Twelve-year Blood Pressure Dynamics in Adults in Ljubljana Area, Slovenia: Contribution of WHO Countrywide Integrated Noncommunicable Diseases Intervention Program

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Aim To determine 12-year dynamics of the average value of arterial blood pressure and arterial hypertension prevalence among adult residents of Ljubljana area in Slovenia, and to assess the probable contribution of World Health Organization's Countrywide Integrated Noncommunicable Diseases Intervention Program (CINDI) to observed dynamics.

Methods A total of 4409 adults aged 25-64 participated in three successive cross-sectional surveys performed in Ljubljana area from late autumn to early spring 1990/1991, 1996/1997, and 2002/2003 ($n_{1990/91} = 1692$, $n_{1996/97} = 1342$, $n_{1990/91} = 1375$). Standardized measurements of systolic and diastolic blood pressure were performed. The subjects were considered to have hypertension if systolic/diastolic blood pressure was ≥140/90 mm Hg. The dynamics of average values of systolic and diastolic blood pressures and arterial hypertension was statistically assessed with multiple linear or logistic regression.

Results After the adjustment for the effects of sex, age, and education, the average value of systolic blood pressure remained almost the same between 1990/1991 and 1996/1997 (130.6 ± 20.3 and 130.6 ± 19.6 mm Hg, respectively; $P = 0.728$), whereas it significantly decreased to 127.6 ± 17.8 mm Hg in 2002/2003 ($P<0.001$). The average value of diastolic blood pressure was not significantly different in 1990/1991, 1996/1997, and 2002/2003 (83.4 ± 11.6 mm Hg, 84.1 ± 11.4 mm Hg, and 83.5 ± 11.2 mm Hg, respectively; $P = 0.059$). The odds ratio for arterial hypertension increased significantly between 1990/1991 and 1996/1997 ($P = 0.001$), but decreased between 1996/1997 and 2002/2003 ($P = 0.135$).

Conclusions The values of blood pressure remained unchanged or increased during the first half of 12-year period, but decreased during the second half. The favorable decrease in average blood pressure could be attributed to systematic intervention promoted by CINDI program activities in Slovenia, which started in the late 1990s.

Arterial hypertension is one of the most important modifiable risk factors for cardiovascular diseases and one of the major contributors to adult mortality or disability in many countries (1). Changing the lifestyle, screening for arterial hypertension, and implementing early antihypertensive drug treatment are among the cornerstones of the successful prevention of cardiovascular diseases (1-3).

Many different international programs were designed and implemented in the last three decades to combat chronic noncommunicable diseases. One of such programs is Countrywide Integrated Noncommunicable Diseases Intervention program (CINDI) of the World Health Organization (WHO), Regional Office for Europe (4), which started in the 1980s (5). Intervention measures target the population in general and high-risk groups and are implemented according to the common protocol (6), preferably on a country level. The CINDI strategy aims to reduce the burden of noncommunicable diseases primarily by discouraging an unhealthy lifestyle. The measures are supposed to be implemented through national or regional noncommunicable diseases prevention policies with a clear link to general national health policies, and lead to the improvement of individual risk by decreasing biological risk factors (obesity, increased arterial blood pressure, and abnormalities in lipid and carbohydrate metabolism) (7). An important element of the program is arterial hypertension control to reduce the risk of cardiovascular diseases. CINDI-WHO Working Group on Hypertension has developed international recommendations, where the most frequently used nonpharmacological interventions for arterial hypertension control are stress management; smoking cessation; salt, calories and saturated fats intake reduction; vegetable and fruit consumption; physical activity increase; and alcohol intake reduction (8). Given the experiences of Finland (North Karelia) and Lithuania, the CINDI program could be extremely successful (9).

