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Hypertension among Polish males during the economic transition

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Abstract

In the late 1980s and early 1990s Polish society experienced deep political, economic and social changes. The aim of the study is to investigate whether changes that occurred in Poland during the transformation significantly influenced the risk of hypertension among adult men. We find that irrespective of age, marital status, education, degree of urbanization, lifestyle variables (smoking, drinking alcohol, and physical activity), and BMI the risk of hypertension after 1989 was higher than before transformation (odds ratio = 1.45, $p < 0.001$). Psychosocial factors are proposed as factors which might at least partly explain the higher risk of hypertension during the first years of economic transition in Poland.
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1. Introduction

Hypertension is a common cardiovascular risk factor, implicated in 35% of all atherosclerotic cardiovascular events (Kannel, 1996), including 49% of all cases of heart failure (Levy et al., 1996). However, in most cases the etiology of hypertension is unknown (i.e. essential or primary arterial hypertension). Relationships between blood pressure and social factors and lifestyle are well-known, low levels of education, unmarried status, and risky behaviors (smoking, drinking alcohol) being independent predictors of hypertension (Jenei et al., 2002; Lipowicz and Łopuszańska, 2005). Futhermore, low occupational prestige, worry about job stability, social

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alienation, and depressive symptoms are known to increase the risk of hypertension, independently of demographic and behavioral risk factors (Levenstein et al., 2001).

In early 1989, deep political, economic, and social changes began in Central and East European countries. The process of the post-socialist transformation, from planned to free-market economy, started through so-called ''the shock therapy'' which lasted until 1993. While bringing some beneficial macroeconomic changes, the transition also brought many negative social consequences. For many households the most dramatic change was an increase in unemployment. Between 1989 and 1992, unemployment increased from less than 1% to 12% (Sachs, 1992; Pałaszewska-Reindl et al., 1992). In 1990, when inflation reached several hundred percent, employees earnings decreased. Increased unemployment, hyperinflation, and forced early retirement of people in the prime of their professional lives caused feelings of insecurity and decreased sense of safety and control over their lives (Watson, 2006).

The aim of the present study is to investigate whether the socio-economic and political transformations in Poland influenced significantly the risk of hypertension among adult men, after adjustment for demographic variables, lifestyle behaviors, and body mass.

2. Materials and methods

The data are part of a very large data set collected and archived by the Lower Silesian Centre for Preventive Medicine (DOLMED) in Wrocław[1] during the course of health screening surveys conducted since the early 1980s on the recommendation of employers (Pawłowski et al., 2000; Lipowicz et al., 2002; Szklarska and Jankowska, 2003). In these screening surveys all workers were investigated, because such medical examinations were demanded for their continued work. Data on males examined between 1983 and 1993 were selected from the archives of DOLMED. The sample consisted of 3870 men, 25–60 years of age, who were healthy (free from overt disease in the time of examination) and who were occupationally active inhabitants of cities and villages in south-western Poland.

As part of the DOLMED study, systolic (SBP) and diastolic (DBP) blood pressures were measured twice in the sitting position, on the left arm at heart level, after at least 5 min rest period. Measurements were done by registered nurses and were assessed automatically by an ''Avionics 1900'' apparatus. The two readings were averaged and were taken in accordance with specified procedures of DOLMED (Ruta et al., 1984).[2] Following the recommendations of the Sixth Report of the Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure (1997), arterial hypertension was diagnosed when SBP $\geq$ 140 mmHg and/or DBP $\geq$ 90 mmHg. To avoid confusion associated with case histories, men taking anti-hypertensive medication at the beginning of the selection from archives were excluded from the analyses. Height and weight were measured at clinical examination, and body mass index was calculated (BMI, weight/height^2).

The years of examination were divided into two periods: (1) from 1983 to 1988, called ''before transformation''; and (2) from 1989 to 1993, called ''after transformation''. Data were divided into four age groups: 25–30, 31–40, 41–50, and 51–60 years. Socioeconomic status and

[1] Dolnośląskie Centrum Diagnostyki Medycznej DOLMED S.A., ul. Legnicka 40, 53-674 Wrocław, Poland; www.dolmed.pl.

