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Blood pressure and cholesterol control in hypertensive participants with hypercholesterolemia: results from the Polish multicenter national health survey WOBASZ II

Short title: Blood pressure and cholesterol control in hypertensive participants

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Abstract

Introduction

Persons with multiple cardiovascular disease (CVD) risk factors are at greater risk than persons exposed to a single risk factor. Control of specific CVD risk factors in Poland is rather poor. Effective control of comorbid hypertension and hypercholesterolemia seems especially challenging.

Objectives

To assess the control of hypertension and hypercholesterolemia in participants with comorbid these two CVD risk factors; data from Polish multicenter national health survey WOBASZ II were analyzed.

Patients and methods

The WOBASZ II study was a cross-sectional survey conducted in 2013–2014 in 6,170 persons (3,410 women and 2,760 men) from 16 voivodships.

Results

Age-standardized prevalence of coexisting hypertension and hypercholesterolemia in WOBASZ II sample was 34.6%. The prevalence of hypercholesterolemia in participants with hypertension was 69.7%. Age-standardized rates of control of hypertension, hypercholesterolemia, and both hypertension and hypercholesterolemia in the entire analyzed age range of 19 to 99 years was 24.3%, 11.2%, and 5.4%, respectively. In multivariable logistic regression models, control of both hypertension and hypercholesterolemia was associated with smoking (OR=0.5 95%CI=0.34-0.76), cardiovascular disease (OR=2.25 95%CI:1.70-2.97), frequent medical visits (OR=1.76 95%CI:1.33-2.32) and high education level (OR=1.37 95%CI:1.03-1.80).

Conclusions

Comorbid hypertension and hypercholesterolemia were observed in one third of the Polish population (included in WOBASZ II study). Only 5.4% have both risk factors controlled. After adjustment for covariates, female gender, non-smoking, comorbid CVD or diabetes, the frequency of medical visits and high education, appeared to increase the proportion of controlled hypertension or hypercholesterolemia.

Key words: clinical epidemiology, control of hypertension and hypercholesterolemia, health examination surveys, prevalence of hypertension and hypercholesterolemia.

Introduction

In the Polish population, according to the WOBASZ II study, the prevalence of hypertension in adults above 20 years of age is 46% and 40% and the prevalence of dyslipidemia is 70% and 64.3% in men and women, respectively [1,2].

In the Polish NATPOL 2011 study, in the general population aged 18 to 79 years, the prevalence of hypercholesterolemia was estimated at 61.1% and the efficacy of treatment (achieving TC <4.9 mmol/l) at 10.9% [3]. In POLFOKUS, another Polish study, elevated level of LDL cholesterol was observed in 49.2%, 61.6% and 61.5% patients with controlled, uncontrolled and resistant hypertension respectively [4]. The prevalence of other modifiable risk factors for cardiovascular disease in the WOBASZ II study population was described earlier [5-8].

The Framingham study showed that hypertension increases the incidence of CVD two to three times – with the highest risk of stroke, heart failure and all forms of coronary heart disease (CHD): angina pectoris, myocardial infarction, sudden cardiac death. In patients aged 40 to 69 years, mortality due to stroke or coronary heart disease doubled with each increase in

systolic and diastolic blood pressure of 20/10 mmHg [9]. A relationship with CVD risk was seen in a wide range of total cholesterol (TC) and low-density lipoprotein (LDL-C) concentrations. This applies to men and women, both with and without diagnosed CVD [10]. It has been proved that changes in systolic blood pressure in the range of 110–170 mmHg are associated with an approximately six-fold increase in CHD risk. Similarly, an increase in total cholesterol level in the range of 4.0–8.0 mmol/l results in an approximately eight-fold increase in the risk of CHD. The blood pressure increase in the range of 110/70 to 170/105 also increases the risk of stroke nearly eight times [11]. The implementation of antihypertensive treatment reduces the risk of CHD by approximately 25% [12]. The inclusion of lipid-lowering treatment in hypertension patients reduces the residual risk of CHD by more than 35% [13], as confirmed by the Air Force/Texas Coronary Atherosclerosis Prevention Study (AFCAPS/TexCAPS) [14] and the Anglo-Scandinavian Cardiac Outcomes Trial-Lipid Lowering Arm (ASCOT-LLA) [15].

Patients with multiple CVD risk factors are at higher risk of incident CVD than persons exposed to only one risk factor. The CVD risk resulting from concomitant hypertension and hypercholesterolemia is typically greater than the sum of risk from individual exposure to hypertension or hypercholesterolemia alone [16,17]. It was found that in hypertension patients with concomitant hyperlipidemia, the risk of CVD increases twice, and in patients with normal cholesterol levels, the coexistence of hypertension results in a 3-fold increase in the risk of CVD [14]. In people with a systolic pressure of 195 mmHg and total cholesterol 8.5 mmol/l increases the CVD as much as 9-fold [18]. Data on men aged 35-64 from the POL-MONICA study showed that the coexistence of hypertension and hypercholesterolemia increases the risk of death caused by coronary heart disease over 4.5 times [19]. The assessment of the overall cardiac risk can be made using the SCORE tables. E.g. in the Polish population, a non-smoker 70-year-old male with SBP 180mmHg and TC 8mmol/l has a 50%

risk of cardiovascular death within 10 years and respectively with SBP 120mmHg and TC 4 mmol/l only 10% [20].

Results of the analyses on the Polish population published so far do not indicate in what extent exposure to hypertension and hypercholesterolemia occurs in the same persons.

