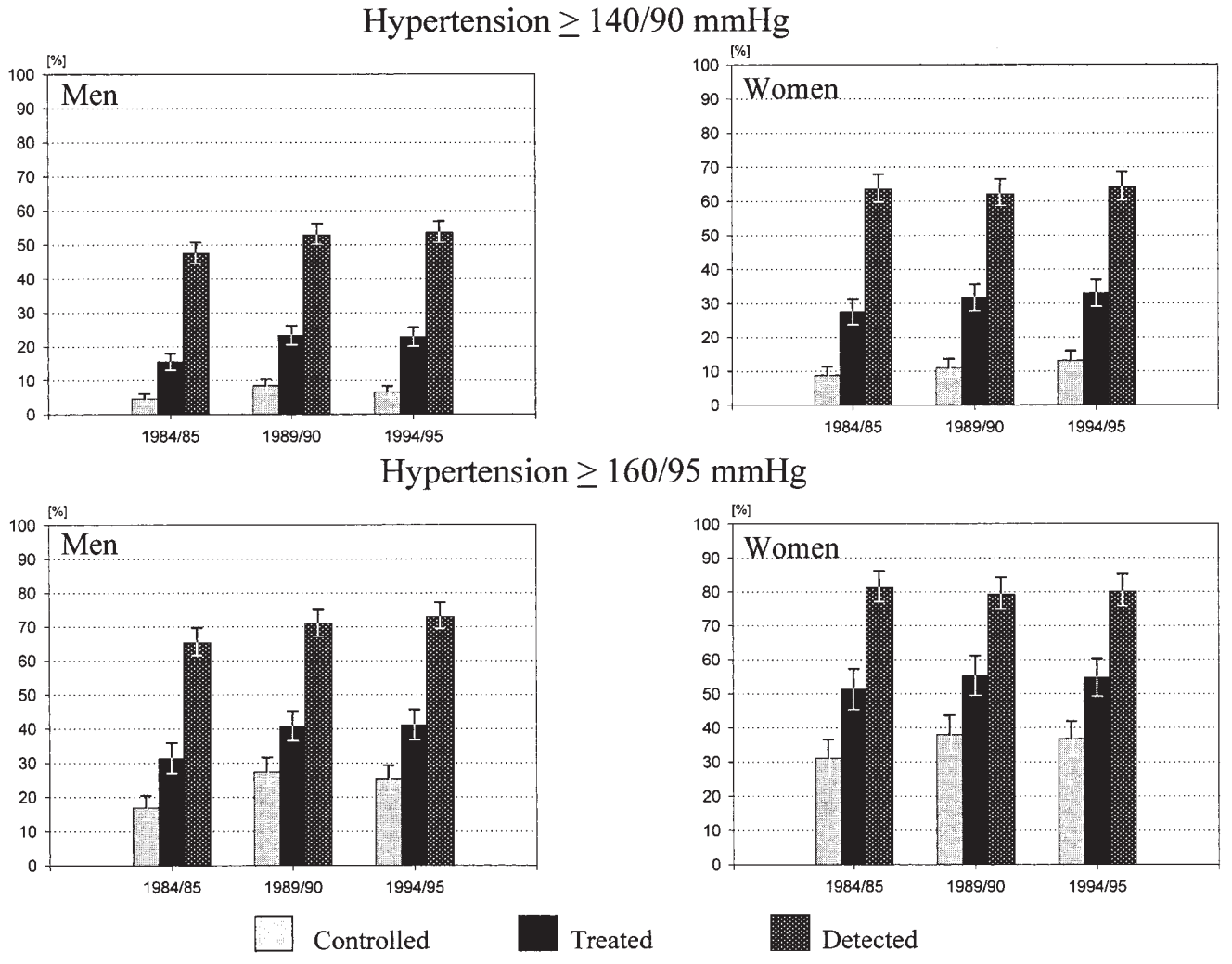

Figure 2 Proportions* of detection, treatment and control of hypertension by two definitions, by gender and survey, 25 to 64 years of age. (*Weights for age-standardisation are based on the prevalence of hypertension at 140/90 mm Hg and 160/95 mm Hg respectively in Survey 1984/85 and the age distribution of the F.R.G. population as of 31 December 1980).

trol rates remained low up to older ages in participants with hypertension defined at 140/90 mm Hg. Among those, in no age group did the percentage of hypertensives reaching below target BP exceed the 20% margin.

Over the decade, fairly sizeable rises in detection and treatment were seen mainly in hypertensive men above 45 years. The increases in the age group from 45 to 54 years between Survey 1984/85 and Survey 1994/95 were 12% (2.9; 21.1) for the detection rate, and 10% (2.7%; 17.3%) for the treatment rate. The respective increases in the age group 55 to 64 years were 9.0% (1.3; 16.7) and 13.0% (5.8; 20.2). However, these trends were not accompanied by consistent trends in the control rates (45 to 54 years: +1% (–2.8; 4.8%), 55 to 64 years +4% (–0.5; 8.5)).

