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# Socioeconomic indicators and ethnicity as determinants of regional mortality rates in Slovakia

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## Abstract

**Objectives:** Regional differences in mortality might reflect socioeconomic and ethnic differences between regions. The present study examines the relationship between education, unemployment, income, Roma population and regional mortality in the Slovak Republic.

**Methods:** Separately for males and females, data on standardised mortality in the Slovak population aged 20–64 years in the year 2002 were calculated for each of the 79 districts. Similarly the proportions of respondents with tertiary education, unemployed status, Roma ethnicity and income data were calculated per district. A linear regression model was used to analyse the data.

**Results:** Socioeconomic differences in regional mortality were found among males, but not among females. While education and unemployment rate significantly contributed to mortality differences between regions, income and the proportion of Roma population did not. The model explained 32.9% of the variance in standardised mortality rate among districts for males and 7.6% for females.

**Conclusion:** Low education and high unemployment rate seems to be an indicator of regions with high mortality of male and therefore should be targeted by policy measures aimed at decreasing mortality in productive age.

**Keywords:** Education – Income – Mortality – Regional differences – Roma population – Unemployment.

## Introduction

The mortality of a particular population is the result of interaction between many conditions and factors of biogenetic, physical and psychosocial character, some of which affect mortality directly (e.g. age, sex, genetic changes; smoking, food, radiation), and others indirectly (socioeconomic factors particularly – for example living standard, employment, education). These factors have differing intensity in different societies and regions. In this way, people are exposed to a spatial differentiation of determinants of mortality.

Since the early 1980's, socioeconomic differences in mortality and health have become an issue of great importance in Europe, North America and Japan. A number of studies indicate significant distinctions between different social groups in terms of health, morbidity and mortality, and at the same time relating to their socio-economic status, level of education and income and other socio-economic factors<sup>1–12</sup>.

An individual's position in the social hierarchy is mainly determined by education, income and occupation. Although these three dimensions of socioeconomic status are strongly related to one another, each has its own specific influence on health and mortality. All these selected socioeconomic indicators feature among the basic social determinants of health<sup>7</sup>.

Information about education is available for everyone, and educational attainment remains relatively stable over time. Also, a cohort effect may occur as the socio-economic status of a certain educational attainment group probably changes over time<sup>13</sup>. A lot of studies confirm the well-known finding that people with high education (including both sexes) have lower mortality compared with the least educated<sup>13–19</sup>.

Ecological studies have shown that the educational level of an area strongly correlates with local mortality rates<sup>14, 16–18, 20–22</sup>. Level of education also correlates with level of income, which is the basis for measuring socioeconomic position by education or by income. Several recent studies have reported a positive correlation between income inequality and mortality<sup>16, 18, 20, 23–24</sup>. Mortality rates are higher in populations experiencing highly unequal income distributions (high income inequality) compared to populations with relatively more equal income distributions (low income inequality), regardless of sex.

An important measure of social position as well as an indication of his/her income may be a person's employment status. The link between unemployment and social disadvantage is generally accepted within the current socio-economic literature<sup>1</sup>. Unemployment typically involves income loss for the individual, and several studies also suggest that unemployment leads to a reduction in happiness and general well-being. It has furthermore been argued that unemployment may be a health hazard, and many studies have shown that unemployed persons have poorer health and higher mortality than employed people. It is generally recognised that those who are unemployed have lower quality of life and probably worse health and shorter life, particularly for males<sup>1–2, 4–5, 10, 25–29</sup>.

A preponderant number of studies treating the relationship between socioeconomic determinants and mortality, deals with populations in West European, North American or developed Asian countries. Only a few studies focus on these disparities in Central European countries (mainly in the Czech Republic, Hungary and Poland<sup>18, 10–11, 19, 28, 30–33</sup>), and a smaller number in the Slovak Republic<sup>6, 34–35</sup>), despite the high degree of interest. The situation in Central and East European countries is of interest for several reasons. First, under the former Socialist regime socioeconomic inequalities were factitiously suppressed and balanced. Comparisons with the United States and Western Europe can show whether four decades of Socialist rule in the end produced substantially smaller differences in mortality. A second reason relates to the unfavourable mortality developments since the 1960's. Results from European studies point out that rates of mortality are consistently higher among people with lower than among those with higher socio-economic position<sup>9, 21–22, 31, 34</sup>. Whereas since that time the mortality decline has accelerated in the West, it has stagnated in Central and East European countries, especially among men of working age<sup>31</sup>. According to cross-national comparisons<sup>31</sup>, mortality differences in the late 20<sup>th</sup> century in the Czech Republic and Estonia were at least as large as in western countries; by far the largest however were the mortality differences in Hungary. The differences between the European Union and the states of Central Europe (Czech Republic, Slovakia, Poland and Hungary) are still relatively

great<sup>34</sup>. Large inequalities between education and health have been found for Hungary and Poland<sup>22</sup>. Several studies have also shown that the Roma population has poor health and high levels of many diseases<sup>36–39</sup>.