The objectives of the study were: 1) to assess the prevalence of comorbid hypertension and hypercholesterolemia in participants of the nationwide WOBASZ II study 2) to assess the prevalence of hypercholesterolemia in the Polish hypertensive population 3) to evaluate blood pressure and cholesterol level control among patients with hypertension and hypercholesterolemia, and 4) to assess the factors related with the control.

Patients and method

The WOBASZ II study was a cross-sectional survey conducted in 2013–2014 in 6,170 persons (3,410 women and 2,760 men) from 16 voivodships (108 communes). The reporting rate was 45.5%. The sampling method used a three-stage scheme, stratified by voivodship, commune category, and sex. The study conduct was approved by the Ethics Committee at the Institute of Cardiology in Warsaw. Each respondent was informed in writing about the purpose of the study and the range of activities (including blood pressure measurements and blood collection for clinical chemistry tests). The study methods have been presented in detail previously [21]. Blood pressure measurements were taken during one visit, three times, in a sitting position, in accordance with ESH/ESC 2013 (European Society of Cardiology/European Society of Hypertension) [22] and PTNT 2015 (Polish Society of Hypertension) [23] guidelines. An UA-631(AND Co., Tokyo, Japan) automatic device was used. The mean of the second and third measurements was used for analysis. Clinical

chemistry tests were performed at the Central Laboratory “Diagnostyka” at the Institute of Cardiology in Warsaw, which has been certified by the CDC (Centre for Disease Control – Lipid Standardization Program) in Atlanta and has the European quality certificate RIQAS (Random International Quality Assessment Scheme). The sequence of procedures was as follows: first, blood pressure measurements were performed, then a survey was taken, and finally, blood was collected for clinical chemistry tests. Details of the methodology for measuring blood pressure, blood collection and clinical chemistry tests have been described earlier [1,2].

The following definitions were used: hypertension was defined as the presence of systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg or use of blood pressure-lowering medication (regular for the last two weeks). Hypercholesterolemia was diagnosed if total cholesterol (TC) levels were 5 mmol/l or higher, or Low-Density Lipoprotein-Cholesterol (LDL-C) levels were 3 mmol/l or higher, or the participant was taking a lipid-lowering medication (regular for the last two weeks). Treated hypertension was defined as the proportion of patients with hypertension who reported taking medication for high BP (affirmative response to the question: "Have you taken these medicines regularly during the last two weeks?"). Treated hypercholesterolemia was defined as the proportion of patients who reported taking medication for high cholesterol level (affirmative response to the question: "Have you taken these medicines regularly during the last two weeks?"). Controlled hypercholesterolemia was defined as the proportion of patients with hypercholesterolemia who had TC < 5 mmol/l and LDL-C < 3 mmol/l for people with intermediate or low cardiovascular risk; LDL-C < 2.5 mmol/l for people with high CVD risk; LDL-C < 1.8 mmol/l for people with very high CVD risk. (The target treatment thresholds have been adopted according to the risk category based on the European guidelines for CVD prevention in clinical practice (version 2016)[24]. Controlled hypertension was defined as the proportion of

patients with hypertension who had SBP <140 mmHg and DBP <90 mmHg. Low CVD risk according to the **S**ystematic **C**oronary **R**isk **E**valuation (SCORE): <1%. Intermediate CVD risk according to SCORE: ≥ 1 and <5%. High CVD risk according to SCORE: ≥ 5 and <10%. Very high CVD risk according to SCORE: $\geq 10\%$. Diabetes – affirmative response to the question: "Have you ever been diagnosed with diabetes?" or the participant taking a hypoglycemic medication (regular for the last two weeks). Smoking – at least one cigarette per day. Comorbid CVD – previously diagnosed coronary artery disease, past myocardial infarction, myocardial revascularization, previous stroke, peripheral atherosclerosis. Physical activity – at least 30 min of uninterrupted activity, e.g., a walk, gymnastic exercises at least 4 days/week.

Alcohol drinkers – affirmative response to the question: "Have you drunk any vodka, wine or beer in the last 12 months at least once?" High education – more than vocational education. Obesity was defined as BMI $\geq 30\text{kg/m}^2$, overweight when BMI was 25-30 kg/m^2 and normal weight when BMI <25 kg/m^2 . Income – income per person in the household > PLN 1,000 (> EUR 250).

Statistical analyses

Continuous variables such as blood pressure values, age were presented using the arithmetic mean, and 95% confidence interval (95%CI), TC, LDL, HDL-C, TG presented using median and (95%CI). Qualitative variables were presented as percentages and 95% CI. Crude prevalence of hypertension and hypercholesterolemia, and the prevalence of both hypertension and hypercholesterolemia control were described as percentages, and 95% CI for the following age ranges 20–49, 50–59, 60–69, 70–79 and over 80 years. The results were standardized [25] for age of the Polish population based on data from the Central Statistical Office report of 31/12/2014. The standardization method has been described in detail earlier

[21]. The prevalence of the analyzed features was compared using the chi-square test for trend. The influence of various parameters (age, sex, BMI, diabetes, HDL-C, TG, smoking, alcohol consumption, education, physical activity, co-existing CVD, marital status, SCORE, number of visits and marital status) on the control of blood pressure, hypercholesterolemia and simultaneous control of both blood pressure and hypercholesterolemia was evaluated by univariate logistic regression. The influence of selected parameters on the control of hypertension, hypercholesterolemia and simultaneous control of both hypertension and hypercholesterolemia was evaluated by multivariable logistic regression with adjusted odds ratios . The logistic regression model took into account the simultaneous influence of age (increase by 10 years), HDL-C, TG concentration (increase by 1mmol / l) as well as sex, diabetes, obesity, smoking, coexistence of other cardiovascular diseases, frequency of visits (less than 4 visits a year vs over 4 visits a year), level of education (vocational education vs secondary and higher) and income (above 1000 PLN vs below 1000 PLN). All statistical tests were two-sided, and statistical significance was accepted for $p < 0.05$. The statistical analysis was performed using Statistica 12.5 (StatSoft Inc., Tulsa, Oklahoma, United States), Excel (Microsoft Corp., Seattle, Washington, United States), and PQStat (PQStat Software, Poznan, Poland).

