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CARDIOVASCULAR DISEASE (CVD) RISK FACTORS IN KRAKÓW AND IN THE WHOLE POLAND ADULT POPULATION. RESULTS FROM THE WOBASZ STUDY AND POLISH ARM OF THE HAPIEE PROJECT

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ABSTRACT

In Kraków, the second largest town in Poland, cardiovascular disease (CVD) mortality rate is lower than in most top largest towns in Poland and lower than the rate for total Polish population.

AIM. The aim of the present analysis was to compare socioeconomic status (SES), prevalence of CVD risk factors and SCORE assessment of risk in Krakow with residents of other big towns in Poland and with general Polish population.

MATERIAL AND METHODS. We used data from the two large, population studies which used comparable methods for risk factors assessment: 1) Polish part of the HAPIEE Project in which 10 615 residents of Krakow at age between 45–69 years were examined, and (2) The WOBASZ Study which contributed with a sub-sample 6 888 of residents of Poland at corresponding age group. WOBASZ sample included 992 residents of big towns other than Krakow. Age-standardized proportions of persons with CVD risk factors were compared between Krakow and the other big towns in Poland and between Krakow and the whole Poland using χ^2 test.

RESULTS. The striking observation was that in Krakow proportions of participants with university education were substantially higher than average for the other big towns and the whole Poland. Also, the proportion of occupationally active men and women was the highest in Krakow. In both sexes, prevalence of smoking, hypercholesterolemia and hypertension in Krakow was similar to the other big towns but the prevalence of hypercholesterolemia and hypertension (in men only) was lower than average for Poland. The distribution by SCORE risk categories were similar in all three samples studied. In general, the distribution by BMI categories was less favourable but the prevalence of central obesity was lower among residents of Kraków than among residents of the other big towns and citizens of the whole Poland. Prevalence of diabetes was higher in Krakow than in the other samples studied.

The differences between population of Krakow and population of other parts of Poland in the exposure to the main risk factors were found diverse and not big enough to be followed by differences in the distribution by the categories of SCORE risk assessment.

The study suggested the importance of obesity and diabetes which are not used for the SCORE risk assessment and especially the importance of psychosocial and economic factors which may influence CVD risk and contribute more to the explanation of the regional differences in CVD mortality.

Key words: *cardiovascular disease, risk factors, regional differences, mortality*

INTRODUCTION

Analysis of the mortality from the diseases of circulatory system in residents of the 11 big Polish towns demonstrated that there is a large variety of the distribution of the specific underlined causes of deaths. Compared to other towns, in Kraków (second largest town in Poland) age-standardised death rates from ischaemic heart disease (IHD) (ICD codes: I20-I25) in 2007-2009 were much higher than Polish average. In contrast, death rates from acute myocardial infarction (AMI) (ICD code: I21) and cerebrovascular disease (ICD codes: I60-I69) were much lower than average. However, in Krakow proportion of deaths with atherosclerosis specified as an underlined cause of death (ICD code: I70) was one of the highest (1). It is obvious that variation in the distribution of the diagnoses given as underlined causes of deaths could be explained by the territorial differences in diagnostic habits related to methodology of coding death causes (2). However, it is unlikely that the latter argument could explain the differences in the rates from all diseases of circulatory system (ICD codes: I00-I99) which varied from 247/100.000 to 358/100.000 in 11 big towns in Poland (1).

It is well known that in Poland, compared to urban areas, CVD mortality rates are higher in rural areas by 20% (3). Results from retrospective analysis of data collected in Podlaskie voivodeship showed that rural residents were at higher risk of ten-year fatal CVD than urban residents (4). Cardiovascular disease (CVD) is the main cause of deaths among all diseases of circulatory system. In a consequence the differences in death rates from circulatory system in big towns of Poland might be related to the differences in the prevalence of CVD risk factors and the consequent risk of developing CVD. However, no confirming evidence is available.

