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Detrimental effects of early rural life on blood pressure among urban male migrants in Wrocław, Poland

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Abstract: The purpose of the study was to compare the blood pressure of rural–to–urban migrants and the sedentary population (non–migratory) of the city of Wrocław, Poland. Additionally, the effect of time spent in the rural area on blood pressure was also assessed. The study sample consisted of 2753 males aged 25–75 years, following a medical examination, underwent an interview and anthropometric measurements between 1989–90. Based on the place of origin all males were divided into rural–to–urban migrant inhabitants of Wrocław (N=1222) and sedentary inhabitants of Wrocław (N=921). The percentage of time spent in the rural area [(time spent in rural area/age)*100] was then calculated and was used in analysis. In each age category, the rural–urban migrants were found to be shorter in height. Age, BMI, level of education and time of migration had a significant effect on both the systolic and diastolic blood pressure irrespective of the level of education. It was demonstrated that the time of migration, allowing for age, body size and education level, significantly correlated with blood pressure. The later in time, the males migrated from rural to urban areas, the higher their blood pressure. It was hypothesized that unhealthy behavior could still have continued in a new urban environment, resulting in migrant – sedentary differences in health parameters.

Key words: rural-to-urban migration, blood pressure, BMI, hypertension

Rural to urban migration is among the most common type of migration (Smith 1984; Bogin 1988), especially among developing countries. For example, the weighted average of annual growth rate of urban populations in OECD countries between 1980 and 1991 was 0.8%, while in low and middle-income countries it was 6.3%. In Western European Countries and in Poland the migration rate is relatively low (Domański 2004). One of the reasons for this in Poland is the relatively low rate of new housing development. However, recently human mobility in Poland has started to increase. The rapid transformation of the socio-economic system, initiated at the turn of the 1980s and 1990s, has caused dramatic changes in the social structure in Poland, with massive short-distance migration, mainly from rural areas to nearby big cities. From an economic point of view,

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such mobility is advantageous for the reduction of unemployment, and further development of industrialized regions (Szklarska et al. 2008; Olszewska and Łaska-Mierzejewska 2008). The census from 2002 indicated that 27% of internal migration between 1989 and 2002 involved movement from rural to urban areas. The main motives for spatial mobility are familial, with improvement of housing conditions being the primary one, with jobs and education being of slightly lesser importance (CSO 2002).

Many studies have reported relationships between health and migration, which are modified by age and migration distance (Lewis 2003). Using census data, Bentham (1988) showed changes in correlations between health status and migration independently of age, stage of life, migration distance and reasons for migration. He pointed to the selectiveness of migration and distinguished the following categories of migration: 1) movement of sick people away from areas with health hazards; 2) transit of sick people in order to be better placed to receive care; and 3) movement for housing or job opportunities (Lewis 2003). Thus, depending on the reason for the migration, migrants can be more or less healthy than their non-migrant counterparts. The relationship between migration and poor health status is clearly visible in the case of mental illness. There is data available on the interaction between mental health and migration in contemporary societies (Moorin et al. 2006; DeVerteuil et al. 2007). For example, individuals with schizophrenia are more likely to move from the suburbs to the inner city areas, and less frequently migrate in the opposite direction (DeVerteuil et al. 2007). In Western Australia, subjects with mental disorders have an increased rate of migration from rural to urban area (Moorin et al. 2006).

In Poland, migration takes place mainly from rural to urban areas, and therefore from the most deprived environments to better ones. Rural areas are poor, with limited access to health services and undeveloped public transport (Gorlach 2000). People are on average less-well educated with low hygiene standards and poorer living conditions (Cianciara 2001). Rural dwellers also experience poorer health than people in urban areas (Lipowicz 2009) and have shorter life expectancies (Kołodziej 2008).

In light of these differences in health status, and in view of the long-lasting effects of early life environments on health status in later life (Lipowicz et al. 2007), it is useful to examine the effect of early rural life on the blood pressure of migrants from rural to urban areas. The aim of the present study is to compare the blood pressure measurements of rural to urban migrant males in Wroclaw, Poland with city-dwellers males there, and evaluate the effect of the length of time having lived in the rural areas on blood pressure, after migration.

