



Factors associated with intensification of antihypertensive drug therapy in patients with poorly controlled hypertension

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Abstract

Objective To assess antihypertensive management of older patients with poor blood pressure (BP) control. **Methods** Physicians, voluntarily participating in the study, included six consecutive hypertensive patients during routine visits. Hypertension had to have been previously recognized and averaged office BP was ≥ 140 and/or ≥ 90 mmHg in spite of ≥ 6 weeks of antihypertensive therapy. The physicians completed a questionnaire on patients' history of cardiovascular (CV) risk factors, comorbidities, home BP monitoring, anthropometric data and the pharmacotherapy. **Results** Mean age of the 6462 patients was 61 years, 7% were ≥ 80 years, 51% were female. Mean \pm SD office BP values were $158 \pm 13/92 \pm 10$ mmHg. The most commonly prescribed antihypertensive drugs were: diuretics (67%), ACE inhibitors (64%), calcium channel blockers (58%) and β -blockers (54%), and their use increased with age. On monotherapy or dual therapy, 43% of the patients and 40% had their latest treatment modification within six months. Home BP monitoring was a factor that accelerated the modification of the therapy. Older patients had to have less chance on faster modification of antihypertensive therapy in spite of presence of diabetes and higher systolic BP. **Conclusions** Our study suggests that a large number of outpatients with poor BP control receive suboptimal antihypertensive therapy, especially in primary care. In older patients, higher BP values in the office settings are more frequently accepted by physicians even in case of higher CV risk. Regular home BP monitoring hastens the decision to intensify of antihypertensive treatment.

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1 Introduction

In spite of increased in public awareness, hypertension remains one of the most important health problems, as a risk factor of cardiovascular (CV) and cerebrovascular morbidity and mortality, dementia, renal failure and blindness.^[1] Moreover, the prevalence of hypertension continues to increase worldwide due to the aging population and unhealthy lifestyle behaviours.^[2] Additionally, despite knowledge of the value of therapeutic lifestyle modifications and newer and newer classes of medications, the number of people with uncontrolled blood pressure (BP) keeps on rising.^[2]

In population-based studies, a beneficial trend toward an increase in awareness and control of hypertension in many countries has been observed.^[3,4] However, while about 50% of treated patients remain well treated in North America, control rates in Europe are lower, especially in older pa-

tients.^[3] Data from the National Health and Nutrition Examination Survey (NHANES) revealed that among all patients on one to two antihypertensive medications, the risk of being uncontrolled increased by 28% with each 10-year increase in age.^[5] In older patients, the lower rate of adequate BP control may be only partly explained by an increased risk of resistant hypertension (RHT).^[6]

Most hypertensive patients are managed in primary care settings. However, many patients are underdiagnosed and undertreated.^[7] The reasons are complex and include a combination of factors related to insufficient prescribing of antihypertensive drugs by physicians, who want to minimize the side effects of drugs by reducing their daily dose, unsatisfactory patient adherence to therapy and also organizational factors.^[8,9]

In the recent years in Poland, a significant improvement in BP control has been observed among the older population and number of controlled hypertension doubled since 2001 year.^[4] However, about 75% of older patients still have uncontrolled BP. A better understanding of current practice in outpatient care might help to develop appropriate strategies for improving antihypertensive treatment. We therefore set out to assess the clinical data of patients with uncontrolled

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BP in ambulatory care to recognize the potentially modifiable factors associated with poor BP control, especially in older patients.

2 Methods

2.1 Study design and population

The nationwide non-interventional observational survey was conducted in Poland (May–September 2014). Each of the physicians (family physicians, internists, cardiologists, hypertension specialists) involved in the study ($n = 1129$) enrolled six consecutive patients with uncontrolled BP who visited their office as part of a routine control visit. The inclusion criteria were: age ≥ 18 years; diagnosis of hypertension had to be confirmed and documented in the patient's medical record; antihypertensive pharmacotherapy had been provided for at least six weeks; and office systolic and diastolic BP during the last visit was ≥ 140 and/or ≥ 90 mmHg.

Of 6602 eligible patients, 6462 were finally included in the study because of missing data on age and gender.