Combating noncommunicable diseases in Slovenia has become one of the most important preventive issues since mortality in the country is still mainly attributable to noncommunicable diseases, with cardiovascular diseases being the leading group of death causes (10). Among the physiological risk factors for noncommunicable diseases in Slovenia, especially in Ljubljana area, there was a 19% high prevalence of severe arterial hypertension (systolic/diastolic blood pressure ≥160/95 mm Hg) registered at the beginning of the 1990s (11,12). Thus, in comparison with Hungary (5%), Israel (7%), Romania (5-10%), and Italy (24-27%), Slovenia belongs among the countries with the highest prevalence of severe arterial hypertension (11). Consecutively, it was realized that a program like CINDI was strongly needed. A group of general practitioners from the city of Ljubljana introduced this program for the first time at the end of the 1980s, but Slovenia as a state officially joined CINDI program at the beginning of the 1990s, when its activities were limited to Ljubljana area (13). The CINDI program in Slovenia was introduced between 1990 and 1994. From the late fall to early spring 1990/1991, the basic cross-sectional CINDI survey (CINDI Risk Factor/Process Evaluation Survey) according to CINDI program protocol (6) was carried out. In 1994, a CINDI Slovenia Preventive Unit was established as an autonomous unit within the Ljubljana Community Health Centre. At that time, no specific major interventions were performed except for the survey on cardiovascular disease risk factors and dissemination of the concerning results on their prevalence among physicians and general population. The need for immediate action in the field of arterial hypertension became more obvious when the second CINDI survey, carried out in late 1996 and early 1997, revealed an increase in arterial hypertension prevalence (14). After that, a more systematic promotional and prevention activities through group health education and individual counseling were put into action and de-

veloped into the Nationwide Program on Primary Prevention of Cardiovascular Diseases, which was launched and carried out under the auspices of the Ministry of Health of the Republic of Slovenia (15,16).

We performed a detailed retrospective analysis of dynamics of the average values of blood pressure and arterial hypertension prevalence detected in three CINDI surveys during the 12-year period in Ljubljana area. We also aimed at assessing the probable contribution of CINDI program activities to this dynamics. The main post-hoc hypothesis was that there were differences in average values of systolic and diastolic blood pressure and arterial hypertension prevalence within the observation period. The beneficial contribution of CINDI program was expected in the second half of the period, after the systematic interventional activities of this program had started.

Methods

Participants

The data were collected in three consecutive CINDI surveys performed in 1990/1991, 1996/1997, and 2002/2003 in Ljubljana area. All local communities covered by the Ljubljana Community Health Centre (Brezovica, Dobrova-Polhov Gradec, Dol pri Ljubljani, Grosuplje, Horjul, Ig, Ljubljana, Medvode, Škofljica, Velike Lašče, and Vodice) participated in the survey. The simple random samples were drawn from the Central Population Registry and slightly corrected for sex and age (men and younger age groups were slightly overrepresented) to assure that the sex and age distribution of participants was as similar as possible to the general population. The age range of participants was 25-64 years. The sample sizes in 1990/1991, 1996/1997, and 2002/2003 surveys were 2436, 2180, and 2643, respectively. The sampling was performed by the Statistical Office of the Republic of Slovenia. People were invited to participate in the survey by an invitation letter explaining its rationale and describing its course. The protocols of all three surveys were approved by the National Ethical Committee in 1990, 1996, and 2002.

Blood pressure measurement

According to CINDI protocol (6), two consecutive measurements of systolic and diastolic blood pressure were performed. They were carried out by highly qualified health professionals, general practitioners (12 in the first two surveys) or nurses (38 in the last survey), who were specially trained for the purposes of the survey to assure the highest possible standardization of measurement process. The mercury sphygmomanometers were used. A special separate set of devices, standardized and tuned before the survey, was used in each survey. All measurements within a study period were performed in a single institution on consecutive days. The environmental conditions, such as room temperature and humidity, were strictly standardized. The first blood pressure measurement was performed in sitting position after short rest of the participant, with no change in body position for at least 5 minutes. The blood pressure measurement was perfomed on the right arm unless there was a deformity. Before the second blood pressure measurement, the examiner reconnected the cuff of the sphygmomanometer and either waited for at least 30 seconds or raised the participant's arm for 5-6 seconds to allow the venous blood to return to the forearm (6). The second measurement of systolic and diastolic blood pressure was taken into consideration in the analysis. The participants were considered to have hypertension according to the present definition of arterial hypertension, ie, if the values of systolic and diastolic blood pressure were ≥140/90 mm Hg (3). If systolic and diastolic blood pressure fell into different categories, the higher value was considered.