[2] Definition of systolic blood pressure and diastolic blood pressure have remained standard as the point at which the first Korotkoff sound was heard and which fifth Korotkoff sound disappeared, respectively.

lifestyle behavior variables were derived from questionnaires filled out by subjects during the medical examination. Based on the numbers of years in school, level of education was placed into one of two categories: (1) well-educated (12 or more years at school), and (2) poorly educated (less than 12 years at school). In Poland, well-educated men represent mainly professionals and non-manual workers whereas poorly educated men practice skilled and unskilled manual jobs. Two categories of marital status were analyzed: (1) currently married; and (2) unmarried (never, separated, divorced, and widowed), in two environments: (1) cities (with a population of more than 100,000); and (2) villages. Whereas inhabitants of cities represented all occupational strata, inhabitants of villages represented manly poorly educated wage-earners from National Collective Farms (i.e. animal keepers, tractor drivers, machinists, farm laborers). Individual farmers are missing from this dataset because they were not called for medical examination by DOLMED. Therefore, this is not a representative sample of the Polish adult male village population. More-or-less equal numbers were obtained for each age-marital-educational group and categories of demographic variables are not representative of the population at large.

Health behaviors used in analysis were: smoking, alcohol consumption and level of physical activity. Smoking status was recorded as (1) never smoker; (2) ex-smoker; and (3) current smoker. Alcohol consumption was categorized as: (1) non-drinker (including former drinkers); (2) moderate drinker (1–3 times a month); and (3) heavy drinker (1–3 times a week). Physical