2.2 BP measurement

All physicians involved in the study were familiarized with the guidelines regards to proper technique of office BP measurement.^[10,11] BP was measured during the visit in a sitting position after a few minutes of rest using the appropriate cuff sizes and validated devices. It was measured at least twice, with an interval 1 to 2 min between measurements, and the last two BP readings were averaged and recorded in the study questionnaire. Pulse pressure (PP) was calculated as the difference between the average systolic and diastolic BP.

2.3 Hypertension management

The physicians were asked to provide detailed information about the actual pharmacologic treatment of hypertension, including trade names of different classes of drugs. The physicians were also asked about changes in antihypertensive therapy has been introduced during the index visit. Additionally, in the study questionnaire, the date of hypertension diagnosis, duration of antihypertensive therapy, and the time since the last modification of treatment were described. Modification of antihypertensive therapy both before and during the index visit was defined as any changes related either the dose or the class of drug.

The patient was asked about regular self-measurement of BP at home and the last available home BP reading was noted.

2.4 Other data collected

Anthropometric measurements, such as weight, height

and waist circumference, were obtained to assess body fat (body mass index (BMI)) and its distribution. Visceral obesity was defined as waist circumference ≥ 102 cm in men and ≥ 88 cm in women.

Based on medical records and an interview with the patient, the presence of traditional CV risk factors—such as hypercholesterolemia, family history of premature CV diseases, obesity, hyperglycemia presence of comorbidities and target organ damage was gathered.

2.5 Ethical issues

Each patient included in the study was identified by the patient number and the patient initials (first letters of the patient's name and surname).

Prior to enrolment, the physician informed the patient about the study objectives and methods, as well as the scope of data that were disclosed for the purpose of the observational program, and the physician was obliged to obtain the patient's written consent for disclosure of medical data. Data were collected and processed maintaining confidentiality and anonymity of the surveyed patients.

Study was conducted in accordance with art. 37a1. of Polish Pharmaceutical Law.

2.6 Statistical methods

General characteristics of the surveyed patients were summarized in three age groups: up to 64 years, 65–79 years, and 80 years and more. Continuous variables were presented as mean \pm SD or median and interquartile range [upper-lower quartile] depending on data distribution. The comparative analyses between the independent groups were based on parametric one-way ANOVA or using GLM models with Tukey's post hoc statistics. The Cochran-Armitage test was used to analyse age-related trends. The chi-square test was used to compare distribution of qualitative variables between the age groups; in cases where the numbers in sub-samples were small, the exact Fisher's test was applied. The degree of relationship between classifications was assessed by the contingency coefficient.

Standard logistic regression analyses were performed to identify the factors, not related to pharmacotherapy, potentially affecting the decision on implementing changes in antihypertensive therapy within the latest six months from the study visit. In unadjusted and age-sex-systolic BP adjusted models, we assessed the effect of gender, age, office systolic, diastolic BP as well as pulse pressure, patients' declaration on regularly performed home BP measurements, smoking status, abdominal obesity and presence of co-morbidities such as coronary heart disease, heart failure, stroke, chronic kidney disease. To assess the predictors of modifi-

cation of therapy during the index visit, we used the same variables. Additionally, we also included to the stepwise logistic regression model the variable reflecting the period of last modification in therapy.

The Hosmer and Lemeshow Goodness-of-Fit test was applied in regression analyses to control colinearity. Two-sided tests were used and the *P*-value was set at < 0.05. Data were collected in Microsoft Access and analyzed using SAS 9.3 (SAS Institute Inc., Cary, NC, USA).

3 Results

3.1 Baseline characteristic of the studied patients

Mean age of the patients with poor control of BP was 61.4 ± 11.6 years (range: 18 to 95 years), 2134 (33.0%) were 65 to 79 years old and 433 (6.7%) were aged 80 years and older. Women accounted for 50.9% ($n = 3287$) of the subjects, and their proportion steadily increased with advanced age (Table 1). Both office and home systolic BPs were significantly higher in older subjects in contrast to diastolic BPs. Consequently, an increase of pulse pressure (PP) with age was observed. Higher pulse pressure (≥ 60 mmHg), a marker of arterial stiffness, was observed in over 85% of patients > 65 years (Table 1).

Older patients more frequently declared regular self-measurement of BP at home than younger ones (< 65 years).