Materials and methods

In 1989–90, the Lower Silesian Medical Centre (presently the Silesian Centre for Preventive Medicine) "DOLMED", with the involvement of the Institute of Anthropology of the Polish Academy of Sciences, took part in this study. All of the subjects were inhabitants of the city of Wrocław. They represented two social groups of men, professionals with a university or, to a lesser extent, college education, and on the other hand skilled workers with vocational and elementary education (the vocational school in Po-

land is 2 or 3 years beyond elementary schooling in a specific trade, such as those of a car mechanic, locksmith, turner, or cook). Education was scored in two categories, university + college education, and vocational + elementary education. This allowed a distinction between those two social groups to be made; in further analysis this factor is named "education".

Height was measured in the standing position, without shoes, with a stadiometer to the nearest 0.5 cm. Weight was measured with a digital scale to the nearest 0.5 kg. These measurements were carried out by trained staff of the Institute of Anthropology PAN. BMI was calculated using height and weight (kg/m^2). Systolic and diastolic blood pressure (SBP, DBP) were measured in the sitting position after a minimum of 5 minutes' rest, using an MPC-350 apparatus (mm Hg). This is the standard monitoring procedure in this clinic. The cuff size was 12 × 22 cm. 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 the measurements were as follows, SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg.

At the time of doing the assessment, all subjects were interviewed in order to determine their socio-economic status. The males were asked about their exact age when they came and settled in Wrocław, and the administrative status of their place of origin. Of the migrants, 70.6% of them originated in rural areas. Migrants from non-rural areas and subjects with incomplete information were excluded from this study, leaving 2042 subjects in the analysis. Based on the place of origin, all males were divided into rural-urban migrants who were present inhabitants of Wrocław (N=1222) and sedentary inhabitants of Wrocław (N=921), henceforth referred to as migrants and the city dwellers population. Additionally, based on the age of migration, the time spent in a rural area and the time spent living in Wroclaw were calculated. Interestingly, the latter highly correlated with chronological age ($r=0.72$; $p<0.001$), whereas the time spent in the rural area was independent of age ($r=0.004$; $p>0.05$). The percentage of time spent in the rural area [(time spent in rural area/age)*100] was then calculated and used in analysis; henceforth, the time it takes to go from one place to another was called "migration time". This avoided high interrelations between independent variables in the analysis. The migration time was divided into three categories, namely short, medium and long, based on tertiles.

A two-way analysis of variance was applied to test the effect of rural to urban migration (migrants versus sedentary population) on blood pressure, height and BMI, controlling for age. Pearson chi-square was used to test for differences in education level achieved by migrants and the sedentary population.

The Generalised Linear Model (GLM) was used to test the relationship between systolic (SBP) and diastolic (DBP) blood pressure, separately, as dependent variables. A set of independent variables were: migration time, education, BMI and height. Education level, height and BMI were used in the model as confounding factors.

Results

Table 1 shows the mean and standard deviations of systolic and diastolic blood pressure, body height and BMI for mi-

grants versus sedentes, and the results of a two-way analysis of variance. Because of significant differences in age between migrants and city-dwellers (the *t*-Student test, $t=8.31$, $p<0.001$), the results are presented in four age groups. Significant differences in height (but no other measure) were found between migrants and city-dwellers to the taller being the inhabitants of Wrocław. In each age category, the rural to urban migrants were shorter. Table 2 gives the level of education of migrants and city-dwellers. Significantly, more migrants concluded their education at the level of elementary or vocational school than did Wroclaw city-dwellers. Only 13.6% of migrants had college or university education.