There were two large, population-based studies which measured CVD risk factors in adults, carried out in the same time in Poland (years 2003-2005). The WOBASZ Study was conducted in general Polish population. The HAPIEE Project involved population of Krakow. The combined analysis of data collected may demonstrate the possible effect of the existing differences in the exposure to the known risk factors on the differences in mortality due to CVD.

The aim of the present analysis was to compare socioeconomic status (SES), prevalence of CVD risk factors and SCORE assessment of CVD risk among residents of Krakow with residents of other big towns in Poland and with general Polish population.

MATERIAL AND METHODS

Data from two studies were used: Polish part of the HAPIEE (*Health, Alcohol and Psychosocial Factors In Eastern Europe*) Study and WOBASZ Study (a multicenter nationwide study of the Polish population's health). The methods used in these studies have been described in details elsewhere (5-8). Brief information relevant to the present analysis is given below.

Polish part of the HAPIEE Project involved a representative sample of residents of Krakow at age between 45–69 years. Analysis of the WOBASZ data was done for the whole sub-sample at age 45-69 (age span corresponding to HAPIEE project) and separately for a sub-sample of residents of the big towns excluding Kraków. Big town was defined as a capital of a voivodeship or a town with 130 000 residents at least according to Statistical Yearbook of the Republic of Poland for the year 2003 (thirty biggest towns in Poland).

Participants were interviewed using standard questionnaires. Following to the interview blood pressure, height, weight, waist and hip circumference were measured and blood samples for measurement of blood lipids and glucose concentrations were taken.

Marital status was classified into the following four categories as single, married, divorced/ separated and widowed. Participants of the HAPIEE Project who declared living with partner were classified as married. The answer "living with a partner" was not included in the WOBASZ questionnaire. Education level was classified into three categories: less than secondary, secondary and university education. In the WOBASZ Study participants who declared to have incomplete secondary or incomplete university education were categorized as less then secondary and secondary, respectively. Perceived health was stratified into three categories of good (included very good and good perceived health), average and poor (included poor and very poor). The answer "very poor" was not included in the WOBASZ questionnaire. Employed persons, entrepreneurs and farmers were classified as occupationally active participants. Pensioners, housewives and unemployed participants were categorized as occupationally inactive persons. Smoking categories included current smokers (regular and occasional smokers), former and never smokers. Weight and height were measured in vertical position in participants without outer garments and shoes using scales with built in vertical ruler. Participants were classified as having normal weight if their BMI (Body Mass Index, calculated as weight/[height]^2) was <25.0, overweight if their BMI was 25.0-29.9 and obese if their BMI was ≥30.0. Central obesity was defined as waist circumference >94 cm in men and >80 cm in women.

Blood pressure was measured in participants after 5 minutes of rest at least, in sitting position, on the right arm, using automatic sphygmomanometers (Omron M5-I). Measurement was done 3 times with 2-minutes intervals, the average of the second and the third measurement was used in the analysis. Hypertension was defined as blood pressure ≥140/90mmHg or taking blood pressure lowering medication within last 2 weeks prior to the examination (6, 9). Blood was collected from participants fasting for 12 hours, from cubital vein, with a limited use of the tourniquet. HAPIEE samples were analysed no later than 4 hours after collection of blood in the laboratory of Dept of Biochemical Diagnostics, Jagiellonian University Medical College, using automated, enzymatic methods. In WOBASZ blood lipids and glucose were determined in frozen (-20°C) plasma samples, which were separated by centrifugation in 30-60 minutes after blood collection (8). The analyses were carried out in one central laboratory (National Institute of Cardiology in Warsaw) using automated, enzymatic methods. Both labs participated in the external quality control program for cholesterol and triglycerides measurements carried out by the laboratory of the Center for Disease Control in Atlanta (USA). Concentration of LDL-cholesterol (LDL-C) was calculated using the formula by Friedewald (10). Hypercholesterolemia was defined as total cholesterol ≥5.0 mmol/l or LDL-cholesterol ≥3.0 mmol/l or lipid lowering medication within last 2 weeks prior to the examination. Diabetes was defined as glucose level ≥7.0 mmol/l and/or participant had diabetes diagnosed