3.2 CV risk factors and clinical profile

The prevalence of traditional risk factors, such as active

smoking or obesity, decreased with age as well as family history of premature CV diseases (Table 2), whereas lipid disorders and impaired fasting glycaemia were more common in older subjects than in patients under the age of 65 years. The most common comorbidities in patients with uncontrolled BP were coronary artery disease (CAD), diabetes and heart failure (HF)—33.5%, 25.9% and 12.9%, respectively. The frequency of CAD, HF, diabetes, and other comorbidities such as stroke or transient ischaemic attack (TIA), peripheral artery disease (PAD) and chronic kidney disease (CKD) significantly increased with advanced age (Table 2).

3.3 Pharmacotherapy

In the studied patients, the most commonly prescribed antihypertensive agents were: diuretics (67%), ACE inhibitors (64%), calcium channel blockers (58%), β -blockers (54%), and angiotensin II receptor blockers (ARBs, 22%). The characteristics of antihypertensive therapy according to age is shown in Figure 1. Except for ARBs, usage of all antihypertensive classes of drugs increased with advancing age, and diuretic with ACE inhibitor was the preferred combination in each age category. Some differences were observed in the usage of other agents; in the youngest patients, calcium channel blockers were used more commonly, while β -blockers were used slightly more frequently in older subjects (≥ 65 years).

Overall, among the patients with poor BP control, 14% ($n = 933$) were on monotherapy, 28% ($n = 1828$) were on

Table 1. Baseline characteristics of Polish outpatients with poor blood pressure control.

	<i>N</i>	≤ 64 yrs ($n = 3895$)	65–79 yrs ($n = 2134$)	≥ 80 yrs ($n = 433$)	<i>P</i> -value
Age, yrs	6462	53.9 ± 7.8	70.6 ± 3.9	83.0 ± 3.2	< 0.001*
Female	6462	1850 (47.5%)	1162 (54.4%)	275 (63.5%)	< 0.001*
BMI, kg/m ²	6430	29.3 ± 4.7	29.9 ± 4.7	28.6 ± 5.0	< 0.001
Office measurements					
Systolic BP, mmHg	6462	157.1 ± 12.6	159.1 ± 13.8	161.1 ± 15.6	< 0.001*
Diastolic BP, mmHg	6462	92.6 ± 9.2	90.4 ± 10.7	87.5 ± 12.1	< 0.001*
Pulse pressure, mmHg	6462	64.6 ± 12.6	68.7 ± 14.5	73.7 ± 16.0	< 0.001*
Pulse pressure ≥ 60 mmHg	6462	2834 (72.8%)	1702 (89.8%)	376 (86.8%)	< 0.001 [†]
BP $\geq 150/90$ mmHg		NA	NA	386 (89.2%)	
Heart rate, beats/min	6362	76.9 ± 9.3	75.4 ± 9.8	75.2 ± 10.5	< 0.001 [#]
Home BP					
Regular measurement	6439	2269 (58.4%)	1367 (64.4%)	256 (59.3%)	0.003
Available data	3882	2262 (58.1%)	1364 (63.9%)	256 (59.1%)	-
Systolic BP, mmHg	3882	148.3 ± 14.1	150.0 ± 14.7	151.8 ± 19.2	< 0.001 [#]
Diastolic BP, mmHg	3882	88.4 ± 9.3	86.8 ± 10.3	84.2 ± 11.9	< 0.001*
BP < 135/85 mmHg	3882	217 (9.6%)	128 (9.4%)	40 (15.6%)	0.056 [‡]

Data are presented as means \pm SD or *n* (%). **P* < 0.05 for the all post-hoc comparisons between the age-categories; [#]*P* < 0.05 for the post-hoc comparison only with the youngest subjects (≤ 64 yrs); [‡]*P*-value for trend (Cochran-Armitage trend test). BMI: body mass index; BP: blood pressure; NA: not applicable criterion of hypertension control in population < 80 years old.

Table 2. Age-related prevalence of cardiovascular risk factors and co-morbidities in hypertensive patients.