Table 3 gives descriptive statistics of time having lived in the city of Wrocław and chronological age, according to the three categories of participants living in rural areas. The analysis of variance shows significant differences between chronological age, though these are not large. The results of GLM analysis are listed in Table 4. All of the independent variables had significant effects on systolic blood pressure, whereas only age and BMI significantly influenced diastolic blood pressure. The time of migration, allowing for age, body size and education level, had a significant effect on systolic blood pressure. The later the males migrated from rural to urban areas, the higher the systolic blood pressure, except in the 40–50 age group where the highest value was in the medium group of time of migration. The relationship between time of migration and diastolic blood

Table 1. Means and standard deviations of blood pressure, height and BMI by age groups in rural-to-urban migrants and city dwellers of Wrocław

Age	SBP			DPB		Height		BMI	
	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
City-dwellers of Wrocław									
<=30	155	131.85	13.08	86.08	9.64	175.58	6.13	24.37	3.52
31–40	348	134.43	14.39	89.60	10.04	173.89	6.66	25.17	3.45
41–50	192	137.93	17.37	91.58	11.19	172.77	6.83	26.36	3.96
>50	125	152.02	23.03	96.56	13.69	169.71	6.31	26.94	3.88
Rural-to-urban migrant dwellers of Wrocław									
<=30	131	131.90	12.45	85.53	9.55	175.36	5.34	24.12	3.04
31–40	388	134.68	14.36	89.41	10.28	172.29	5.96	25.98	3.74
41–50	338	141.47	16.88	93.99	10.54	170.77	5.50	27.04	4.07
>50	362	149.10	20.03	94.58	11.31	168.21	5.93	26.98	4.04
		F	p	F	p	F	p	F	p
Migration		0.08	0.7804	0.02	0.8852	19.66	0.0001	2.87	0.0902
Age		94.61	0.0001	54.17	0.0001	67.65	0.0001	36.76	0.0001
Interaction		2.70	0.0442	3.20	0.0224	1.31	0.2678	1.86	0.1348

Table 2. Distribution of education level in groups of rural-to-urban migrants and city-dwellers of Wrocław

Inhabitants	University + College	Trade + Primary	All
	n (%)	n (%)	n
Rural-to-urban migrants	166 (13.6)	1056 (86.4)	1222
City-dwellers	285 (34.8)	535 (65.2)	820
All	451	1591	2042

Chi-square=127.83; $p=0.0000$

pressure is not linear in all age classes. In the lower terciles of time migration, or the shortest time living in rural areas, the average blood pressure is the lowest, except for the age category 40–50 years for DBP (Tables 5, 6).

The rates of hypertension of migrants and city-dwellers are presented in Figure 1. The rural migrants suffered significantly more from elevated systolic or diastolic blood pressure, or both. The distribution of hypertension across

Table 3. Descriptive statistics of chronological age, time habitation in rural area, and time habitation in city of Wroclaw in three groups of rural-urban migrants dwellers of the city defined on percentage of time living in rural (short, medium, long) based on terciles

Rural time%	Chronological age			Rural time (years)		City time (years)	
	N	x	SD	x	SD	X	SD
Short <=35%	404	48.53	9.66	10.96	5.31	37.37	7.94
Medium 36%–78%	415	42.37	8.52	21.30	5.79	20.89	7.97
Long >79%	403	37.95	9.35	36.85	9.39	4.52	2.81

Table 4. Relationship between Systolic (SBP) and Diastolic (DBP) blood pressure and time of habitation in rural area, allowing for age, education and BMI assessed by the analysis of covariance

Variables	SBP		DBP	
	Wald's chi-square (df)	p	Wald's chi-square (df)	p
Age	139.27 (1)	0.0001	43.67 (1)	0.0001
Rural time %	6.47 (2)	0.0393	2.58 (2)	0.2747
BMI	109.72 (1)	0.0001	162.70 (1)	0.0001
Level of education	6.58 (1)	0.0103	0.46 (1)	0.4985

Table 5. Means and standard deviations of systolic blood pressure for rural-urban migrants dwellers of Wroclaw in three groups according to percentage of time of living in rural environmental and city-dwellers of Wroclaw by age groups

Age years	Rural-urban migrants									City-dwellers		
	Short			Medium			Long					
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
<=30	17	130.76	10.78	25	131.28	8.76	89	132.29	13.66	155	131.85	13.08
30–40	58	132.21	14.89	160	134.51	13.30	170	135.68	15.10	348	134.43	14.39
40–50	113	140.73	17.17	143	142.45	17.23	82	140.77	15.96	192	137.93	17.37
>50	214	147.19	18.66	86	149.01	20.05	62	155.79	23.23	125	152.02	23.03