Table I. Distribution of SES characteristics, perceived health, prevalence of CVD risk factors and distribution by SCORE risk categories by sample studied in men

	Kraków (Project HAPIEE)		Whole Poland (WOBASZ Study)			Big towns[a] (WOBASZ Study)		
Variable	n	% (age adjusted)	n	% (age adjusted)	p[b]	n	% (age adjusted)	p[c]
Marital status								
Single	210	4.5	194	6.1		16	3.3	
Married	4455	86.6	2861	86.7	<0.001	428	89.0	0.407
Divorced/ Separated	291	5.8	140	4.3		22	4.6	
Widowed	193	3.1	99	2.9		15	3.1	
Education								
Less than secondary	1911	36.8	2163	65.6		214	44.5	
Secondary	1691	33.0	816	24.7	<0.001	195	40.4	<0.001
University	1557	30.2	318	9.7		72	15.1	
Perceived health								
Good	2075	44.3	1835	56.6		303	64.1	
Average	2366	43.1	1184	35.2	<0.001	145	29.1	<0.001
Poor	715	12.6	278	8.2		34	6.8	
Occupationally active	2127	50.6	1284	40.8	<0.001	232	50.0	0.791
Smoking status								
Current	1862	39.2	1352	41.6		185	38.8	
Former	1850	33.8	1132	33.8	0.026	179	37.0	0.261
Never	1435	27.0	815	24.6		118	24.2	
BMI								
Normal	1003	23.8	983	30.4		137	28.8	
Overweight	2223	49.3	1387	42.4	<0.001	231	47.9	0.035
Obese	1217	26.9	894	27.2		114	23.3	
Central obesity	2698	59.7	2037	61.8	0.069	309	63.8	0.080
Hypertension	3573	66.1	2063	61.9	<0.001	333	68.8	0.246
Hypercholesterolemia (TC≥5 mmol/l or LDL≥3 mmol/l or lipid lowering medication)	3860	84.4	2589	80.1	<0.001	398	82.6	0.306
TC≥5 mmol/l	3368	76.1	2300	71.4	<0.001	359	74.7	0.495
LDL-C ≥3 mmol/l	3261	75.2	2164	67.9	<0.001	343	73.2	0.342
Diabetes	690	13.9	377	11.4	0.001	52	10.4	0.030
SCORE								
<1%	1410	44.4	1304	43.1		199	44.3	
1-5%	1774	35.4	1185	35.5	0.355	172	34.2	0.773
>5%	1239	20.2	737	21.4		110	21.5	

[a] Kraków residents excluded
[b] p-value for comparison of Krakow vs. whole Poland
[c] p-value for comparison of Krakow vs. big towns
TC = Total Cholesterol, LDL-C = LDL-cholesterol, BMI = Body Mass Index

by the doctor in the past. Ten-year risk of fatal CVD was calculated for each participant using the SCORE (Systematic Coronary Risk Evaluation) algorithm that included age, sex, smoking status, systolic blood pressure and concentration of total cholesterol, according to Conroy R.M. et al. (11). The risk was subcategorized as low (<1%), average (1-<5%) and high (≥5%). Women were asked if they still had periods and those who answered negatively were asked additional question about cause of menopause (natural or surgical).

The WOBASZ study was approved by the Ethics Committee at National Institute of Cardiology in Warsaw and the HAPIEE Project was approved the ethics committee at University College London, United Kingdom and by the Ethics Committee at Jagiellonian University Medical College, Krakow, Poland. All participants gave written informed consent.

Statistical analysis was done separately for men and women. Calculated percentages were adjusted according to age. For the adjustment, age distribution of the general Polish population in 2003 (standard population) was used. The method applied was described by Kalton G. and Flores-Cervantes I. (12). The differences between Krakow sample and whole Poland sample and between Krakow sample and sample from the other big towns were tested using χ^2 test. Statistical significance was accepted at $p<0.05$. Results were presented as numbers of participants observed in each category and age-adjusted percentage. All calculations were done using SPSS Software, IBM, Armonk, NY.