Results

The analysis included 5,939 participants aged 19–99 years (2,647 men and 3,292 women).

231 people with no blood pressure or no cholesterol levels were excluded from the analysis

Mean age was 49.5 ± 16.3 (for men 48.9 ± 16.3 , for women 50.0 ± 16.3).

In whole WOBASZ II population hypertension was found in 2,784 (crude data 46,9%) persons (1,365 men and 1,419 women). Mean age was 58.4 ± 13.9 years (men: 55.8 ± 14.4 ; women: 60.9 ± 13.0).

Comorbid hypertension and hypercholesterolemia was found in 2,037 persons (982 men and 1,055 women). Mean age was 58.8 ± 12.9 years (men: 56.1 ± 13.4 ; women: 60.5 ± 11.8).

Descriptive statistics of the study group are summarized in Table 1 and 2.

Age-standardized prevalence of coexisting hypertension and hypercholesterolemia in WOBASZ II population was 32.2% (95%CI: 30.8-33.7), in men 34.5% (95%CI: 32.3-36.7) and in women 31% (95%CI: 29.1-32.9). Table 3.

Age-standardized prevalence of hypercholesterolemia in patients diagnosed with hypertension was 69.7% (95% CI: 65.9–73.4) in the entire study sample, 70% (95% CI: 64.9–75.2) in men, and 68.6% (95% CI: 63.1–74.2) in women. The highest prevalence (crude data) was observed in women aged 50–59 years (83.3% [95% CI: 79.6–87.1]) and in men aged 60–69 years (76.2% [95% CI: 71.9–80.6]). Table 4.

Among patients with coexisting hypertension and hypercholesterolemia, the highest control rate of hypertension, hypercholesterolemia and both hypertension and hypercholesterolemia (crude data) was seen in the oldest subjects above 80 years of age (37.7%, 29.2%, and 17%, respectively). Age-standardized control of hypertension, hypercholesterolemia, and both hypertension and hypercholesterolemia in the entire sample (age range of 19 to 99 years) was 24.3%, 11.2%, and 5.4%, respectively (Table 5).

Age, comorbid diabetes, comorbid CVD, frequent medical visits, SCORE < 5% were positively associated with a control of hypertension, hypercholesterolemia, and both. Female sex, obesity, income above EUR 250 per person in the household were not associated with

hypercholesterolemia control, but related with control of hypertension and a control of both hypertension and hypercholesterolemia. Education higher than vocational was associated only with improvement in hypertension control. Conversely, smoking was associated with worse control of hypertension, hypercholesterolemia, and both conditions. BMI <25 kg/m², alcohol consumption, and SCORE ≥10% were inversely associated with hypertension control (Table 6).

After adjustment for covariates, female sex, comorbid CVD, frequent medical visits and high education increased the odds of hypertension control. The strongest effect was observed for comorbid CVD (OR=2.35 95%CI=1.93-2.86). Hypercholesterolemia control was positively related with comorbid diabetes, CVD, and with controlled hypertension.

Hypercholesterolemia control was inversely related with smoking (OR=0.57. 95%CI=0.45-0.71) The control of both hypertension and hypercholesterolemia was more frequent in participants with comorbid CVD, frequent medical visits and with high education. Smoking decreased twice the odds of control of both hypertension and hypercholesterolemia (Fig. 1, Suppl.Tab 1).

Discussion

Our results suggest that about one third of the adult population have comorbid hypertension and hypercholesterolemia. Control of hypertension in this group appeared similar to the control in general population but control of hypercholesterolemia was better than in general population [1,2]. Nevertheless, proportion of persons with both conditions controlled was only about 5%.

Considering the more stringent thresholds of antihypertensive treatment in accordance with the guidelines of ESH 2018 [26] and PTNT 2019 [27] (for patients below 65 years old, the

target pressure below 130/80 mmHg, between 65 and 85 - below 140/80 mmHg and over 80 - below 150/80 mmHg) blood pressure control in the WOBASZ II population would decrease from 23% to approximately 14% and simultaneous control of hypercholesterolemia and blood pressure would only reach 3.5% of patients.

Achieving treatment targets for hypertension or hypercholesterolemia was more frequent in women, high educated participants, non-smokers, persons with comorbid CVD or diabetes and in participants who attended medical visits more frequently.

In the interpretation of the results obtained some caution is recommended mainly due to relatively low (approximately 45.5%) participation rate which could have affected the representativeness of the sample. In previous WOBASZ II analysis it was found that regional differences in the prevalence of hypercholesterolemia were related to the participation rate (0.4% increase in the percentage of people with hypercholesterolemia per 1% increase in reporting rate) [2]. Such relationship was not observed in case of hypertension prevalence [1]. Moreover, our participation rate was similar to that recorded in other European studies, e.g. the EHES study conducted in 2009–2012, in which the reporting rate ranged from 16% to 57% in men and from 31% to 74% in women [28]. However, it is likely that low response rate although might have contributed to some underestimation in the prevalence rates, but affected less the relationships studied [29,30].