In hypertensive women, the treatment and control rates increased mostly in those 35 to 54 years old (Treatment rates: 35–44 years: +10.0% (–2.8; 22.7); 45–54 years: +6.0% (–3.3; 15.3); control rates: 35–44 years: +5.0% (–4.2; 14.2); 45–54 years: +10% (3.8; 16.2%)).

For hypertension defined at 160/95 mm Hg the treatment rates and control rates appeared generally more favourable. Treatment rates almost doubled in some age groups and control rates were about four-fold higher than at the lower cut-off point definition (140/90 mm Hg). Increases of treatment and control over the decade were restricted to the same age groups for which increases at 140/90 mm Hg were reported.

Blood pressure levels among treated hypertensives

In a final step, we assessed the levels of measured BP in treated hypertensives aged 25 to 64 years (Table 5). The total number of hypertensives using medication rose from S1 to S3. However, among treated men, the fraction of those having BP below

Table 3 Proportions (%) of detection, treatment and control of hypertension among men with hypertension defined at two different levels, by 10-year age groups

	>140/90 mm Hg			*>160/95 mm Hg*		
	Survey 1984/85	*Survey 1989/90*	*Survey 1994/95*	*Survey 1984/85*	*Survey 1989/90*	*Survey 1994/95*
25–34 years (total)	*n* = 93	*n* = 103	*n* = 99	*n* = 34	*n* = 33	*n* = 25
Detected (%)	53	52	43	53	70	60
Treated (%)	5	5	3	15	15	12
Controlled (%)	3	3	3	12	12	12
35–44 years (total)	*n* = 181	*n* = 157	*n* = 165	*n* = 92	*n* = 76	*n* = 72
Detected (%)	43	41	44	57	58	65
Treated (%)	10	12	10	20	25	24
Controlled (%)	3	5	4	11	18	18
45–54 years (total)	*n* = 242	*n* = 238	*n* = 215	*n* = 119	*n* = 136	*n* = 132
Detected (%)	42	51	54	59	69	74
Treated (%)	15	20	25	29	35	41
Controlled (%)	4	8	5	11	23	24
55–64 years (total)	*n* = 292	*n* = 281	*n* = 324	*n* = 158	*n* = 187	*n* = 203
Detected (%)	55	63	64	79	81	80
Treated (%)	24	41	37	44	62	59
Controlled (%)	7	14	11	27	41	34
65–74 years (total)		*n* = 359	*n* = 338		*n* = 221	*n* = 231
Detected (%)		54	60		74	80
Treated (%)		40	45		65	66
Controlled (%)		12	17		44	49

n, number of hypertensives by 10-year age groups is equal to 100%.

Table 4 Proportions (%) of detection, treatment, and control of hypertension among women with hypertension defined at two different levels, by 10-year age groups

	>140/90 mm Hg			*>160/95 mm Hg*		
	Survey 1984/85	*Survey 1989/90*	*Survey 1994/95*	*Survey 1984/85*	*Survey 1989/90*	*Survey 1994/95*
25–34 years (total)	*n* = 24	*n* = 30	*n* = 20	*n* = 7	*n* = 10	*n* = 8
Detected (%)	63	50	60	86	50	88
Treated (%)	17	10	5	57	30	13
Controlled (%)	8	3	0	29	30	0
35–44 years (total)	*n* = 84	*n* = 77	*n* = 73	*n* = 40	*n* = 39	*n* = 41
Detected (%)	51	56	58	68	74	68
Treated (%)	16	21	26	33	41	46
Controlled (%)	7	8	12	20	26	29
45–54 years (total)	*n* = 176	*n* = 170	*n* = 193	*n* = 106	*n* = 105	*n* = 115
Detected (%)	66	65	62	81	81	79
Treated (%)	27	33	33	44	53	55
Controlled (%)	6	12	16	26	33	37
55–64 years (total)	*n* = 261	*n* = 246	*n* = 273	*n* = 156	*n* = 158	*n* = 189
Detected (%)	71	68	72	89	87	87
Treated (%)	41	46	48	69	72	69
Controlled (%)	13	15	16	43	52	49
65–74 years (total)		*n* = 296	*n* = 321		*n* = 218	*n* = 217
Detected (%)		72	69		89	91
Treated (%)		53	52		72	77
Controlled (%)		13	15		50	50

n, number of hypertensives by 10-year age groups is equal to 100%.