RESULTS

The final study sample included 17 503 participants, 6 888 (39.4%) from the WOBASZ Study (the whole Poland sample) and 10 615 (60.6%) from the HAPIEE Project (Krakow sample). In WOBASZ sample, there were 992 residents of big towns (excluding Krakow). There was no difference in proportion of men and women and in age distribution in the samples studied.

Distribution of SES characteristics, perceived health, prevalence of CVD risk factors and distribution by SCORE risk categories in men is presented in Table I. There were slightly more single men in the whole Poland sample than in Krakow sample (6.1% vs. 4.5%), and more divorced men in Krakow than in the whole Poland (5.8% vs. 4.3%). Men in Krakow had similar distribution of marital status compared to men in other big towns. One-third of men from Krakow had university education, while in Poland and big towns proportion of university education was much lower (9.7% and 15.1%, respectively). Compared to Krakow (44.3%), more men from the whole Poland sample and more men from big towns sample reported their perceived health as good (56.6% and 64.1%, respectively). Men from Krakow were more frequently occupationally active than participants from the whole Poland (50.6% vs. 40.8%), but occupational activity in men in Krakow was similar to the other big towns. Men in Krakow smoked less frequently than men in the whole Poland (39.2% vs. 41.6%), but the proportion of smokers was similar to men in other big towns. There were more overweight participants in Krakow than in the whole Poland (49.3% vs. 42.4%) and more obese participants in Krakow than in the other big towns (26.9% vs. 23.3%). Hypertension and hypercholesterolemia were more frequent in men from Krakow than in men from the whole Poland but when compared with men in the other big towns, the prevalence was similar. Diabetes was more frequent in men from Krakow (13.9%) than in the whole Poland as well as in men from the other big towns (11.4% and 10.4%, respectively). The differences in the distribution by SCORE risk categories between the samples studied were not significant.

Distribution of SES characteristics, perceived health, prevalence of CVD risk factors and distribution by SCORE risk categories in women are presented in Table II. There were more married women in the whole Poland sample than in Krakow sample (73.7% vs. 67.7%), while more single and divorced women in Krakow than in the whole Poland (7.3% vs. 4.3% and 9.7% vs. 5.3%, respectively). There was no significant difference in distribution by the categories of marital status between women from Krakow and women from big towns. More women in Krakow (27.7%) than in the whole Poland and big towns sample had university level of education (9.1% and 16.5%, respectively). Fewer women from Krakow (34.2%) had good perceived health compared to women from the whole Poland and from the other big towns. (50.2% and 56.1%, respectively). Women from Krakow were more occupationally active than women from the whole Poland (39.4% vs. 30.1%), but proportion of occupationally active women in Krakow was similar to the other big towns. Women in Krakow smoked more often than women in the whole Poland (30.5% vs. 24.9%), but similar to women in the other big towns. Women from Krakow were more frequently obese than women from the other towns (32.5% vs. 26.8%). Prevalence of overweight (including obesity) was higher in Krakow than in the other big towns but the distribution by BMI category in Krakow was similar to the whole Poland sample. Central obesity was the least frequent in women who lived in Krakow (67.9%) compared to women from the whole Poland and from the other big towns (77.7% and 74.7%, respectively). There were no significant differences in the prevalence of hypertension between the samples studied. Prevalence of hypercholesterolemia was higher in women from Krakow than in women from the whole Poland sample (86.5% vs. 82.7%) but

Table II. Distribution of SES characteristics, perceived health, prevalence of CVD risk factors and distribution by SCORE risk categories by sample studied in women