Further, cross-sectional study design does not allow to address the problem of causality.

Although multivariate models allow to control the effect of important covariates, residual confounding is still possible.

Nevertheless, there are strengths of the study. One would be that in contrast to most of the evidence collected in patients from the clinics, our study involved a large, nationwide sample. The other is that research team applied standardized research procedures to ensure highest possible data quality.

Comparing our results to a large epidemiological study conducted in the USA in 2005–2010, NHANES, we found that the US participants more than four times more often (45.4% vs. 11.2%) achieved the goal of lipid-lowering therapy and control of both hypertension and hypercholesterolemia was six times more common than in our study (30.7% vs. 5.4%) [31]. These comparison might have indicated the gap in the effectiveness of risk factors control between Poland and USA. However, observed difference could also be explained by larger prevalence of obesity, diabetes and lower prevalence of smoking in the NHANES sample. According to our results these factors seem to improve hypertension and hypercholesterolemia control.

The i-SEARCH study, conducted in more than 17,000 patients from 26 countries with treated hypertension, found lower prevalence of hypercholesterolemia (average 49%) than observed in our study. However, there was large variation in hypercholesterolemia prevalence in different regions – the lowest prevalence was observed in Southern Europe (43.3%) and Asia (43.1%) and the highest in North America (64.4%), the Middle East (56.1%) and Northern Europe (53%) [32]. In the Polish POSTER study (Therapeutic strategies in poorly controlled hypertension in outpatient setting in Poland), which enrolled 8,766 patients with poorly controlled hypertension, the prevalence of hypercholesterolemia was estimated at 64.8% [33]. Our results are in accordance with findings from Polish part of the EUROASPIRE IV study, which showed better control of hypertension and hypercholesterolemia in patients after hospitalization due to CHD [34] compared to the findings from general population [1,2].

In our study, in participants with comorbid hypertension and hypercholesterolemia, we found that blood pressure control was low and comparable to the general population (23% vs. 24.3%), whereas hypercholesterolemia control was nearly twice higher than in the general population (11.2% vs. 6%) [1]. Many patients with hypertension and hypercholesterolemia present low *compliance* and *adherence* to medical advising and do not achieve the therapeutic goals, which has significant clinical and economic consequences [35-37]. Recently, a promoted way of improving blood pressure and hypercholesterolemia control could be use of a polypill - a single tablet containing a combination of several drugs (including antihypertensive and lipid-lowering agents) with proven efficacy and cardioprotective effect. It is suggested that in the population above 55 years of age such a combination product could prevent as many as 80% of cardiovascular events [38-42]. Although combination pills containing both antihypertensive and lipid-lowering drugs exist, they are not often used in clinical practice. Their use on a larger scale could contribute to an improvement in blood pressure control, as well as to the achievement of cholesterol targets; for this reason, the position of combination products has recently been strengthened in the European guidelines for hypertension and hypercholesterolemia treatment [43,44].

It seems that introduction of polypill could contribute to solve a problem of not undertaking or discontinuing of treatment (13% of hypertension and 17% of hypercholesterolemia) or a problem of the use of ineffective doses (23% of hypertension and 23% of hypercholesterolemia) [1,2]. Still the final effect would be related largely to the level of motivation of patients to change the lifestyle (diet, physical activity) and keep the long term treatment regime. However, the largest public health problem in Poland is poor detection of risk factors, Over 60% of people with hypercholesterolemia and about 40% with hypertension

are not aware of the condition [1,2], which substantially limits the potentials of the available treatments.

Conclusions

Hypertension and hypercholesterolemia were observed in one third of the Polish population (included in WOBASZ II study). Only 5,4% have both risk factors controlled. After adjustment for covariates, female gender, non-smoking, comorbid CVD or diabetes, frequency of medical visits and high education, appeared to increase the proportion of controlled hypertension or hypercholesterolemia.

Contribution statement

AN conceived the idea for the manuscript, contributed to the study design, analyzed the data, interpreted the results and wrote the paper. JM, MK, AP, TZ, WD, AP, MK, KK, AT provided the data of WOBASZ II study and contributed to the writing of the paper. AN, JM performed the statistical analysis. MK, AP critically revised the manuscript All authors read and approved the final manuscript.

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Ethics approval and consent to participate

The study was accepted by the Bioethics Committee at the Institute of Cardiology in Warsaw (no 1344). All subjects were asked for their approval before starting the interview and a consent form was explained and then signed by all subjects.