Cardiovascular risk factors	N	≤ 64 yrs (n = 3895)	65–79 yrs (n = 2134)	≥ 80 yrs (n = 433)	P-value
Current smoking	1407	1058 (27.2%)	330 (15.5%)	19 (4.4%)	< 0.001
Lipid disorders	6462	2828 (72.6%)	1759 (82.4%)	322 (74.4%)	< 0.001
Impaired fasting glycaemia	6462	1116 (28.7%)	894 (41.9%)	200 (46.2%)	< 0.001 [†]
Obesity	6462	1744 (44.8%)	1078 (50.5%)	158 (36.5%)	< 0.001
Abdominal obesity	6462	1972 (50.6%)	1240 (58.1%)	207 (47.8%)	< 0.001
Family history of premature CVD	6462	1672 (42.9%)	810 (38.0%)	114 (26.3%)	< 0.001 [†]
Co-morbidities					
Coronary artery disease	6401	864 (22.4%)	1047 (49.5%)	251 (58.8%)	< 0.001 [†]
Heart failure	6390	228 (5.9%)	432 (20.5%)	171 (40.5%)	< 0.001 [†]
Diabetes	6408	766 (19.8%)	734 (34.7%)	175 (40.7%)	< 0.001 [†]
Stroke or TIA	6410	169 (4.4%)	270 (12.8%)	96 (22.3%)	< 0.001 [†]
Peripheral artery disease	6405	356 (9.2%)	364 (17.2%)	101 (23.6%)	< 0.001 [†]
Chronic kidney disease	5728	118 (3.1%)	227 (10.8%)	107 (25.2%)	< 0.001 [†]

Data are presented as *n* (%). Abdominal obesity was defined as waist circumference in men: 102 cm and in women: 88 cm; impaired fasting glycaemia was defined as 5.6 to 6.9 mmol/L or 102 to 125 mg/dL; obesity was defined if BMI ≥ 30 kg/m²; family history for premature CVD: in men < 55 and women < 65 years old; chronic kidney disease (GFR: 30–60 mL/min per 1.73 m²). [†]*P*-value < 0.05 for trend (Cochran-Armitage trend test). CVD: cardiovascular disease; GFR: glomerular filtration rate; TIA: transient ischemic attack.

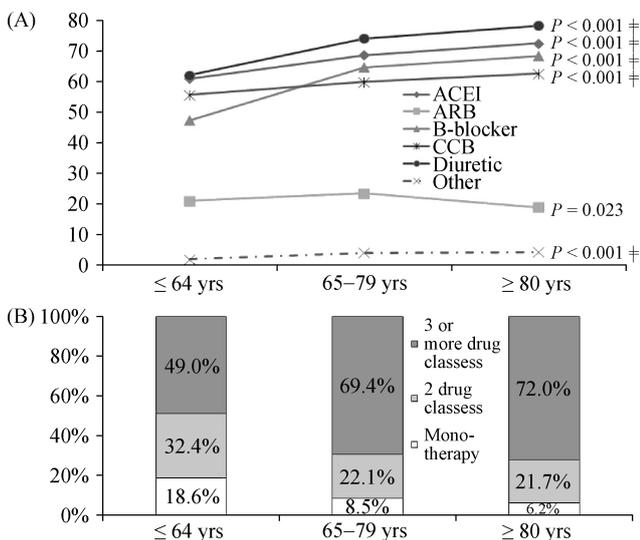


Figure 1. Antihypertensive therapy among outpatients according to age. (A): drug classes applied according to age; (B): monotherapy and combination therapy in three age groups. ACEI: angiotensin converting enzyme inhibitors; ARB: angiotensin II receptor blocker; CCB: calcium channel blocker; other: alpha-blocker or centrally acting. [†]*P* < 0.05 for trend (Cochran-Armitage trend test).

two antihypertensive drug classes and 57% (*n* = 3700) on 3 or more drug classes, and in the vast majority of these patients (90%) a diuretic was included. Percentage of the subjects on suboptimal therapy (mono- or dual therapy) decreasing with advanced age (Figure 1B). Fixed-dose combinations were used in 23% of the patients, most often in the youngest group.

According to the inclusion criteria, all patients were on antihypertensive therapy for at least six weeks, but most of them had been treated long-term from one to five years (33%, *n* = 2149) or more than 10 years (30%, *n* = 1930); afterwards, the subjects used antihypertensive treatment from 6 to 10 years (25%, *n* = 1451). The smallest group consisted of patients on antihypertensive therapy for less than 1 year (11%, *n* = 706).

