

## PREVALENCE AND CORRELATES OF HYPERTENSION IN A TRANSITIONAL SOUTH- EASTERN EUROPEAN POPULATION: RESULTS FROM THE ALBANIAN DEMOGRAPHIC AND HEALTH SURVEY

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We assessed the prevalence and socioeconomic and behavioural correlates of hypertension in the young to middle-aged population of Albania, a transitional post-communist country in the Western Balkans. We analysed a sample of 2,837 men and 3,580 women aged 15 to 49 from the 2008/2009 Albanian Demographic and Health Survey. Hypertension was defined as SBP $\geq$ 140 mm Hg, or DBP $\geq$ 90 mm Hg, or if the subjects were under treatment for hypertension. Data on demographic and socioeconomic characteristics and behavioural factors were also collected. Logistic regression was used to assess the association of hypertension with covariates. Hypertension was significantly higher among men (27.3 %) than women (20.0 %), and significantly increased with age. The harmful effect of excessive weight and obesity on hypertension was stronger among women than among men and this effect increased with age, especially in women. Smoking and alcohol were risk factors for hypertension in men, but not women. Education had a protective effect on hypertension in women but not in men.

**KEY WORDS:** *blood pressure, obesity, risk factors, socioeconomic and behavioural correlates of hypertension*

Hypertension is one of the most important challenges to public health worldwide, especially in developed countries. It is a risk factor for circulatory system diseases, primarily ischemic heart and cerebrovascular diseases, which are major causes of death in Albania. Hypertension is also a contributory factor to kidney disease (1, 2). It has been identified

as a leading risk factor for mortality and ranked third as a cause of disability-adjusted life-years (3, 4).

Analysis of the global hypertension burden reveals that over 25 % of the world's adult population in 2000 suffered from hypertension and this proportion is expected to increase to 29 % by 2025 (5). Limited data on the trends of prevalence of hypertension suggest

that it has increased in economically developing countries in recent years while remaining stable or having decreased in developed countries (6). There is evidence that, in developed and high-income countries, hypertension is inversely associated with socioeconomic status, and so are morbidity and mortality from cardiovascular diseases (CVD) (7-12). In the developing world, however, these relationships are not as clear, particularly in middle-income countries undergoing epidemiological and nutritional transition (13).

Observational studies have shown that diabetes, dyslipidemia, obesity, psychological disorders, unhealthy dietary habits, smoking, and physical inactivity are major risk factors for the development of hypertension (14), as are excessive weight, obesity, and weight gain (15, 16). Tobacco smoking, excessive alcohol consumption, low physical activity, and unhealthy eating habits have been directly associated with an increased risk of coronary heart disease (CHD), as well as inversely related to socioeconomic status (17). Lifestyle factors like leisure-time physical activity, smoking, alcohol drinking, and dietary habits may mediate the correlation between socioeconomic status and cardiovascular risk factors (18).

In Albania, unlike other former communist countries of Eastern Europe, mortality from CVD has traditionally been low, similarly to other Mediterranean countries (19). During the communist regime and before the dramatic political changes in 1991, the typical Albanian lifestyle was quite unique (20). Little is known about the prevalence of hypertension and its risk factors in Albania. In this paper, we report the prevalence of hypertension and its risk factors in Albania based on a nationally representative survey conducted during the period 2008/2009.

We undertook a population-based, large-scale, and nationally representative study to document the prevalence of hypertension and examine the demographic, socioeconomic, and behavioural factors associated with hypertension among 15 to 49 year old men and women in Albania. We used data from the first national survey, the 2008/2009 Albanian Demographic and Health Survey (ADHS) (21), which used a standardized adult health module to collect data on blood pressure, anthropometry, and other behavioural aspects. We conducted a multivariate analysis to determine the risk factors of hypertension after adjusting for the effects of confounding variables.

## METHODS

### *Study population*

Albania is an ethnically homogeneous country; Albanian 95 %, Greek 3 %, others 2 % (Vlach, Roma, Serb, Macedonian, Bulgarian). The total population of Albania is 3,011,405 and 52 % live in urban areas. The median age of the total population is 31.2 years (21).