	Kraków (Project HAPIEE)		Whole Poland (WOBASZ Study)			Big towns[a] (WOBASZ Study)		
Variable	n	% (age adjusted)	n	% (age adjusted)	p[b]	n	% (age adjusted)	p[c]
Marital status								
Single	382	7.3	154	4.3		32	6.3	
Married	3618	67.7	2652	73.7	<0.001	362	70.6	0.167
Divorced/ Separated	507	9.7	195	5.3		36	7.0	
Widowed	925	15.3	586	16.7		80	16.1	
Education								
Less than secondary	1559	27.8	2002	56.1		168	33.3	
Secondary	2405	44.5	1258	34.8	<0.001	256	50.2	<0.001
University	1473	27.7	327	9.1		85	16.5	
Perceived health								
Good	1730	34.2	1808	50.2		287	56.1	
Average	2840	50.7	1471	41.1	<0.001	189	37.2	<0.001
Poor	862	15.1	308	8.7		34	6.7	
Occupationally active	1823	39.4	1080	30.1	<0.001	195	38.1	0.572
Smoking status								
Current	1552	30.5	903	24.9		149	29.0	
Former	1129	20.7	639	17.6	<0.001	115	22.6	0.583
Never	2748	48.8	2048	57.5		246	48.4	
BMI								
Normal	1328	30.0	1057	29.9		171	34.2	
Overweight	1770	37.5	1306	36.7	0.659	196	39.0	0.024
Obese	1608	32.5	1189	33.4		135	26.8	
Central obesity	3269	67.9	2769	77.7	<0.001	377	74.7	0.002
Hypertension	3370	59.4	2170	60.5	0.354	298	58.3	0.609
Hypercholesterolemia (TC≥5 mmol/l or LDL≥3 mmol/l or lipid lowering medication)	4235	86.5	2917	82.7	<0.001	448	87.4	0.546
TC≥5 mmol/l	3865	80.8	2270	77.2	<0.001	410	81.8	0.578
LDL-C ≥3 mmol/l	3558	74.9	2550	71.7	0.001	383	76.3	0.484
Diabetes	528	10.2	313	9.0	0.076	42	8.6	0.256
SCORE								
<1%	3688	82.1	2845	80		398	78.6	
1-5%	823	14.8	548	16.4	0.062	81	17.0	0.107
>5%	170	3.1	116	3.6		20	4.4	
Periods (regularly or irregularly)	1342	31.8	1040	29.7	0.035	173	34.7	0.185
Natural menopause	3328	80.5	2115	88.8	<0.001	268	85.5	0.030

[a] Kraków residents excluded
[b] p-value for comparison of Krakow vs. whole Poland
[c] p-value for comparison of Krakow vs. big towns
TC = Total Cholesterol, LDL-C = LDL-cholesterol, BMI = Body Mass Index

similar to women from the other big towns. Similar to men the differences in the distribution by SCORE risk categories between the samples studied were not significant in women. Women in Krakow (80.5%) less frequently reported natural cause of menopause compared to women from the whole Poland as well as those from big towns (88.8% and 85.5%, respectively).

DISCUSSION

Compared to residents of the whole Poland and to residents of the other big towns, residents from Krakow had better socioeconomic characteristics (higher education and were more frequently occupationally active) but reported worse perceived health. Krakow sample did not differ from sample from the other big towns in Poland in respect to classical risk factors which contribute to the SCORE assessment of risk. Hypercholesterolemia and hypertension (only in men) were more frequent in Krakow than in the whole Poland sample. However, these differences were not strong enough to be reflected in the differences in the distribution by SCORE risk category, which was similar in all three samples studied. In men, the differences found between the frequency of overweight and obesity (according to BMI) between the

Krakow sample and the other samples studied were not found according to central obesity, but were reflected in higher prevalence of diabetes among residents of Krakow in comparison to residents of other big cities and residents of the whole Poland. In women, overweight and obesity (according to BMI) were more frequent in the Krakow sample in comparison with residents of the other big cities, while central obesity was less frequent in residents of Krakow in comparison to sample of the other big cities, what was not reflected in differences in frequency of diabetes. Results of such comparison are not consistent with findings of other authors, which suggested advantage of parameters of central obesity over measurement of BMI (13-14), but our results are similar to outcomes found in other studies (15-16).