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Table 1. Descriptive characteristics of participants with hypertension and hypercholesterolemia in WOBASZ II Study

Descriptor, Mean (95%CI)	Hypertension and Hypercholesterolemia	
	n	% (95% CI)
Age, y	2037	58.8(58.2-59.3)
Gender, % male	982	48.3(45.1-51.4)
BMI <25 kg/m ² , %	353	17.3(13.4-21.3)
BMI 25-30 kg/m ² , %	911	44.7(41.5-47.9)
BMI >30 kg/m ² , %	773	37.9(34.5-41.4)
SBP, mmHg	2037	144.7(143.8-145.5)
DBP, mmHg	2037	86.2(85.7-86.7)
TC, mmol/l ^a	2012	5,6(5,5-5,6)
LDL-C, mmol/l ^a	2008	3,5(3,4-3,6)
HDL-C, mmol/l ^a	2009	1,4(1,3-1,4)
TG, mmol/l ^a	2010	1,5(1,4-1,6)
Hypertension treatment, %	1201	59(56.2-61.7)
Hypercholesterolemia treatment, %	637	31.3(27.7-34.9)
Diabetes, %	286	14(10.0-18.0)
Smoking, %	443	21.7(17.9-25.6)
Alcohol drinkers, %	1636	80.3(78.4-82.2)
Education, %	1532	75.2(73-77.4)

Physical activity, %	1159	56.9(54-59.7)
Coexisting CVD, %	562	27.6(23.9-31.3)
Married, %	483	23.7(19.9-27.5)
SCORE		
SCORE \geq 5%, %	1112	54.6(51.7-57.5)
SCORE \geq 5 and <10%, %	547	26.9(23.1-30.6)
SCORE \geq 10%, %	378	18.6(14.6-22.5)
Visits, number/y, %		
0	230	11.3(7.2-15.4)
1	521	25.6(21.8-29.3)
2-4	528	25.9(22.2-29.7)
5-6	143	7(2.8-11.2)
>7	615	30.2(26.6-33.8)
Income, %		
\leq PLN 1000 ($<$ EUR 250)	753	43(39.5-46.5)
$>$ PLN 1000 ($>$ EUR 250)	998	57(53.9-60.1)

^a -median

Abbreviations: y, years; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL-C, low density cholesterol; HDL-C, high density cholesterol; TG, triglycerides; SCORE, Systematic COronary Risk Evaluation; Education – higher than vocational

Table 2. Descriptive characteristics of patients with hypertension and hypercholesterolemia in WOBASZ II Study

Descriptor, Mean (95%CI)	Controlled Hypertension and Hypercholesterolemia		Controlled Hypertension Uncontrolled Hypercholesterolemia		Controlled Hypercholesterolemia Uncontrolled Hypertension		Uncontrolled Hypertension and Hypercholesterolemia	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Age, y	151	64.1(62.4-65.7)	411	57.3(56-58.5)	171	46(45.4-46.6)	1275	58(48-66)
Gender, % male	59	39.1(26.6-51.5)	156	38(30.3-45.6)	76	44.4(33.3-55.6)	681	53.4(49.7-57.2)
BMI <25 kg/m ² , %	21	13.9(-0.9-28.7)	62	15.1(6.2-24)	16	9.4(0-23.6)	251	19.7(14.8-24.6)
BMI 25-30 kg/m ² , %	63	41.7(29.5-53.9)	181	44(36.8-51.2)	73	42.7(31.3-54)	582	45.6(41.6-49.7)
BMI >30 kg/m ² , %	67	44.4(32.5-56.3)	168	40.9(33.4-48.3)	82	48(37.1-58.8)	442	34.7(30.2-39.1)
SBP, mmHg	151	124.3(122.7-125.9)	411	144.2(142.8-145.6)	171	120.2(119.7-120.6)	1275	149(141.5-161.5)
DBP, mmHg	151	75.8(74.4-77.1)	411	85.9(85.1-86.7)	171	76.1(75.7-76.4)	1275	90.5(84.5-96.5)
TC, mmol/l ^a	151	4.1(3.9-4.2)	411	5.7(5.5-5.8)	171	4.1(3.8-4.4)	1275	5.9(5.8-5.9)
LDL-C, mmol/l ^a	151	2.1(2-2.2)	411	3.6(3.5-3.7)	171	2.1(2-2.2)	1274	3.7(3.7-3.8)
HDL-C, mmol/l ^a	151	1.2(1.2-1.3)	411	1.3(1.3-1.4)	171	1.3(1.1-1.4)	1275	1.4(1.4-1.4)

TG, mmol/l ^a	150	1.3(1.1-1.4)	411	1.6(1.5-1.7)	171	1.3(1-1.5)	1274	1.6(1.5-1.6)
Hypertension treatment, %	151	100(100-100)	411	100(100-100)	132	77.2(70-84.4)	481	37.7(33.4-42.1)
Hypercholesterolemia treatment, %	151	100(100-100)	112	27.3(19-35.5)	164	95.9(92.9-98.9)	182	14.3(9.2-19.4)
Diabetes, %	36	23.8(9.9-37.8)	60	14.6(5.7-23.5)	46	26.9(14.1-39.7)	137	10.7(5.6-15.9)
Smoking, %	15	9.9(0-25.1)	79	19.2(10.5-27.9)	21	12.3(0-26.3)	325	25.5(20.8-30.2)
Alcohol drinkers, %	123	81.5(74.6-88.3)	304	74(69-78.9)	137	80.1(73.4-86.8)	1055	82.7(80.5-85)
Education, %	104	68.9(60-77.8)	311	75.7(70.9-80.4)	117	68.4(60-76.8)	982	77(74.4-79.7)
Physical activity, %	83	55(44.3-65.7)	229	55.7(49.3-62.2)	100	58.5(48.8-68.1)	731	57.3(53.7-60.9)
Coexisting CVD, %	84	55.6(45-66.3)	138	33.6(25.7-41.5)	87	50.9(40.4-61.4)	240	18.8(13.9-23.8)
Married, %	46	30.5(17.2-43.8)	95	23.1(14.6-31.6)	53	31(18.5-43.4)	279	21.9(17-26.7)
SCORE								
SCORE ≥5%, %	110	72.8(64.5-81.2)	254	71.8(66.2-77.3)	77	55(43.9-66.1)	556	51.9(47.8-56.1)
SCORE ≥5 and <10%, %	15	9.9(0-25.1)	96	27.1(18.2-36)	61	43.6(31.1-56)	373	34.8(30-39.7)
SCORE ≥10%, %	26	17.2(2.7-31.7)	4	1.10-11.5)	2	1.4(0-17.9)	142	13.3(7.7-18.8)
Visits, number/y, %								