We analysed a sample of 2,837 men and 3,580 women aged 15 to 49 from the 2008/2009 ADHS. The survey included a nationally representative sample of almost 9,000 households. The sample was selected in such a manner as to allow separate urban and rural, as well as regional, level estimates for key population and health indicators. ADHS utilized a two-stage sample design. In accordance with the sample design, weighing procedures were used to ensure that the results presented are nationally representative and representative for each study domain.

All women aged 15 to 49 in the sample households and all men aged 15 to 49 in the subsample of half of the households, who were either usual household residents or visitors present on the night before the survey, were eligible to be included in the survey for data collection.

### *Data collection*

ADHS was conducted by the Institute of Public Health (ISHP) and the National Institute of Statistics (INSTAT) with the technical support of Macro International (now ICF International) as part of the worldwide Demographic and Health Survey (DHS) programme. DHS has been carried out in about 90 countries in the world in the last 20 years and has been a rich source of demographic and health data. It has developed standard methods and procedures, including questionnaires. It has an adult health module that collects data on blood pressure and anthropometric data. Mass in kilogram, height in centimetre, haemoglobin testing and blood pressure (BP) were measured for the male and female participants aged 15 to 49. Interviewers were provided with the Omron HEM-711ac blood pressure monitor - a fully automatic, digital oscillometric blood pressure measuring device with automatic upper-arm inflation and automatic pressure release. Three measurements of systolic and diastolic BP were taken during the survey interview with an interval of at least 10 min between each

**Table 1** Prevalence of hypertension by socioeconomic and behavioural factors, men and women aged 15 to 49, Albania  
 Demographic and Health Survey, 2008 to 2009

Variables	Men			Women		
	Sample N (%)	Hyper- tensive / %	Odds ratio (95% CI)*	Sample N (%)	Hyper- tensive / %	Odds ratio (95% CI)*
<b>All cases</b>	2837 (100.0)	27.3	-	3580 (100.0)	20.0	-
<b>Age / year</b>						
15 to 19	625 (22.0)	11.3	1.00 (reference)	670 (18.7)	5.9	1.00 (reference)
20 to 24	373 (13.1)	20.7	2.04 (1.43 to 2.90)	408 (11.4)	7.6	1.32 (0.82 to 2.16)
25 to 29	254 (9.0)	25.4	2.67 (1.83 to 3.89)	402 (11.2)	8.9	1.57 (0.98 to 2.51)
30 to 34	256 (9.0)	30.5	3.44 (2.39 to 4.94)	448 (12.5)	16.8	3.25 (2.17 to 4.88)
35 to 39	353 (12.4)	28.8	3.18 (2.26 to 4.45)	550 (15.4)	26.8	5.87 (4.04 to 8.53)
40 to 44	474 (16.7)	34.7	4.06 (2.97 to 5.55)	585 (16.3)	31.0	7.20 (4.99 to 10.39)
45 to 49	502 (17.7)	45.3	6.19 (4.57 to 8.38)	517 (14.4)	41.0	10.72 (7.42 to 15.47)
<b>Education / year</b>						
>12	354 (12.5)	19.1	1.00 (reference)	456 (12.7) <sup>‡</sup>	7.4	1.00 (reference)
9 to 12	1329 (46.8)	26.2	1.54 (1.14 to 2.08)	1331 (37.2)	18.8	2.47 (1.68 to 3.63)
<8	1154 (40.7)	31.5	2.01 (1.48 to 2.71)	1793 (50.1)	24.2	3.47 (2.38 to 5.05)
<b>Employment</b>						
Employed	1873 (66.0)	77.2	1.00 (reference)	1106 (30.9)	35.3	1.00 (reference)
Unemployed	964 (34.0)	22.8	0.64 (0.62 to 0.92)	2475 (69.1)	64.7	1.08 (0.90 to 1.29)
<b>Marital status</b>						
Married/ cohabiting	1625 (57.3)	35.7	1.00 (reference)	2499 (69.8)	25.2	1.00 (reference)
Single	1212 (42.7)	16.7	0.76 (0.59 to 1.04)	1081 (30.2)	8.1	0.92 (0.72 to 1.18)
<b>Region</b>						
Urban Tirana	486 (17.1)	5.2	1.00 (reference)	564 (15.8)	3.9	1.00 (reference)
Central	1332 (46.9)	50.3	4.93 (3.47 to 6.99)	1642 (45.8)	53.4	6.33 (4.21 to 9.49)
Mountain	267 (9.4)	9	4.20 (2.73 to 6.46)	364 (10.2)	12.4	7.28 (4.58 to 11.58)
Coastal	752 (26.5)	35.6	6.74 (4.69 to 9.68)	1011 (28.2)	30.3	5.47 (3.60 to 8.31)
<b>Residence</b>						
Urban	1353 (47.7)	23.9	1.00 (reference)	1609 (44.9)	15.8	1.00 (reference)
Rural	1484 (52.3)	31	1.50 (1.26 to 1.78)	1971 (55.1)	23.5	1.77 (1.48 to 2.11)
<b>Wealth index</b>						
High	1384 (48.8)	37.8	1.00 (reference)	495 (13.8)	32.7	1.00 (reference)
Middle	521 (18.4)	23.5	1.37 (1.09 to 1.71)	1373 (38.3)	24	1.56 (1.24 to 1.97)
Low	932 (32.9)	38.8	1.41 (1.16 to 1.71)	1712 (47.8)	43.3	1.68 (1.38 to 2.05)
<b>BMI / kg cm<sup>-2</sup></b>						
<25	1312 (46.6)	19.6	1.00 (reference)	2118 (60.9)	13	1.00 (reference)
25 to 29.9	1261 (44.8)	33.1	1.43 (1.18 to 1.75)	1018 (29.2)	26.4	1.39 (1.14 to 1.70)
≥30	244 (8.7)	45.1	1.97 (1.45 to 2.68)	344 (9.9)	47.3	3.08 (2.38 to 3.98)
<b>Smoking</b>						
No	1633 (57.6)	22.8	1.00 (reference)	3445 (96.2)	20.2	1.00 (reference)
Yes	1204 (42.4)	34.2	1.43 (1.19 to 1.72)	135 (3.8)	16.7	0.83 (0.51 to 1.34)
<b>Alcohol intake</b>						
No	1008 (35.5)	22.9	1.00 (reference)	2377 (66.4)	64.9	1.00 (reference)
Yes	1829 (64.5)	77.1	1.76 (1.44 to 2.14)	1204 (33.6)	35.1	1.03 (0.86 to 1.23)