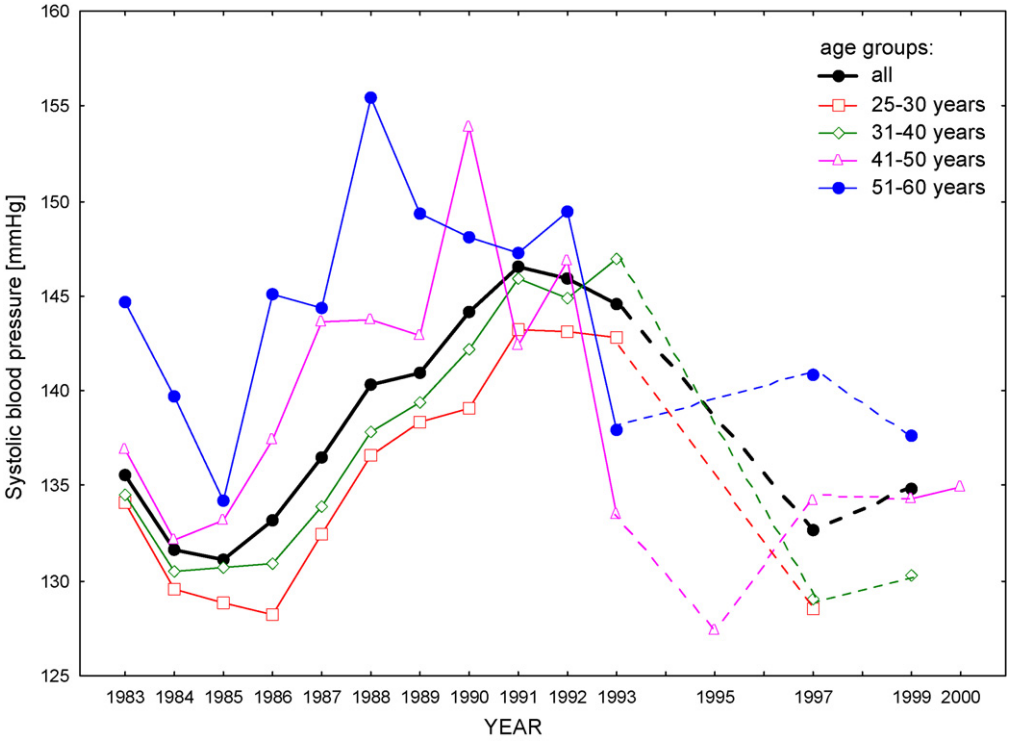

Fig. 1. The mean values of systolic blood pressure of Polish males by years in each age-group. Solid lines indicate complete data set collected annually and analyzed in the paper; dashed lines indicate data from archives of the Institute of Anthropology, Polish Academy of Sciences, Kuznicza 35, 50-951 Wroclaw, Poland. Mean values of systolic blood pressure for men surveyed in years 1995, 1997, 1999, and 2000 were not previously published and because of their incompleteness were not analyzed in this article.

activity was graded as: (1) regularly active (more than 4 h per week); (2) not regularly active (1–3 h per week); and (3) inactive. To test the differences between two proportions, a chi-square test was employed; p values below 0.05 were considered significant.

Generalized linear models with binomially distributed dependent variable were used to examine the influence of the transition on the risk of the arterial hypertension. Model 1 was fitted containing ''transformation'' and demographic confounders (age, marital status, education, and degree of urbanization). Model 2 was fitted containing also health behaviors and BMI. The regression coefficients of the variables and their standard errors were used to calculate odds ratios (ORs) with 95% confidence intervals (CI). The following reference categories were chosen: age group 25–30 years; well-educated; married; living in cities; never smoker; non-drinker; and regularly active. BMI was treated as a continuous variable. The significance of effect of each variable on health status was assessed by Wald's chi-square statistics. Differences between systolic and diastolic blood pressure before and after transformation in the same age-group were assessed by Bonferroni test. The STATISTICA 7.0 package was used for all analyses.

In addition to the data we analyze in detail in this paper for the period 1983–1993 we include blood pressure values for men surveyed in years 1995, 1997, 1999, and 2000 (Figs. 1 and 2). These data come from archives of the Institute of Anthropology, Polish Academy of Sciences in Wrocław but because they are incomplete (lack of socioeconomic and life-style variables) they