Table 5 Numbers and proportions (%) in categories of measured blood pressure, treated hypertensive men and women aged 25 to 64 years

BP category	*Survey 1984/85*	*Survey 1989/90*	*Survey 1994/95*
	No. (%)	*No. (%)*	*No. (%)*
Male treated hypertensives, 25–64 years			
Total	$n = 128$	$n = 187$	$n = 193$
SBP <140 and DBP <90 mm Hg	38 (30)	68 (37)	57 (30)
SBP 140–159 and/or DBP 90–94 mm Hg	32 (24)	57 (31)	59 (31)
SBP ⩾160 and/or DBP ⩾95 mm Hg	58 (46)	62 (33)	77 (39)
Female treated hypertensives, 25–64 years			
Total	$n = 171$	$n = 188$	$n = 213$
SBP <140 and DBP <90 mm Hg	52 (31)	64 (34)	82 (40)
SBP 140–159 and/or DBP 90–94 mm Hg	53 (30)	66 (35)	65 (29)
SBP ⩾160 and/or DBP ⩾95 mm Hg	66 (39)	58 (31)	66 (32)

SBP, systolic blood pressure; DBP, diastolic blood pressure.

140/90 mm Hg was 30% in S1, 37% in S2 (+7% (–3.5; 17.5)), and 30% again in S3. The percentage of those with BP levels above 160/95 mm Hg despite treatment declined to 39% in S3 (–7%; (–4.6; 18.0)). Treatment appeared more effective in hypertensive women. Thus, the proportion of treated hypertensive women below 140/90 mm Hg rose by 9.0% (–0.6; 18.6) to 40% in 1994/95, while the proportion of those with blood pressures above 160/95 mm Hg dropped in parallel by 7.0% (–2.6; 16.6) to 32% (Table 5). Due to the small numbers, the 95% confidence intervals for rises and declines were wide and each encompassed the null value.

Discussion

Our 10-year monitoring study of the Augsburg population shows that the prevalence of hypertension was practically unchanged between 1984/85 and 1994/95. In fact, there were indications of slight prevalence increments in the older age groups. These findings refer to both definitions of hypertension and to men and women alike. The detection rate of hypertension rose moderately in men, particularly in those of middle age, but much less in women. Detection rates for hypertension defined at 140/90 mm Hg were generally low. The proportion of individuals in the overall population that used antihypertensive drugs increased as did their percentage among the hypertensives. Over the 10 years of observation, there was no clear indication that, despite changes in therapeutic regimens, drug therapy in hypertensives became more effective in terms of raised control rates.

In spite of lower prevalence of hypertension, women received antihypertensive treatment more frequently. And although the moderate increases in detection, treatment and control were more pronounced in men, the absolute rates remained about 10% higher in women. Similar patterns have been observed in other studies.[16–20] They appear to represent an almost global characteristic of hypertension management and may reflect, for example, gender differences in the numbers of annual doctor contacts or in compliance with therapy.[21,22]

Hypertension prevalence, detection, treatment and control increased with age. In 1994/95 about 31% of all men and about 36% of all women in the 65 to 74-year age groups were taking antihypertensive drugs. Despite the fact that clinical trials showing the efficacy of hypertension treatment in the elderly became available only in the 1990s[23] antihypertensive treatment of the 65 to 74-year-old age group has been widely applied in this study region before. The detection and treatment rates were similar to those reported for this age group in the Canadian Heart Health Surveys (HHS) and in the Second National Health and Examination Survey (NHANES II).[16,24]

The absence of a change in hypertension prevalence in the Augsburg study region is in accordance with other German data.[14] Decreases have only been reported for subgroups and in regions that underwent intensive primary cardiovascular prevention programmes.[14,25] This creates a remarkable contrast to major declines of hypertension prevalence reported from other WHO-MONICA centres in Belgium, Denmark, Finland and Switzerland, and

estimates reported from New Zealand and the US.[16,20,26–29] The reasons for these discrepancies are not immediately clear. Of note, the definition of hypertension used in these reports and in our study encompasses all treated hypertensives in the group of hypertensives thus excluding the possibility that drug mediated BP reductions affected prevalence estimates.

Partition values used for defining hypertension differ in most recommendations for the management of hypertension from the cut-off points for initiating antihypertensive treatment.[3–5] Thus, estimates of treatment and control rates have to take into account which population segment is considered eligible for treatment. At the beginning of our monitoring study in 1984/85, treatment recommendations were predominantly based on the 160/95 mm Hg cut-off point and, hence, a much smaller proportion of hypertensives was eligible for routine drug treatment. Although first suggestions to treat borderliners with additional risk factors date back to the early 1980s,[30] this concept gained full attention and emphasis only more recently.[31] Before this background it may appear plausible that the implementation of new definitions and treatment recommendations into clinical practice was slow and possibly not yet completed by the end of our observation period in 1994/95.