**Figure 1** Map of Albania

measurement. At the end of the interview, respondents were given information about their average BP reading and advised to see a physician for further screening if the reading fell outside normal ranges according to internationally recommended guidelines.

ADHS was approved by the Albanian Committee of Biomedical Ethics. Before the interview, an informed consent was obtained from all of the study participants.

#### *Factors considered in the analysis*

The demographic and socioeconomic factors considered in the study included age, marital status (married/cohabiting vs. single), education [ $>12$  years, (9 to 12) years,  $<8$  years], employment status (employed vs. unemployed), wealth index (High, Middle, Low), region (Urban Tirana, Central, Mountain, Coastal), and place of residence (urban vs. rural areas). Behavioural factors included smoking, alcohol consumption, and body mass index (BMI). Detailed data concerning alcohol consumption and smoking were collected. Alcohol consumption and smoking were considered binary variable (never consumed vs. consumed). BMI was calculated for each individual and used as anthropometric index of body mass. Subjects were considered to have hypertension if they were under treatment for elevated blood pressure or had systolic blood pressure (SBP)  $\geq 140$  mm Hg or diastolic blood pressure (DBP)  $\geq 90$  mm Hg.

#### *Statistical analysis*

Descriptive statistics was used to summarize cohort characteristics. We examined the correlation between hypertension and demographic,

socioeconomic, and behavioural factors by using both bivariate and multivariate logistic regressions. Both estimated unadjusted and adjusted odds ratios (ORs) and their corresponding 95 % confidence intervals (95 % CIs) are given. We considered a  $p$ -value of  $<0.05$  as statistically significant. Statistical Package for Social Sciences (SPSS for Windows, version 19.0) was used for all of the analyses.

## RESULTS

The sample is described separately for men ( $n=2,837$ ) and women ( $n=3,580$ ) in Table 1. The prevalence of hypertension among men and women was 27.3 % and 20.0 %, respectively. The men to women difference was statistically significant ( $p<0.01$ ). Hypertension among both men and women significantly and sharply increases with age; an increase of one year of age was associated with a 5 % and 9 % increase in the odds of hypertension [OR=1.05 (95 % CI = 1.04 to 1.06) and 1.09 (95 % CI = 1.05 to 1.10)], respectively.