3.4 Determinants of pharmacotherapy modification

Approximately 10% of the patients with uncontrolled hypertension had their latest treatment modification within one month before the study visit (*n* = 619), 1811 (28.0%) between one to six months, 1261 (19.5%) between 7 and 12 months, and 1824 (28.2%) patients more than one year before the visit. Moreover, in 769 (11.9%) patients, information on the time of last treatment modification was not possible to determine while in 178 (2.8%) it was missing. Characteristic of the subjects in relation to the period of last changes in therapy was presented in Supplemental material (Table S1). In the multivariate regression analysis older age of the patients with poor BP control, higher systolic BP and presence of diabetes were significantly associated with lack of antihypertensive modification within six months (Table 3). On the contrary, regular BP measurement at home significantly increased the chance for earlier modification of antihypertensive therapy.

Based on the physicians' declaration we also determined number of patients in whom the current antihypertensive therapy was changed during the index visit (Table 4). Sum-

Table 3. Factors associated with lack of antihypertensive therapy modification during last six months in patients with poor BP control.

	N	Logistic regression models		
		Unadjusted OR (95% CI)	Adjusted to age-sex-systolic BP OR (95% CI)	Fully adjusted* OR (95% CI)
Age, yrs	6284	1.02 (1.01–1.02)	1.02 (1.01–1.02)	1.01 (1.01–1.02)
Female	6284	1.04 (0.94–1.15)	1.06 (0.96–1.18)	-
Office measurements				
Systolic BP, per 10 mmHg	6284	1.07 (1.03–1.12)	1.06 (1.02–1.11)	1.06 (1.02–1.11)
Diastolic BP, per 5 mmHg	6284	1.02 (0.99–1.05)	1.02 (0.99–1.05)	-
Pulse Pressure, per 10 mmHg	6284	1.05 (1.01–1.09)	0.98 (0.92–1.03)	-
Regular home BP measurement	6264	0.85 (0.76–0.94)	0.85 (0.77–0.95)	0.82 (0.74–0.92)
Comorbidities and CV risk factors				
Coronary artery disease	6232	1.14 (1.02–1.27)	1.04 (0.93–1.17)	-
Heart failure	6220	1.11 (0.95–1.29)	0.97 (0.82–1.14)	-
Diabetes	6235	1.32 (1.17–1.48)	1.25 (1.11–1.41)	1.28 (1.13–1.44)
Stroke or TIA	6239	1.03 (0.86–1.24)	0.94 (0.77–1.13)	-
Chronic kidney disease	5587	1.05 (0.86–1.28)	0.93 (0.75–1.14)	-
Current smoking	6263	0.86 (0.76–0.97)	0.88 (0.77–0.99)	0.87 (0.77–0.99)
Abdominal obesity	6284	1.16 (1.04–1.28)	1.14 (1.03–1.27)	1.09 (0.98–1.21) [‡]

*Fully adjusted model included age; systolic BP; regular home BP measurement; diabetes; current smoking; abdominal obesity. [‡]Removed due to backward elimination procedure in the stepwise logistic regression model. BP: blood pressure; CV: cardiovascular; TIA: transient ischemic attack.

marizing the comparative analysis, we did not observe the effect of age in regards to the frequency of modification of the specific drug classes. However, in older patients significantly fewer changes in combined therapy were observed. In summary, results of multivariate analysis demonstrated that higher office SBP wasn't a predictor of therapy modification during the visit—odds ratio (OR) and 95% confidence limits (95% CL) was 0.99 (0.98–0.99). On contrary, the significant predictor for the therapy modification occurred regular BP measurement at home (OR: 1.27, 1.13–1.44). Moreover, home measurements gained in importance in presence of co-morbidities such as diabetes (OR: 1.47, 1.27–1.70), heart failure (OR: 1.34, 1.10–1.64) and chronic

kidney disease (OR: 1.32, 1.03–1.70), and in males (OR: 1.28, 1.13–1.44).

3.5 Sensitivity analyses

In general, physicians provided primary care (general practitioners, internal medicine specialists) represent 83.0 % of all surveyed physicians. Non-primary care physicians were 17.0% of the sample and they were represented by cardiologists (15.9%) and hypertension specialists (1.1%). We compared then the patients profile and hypertension management in relation to reference of medical care. Detailed data has been presented in the Supplemental material. In general, there was no significant difference in rela-

Table 4. Changes of hypertension therapy in the patients with poor hypertension control during the index visit according to the patients' age category.