Table 6. Means and standard deviations of diastolic blood pressure for rural-urban migrant dwellers of Wroclaw in three groups according to percentage of time of living in rural environmental and city-dwellers of Wroclaw by age groups

Age years	Rural-urban migrants									City-dwellers		
	Short			Medium			Long					
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
<=30	17	83.76	6.30	25	86.52	8.76	89	85.60	10.29	155	86.08	9.64
30–40	58	87.31	10.19	160	89.29	9.69	170	90.24	10.79	348	89.60	10.04
40–50	113	93.87	11.19	143	94.41	10.45	82	93.44	9.85	192	91.58	11.19
>50	214	93.77	11.07	86	94.81	10.27	62	97.05	13.15	125	96.56	13.69

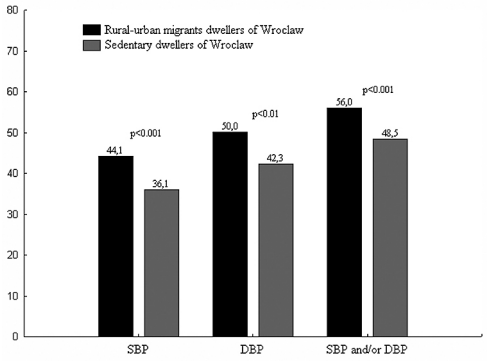

Figure 1. Percentage of hypertension (SBP>140 mmHg, DBP>90 mmHg) in rural-to-urban migrant dwellers of Wrocław and city-dwellers of Wrocław. Differences in distribution were tested by Pearson chi-square test

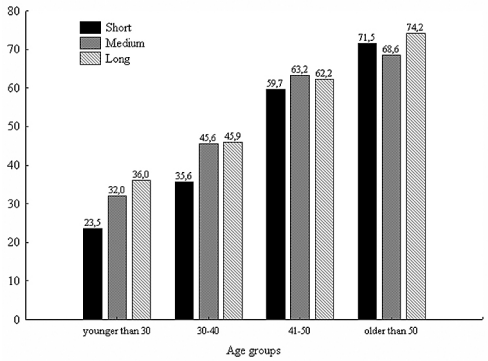

Figure 2. Percentage of hypertension (SBP>140 mmHg and/or DBP>90 mmHg) in rural-to-urban migrant dwellers of Wroclaw by the time of habitation in rural area and decade of age

the terciles of time of migration in age groups is shown in Figure 2. In all age groups, there are visible differences between the two extreme groups of time spent in rural areas, especially in the two younger age groups.

Discussion

This study shows that rural to urban migrants more often suffer from hypertension than do city-dwellers, and the longer migrants have lived in rural areas, the higher the systolic blood pressure. Thus rural environments may have detrimental effects on health. Migration is a selective process and its selectivity is related to health. Young migrants, especially those moving longer distances, have been shown to be healthy relative to non-migrants of the same age. Migration amongst elderly people takes place among those in poor health moving to avoid environmental hazards, or to be better placed to receive care (Bentham 1988). Based on an exhaustive study of Finnish twins who migrated to Sweden, Silventoinen et al. (2007) identified the following risk factors for future migration: life dissatisfaction, higher alcohol abuse and smoking in both sexes, in addition to male unemployment, neuroticism and extroversion. Excessive smoking, alcohol abuse and others unhealthy behaviours may be self-selective factors of rural to urban migration. A high prevalence of unhealthy behaviours such as smoking, physical inactivity and obesity have been found among migrants in Sweden in comparison with the native population. Such unhealthy behaviors, among them risk factors for coronary disease, in many migrant groups may be a lifestyle remnant from their country or place of birth (Gadd 2005).