0	25	16.6(2-31.1)	60	14.6(5.7-23.5)	59	34.5(22.4-46.6)	115	9(3.8-14.3)
1	4	2.6(0-18.4)	34	8.3(0-17.5)	17	9.9(0-24.2)	464	36.4(32-40.8)
2-4	37	24.5(10.6-38.4)	111	27(18.7-35.3)	8	4.7(0-19.3)	333	26.1(21.4-30.8)
5-6	22	14.6(0-29.3)	35	8.5(0-17.8)	8	4.7(0-19.3)	74	5.8(0.5-11.1)
>7	63	41.7(29.5-53.9)	171	41.6(34.2-49)	79	46.2(35.2-57.2)	289	22.7(17.8-27.5)
Income, %								
<= PLN 1000 (< EUR 250)	58	42.6(29.9-55.4)	152	41.3(33.5-49.1)	52	35.1(22.2-48.1)	482	45(40.5-49.4)
> PLN 1000 (> EUR 250)	78	57.4(46.4-68.3)	216	58.7(52.1-65.3)	96	64.9(55.3-74.4)	590	55(51-59.1)

^a -median

Abbreviations:

y, years; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL-C, low density cholesterol; HDL-C, high density cholesterol; TG, triglycerides; SCORE, Systematic COronary Risk Evaluation; Education – higher than vocational

Table 3 Crude and age-standardized prevalence of hypertension and hypercholesterolemia in the Polish population aged 19–99

Total			Men		Women	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
19-49	432	15(13.7-16.3)	278	20.9(18.8-23.1)	154	9.9(8.4-11.4)
50-59	596	46.7(44-49.5)	276	50.9(46.7-55.1)	320	43.7(40.1-47.2)
60-69	613	58.2(55.2-61.2)	280	58.3(53.9-62.7)	333	58.1(54.1-62.2)
70-79	290	60.4(56-64.8)	116	56.6(49.8-63.4)	174	63.3(57.6-69)
>=80	106	52(45.1-58.8)	32	41.6(30.6-52.6)	74	58.3(49.7-66.8)
Age standardized	2037	32.2(30.8-33.7)	982	34.5(32.3-36.7)	1055	31(29.1-32.9)

Table 4. Crude and age-standardized prevalence of hypercholesterolemia in the Polish hypertensive population aged 19–99

Total			Men		Women	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
19-49	666	64.9(61.2-68.5)	413	67.3(62.8-71.8)	253	60.9(54.9-66.9)
50-59	746	79.9(77-82.8)	362	76.2(71.9-80.6)	384	83.3(79.6-87.1)
60-69	790	77.6(74.7-80.5)	362	77.3(73-81.7)	428	77.8(73.9-81.7)
70-79	407	71.3(66.9-75.7)	167	69.5(62.5-76.4)	240	72.5(66.9-78.1)
>=80	174	60.9(53.7-68.2)	60	53.3(40.7-66)	114	64.9(56.2-73.7)
Age standardized	2.037	69.7(65.9-73.4)	982	70(64.9-75.2)	1.055	68.6(63.1-74.2)

Table 5. Crude and age-standardized prevalence of controlled blood pressure, hypercholesterolemia or both in the Polish population with hypertension and hypercholesterolemia aged 19–99.

Age (years)													
	19-49		50-59		60-69		70-79		≥80		19-99		
	n	% (95%CI)	n	% (95%CI)	n	95% CI	P for trend						
Controlled hypertension													
Total	81	18.8(15.1-22.4)	182	30.5(26.8-34.2)	194	31.6(28-35.3)	80	27.6(22.4-32.7)	40	37.7(28.5-47)	577	24.3(21.7-26.9)	<0.001
Men	45	16.2(11.9-20.5)	69	25(19.9-30.1)	73	26.1(20.9-31.2)	24	20.7(13.3-28.1)	8	25(10-40)	219	19.7(16.5-22.9) ^a	0.01
Women	36	23.4(16.7-30.1)	113	35.3(30.1-40.5)	121	36.3(31.2-41.5)	56	32.2(25.2-39.1)	32	43.2(32-54.5)	358	29.5(25.1-33.9)	<0.001
Controlled hypercholesterolemia													
Total	21	4.9(2.8-6.9)	84	14.1(11.3-16.9)	128	20.9(17.7-24.1)	58	20(15.4-24.6)	31	29.2(20.6-37.9)	322	11.2(9.7-12.7)	<0.001
Men	18	6.5(3.6-9.4)	43	15.6(11.3-19.9)	44	15.7(11.5-20)	22	19(11.8-26.1)	8	25(10-40)	135	10.8(8.6-13) ^b	<0.001
Women	3	1.9(0-4.1)	41	12.8(9.2-16.5)	84	25.2(20.6-29.9)	36	20.7(14.7-26.7)	23	31.1(20.5-41.6)	187	11(9.1-12.8)	<0.001