	≤ 64 yrs (n = 3895)	65–79 yrs (n = 2134)	≥ 80 yrs (n = 433)	P-value
Any modification according to drug classes				
ACE inhibitor	1114 (28.6%)	753 (35.3%)	152 (35.1%)	< 0.001
ARB	316 (8.1%)	254 (11.9%)	36 (8.3%)	0.002
β-blocker	1281 (32.9%)	1018 (47.7%)	211 (48.7%)	< 0.001
Calcium channel blocker	287 (7.4%)	227 (10.6%)	56 (12.9%)	< 0.001
Diuretic	529 (13.6%)	444 (20.8%)	113 (26.1%)	< 0.001
α-blocker or centrally acting	54 (1.4%)	71 (3.3%)	13 (3.0%)	< 0.001
Fixed-dose combination	440 (11.3%)	180 (8.4%)	37 (8.6%)	0.001
Patients without any modification of HT therapy	1396 (35.8%)	520 (24.4%)	110 (25.4%)	< 0.001

Data are presented as n (%). ACE inhibitor: angiotensin-converting-enzyme inhibitor; ARB: angiotensin II receptor blocker; HT: hypertension.

tion to age of the patients, the prevalence of main CV risk factors (smoking, lipid disorders, central and abdominal obesity), systolic BP in the office, office PP and home BP level. The significance differences were observed in relation to gender distribution and co-morbidities—the prevalence of coronary heart disease, diabetes and chronic kidney diseases was higher in patients non-primary care specialists (Supplemental Table S2). ACE inhibitors, calcium channel blockers, β -blockers and fixed-dose combination were significantly often prescribed by non-primary than primary care specialists. Primary care specialists more frequently treated their patients with monotherapy or two drug classes, and made less modification in the treatment regimen (Supplemental Table S3).

4 Discussion

The main finding of the study is that the large group (43%) of the studied patients with uncontrolled hypertension, especially from primary care settings were on a suboptimal therapy. Although the older subjects were most likely to use three or more antihypertensive drug classes, a fixed-dose combinations were used only in one fifth of these patients. Furthermore, majority of the patients (61%) had their latest treatment modification more than six months from the study visit, and this concerned particularly older people with higher CV risk (co-existed higher office BP level and/or diabetes). The earlier modification of antihypertensive therapy by the physician was associated with regular home BP monitoring by the patient.

Suboptimal antihypertensive drug regimens remains significant reason of poor BP control. In our study, only 51% of patients were on three or more antihypertensive drugs, including a diuretic, and these data correspond with results published earlier by Garg, *et al.*^[12] Of 141 patients referred to a tertiary care clinic and who met the criteria for RHT, in 58% the resistance was caused by suboptimal antihypertensive therapy. By increasing the number of antihypertensive medications and/or optimizing the diuretic regimen, BP target was achieved in 53% of these patients.^[12] Furthermore, among 468,877 hypertensive patients in a community-based practice network, 31.5% had uncontrolled hypertension. Of these, 30.3% (44,684) patients were receiving three or more medications, but only half of these patients were receiving optimal doses including a diuretic.^[13] Independently of age, the most commonly used antihypertensive drug classes in our study were diuretics and ACE inhibitors, and these data correspond to the Pol-Fokus study.^[14] Moreover, in our study and the Pol-Fokus data,^[15] in older patients β -blockers were more frequently used than calcium channel

blockers. In the very old (80 years and more) hypertensive population in the USA (NHANES 2005–2010), β -blockers were the most commonly prescribed, and then diuretics and ACE inhibitors.^[16] The guidelines^[11,17] suggest the first-line choice of antihypertensive drugs should take into account the co-existed chronic conditions. Although some data indicating lack of sufficient evidence that different antihypertensive regimens are superior in older (> 65 years) than younger (\leq 65 years) hypertensive patients in reducing CV events,^[18] data from clinical trials^[19–22] as well as expert recommendations^[17] highlighted calcium channel blockers or thiazide-like diuretics as generally favourable for older people.