Statistical analysis

Overall differences in average values of systolic and diastolic blood pressures between the three

measurements were analyzed with analysis of variance (ANOVA), whereas the overall differences in arterial hypertension prevalence were analyzed by χ^2 test (17). The differences adjusted for the effects of sex, age, and education level in systolic and diastolic blood pressure were assessed by multiple linear regression, whereas multiple binary logistic regression was applied to test the differences in arterial hypertension prevalence (18,19). For sex variable, the simple method for coding dummy variables was used, whereas the sequential method was used for age, education level, and survey year (20). $P<0.05$ were considered statistically significant. The SPSS 13.0 statistical package for Windows (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses.

Results

The response rates in 1990/1991, 1996/1997, and 2002/2003 were 69.5% (1692 participants), 61.6% (1342 participants), and 52.0% (1375 participants), respectively. There were 49.9%, 52.0%, and 51.3% of women in the 1990/1991, 1996/1997, and 2002/2003 study samples, respectively ($P=0.509$). In sex distribution, none of the samples considerably differed from general population aged 25-64 in Ljubljana area (50.7% of women). However, they differed in age distribution when compared with general population in Ljubljana area, as the response rate was slightly lower in younger groups and higher in older ones (general population: 12.9%, 26.6%, 27.3%, 23.6%, and 9.7% in 25-29, 30-39, 40-49, 50-59, and 60-64 age group, respectively; 1990/1991 sample: 8.6%, 27.6%, 24.9%, 25.6%, and 13.3%; 1996/1997 sample: 9.8%, 23.0%, 23.3%, 28.0%, and 15.9%; 2002/2003 sample: 10.5%, 23.4%, 24.7%, 25.2%, and 16.2%, respectively). The three samples significantly differed in distribution of age ($P=0.012$) and education level ($P<0.001$). The total sample in the three surveys was assessed as acceptable for analysis of blood pressure dynamics over time if adjusted for age and education level.

Average blood pressure values

The estimates of global average values (±standard deviation) of systolic blood pressure 1990/1991, 1996/1997, and 2002/2003 were 130.6±20.3 mm Hg, 130.6±19.6 mm Hg, and 127.6±17.8 mm Hg, respectively ($P<0.001$). Average values of systolic blood pressure in both men and women were significantly lower in 2002/2003 than in the previous two measurements, as well as in age groups 30-39, 50-59, and 60-64 (Table 1). According to education level, participants with completed elementary and high school had significantly lower average systolic blood pressure in 2002/2003 (Table 1). After adjustments for the effects of sex, age, and education level, the average value of systolic blood pressure remained almost unchanged between 1990/1991 and 1996/1997, whereas it decreased highly significantly between 1996/1997 and 2002/2003 (Table 2).

Table 1. Estimated average values of systolic blood pressure in adult residents of Ljubljana area, Slovenia, over a 12-year period