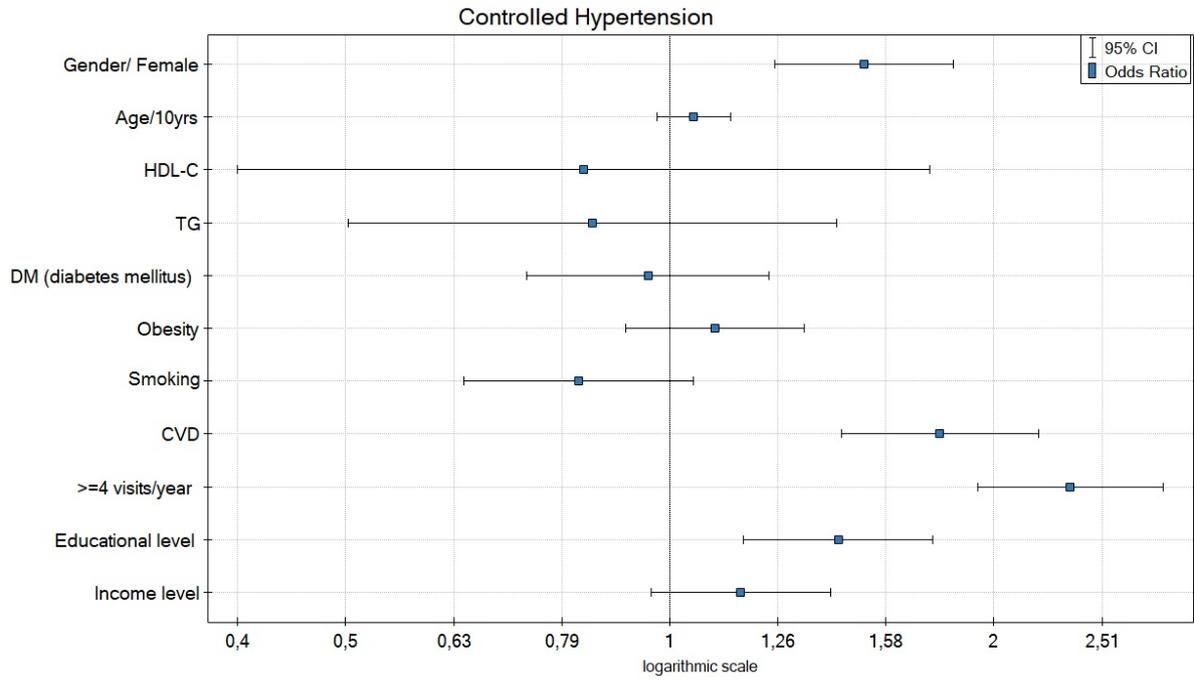
Controlled hypertension and hypercholesterolemia													
Total	10	2.3(0.9-3.7)	44	7.4(5.3-9.5)	57	9.3(7-11.6)	22	7.6(4.5-10.6)	18	17(9.8-24.1)	151	5.4(4.3-6.4)	<0.001
Men	8	2.9(0.9-4.8)	18	6.5(3.6-9.4)	19	6.8(3.8-9.7)	11	9.5(4.2-14.8)	3	9.4(-0.7-19.5)	59	4.7(3.3-6.1) ^c	0.09
Women	2	1.3(0-3.1)	26	8.1(5.1-11.1)	38	11.4(8-14.8)	11	6.3(2.7-9.9)	15	20.3(11.1-29.4)	92	5.7(4.3-7.1)	<0.001

^a - men vs women $p < 0.001$; ^b - men vs women $P = 0.9547$; ^c - men vs women $P = 0.788$

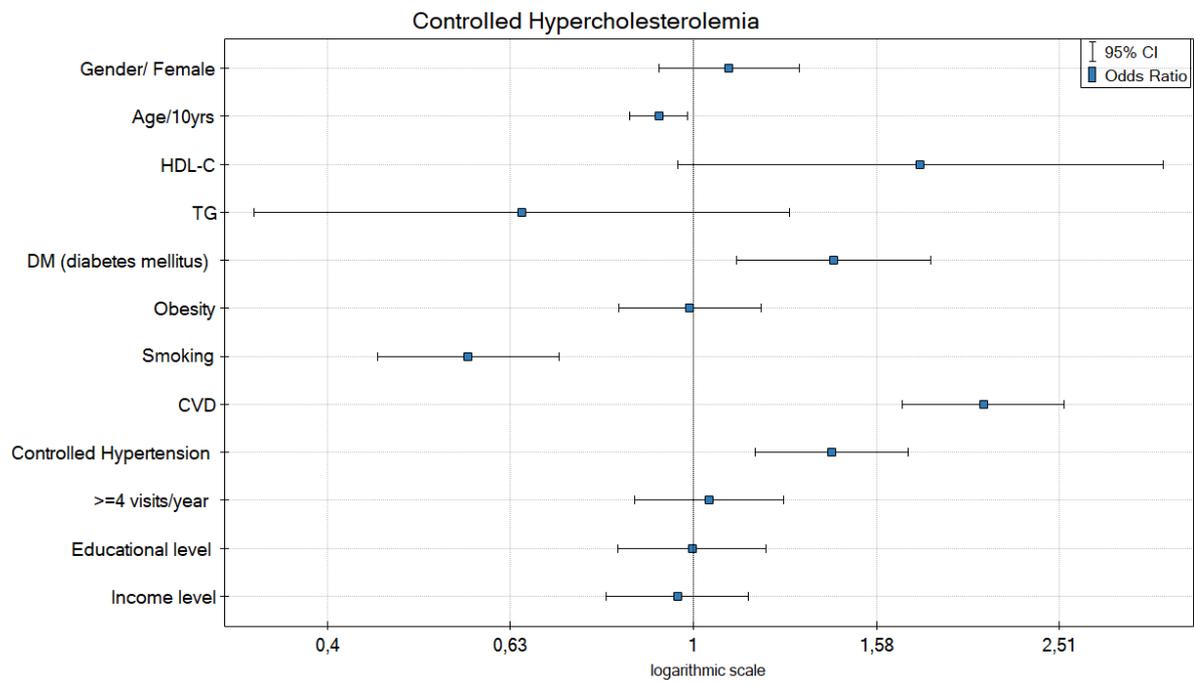
Table 6. Univariate odds ratios and 95% confidence limits of factors associated with control of hypertension, hypercholesterolemia or both in patients with hypertension and hypercholesterolemia in WOBASZ II study.