The rural migrants in each category of age in the present study were shorter than their urban counterparts. There are two possible explanations for these differences. Firstly, there may have been a selective migration from rural to urban areas in respect to height. Shorter individuals may migrate to urban centres more than taller residents of rural areas. Secondly, the rural environment may have impeded the growth of children,

resulting in the deficit in adult height in comparison to their urban counterparts. In this case, even if the rural-urban migration were random in relation to height, the rural migrants on average would remain shorter. There are several studies reporting the shorter stature of rural children and adults in comparison to children and adults from towns and big cities (Waliszko et al. 1980; Hulanicka et al. 1990; Bielicki et al. 1997), making the second explanation more probable. In relation to this explanation, very interesting results were reported by Kołodziej et al. (2001), who showed that 19-year old male descendants of rural to urban migrants with both parents of rural origin were on average taller than their counterparts with both parents of urban origin. It seems that rural to urban migrants may have a greater variety of adaptive strategies to urban conditions because of their combined rural and urban experiences. Continued access to rural resources may have allowed them to provide better care to their urban offspring.

Rural-urban differences in health have been frequently reported, even when demographic and socio-economic differences between those populations have been accounted for. This phenomenon is observed in many countries (Verheij 1995), including Poland (Kołodziej 2008). Inhabitants of villages have been characterized as having worse biological conditions and more rapid ageing. They are heavier and have poorer lung efficiency. Furthermore, the risk of hypertension, hypercholesterolemia and hyperglycemia was higher in rural than urban dwellers (Lipowicz 2009). Rural-urban health differences could be a cumulative result of various factors working throughout life. The longer a migrant lives in a rural area, the more health problems they accumulate, and in effect the greater the differences with regard to urban dwellers.

The environment influences every aspect of life, health and well-being: housing circumstances, air quality, food and water, working conditions and distance to health care centres (Galea et al. 2005). Urban and rural environments differ not only with respect to population characteristics and natural surroundings, but also in terms of economic, social and cultural factors. In Poland, the rural environment is characterized by decidedly worse living conditions as compared with the urban environment. Over half of all villages are represented by low levels of infrastructure (power grid, heating, water system, sewage treatment). Due to underdeveloped public transport, the use of health care or cultural centres is difficult. Chances of attaining better education by rural children and youth are noticeably slimmer than among children living in towns (Gorlach 2000). Inhabitants of villages have more hazardous life styles: they smoke and drink alcohol more frequently, their dietary habits are less in line with nutritional guidelines and the level of physical activity is lower as compared with inhabitants of cities. Such unhealthy behaviors remain unchanged even if rural dwellers migrate to cities (Gorlach 2000; Uramowska-Zyto et al. 2004).

These differences in adult health status between rural migrants and sedentary urban inhabitants might start in the first years of life spent in different environments. A childhood environment including poverty or poor growth conditions might partly explain observed rural-urban health differences in adult life (Mheen van de et al. 1997). Differences in morphological development are visible

from preschool age. Rural children and youth are significantly shorter and thinner than urban children (Hulanicka et al. 1990; Bielicki et al. 1997). With respect to tempo of growth, fitness and intellectual abilities, urban children dominate rural children (Szklarska 1998). Poor diets with low standards of hygiene are considered by nutritionists to be important reasons for the poor biological, physical, emotional and intellectual growth of rural Polish children (Dyjak 2005). These unhealthy behaviors may persist in the urban environment that new migrants face, resulting in differences in health parameters between migrants and city-dwellers.

An important limitation of our study is the lack of information about life style, especially concerning smoking and drinking habits. However, the effect of smoking on blood pressure and its precise nature is still unclear (Okubo et al. 2004). The association between increased ethanol consumption and blood pressure is more evident (Kaplan 1995). Thus, we suspect that elevated alcohol consumption might be responsible for much of the hypertension and higher blood pressure found among recent migrants. Thus we conclude that unhealthy behavior could still have continued in a new urban environment, resulting in migrant – sedentary differences in health parameters like blood pressure found in our study.

Authors' contribution

SK conceived and designed the paper, was a principal investigator for the research project, drafted and approved the final manuscript; SU was an investigator for the research and co-author of the manuscript; AL performed statistical analysiss, interpreted data and was co-author of the manuscript. All authors read and approved the final manuscript.

Conflicting interests

The authors declare that they have no conflicts of interest in the research.

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