We found that 45 % of men and 41% of women aged 45 to 49 were hypertensive. There was an inverse and significant relationship between hypertension and educational level, and such a relationship was stronger for women than for men. For example, the odds of hypertension were 2.01 times higher among men and 3.47 times higher among women with eight or less years of schooling than their counterparts with 12 or more years of schooling. Hypertension was significantly associated with wealth index.

The odds of hypertension among men who were unemployed were 0.64 times (95 % CI = 0.62 to 0.92) lower than among those who were employed. Such a correlation was not recorded for women. The lower hypertension among unemployed men was probably a confounding effect of age because unemployed men are likely to be young and without hypertension than older men.

There was a wide variation of hypertension among regions. It was substantially lower in Urban Tirana compared to other regions such as the Central, Mountain and Coastal. Hypertension was higher in rural than in urban areas (OR=1.50; 95 % CI=1.26 to 1.78 for men, and OR=1.77; 95 % CI=1.48 to 2.11 for women).

With regard to behavioural factors, hypertension was significantly higher in men who smoked than those who did not (OR=1.43; 95 % CI=1.19 to 1.72),

**Table 2** Adjusted odds ratios (ORs) of factors associated with hypertension among men and women aged 15 to 49, Albania DHS, 2008 to 2009

Variable	Men (N=2837)		Women (N=3580)	
	OR (95% CI)	p	OR (95% CI)	p
<b>Age (one year increase)</b>	1.05 (1.05 to 1.06)	<0.01	1.09 (1.05 to 1.10)	<0.01
<b>Education</b>		<b>0.11</b>		<b>&lt;0.01</b>
>12 years	1.00 (reference)	-	1.00 (reference)	-
9 to 12 years	1.15 (0.83 to 1.59)	0.39	1.96 (1.30 to 2.96)	<0.01
<8 years	1.33 (0.96 to 1.87)	0.09	2.30 (1.50 to 3.49)	<0.01
<b>Employment</b>				
Employed	1.00 (reference)		1.00 (reference)	
Unemployed	0.84 (0.67 to 1.05)	0.12	0.86 (0.70 to 1.05)	0.12
<b>Marital status</b>				
Married/cohabiting	1.00 (reference)		1.00 (reference)	
Single	0.70 (0.53 to 0.94)	0.01	0.96 (0.73 to 1.25)	0.74
<b>Region</b>		<b>&lt;0.01</b>		<b>0.01</b>
Urban Tirana	1.00 (reference)	-	1.00 (reference)	-
Central	4.80 (3.33 to 7.01)	<0.01	5.05 (3.25 to 7.15)	<0.01
Mountain	4.17 (2.63 to 6.66)	<0.01	6.64 (4.03 to 10.96)	<0.01
Coastal	6.34 (4.34 to 9.40)	<0.01	4.57 (2.93 to 7.5)	<0.01
<b>Residence</b>				
Urban	1.00 (reference)		1.00 (reference)	
Rural	0.96 (0.79 to 1.17)	0.68	1.07 (0.86 to 1.32)	0.55
<b>Wealth index</b>		<b>0.23</b>		<b>0.70</b>
High	1.00 (reference)	-	1.00 (reference)	-
Middle	1.13 (0.89 to 1.44)	0.32	0.89 (0.67 to 1.18)	0.42
Low	1.18 (0.97 to 1.45)	0.10	0.90 (0.68 to 1.19)	0.45
<b>BMI / kg cm<sup>-2</sup></b>		<b>&lt;0.01</b>		<b>&lt;0.01</b>
<25	1.00 (reference)	-	1.00 (reference)	-
25 to 29.9	1.47 (1.20 to 1.80)	<0.01	1.35 (1.10 to 1.67)	<0.01
≥30	2.10 (1.51 to 2.89)	<0.01	2.82 (2.16 to 3.69)	<0.01
<b>Smoking</b>				
No	1.00 (reference)		1.00 (reference)	0.45
Yes	1.32 (1.09 to 1.61)	0.01	1.22 (0.72 to 2.06)	
<b>Alcohol</b>				
No	1.00 (reference)		1.00 (reference)	0.19
Yes	1.38 (1.12 to 1.70)	0.01	1.14 (0.94 to 1.38)	

but smoking was not significantly associated with hypertension in women. It may be noted that the prevalence of smoking was 42 % for men and only 4 % for women. Similarly, 65 % of men reported alcohol consumption compared to 35 % of women. The odds of hypertension were 1.76 times (95 % CI=1.44 to 2.14) higher among men who drank alcohol than those who did not. For women, hypertension was not associated with alcohol drinking.