Descriptor	Controlled Hypertension	Controlled Hypercholesterolemia	Controlled Hypertension and Hypercholesterolemia
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Age, per 10y	1.22(1.15-1.3)	1.06(1-1.13)	1.31(1.2-1.43)
Gender (female)	1.72(1.45-2.04)	1.17(1-1.38)	1.48(1.16-1.88)
BMI, (>30kg/m ²)	1.31(1.1-1.55)	1.17(0.99-1.38)	1.36(1.07-1.74)
Diabetes	1.39(1.1-1.74)	1.75(1.4-2.18)	1.73(1.28-2.33)
HDL-C, per 1,0 mmol/l	0.94(0.48-1.84)	1.62(0.9-2.93)	1.44(0.67-3.1)
TG, per 1,0 mmol/l	0.87(0.54-1.4)	0.63(0.33-1.18)	0.73(0.29-1.83)
Smokers	0.61(0.49-0.76)	0.56(0.45-0.69)	0.41(0.28-0.6)
Alcohol drinkers	0.98(0.96-0.99)	0.99(0.99-1)	0.98(0.96-1)
Education (more than vocational education)	1.2(1.01-1.42)	1.01(0.86-1.19)	1.1(0.86-1.39)
Physical activity (more than 30 min. and > 4 days/week)	1.02(0.87-1.21)	0.89(0.75-1.04)	1.04(0.82-1.33)
Coexisting CVD	2.33(1.95-2.78)	2.15(1.81-2.56)	3.01(2.36-3.83)
Married	1.06(0.88-1.29)	1.19(0.99-1.44)	1.16(0.88-1.52)
SCORE, (< 5%)	1.72(1.45-2.04)	1.62(1.37-1.91)	2.08(1.61-2.69)

A



B



C

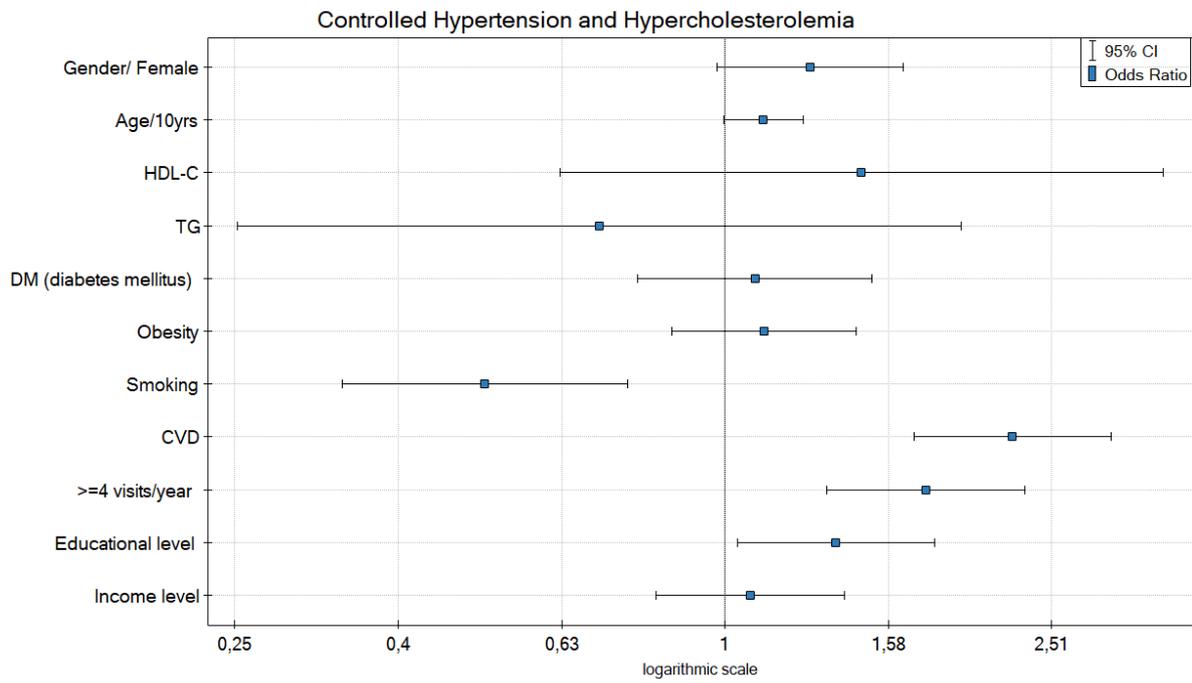


Fig. 1. Multivariable odds ratios and 95% confidence limits for clinical variables associated with control of hypertension (A), hypercholesterolemia (B) or both (C).