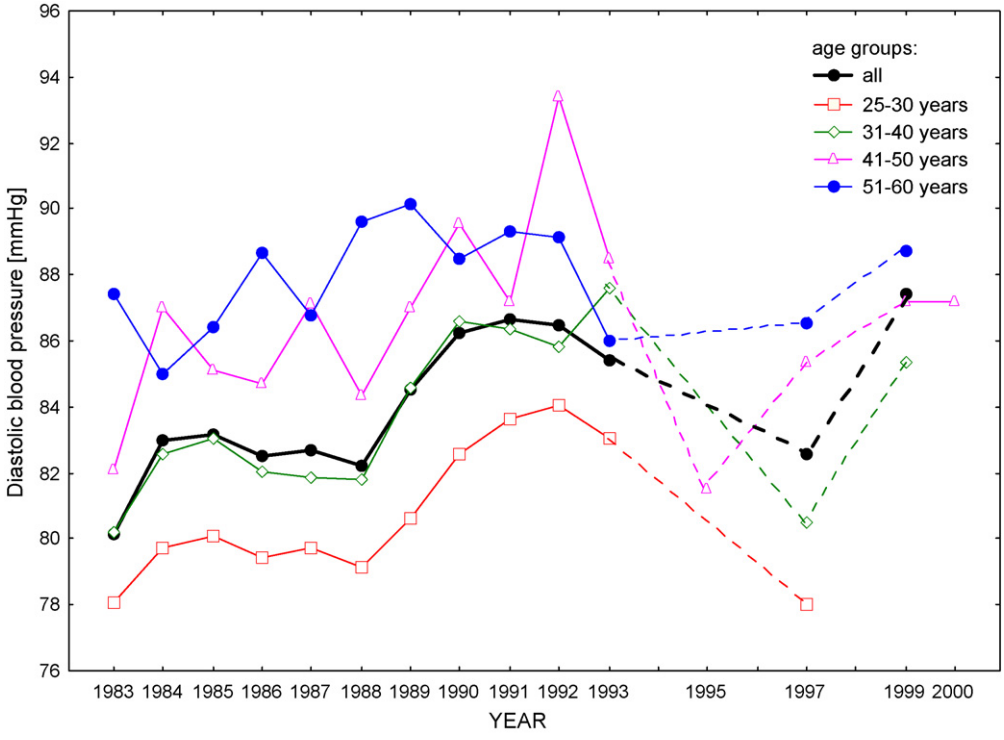

Fig. 2. The mean values of diastolic blood pressure of Polish males by years in each age-group. Solid line indicated complete data set collected annually and analyzed in the paper; dashed line indicated data from archives of the Institute of Anthropology, Polish Academy of Sciences, Kuznicza 35, 50-951 Wroclaw, Poland. Mean values of diastolic blood pressure for men surveyed in years 1995, 1997, 1999, and 2000 were not previously published and because of their incompleteness were not analyzed in this article.

were not analyzed. Nonetheless, they do indicate some tendency of the trends in blood pressure in Poland in the late 1990s.

3. Results

The distribution of background characteristics and lifestyle behaviours for the two periods are presented in Table 1. Individuals before and after transformation did not vary in smoking and drinking habits, whereas only difference that occurred in the lifestyle behaviours was in the level of physical activity, which increased after 1989. Table 2 lists the mean values of systolic and diastolic blood pressure and prevalence of hypertension in men before and after transformation by age-group. Systolic and diastolic blood pressure increased with age in both periods. The

Table 1
Background characteristics and lifestyle behaviours of adult men in the sample before and after transformation

	Before transformation	After transformation
N	2990	880
Age		
25–30	34.8	30.1**
31–40	34.2	41.9***
41–50	17.1	14.1*
51–60	13.9	13.9
Marital status		
Married	42.4	46.3*
Unmarried	57.6	53.7*
Education		
Well educated	40.7	36.5*
Poorly educated	59.3	63.5*
Urbanization		
Cities	61.7	58.3*
Villages	38.3	42.7*
Smoking		
Never smoker	23.1	22.9
Ex-smoker	13.7	15.8
Current smoker	63.2	61.3
Alcohol consumption		
Non-drinker	19.0	19.4
Moderate drinker	47.9	48.6
Heavy drinker	33.1	32.0
Physical activity		
Inactive	52.8	45.4***
Non-regularly active	11.8	16.9***
Regularly active	35.4	37.7
BMI		
–24.99	52.6	51.3
25.0–29.99	36.9	37.1
30.0–	10.5	11.6

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, level of significance for differences between categories before and after transformation. *Note*: Before transformation: 1983–1988, after transformation: 1989–1993.

Table 2
Systolic and diastolic blood pressure, and prevalence of hypertension in men before and after transformation by age-group

	Age-group							
	25–30		31–40		41–50		51–60	
	Before transformation	After transformation	Before transformation	After transformation	Before transformation	After transformation	Before transformation	After transformation
N	1036	271	1029	370	509	118	416	121
Systolic blood pressure[a]								
Mean (mmHg)	131.7	140.2***	133.3	142.3***	137.4	146.5**	142.4	149.0*
S.D. (mmHg)	14.5	15.3	16.0	15.9	21.5	20.1	23.0	22.2
% with systolic hypertension[b]								
x–139 mmHg	71.9	49.1***	66.0	43.0***	57.2	41.5**	47.8	35.5**
140–159 mmHg	22.6	38.4***	25.7	41.6***	26.7	33.1	25.7	34.7*
160–*x* mmHg	5.5	12.5***	8.3	15.4***	16.1	25.4*	26.5	29.8
Diastolic blood pressure[a]								
Mean (mmHg)	79.3	82.0**	81.9	85.7**	85.0	88.2	87.2	89.4
S.D. (mmHg)	8.5	9.6	9.5	10.1	11.5	11.2	11.7	10.5
% with diastolic hypertension[b]								
x–139 mmHg	84.6	77.9*	74.0	65.7**	63.3	56.8	54.3	56.2
140–159 mmHg	15.0	20.7*	24.8	32.2**	32.2	39.0	40.4	41.3
160–*x* mmHg	0.4	1.4	1.2	2.1	4.5	4.2	5.3	2.5
% with arterial hypertension (SBP $\geq$ 140 mmHg and/or DBP $\geq$ 90 mmHg)[b]								
Yes	33.6	53.5***	42.5	63.2***	51.7	64.4**	58.6	69.4*
No	66.4	46.5***	57.5	36.8***	48.3	35.6**	41.4	30.6*