	Systolic blood pressure (mm Hg; mean±standard deviation) in years			
Population group	1990/1991 (n=1692)	1996/1997 (n=1342)	2002/2003 (n=1375)	*P**
Sex:				
men	134.4±18.7	132.3±17.0	131.8±17.3	0.011
women	126.9±21.1	129.1±21.7	123.6±17.4	<0.001
Age group (y):				
25-29	118.5±13.5	119.1±13.8	119.2±12.8	0.903
30-39	121.6±15.6	121.1±15.5	118.0±12.4	0.002
40-49	127.5±17.0	125.6±15.5	125.5±14.6	0.164
50-59	139.6±20.9	138.8±19.5	133.5±18.1	<0.001
60-64	146.1±20.6	144.6±19.3	141.1±19.5	0.024
Education level:				
uncompleted primary	138.3±20.7	143.1±23.1	141.3±22.9	0.502
primary	131.0±21.0	138.5±22.5	134.9±21.2	0.002
vocational	132.6±20.3	132.2±18.1	131.4±18.0	0.711
secondary	130.2±20.3	129.9±18.8	126.2±16.4	0.002
college	127.6±18.1	126.3±18.0	122.8±17.0	0.089
university	125.8±19.0	125.5±18.9	122.7±14.9	0.073

*Analysis of variance.

The estimates of global average values of diastolic blood pressure in 1990/1991, 1996/1997, 2002/2003 were 83.4±11.6 mm Hg, 84.1±11.4

Table 2. Multiple linear regression analysis of systolic blood pressure in 4309 adult residents of Ljubljana area, Slovenia, over a 12-year period*

Risk factor			
observed category	reference category	ß (95% CI)	*P*
Sex:			
men	women	6.7 (5.7-7.7)	<0.001
Age group (y):			
30-39	25-29	1.4 (-0.4-3.3)	0.135
40-49	30-39	5.6 (4.2-7.0)	<0.001
50-59	40-49	10.9 (9.5-12.1)	<0.001
60-64	50-59	6.0 (4.4-7.6)	<0.001
Education level:			
primary	uncompleted primary	-2.1 (-4.9-0.6)	0.128
vocational	primary	-2.8 (-4.6 to -1.1)	0.001
secondary	vocational	-0.6 (-2.0-0.8)	0.379
college	secondary	-3.0 (-4.8 to -1.1)	0.002
university	college	-1.2 (-3.3-0.8)	0.241
Year of the survey:			
1996/1997	1990/1991	-0.2 (-1.4-1.0)	0.728
2002/2003	1996/1997	-2.4 (-3.7 to -1.1)	<0.001

*Abbreviations: ß – regression coefficient, CI – confidence interval.

Table 3. Estimated average values of diastolic blood pressure in adult residents of Ljubljana area, Slovenia, over a 12-year period

	Diastolic blood pressure (mm Hg; mean ± standard deviation)			
Population group	1990/1991 (n = 1692)	1996/1997 (n = 1342)	2002/2003 (n = 1375)	*P**
Sex:				
men	86.1 ± 11.4	86.0 ± 10.5	85.8 ± 10.1	0.794
women	80.6 ± 11.1	82.4 ± 11.9	80.6 ± 10.0	0.002
Age group (y):				
25-29	76.0 ± 8.1	78.3 ± 9.7	78.0 ± 8.9	0.055
30-39	79.6 ± 10.7	80.5 ± 11.2	78.7 ± 9.4	0.111
40-49	83.1 ± 10.6	82.5 ± 10.5	83.2 ± 10.1	0.683
50-59	88.1 ± 11.8	88.2 ± 11.2	86.5 ± 10.5	0.068
60-64	87.7 ± 11.0	87.9 ± 10.6	87.3 ± 9.1	0.844
Education level:				
uncompleted primary	86.3 ± 11.4	88.4 ± 11.3	88.3 ± 11.2	0.537
primary	82.9 ± 11.6	85.8 ± 11.5	85.9 ± 10.2	0.006
vocational	84.6 ± 11.8	86.1 ± 10.7	85.9 ± 10.2	0.162
secondary	83.3 ± 11.6	83.8 ± 11.3	82.6 ± 10.2	0.201
college	82.2 ± 10.5	82.1 ± 11.7	81.7 ± 9.8	0.920
university	81.3 ± 11.5	81.7 ± 11.6	81.2 ± 10.0	0.881

*Analysis of variance.

mm Hg, and 83.5 ± 11.2 mm Hg, respectively. The differences between the values were not statistically significant ($P = 0.059$). Average values of diastolic blood pressure in women were significantly higher in 1996/1997 than in the other two measurements (Table 3). There were no differences in average diastolic blood pressure between three measurements according to age and education level groups, except for the group of respondents with completed primary education (Table 3). After adjustments for the effects of sex, age, and education level, no significant increase in the average value of diastolic blood pressure was found between 1990/1991 and 1996/1997 or between 1996/1997 (Table 4).