The important discovery of our study seems to be a substantial range of clinical inertia among physicians. Spanish data indicated the physicians' perception of BP control, being on treatment with combined therapy, and the absence of risk factors or CV disease as the main predictors of therapeutic inertia.^[23] In our study, paradoxically the problem was particularly pronounced in relation to the patients with higher CV risk, which is in the older hypertensive patients with coexisted diabetes. Unfortunately, our data are complementary with previously published data from primary care settings in Poland, showing among primary care physicians poor compliance with hypertension treatment guidelines especially in diabetic patients.^[24]

We found that being older patient presenting higher systolic BP in the office was associated with less chance to earlier modification of antihypertensive treatment. It is known that poor BP control is generally more prevalent in oldest age,^[15,25] and some clinical aspects should be considered in explanation of this association. The important factor potentially worsening BP control in the very old hypertensive patients could be multimorbidity. Across Europe, the prevalence of multimorbidity is 31.4%, with the highest prevalence in Eastern and Central Europe.^[26] In our study, the incidence of CV and non-CV comorbidities significantly increased with advanced age. Patients with poor BP control were more likely to have a concomitant medical condition than patients with optimal BP control.^[27] Furthermore, mood or cognitive disturbances, even at a subclinical level, are also linked with poor control of BP and worse compliance in older patients.^[15] Besides, the clinical and patient-related reasons of poor BP control in older hypertensive patients, one should also take into account the issue of therapeutic inertia among physicians. Our study has not been designed to point the potential causes of lack of modification or to evaluate changes in treatment during the index visit. We can only assume that the presence of several chronic diseases in older patients presenting symptoms of

frailty, makes decision on intensification of antihypertensive treatment more difficult, so as not to be iatrogenic at the same time.

The still debatable issue is how far to lower BP values in older patients. The ESH/ESC guidelines recommend reducing SBP below 150/90 mmHg in older hypertensives in office settings.^[11] The National Institute for Health and Clinical Excellence (NICE) hypertension guidelines^[28] additionally suggest in people ≥ 80 years old a daytime target for BP control of below 145/85 mmHg with ambulatory blood pressure monitoring. Taking into account the European recommendations of the patients involved to the our study, we found 10.8% patients over 80 years with good BP control. The well know SPRINT study suggest that more intensive treatment of hypertension and lowering systolic BP below 120 mmHg might be beneficial in reducing major CV events and death from any cause when compared to standard treatment.^[29] However, this threshold seems to be too aggressive for example for frail older patients.

Interesting data from a Swedish cross-sectional study examined the relationship between level of BP control and functional status, measured by speed of walking, and its influence on the risk of mortality in very old patients (85 years and more).^[30] The study indicated an increased risk of mortality with higher SBP and DBP ($\geq 140/80$ mmHg) but only in those with better functional condition, that is in the faster-walking subcohort (≥ 0.5 m/s). In very old non-walking or slowly walking people, lower BP ($<140/80$ mmHg) could in fact be a marker of increased risk of mortality. Thus, in line with current European recommendations, the decision about the therapeutic target in frail hypertensive octogenarians should be highly individualized and therefore finally left to the physician.^[11]

4.1 Strengths and limitations

The strength of our study is a large sample of older outpatients with uncontrolled BP have been characterized according to antihypertensive treatment regimen as well as factors potentially modifiable the effectiveness of the therapy. However, our older subjects were physically able to visit the physicians' office so the study results cannot be extrapolated to whole group of older patients, in particular those with severe comorbidities or dementia, who are unable to leave home, as well as residents of a nursing homes.

The cross-sectional design of the study based on the declarative data obtained from the physicians is the most important study limitation. Because BP was gathered during a single visit, we cannot exclude that some of our patients presented the white-coat effect, in spite of recommended technique of BP measurement in office settings. Moreover,

even if modifications of therapy were introduced during the previous visit, an improvement in hypertension control would not necessarily be achieved. Our study has an observational nature, therefore, in order to evaluate that issue more deeply and accurately, further research is needed.

4.2 Conclusions

Results of the presented study suggest that a large group of outpatients with uncontrolled BP receive suboptimal antihypertensive therapy. In older patients, higher BP values seem to be more frequently accepted by physicians, who are less motivated to intensify therapy in spite of the higher cardiovascular risk in the patient. On the contrary, regular home BP monitoring positively affects the decision to modify antihypertensive treatment.

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