Level of significance: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. *Note*: Before transformation: 1983–1988, after transformation: 1989–1993.

[a] Significances assessed by Bonferroni test for differences between systolic/diastolic blood pressure before and after transformation in the same age-group.

[b] Significances assessed by chi-square test for differences between frequencies of systolic/diastolic hypertension before and after transformation in the same age-group.

prevalence of arterial hypertension was significantly higher after transformation than before transformation in every age group.

Between 1983 and 1985, the mean values of systolic blood pressure declined in every age-group (Fig. 1). Thereafter systolic blood pressure increased from 131 to 146 mmHg circa 1991 and tended to decline. By the late 1990s mean systolic blood pressure was back to the level that prevailed in the mid-1990s. In contrast, diastolic blood pressure tended to remain constant until 1988 and then rose from 82 to 86 mmHg until 1991 and also declined slightly thereafter (Fig. 2). Diastolic blood pressure at the end of the 1990s was back at the level of the early 1990s. Thus

Table 3
Odds ratios (OR) and 95% confidence intervals (95% CI) of the probability of arterial hypertension among Polish males, aged 25–60 years (results of generalized linear models with binomially distribution)

	Model 1 Transformation + age		Model 2 Transformation + confounders		Model 3 Transformation + confounders + lifestyle + BMI	
	OR	±95% CI	OR	±95% CI	OR	±95% CI
Transformation						
Before 1989	1.00		1.00		1.00	
After 1989	1.45***	1.34–1.57	1.45***	1.33–1.57	1.45***	1.34–1.57
Age						
25–30 year	1.00		1.00		1.00	
31–40 year	0.88*	0.80–0.98	0.87*	0.78–0.97	0.87*	0.78–0.97
41–50 year	1.20**	1.05–1.37	1.20*	1.04–1.38	1.19*	1.03–1.36
51–60 year	1.57***	1.36–1.81	1.56***	1.34–1.82	1.59***	1.36–1.86
Marital status						
Married			1.00		1.00	
Unmarried			1.26***	1.17–1.36	1.24***	1.15–1.34
Education						
Well-educated			1.00		1.00	
Poorly educated			1.18***	1.10–1.27	1.20***	1.11–1.29
Urbanization						
Cities			1.00		1.00	
Villages			1.24***	1.15–1.33	1.23***	1.14–1.32
Lifestyle						
Smoking						
Never smoker					1.00	
Ex-smoker					0.96	0.84–1.09
Current smoker					0.90*	0.81–0.99
Drinking alcohol						
Non-drinker					1.00	
Moderate drinker					0.95	0.86–1.04
Heavy drinker					1.09	0.99–1.21
Physical activity						
Regularly					1.00	
Non-regularly					1.06	0.92–1.22
Inactive					1.05	0.95–1.16
BMI			1.14***	1.12–1.17	1.14***	1.12–1.16

*$p < 0.05$, ***$p < 0.001$, level of significance. *Note*: Arterial hypertension—SBP $\geq$ 140 mmHg and/or DBP $\geq$ 90 mmHg.

after transformation diastolic blood pressure increased by less than systolic blood pressure, but the increase turned out to be more permanent than that of systolic blood pressure.