Hypertension was highly significantly increased with BMI and the correlation was stronger for women than men. Overall, 53 % of men and 39 % of women

aged 15 to 49 were overweight or obese, which was much more present in 40 to 49 year-olds. About 74 % and 63 % of 40 to 49 year-old men and women were overweight or obese.

Table 2 shows adjusted ORs and corresponding 95 % CIs for three models: men, women, and combined. The strength and nature of the correlation between hypertension and various factors changed in the models that were adjusted adjust for the effects of confounding factors in the multivariate models. As expected, by and large, OR values were smaller in the multivariate adjusted models than in the bivariate

**Table 3** Regression coefficients of the effects of age, sex, BMI, and their interactions on hypertension (after controlling for other factors considered in Table 2)

Variables in the model	Regression coefficient	p
<i>Model 1</i>		
male	0.233	0.014
age	0.057	<0.001
BMI	0.085	<0.001
<i>Model 2</i>		
BMI*male	-0.042	0.018
<i>Model 3</i>		
age*male	-0.033	<0.001
<i>Model 4</i>		
age* BMI	0.001	0.235
<i>Model 5</i>		
age*BMI*Male	-0.004	0.052

unadjusted models. Some factors lost their significance; for example, education in men, employment in men, and residence (urban vs. rural) were no longer significantly associated with hypertension. In bivariate models, marital status was significantly associated with hypertension neither in men nor in women, but in the adjusted model it appeared that single men did have a lower risk of hypertension than married men. Age, sex, and region remained significant factors associated with hypertension both for men and women as were in the bivariate models. As in the bivariate models, smoking and alcohol remained significant risk factors of hypertension only in men. BMI remained a highly significant risk factor of hypertension in both men and women. Finally, belonging to the male sex was a strong risk factor for hypertension, that is, men had a higher risk of suffering from hypertension than women.

The coefficients related to sex, age, and BMI represent the ORs shown in the pooled model of Table 2. The main purpose of the combined or pooled model was to test the interaction effects of the variables that were differently associated with hypertension among men and women, especially age and BMI. Interaction models are shown in Table 3. The negative and significant BMI - male interaction in Model 2 indicates that the adverse effect of BMI on hypertension was weaker among men than among women. Similarly, significant and negative age to male interaction effect indicated that the adverse effect of age on hypertension

was weaker among men than among women. Finally, the significant negative interaction effect of age, BMI, and male sex indicated that the risk associated with increased age and BMI was weaker for men than for women. Therefore, our findings show that the risk of hypertension increases with age and/or with BMI. The risk of hypertension among older persons due to increased BMI was greater among women than among men.

## DISCUSSION

### Main findings

The prevalence of hypertension was 27 % for men and 20 % for women, and the odds of hypertension in men were 1.26 times higher (95 % CI = 1.05 to 1.52) than in women. The risk of hypertension sharply increased with age, a 6 % (95 % CI = 5 to 7) increase for one unit increase in age. Body mass index was a strong biomedical risk factor of hypertension; the odds for hypertension for an overweight person were 1.44 times higher than for a person with a normal BMI (95 % CI = 1.25 to 1.66) and the odds for hypertension for an obese person were 2.65 times (95 % CI = 2.06 to 3.10) higher than for a person with a normal BMI. This harmful effect of excessive weight and obesity on hypertension was stronger among women than among men. The effect of excessive weight and obesity additionally increased with age, especially in women. Smoking and alcohol consumption were risk factors for hypertension for men only, not women.

Education had a beneficial effect on hypertension, but only for women; and marital status (unmarried) was protective for hypertension, which was true only for men. The prevalence of hypertension widely varied between regions.