There is another striking finding in this study. Interestingly, marked increments of detection, treatment and control were almost entirely restricted to the time between 1984/85 and 1989/90. This suggests that the initial improvements of hypertension management lost their pace again in subsequent years. We can only speculate about the reasons that may have contributed to this stagnation. It seems reasonable to consider the advent of a phase of severely limited financial resources in the health care sector in Germany as a relevant cause because drug rationing may be more easily employable among mostly symptom-free hypertensives than in other patient groups. A stagnation in detection, treatment and control has also been reported for the US between 1988–1991 and 1991–1994[4] although absolute rates were on much higher levels. By contrast, detection, treatment and control rates at 160/90 mm Hg increased continuously in several regions in Finland.[27]

For international comparisons it should be kept in mind that cut-off points for initiating pharmaceutical treatment vary substantially across countries and time.[15] Our definition of two thresholds for treatment are consistent with reports from the NHANES[16] and with studies conducted in Europe.[20,32–34] While detection rates were clearly higher in the US (74% at 140/90 mm Hg and 90% at 160/95 mm Hg) and similar in Canada (58% at 140/90 mm Hg),[16,24] the detection rates in the Augsburg region were within the range of values found in European countries.[18,20,27] Treatment rates found elsewhere ranged from 24% in Spain to 58% in the US at 140/90 mm Hg and from 50% in the UK to 90% in the US at 160/95 mm Hg.[4,16,20,24,33,34] Control rates varied from 6% in England to 28% in France at 140/90 mm Hg and from 27% in Finland to 64% in the US at 160/95 mm Hg.[4,18,27,32] These comparisons reveal that the Augsburg region ranks in the lower third of these ranges.

A prominent finding of our study is that only about one-third of all treated hypertensives achieved BP levels below 140/90 mm Hg and, most strikingly, that this proportion remained unchanged over the 10-year period. The monitoring period was characterised by the introduction of new drug classes and accompanied by a strong tendency to prescribe monotherapies more frequently.[35] However, the unchanged low control rates indicate that the effectiveness of antihypertensive therapy with respect to reaching the target BP has not improved. Possible explanations could be persistent non-compliance of patients, inadequate dosing or selection of drugs or fixed fractions of therapy-resistant hypertension.[36] Another explanation may be that physicians were reluctant to treat hypertensives more aggressively, influenced by the debate about the J-curve concept which suspected increased cardiovascular risk when BP was lowered too vigorously.[37] Moreover, physicians may have relied on clinical trials demonstrating that risks are effectively decreased by lowering usual BP by 5 to 6 mm Hg diastolic.[38]

We reported recently that trends for other cardiovascular risk factors in the Augsburg region were equally unfavourable with the exception of smoking in men.[39] In the light of these findings, it seems prudent to state that primary prevention efforts impacting on the management of BP elevations and hypertension appear to have failed in the Augsburg population. The National Blood Pressure Programme (NBP) of the German Hypertension League successfully initiated several modules, such as work site screenings, BP measurement training and a telephone service for the public. However, the modules were not applied nationwide and consequently lacked effectiveness on the population level.[40] We also mentioned the financial constraints within the health care system that may have contributed to the hesitancy of physicians to implement new concepts of hypertension management.

There are limitations to this study. Our estimates of prevalence and rates of detection, treatment and control of hypertension originate from an epidemiological study setting. Thus, participants were categorised as hypertensive based on the average of the last two of three measurements taken at one occasion. They were not confirmed by measurements at subsequent occasions. This may have led to an overestimation of hypertension prevalence and, consequently, to an underestimation of the rates of detection, treatment and control.[32,41] On the other hand, our response rates were stable and the methods were strictly controlled and kept very consistent over the study period according to the WHO-

MONICA protocol.[10–12] Thus, our main objective, the assessment of temporal changes in hypertension management, could still be detected with high validity. Moreover, our results are directly comparable with the studies conducted in the international WHO MONICA project focussing on the same issue,[18–20,25–28,33,42] and those studies using similar methods and the same cut-off point definitions for hypertension and reporting proportions of detection, treatment and control of actual hypertensives.[4,16,18,24,29,32,34,43]

It should further be noted that we had no information on the BP values preceding and prompting antihypertensive treatment or the duration of therapy. However, the absence of a clear rise in the control rates, especially among treated men, does not appear to support the idea that individuals with less severe hypertension were increasingly selected into the group of men receiving antihypertensive drug treatment. The more favourable trends in female treated hypertensives might have been created by such a selection but due to the limited number of individuals the precision of the change estimates was inconclusive.

In conclusion, stagnation in the management of hypertension indicates that population-based strategies of cardiovascular risk factor prevention were ineffective during 1984 and 1995 in the Augsburg region. Novel therapeutics had only a very modest impact on the control of hypertension. The reasons for these unfavourable trends and, in particular, the apparent undertreatment of hypertension need clarification and require appropriate public health action.

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