In all three models the risk of hypertension after transformation was higher that before transformation (OR = 1.45, $p < 0.001$; Table 3). Unmarried men had a significantly higher risk of hypertension than married men (OR = 1.26, $p < 0.001$). Furthermore, age and educational level influenced the incidence of hypertension. After the age of 40 years, men had significantly higher risk of hypertension than younger men. Poorly educated men had a higher risk of hypertension than well-educated men (OR = 1.18, $p < 0.001$). Risk was also significantly higher for inhabitants of villages than for inhabitants of cities (OR = 1.24, $p < 0.001$). After adjustment for lifestyle variables and BMI (Model 3), the associations found in the initial model persisted.

4. Discussion

In late 1980s and early 1990s, Polish society experienced deep political changes which had economic and social consequences. The process of the post-socialist transformation, from a planned economy to one based on free-market principles was perceived by people as a time of chaos and instability. Hyperinflation, reducing state subsidies for manufacturers and consumers, and the threat of unemployment created negative perceptions, uncertainty for the future, anxiety, and difficulties in understanding and interpreting events among the citizens of Poland. This situation influenced not only the economy but also health status of adults (Ryglewicz et al., 1997; Kozieł et al., 2004; Tukiendorf, 2005). Similar changes in the general economic situation were responsible for the negative changes among children in Kazakhstan and produced sex differences in growth as a result of gender-discrimination in food allocation (Dangour et al., 2003).

There is an abundance of literature documenting the effects of psychosocial factors on health and mortality. Levenstein et al. (2001) showed that psychosocial stressors, especially job-related threats, increased 20-year risk of developing hypertension, particularly in men (OR = 1.5 for men worried about keeping their job). In the Framingham Study, anxiety was a factor which predicted the risk of hypertension over an 18–20-year period in middle-aged men, after adjustment for smoking and initial systolic blood pressure (Markovitz et al., 1993). Although behavioral risk factors and demographic variables accounted for much of the association between psychosocial factors and frequency of hypertension, the relationship between psychosocial factors and cardiovascular health status remained.

A strong association between socio-economic transformation in Poland and risk of hypertension is found in this sample. After 1989, adult Polish males had a higher risk of hypertension than before the economic transition. This effect remained even when demographic, socio-economic variables, behavioral risk factors and BMI were controlled for.[3] Systolic blood pressure was more sensitive to the socio-economic changes than diastolic blood pressure. Nonetheless, both increased between 1989 and 1991 by 3.5% and 2.5%, respectively, indicating the effect of increased socio-economic stress in the human biological system.

Psychobiological pathways might best explain the higher risk of hypertension during the first years of political transformation in Poland. There are various studies emphasizing the potential

[3] Individuals taking hypertension medication were excluded from the sample at the beginning of the selection from archives. Thus, this variable was not analyzed. During the MONICA study, the use of antihypertensive medication in Warsaw increased from 10.7% in 1984 to 12.7% in 1993 (Tunstall-Pedoe et al., 2006). If men taking medication would be included in the analysis, it could be expected that the increase in hypertension would have been greater.

role of stress as a cardiovascular risk factor (Stansfeld and Marmot, 2002; Rosmond, 2005). The allostasis theory attributes the pathogenesis of hypertension to prolonged adaptation to hyposatisfaction (Sterling, 2004). The socio-economic transformation was a source of stress and negative emotion for almost all the population of Poland. In an investigation of psychosocial and material factors and health in Nowa Huta (industrial district of Kraków, a city comparable to Wrocław), Watson (2006) found stress to be the most important factor. Psychosocial factors influence biological systems via the brain and neuroendocrine and immune systems. The persistent stimulation of the hypothalamic–pituitary–adrenal (HPA) axis and cortisol hypersecretion causes not only hypertension but also visceral obesity, insuline resistance, dyslipidemia, osteoporosis and depression (Bjorntorp, 1993; Chrousos and Gold, 1998).

The above interpretation illustrating the connection between change of blood pressure in the population and political and economic changes, explains also higher systolic blood pressure in the year 1983. Martial law in Poland, declared in December 1981 and formally lifted in July 1983, drastically restricted normal life and without doubt was a source of enormous stress, which influenced health status.