### What is known

The prevalence of hypertension in our study is comparable with that in Armenia; hypertension was 27 % for men and 22 % for women aged 15 to 49 (22). However, based on DHS data for the 15 to 49 year old population in Azerbaijan, Bosnia, and Ukraine (23-25) reported a higher prevalence of hypertension than Albania. Local studies in Albania with different methodologies also showed different results. Men and women aged 25 to 44 from Tirana city had a prevalence of 18.4 % and 15.8 % (26). Hypertension was reported

to be higher in women (18.7 %) than in men (15.0 %) for the 35 to 74 age group (27). The sex difference in hypertension was widely observed in various populations (28). Most European studies have shown lower blood pressure levels in women than in men (29-32). Such sex differences in hypertension between European populations appear during adolescence and persist up to the age of 60 (33, 34). The mechanisms of this sex difference are not well-understood; however, the possible causes of these differences may be hormonal.

#### *What this study adds*

Our finding that hypertension increased with BMI is consistent with that of other studies that reported a strong positive correlation between BMI and blood pressure level (35, 36). However, our finding that the harmful effect of increased BMI is stronger in women than in men, especially at older age, is new to our knowledge. The mechanism of this sex differential effect of excessive weight and obesity on hypertension is not familiar. It may well be that certain behaviours lead to both a higher BMI and hypertension and that these behaviours differ for men and women. Excessive weight and obesity may negatively affect physical activities that may in turn increase the chance of hypertension.

Our findings on risk factors for hypertension could have a strong significance for drafting policies and clinical treatment. As mentioned, the major causes of death in Albania are associated with diseases of the circulatory system, and a major contributory factor to these diseases is hypertension. More than one in four men and one in five women aged 15 to 49 are hypertensive. This is an even more serious problem for older or middle-age men and women.

Excessive weight and obesity, major risk factors for hypertension, are common in Albania. The Albanian Ministry of Health should undertake preventive programs to help reduce both excessive weight/obesity and hypertension. People should be made aware of the cause for these disorders and educated on the prevention of these problems.

Practicing clinicians should also be made aware of problems regarding excessive weight/obesity and hypertension, especially of the higher risk of hypertension for women who are overweight/obese and of older age. The clinicians can then design appropriate counselling and education programs for their patients. Screening and monitoring of overweight and obese men and especially women can reduce the

likelihood of hypertension and thus the burden of diseases of the circulatory systems.

Further studies can help gain a better understanding of the lifestyles and behaviours associated with excessive weight/obesity and hypertension in order to develop affordable and effective interventions, as well as to gain insight into the sex differentials of hypertension.

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### **Sažetak**

#### **PRISUTNOST I KORELATI HIPERTENZIJE U JEDNOJ TRANZICIJSKOJ JUŽNOEUROPSKOJ POPULACIJI: REZULTATI DEMOGRAFSKOG I ZDRAVSTVENOG ISTRAŽIVANJA U ALBANIJU**

Ovaj rad istražuje prisutnost te socioekonomske i bihevioralne korelate hipertenzije u populaciji Republike Albanije, tranzicijske postkomunističke zemlje na zapadu Balkanskoga poluotoka. Obradili smo uzorak od 2837 muškaraca i 3580 žena u dobi od 15 do 49 godina iz Albanskog demografskog i zdravstvenog istraživanja (2008./2009.). Hipertenzija je definirana kao sistolički tlak >140 mm Hg, ili dijastolički tlak  $\geq$ 90 mm Hg, ili ako su se ispitanici liječili od hipertenzije. Prikupljeni su i podaci o demografskim i socioekonomskim obilježjima te bihevioralnim čimbenicima. Za procjenu povezanosti hipertenzije i kontrolnih varijabli korištena je logistička regresija. Hipertenzija je bila značajno viša među muškarcima (27,3 %) nego među ženama (20,0 %) i njena se učestalost značajno uvećavala s dobi. Štetni učinak prekomjerne težine i pretilosti na hipertenziju bio je snažniji u žena nego u muškaraca te se također povećavao s dobi, pogotovo u žena. Pušenje i alkohol bili su faktori rizika u muškaraca, ali ne i u žena. Obrazovanje je imalo zaštitni učinak na hipertenziju u žena, ali ne i u muškaraca. Državna tijela trebala bi osmisliti preventivne programe za borbu protiv prekomjerne težine/pretilosti i hipertenzije.

**KLJUČNE RIJEČI:** *faktori rizika, krvni tlak, pretilost, socioekonomski i bihevioralni korelati hipertenzije*

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