Such differences might be reflected in higher CVD death rates in Krakow. However, according to the data from 2010 (last available) Krakow had relatively low crude mortality rate from the diseases of circulatory system (442/100.000) compared with general Polish population (461/100.000) (17). The rates were also higher in Warsaw (459/100.000), Wroclaw (472/100.000), Katowice (540/100.000) and in Łódź (565/100.000) (17-20).

Differences between Krakow and the whole Polish population could largely be explained by the differences between urban and rural population. In 2010 CVD death rates in urban areas in Poland were 430/100,000 and in rural areas 495/100,000 and the difference existed also between age standardized rates (3). Partly, the latter difference may be explained by high prevalence of CVD risk factors in rural respondents which was confirmed in Polish study (4). In the foreign studies, self-reported data collected from American men indicated that men living in rural areas were nearly twice as likely to report having two or more CVD risk factors than urban men (21). Rural residents had higher values of systolic and diastolic blood pressure, higher levels of LDL-cholesterol, triglycerides and fasting blood glucose, as well as higher values of BMI and Waist to Hip Ratio (WHR) than urban respondents (22). Compared to urban women, those from rural areas were more likely to be overweight or obese (23). Moreover, patients with CVD who were residents of rural areas had worse access to CVD treatments, such as aspirin, antiplatelets, beta-blockers, calcium channel blockers, diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers and statins (24).

There is strong evidence that high SES is related to the lower CVD risk. It is likely that more favourable social structure could contribute to better health of Cracovians. Surprisingly perceived health, which was found to be related negatively to CVD mortality (25-26), was lower in Krakow compared to other big towns and to the whole Poland. This suggests that a relation between psycho-socio-economic factors and CVD mortality is more complex.

The strength of our analysis is that the data used were collected in the large, population studies which used standardized research methods and CVD risk factors were defined on the same way according to the European Guidelines on Cardiovascular Disease Prevention in Clinical Practice (27). However, there are some limitations in the interpretation of the results presented. First, although both studies aimed to study a representative sample of the study populations, the final participation rate could bias results. In the HAPIEE Project participation rate was 61% (5). In the WOBASZ Study participation rates differed by sex and by region but in general they were slightly higher (from 64% in men from big towns to 87% in women from small communities) (8). The rates below 70% seem to be low, but they were relatively high when compared with other epidemiological studies including the other arms of the HAPIEE Project (5, 28). Usually respondents of a study have better health and socioeconomic conditions of living than those who did not agree to participate (29). Also, it was demonstrated that in the Polish part of the HAPIEE Project respondents had lower risk of death than non-respondents (30). Second, although the same or similar methods were used in both studies, there is some concern about the comparability of data, in particular on blood lipids (31). It is unlikely that there was a larger bias due to the differences in laboratory methods as the participating laboratories were covered by the same external quality control programs. However, the differences in the pre-laboratory procedures, including deep freezing of samples in WOBASZ Study, might be a source of the small bias. Also, there were few discrepancies in wording used in questionnaires and in some cases answers obtained had to be combined to ensure data comparability. The latter procedure probably did not influence the results presented but limited the information available.

CONCLUSIONS

Our results suggest that Krakow differs from the other big towns in Poland and from the whole Poland mainly in social structure. Differences in perceived health may indicate also a different psychological environment. The differences in the exposure to the main risk factors were found diverse and not big enough to be followed by differences in the distribution by categories of SCORE risk assessment which appeared to be similar in Kraków, as in the other Polish big towns and as in the whole Poland. We believe that our study emphasizedsuggested the importance of the risk factors which are not used by the SCORE risk assessment

i.e. obesity, diabetes and especially psychosocial and economic factors which may influence CVD risk and contribute more to the explanation of the regional differences in CVD mortality.

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