Stress may affect health not only through its biological effects, but also through changes in behaviours. Among lifestyle variables, in this data set only smoking habits significantly influenced health status of adult men, with surprising result that non-smokers had higher risk of hypertension as compared with current smokers. Such inverse relationship was also observed by other authors (Arkwright et al., 1982; Hazarika et al., 2000). Arkwright et al. (1982) suggested selective mortality among smoking hypertensive individuals, which would leave behind a population of smokers with lower-than-average blood pressures. Moreover, the alleviation of stress by smoking is another potential explanation of such an unexpected result. However, men examined before and during transformation did not differ in smoking and drinking habits, but the level of physical activity increased after 1989.

The great change of economic circumstances during the first years of transformation in Poland influenced health not only via the psyche. The diminution of full-time employment (in Lower Silesia, the frequency of part-time employees with lower income rose from 3.18% in 1980 to 8.0% in 1990, Statistical Yearbook of the Lower Silesia, 1981, 1991), hyperinflation, and a decline in real purchasing power occurred, which resulted on increase of poverty and economic disparities. The decrease of real household income caused a decrease of money spent on qualitatively better and healthier foods, recreation, and medical treatment. Families tended to substitute larger amounts of starch in place of fresh fruits, vegetables, and lean meat in the diet (Bakken et al., 1999). These findings are in line with studies concerning the impact of stress on diet. Willenbring et al. (1986) analyzed the eating habits of 80 men and women and found that almost all of them reported changes in eating habits with stress. Similarly, Olivier and Wardle (1999) asked students about perceived changes in intake of a number of specific foods or food categories and found that sweets and chocolate were reported to be eaten more under stress while fruit and vegetables, and meat and fish, were eaten less. Dietary habits and preferences may be modified not only because of cost or psychological factors, but also through extensive advertising by the food industry and food distributors. During the economic transformation, many fast-food outlets and restaurants were opened. While especially popular among adolescents, fast-food outlets were also regularly visited by adults because of their novelty in the post-communist era. Fast-food consumption is associated not only with higher fat and energy intakes, and low intakes of fruit, vegetables, and milk (French et al., 2000) but also with significantly higher intake of sodium and lower intake of potassium. Dietary sodium intake is one of the major dietary factors known to influence blood pressure. Excessive dietary sodium can result in fluid retention, and in

consequence may lead to hypertension (Geleijnse et al., 1994). Sodium and potassium working together in water homeostasis, have opposite effects on blood pressure. A 30–45 mmol (millimole) increase in daily potassium intake was accompanied by an average 2–3 mmHg reduction of systolic blood pressure in the INTERSALT Study (INTERSALT Cooperative Research Group, 1994). As potassium is found primarily in fresh fruit and vegetables, increased consumption of fast foods may lead to a decrease in potassium intake. In the United States, Paeratakul et al. (2003) found significantly higher daily sodium intake and significantly lower daily potassium intake in adults who reported eating fast food as compared with individuals who did not report eating fast food. The effects of such unbalanced diet could be responsible at least partly for increased risk of hypertension during the transition in Poland.

It is well known that migration is a significant factor of health status (Newbold and Danforth, 2003) and selective migration might be responsible for health differences. However, any possible effects of selective migration probably did not affect on this study. The official data of the Lower Silesia Statistical Office do not confirm any considerable waves of migration neither from the region, nor to the Lower Silesia during analyzed period.[4]

An increase of blood pressure in the late 1980s and early 1990s was followed by a decline and then flattening out during the second half of the decade. This pattern is reflected in mortality rates from coronary heart disease (CHD) observed in Poland after 1991 (Zatonski et al., 1998; Zatonski and Willet, 2005). In 2002, for the age group 45–64 years, mortality due to CHD fell by 38% in men and 42% in women as compared with 1990. The authors pointed to increases in the ratio of polyunsaturated fat to saturated fat in people's diet and fruit consumption (mainly imported fruit) as a major cause of the reduction in mortality rates.