Table 4. Multiple linear regression analysis of diastolic blood pressure in 4309 adult residents of Ljubljana area, Slovenia, over a 12-year period*

Risk factor			
observed category	reference category	ß (95% CI)	*P*
Sex:			
men	women	5.0 (4.4-5.6)	<0.001
Age group (y):			
30-39	25-29	2.3 (1.2-3.5)	<0.001
40-49	30-39	3.2 (2.4-4.1)	<0.001
50-59	40-49	4.6 (3.7-5.4)	<0.001
60-64	50-59	-0.3 (-1.3-0.7)	0.580
Education level:			
primary	uncompleted primary	-1.4 (-3.1-0.3)	0.107
vocational	primary	-0.7 (-1.8-0.4)	0.189
secondary	vocational	-0.2 (-1.0-0.7)	0.688
college	secondary	-1.2 (-2.4 to -0.1)	0.032
university	college	-0.8 (-2.1-0.4)	0.204
Year of the survey:			
1996/1997	1990/1991	0.7 (-0.1-1.4)	0.070
2002/2003	1996/1997	-0.7 (-1.5-0.1)	0.080

*Abbreviations: ß – regression coefficient, CI – confidence interval.

Arterial hypertension prevalence

The estimates of global arterial hypertension prevalence in 1990/1991, 1996/1997, 2002/2003 were 37.9%, 43.3%, and 39.5%, respectively. The differences between these values were univariately statistically significant ($P = 0.009$). The prevalence of arterial hyperten-

Table 5. Estimated prevalence of arterial hypertension in adult residents of Ljubljana area, Slovenia, over a 12-year period*

	Estimated prevalence (%) of arterial hypertension			
Population group	1990/1991 (n = 1692)	1996/1997 (n = 1342)	2002/2003 (n = 1375)	*P*†
Sex:				
men	46.7	48.0	49.5	0.559
women	29.1	39.0	30.0	<0.001
Age group (y):				
25-29	11.0	19.2	16.0	0.155
30-39	20.6	27.8	18.9	0.016
40-49	31.8	33.3	39.1	0.100
50-59	57.0	60.4	52.7	0.114
60-64	66.1	65.0	64.7	0.949
Education level:				
uncompleted primary	54.2	67.9	71.4	0.140
primary	36.2	53.0	56.6	<0.001
vocational	42.3	51.3	48.1	0.078
secondary	36.4	41.9	35.5	0.064
college	34.7	34.6	33.9	0.990
university	29.2	32.4	27.2	0.451

*Arterial hypertension defined as systolic/diastolic pressure ≥140/90 mm Hg.
†χ^2 test.

sion in women and in 30-39 age group was the highest in 1996/1997 (Table 5). According to education level, the prevalence in 2002/2003 was significantly higher than in the previous measurements in respondents with completed elementary education, whereas no such differences were found for respondents in other groups (Table 5). After adjustments for the effects of sex, age, and education level using, the odds ratio for arterial hypertension significantly increased between 1990/1991 and 1996/1997, whereas no statistically significant change was detected between 1996/1997 and 2002/2003 (Table 6).