The decrease of blood pressure after the first, ''nervous shock'' stage of the transformation was probably brought about by decreased levels of stress. Inflation gradually diminished to 15% in 1997. The unemployment rates after a rapid increase in 1990 reached 16% in 1993 but declined to 10% in 1997 (Labour Force Survey in Poland in the Years 1992–2001, 2002). Additionally, after a period of rapidly increasing unemployment, when many people in the community were without work, feelings of stress and stigmatization decreased (Martikainen and Valkonen, 1996).

Every post-communist country in Central and Eastern Europe experienced an increase of cardiovascular mortality during the first years of political, social and economic transition (Kalediene and Petrauskiene, 2004; Kopp and Rethelyi, 2004; Becker and Urzhumova, 2005; Petersen et al., 2005), but its pattern and rate varied by country (Fig. 3). The health status of the population in countries in which the rate of transformation was slower (i.e., Russia, Ukraine) seems to be much worse than in those countries with shorter periods of destabilization (Shkolnikov et al., 1998). The countries in which reform proceeded faster (especially reforms in health services), achieve lower mortality rates today than before transformation and approach patterns observed in western countries (Petersen et al., 2005). Studying the rapid changes in health patterns in societies undergoing transformation in socio-economic structures provides the possibility of understanding pathways of chronic disease prevalence and observing how such changes affect health status (Marmot and Bobak, 2000).

[4] Migration, significant for demographic processes, probably started after 1st May 2004, when labour markets in UE was opened for Polish citizens.

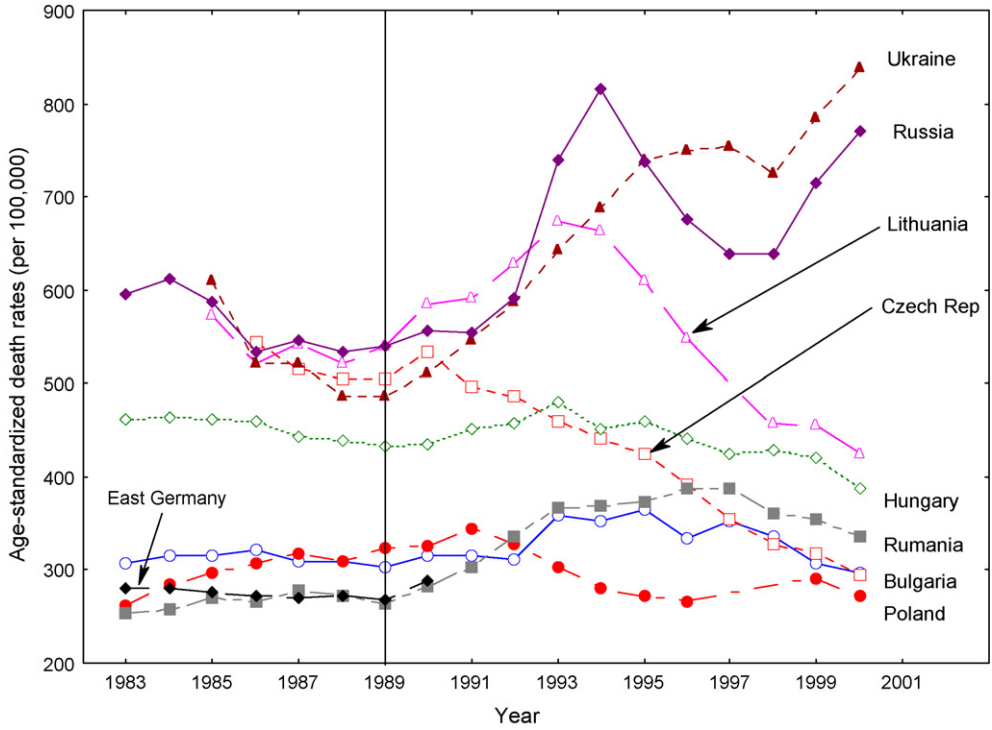

Fig. 3. Age-standardized death rates from Coronary Heart Disease for adult men aged 35–74 in several post-communist countries. *Source*: Petersen et al. (2005), p. 26.

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