Table 6. Multiple logistic regression analysis of arterial hypertension in 4309 adult residents of Ljubljana area, Slovenia, over a 12-year period*

Risk factor			
observed category	reference category	OR (95% CI)	*P*
Sex:			
men	women	2.2 (2.0-2.6)	<0.001
Age group (y):			
30-39	25-29	1.6 (1.2-2.2)	0.002
40-49	30-39	1.8 (1.6-2.2)	<0.001
50-59	40-49	2.5 (2.1-3.0)	<0.001
60-64	50-59	1.4 (1.1-1.7)	0.003
Education level:			
primary	uncompleted primary	0.7 (0.5-1.0)	0.046
vocational	primary	0.9 (0.7-1.1)	0.214
secondary	vocational	0.9 (0.7-1.0)	0.130
college	secondary	0.9 (0.7-1.1)	0.199
university	college	0.7 (0.5-1.0)	0.024
Year of the survey:			
1996/1997	1990/1991	1.3 (1.1-1.5)	0.001
2002/2003	1996/1997	0.9 (0.7-1.0)	0.135

*Abbreviations: OR – odds ratio, CI – confidence interval; arterial hypertension defined as systolic/diastolic pressure ≥140/90 mm Hg.

Discussion

We found that the average values of blood pressure in Ljubljana area after being adjusted for effects of sex, age, and education level increased or remained stable in the first half of the 12-year study period, whereas they decreased in the second half. In general, the most important finding is the prominent decrease in average value of systolic blood pressure between 1996/1997 and 2002/2003. In the average value of diastolic blood pressure, no significant changes were found over the 12-year study period. The changes in arterial hypertension prevalence were characterized by its prominent increase between 1990/1991 and 1996/1997, whereas a minor decrease was registered between 1996/1997 and 2002/2003. This decrease, although not statistically significant, was still important in an epidemiologic sense since the trend reverted from an increasing to a decreasing one.

Arterial hypertension prevalence was much higher in men than in women in our study. In men, there was a slight but constant increase registered over time, while in women it increased over the first 6-year period, whereas in the second half of the study period it decreased almost to its initial value. These results may indicate that women in Slovenia were probably more susceptible to population-based interventions than men. Along with the results of other studies, which showed that men in Slovenia have in many respects very unhealthy behavior (21), it is obvious that they should be one of the priority target groups in preventive activities to reduce arterial hypertension prevalence. Furthermore, arterial hypertension prevalence was increasing with the age groups, as expected. In the first hald of the study period, arterial hypertension prevalence increased, and in the second part it decreased in all age groups, except for the 40-49 group where a constant increase was registered. This phenomenon could be explained to a certain extent by the highest prevalence of stress perception in this group, which could be predominantly attributable to the Slovene society transition effects being very strong in this age group (22). According to the education level, arterial hypertension prevalence was generally higher in participants with lower education level, with a constant increase being most prominent between 1990/1991 and 1996/1997. This could be explained either by poorer compliance with treatment in less educated groups or by their poor awareness of the disease. By the end of the study period, there was a considerable gap in arterial hypertension prevalence between the least and the most educated

groups. These low-education groups should also be a priority in preventive activities to reduce arterial hypertension level, since arterial hypertension prevalence decreases with increasing education level (23).

The results of our study for the second half of the observation period are comparable to the results of other similar studies performed in Finland (24) and Spain (25). The intervention Pomurje, a northeastern region of Slovenia, showed a decrease of about 5% in average systolic and diastolic blood pressure values only one year after the intervention onset (26). In that process, CINDI program played an important role.

The observed blood pressure dynamics in Slovenia between 1990/1991 and 1996/1997 should be interpreted within the context of a political and socioeconomic transition after the country had gained independence in 1991. Important changes in the lifestyle of the population that took place (27) at the time likely had significant implications on blood pressure and other cardiovascular risk factors (28,29). Unfortunately, during that period the population-based approach to control of cardiovascular risk factors was not among the priorities of Slovene public health. In the second half of the 1990s, Slovenia actively joined CINDI program and the 1996/1997-2002/2003 period was characterized by important achievements in healthy lifestyle promoted the CINDI movement. After the second CINDI survey, CINDI philosophy spread countrywide and required broader support and implementation, ie, on the national level. In response, Slovene National Forum on Cardiovascular Diseases Prevention, founded by the Slovene Society of Cardiology, was established in 1999 (14,15). This Forum brought together all important stakeholders in the field of cardiovascular diseases prevention in Slovenia, including health care workers, public health institutions, governmental representatives, and many relevant scientific, professional medical, and nongovernmental societies (14,15). At that time, a joint collaboration group, initiated by the CINDI Slovenia Preventive Unit, elaborated the project on national cardiovascular diseases and other noncommunicable diseases prevention program (15,16). The most important interventional arm of the project was health education of individuals at high risk for cardiovascular diseases, performed within the network of 61 Health Education Centers all over Slovenia, and coordinated by the CINDI Slovenia Preventive Unit. On the basis of this project, the Slovene Ministry of Health decided to support the implementation of the Nationwide Slovene Program on Primary Cardiovascular Diseases Prevention, which was launched in the fall of 2001 and legally introduced from the beginning of 2002 (15,16). The necessary financial resources were provided by the National Health Insurance Institute of Slovenia (15,16). The program included targeting population through various national policies and campaigns, such as governmental resolution on National Healthy Nutrition Policy, development of the National Strategy on Health Enhancing Physical Activity, and national campaign "Let's Live Healthy", and targeting individuals at high risk for cardiovascular diseases by screening the specific age groups of adult population for major cardiovascular risk factors and intervening in those at absolutely high risk by appropriate health education and other necessary measures, including pharmacological treatment (15).

In this project all practicing general practitioners participated in screening of the whole adult population of a certain age (men aged 35-65 and women aged 45-70). Its intermediate aims were to decrease the prevalence of cardiovascular risk factors, including arterial hypertension, in the population mainly by changes in lifestyle, and to improve early detection and treatment of cardiovascular risk factors (15,16). The favorable changes in the 1996/1997-2002/2003 period could be attributed to these systematic and integrated pri-

mary and secondary prevention activities implemented in this period (15,16).

CINDI Slovenia Preventive Unit group also worked on the activities for salt reduction in food industry and enhancement of healthy behaviors, such as healthy nutrition patterns and physical activity. It was also involved in the CINDI-EuroPharm-Forum project, which aimed at enhancing the role of the pharmacist in blood pressure management (4). We could justifiably claim that without CINDI movement, the gap in blood pressure values between various population groups could be even larger than it is.

The present study provided a clearer insight into short- and long-term activities (26) and research needed in Slovenia to intensify lifestyle changes (21) and stress reduction, especially at work-place (22). Nevertheless, trying to change the lifestyle of population groups at risk will not suffice and the highest priority should be establishing the sustainable supporting environments (23).

Our study has several limitations. The most important limitation was that blood pressure was not measured on both arms on at least three different occasions (3). However, the measurements were strictly standardized and unchanged in time. The second limitation was that participants who were taking antihypertensive drugs (3) could not be considered as having arterial hypertension, since the second survey did not control for antihypertensive medication use. The third limitation could be that contribution of CINDI program to hypertension control could not be clearly distinguished from other parallel activities targeted at cardiovascular diseases prevention in Slovenia, but as these activities were not numerous, it is possible that their influence was not strong. Finally, some considerable differences in our study samples, especially in education level, could be regarded as a limitation. These differences were unavoidable, since education level of Slovene population has been increasing (30). On the other hand, the differences in blood pressure over time were adjusted for the effect of education changes, as well as for differences in sex and age.

Our study also has some strong advantages, such as a rather high number of participants. Furthermore, all three surveys were methodologically the same regarding the blood pressure measurement, and they were performed by almost the same team of specially educated general practitioners, nurses, and interviewers. The study provides valuable descriptive information on blood pressure trend in Slovenia and points to possibilities of controlling arterial hypertension in countries with similar political and socioeconomic situation. This information could be useful to public health professionals and policy makers, as advantageous changes in blood pressure could be to a great extent attributed to the preventive activities, promoted and implemented countrywide through the CINDI program.

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