For this study, socioeconomic indicators were chosen from official statistics available in the Slovak Republic on the district level. These indicators are of interest for the population in the age group 20–64 years, which is primarily associated with the labour market (economically active population). This part of the population has relatively the lowest mortality rate by age, has finished the process of education and receives a certain kind of income (salary or unemployment benefits). The aim of the present study was to analyse the geographic distribution of mortality in the age group 20–64 years by gender and by small area, and to assess the associations between socioeconomic position and ethnicity and mortality in the districts of the Slovak Republic.

## Methods

The study population covers all inhabitants of the Slovak Republic aged 20–64 years in the year 2002. In this year the number of inhabitants aged 20–64 years in the Slovak Republic as of July 1<sup>st</sup> was 3 332 595 people (49.4% men). The total number of deaths among those aged 20–64 years was 14 448 (71.9% men).

To be able to explore regional differences, the study population was analysed at the level of districts. The Slovak Republic is divided into 79 districts, of which 5 constitute the capital city Bratislava and 4 the second largest city, Košice. The mean number of inhabitants per district is 42 185 persons; ranging from 7 349 to 102 556 inhabitants (2002).

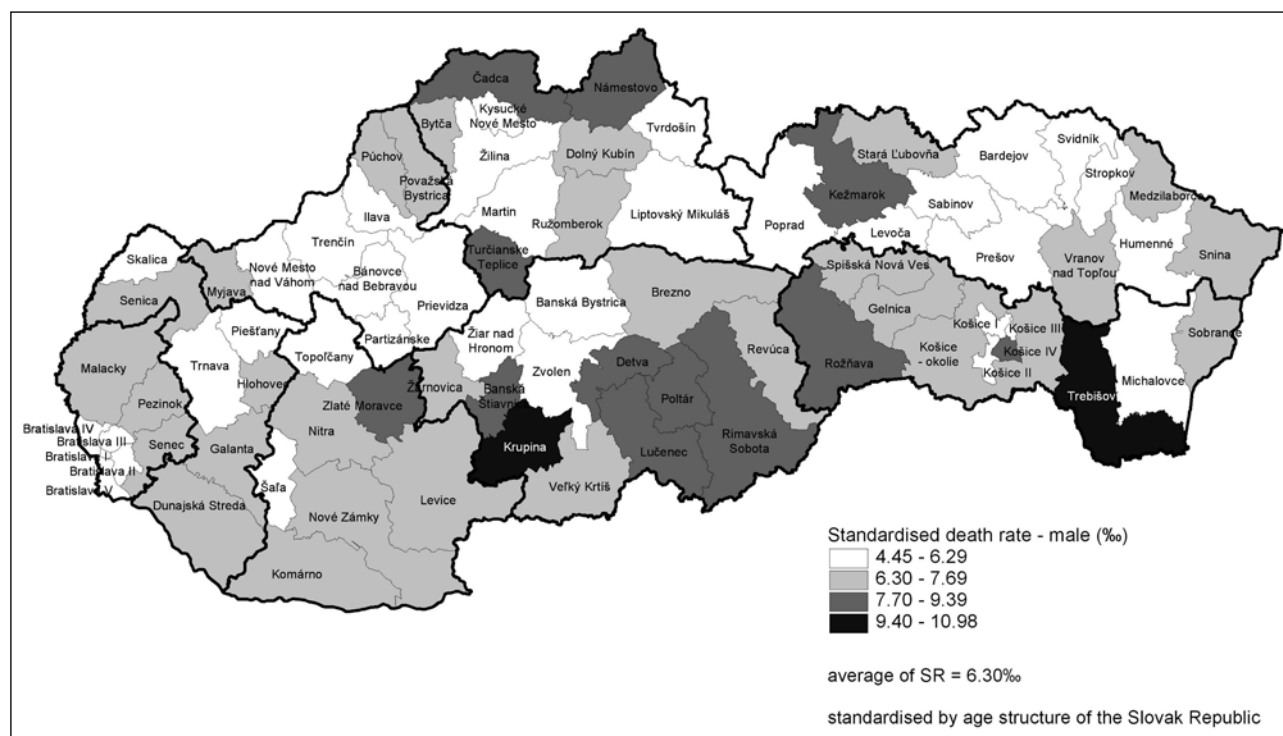
The data consist of absolute population numbers and numbers of deaths by gender in the districts of the Slovak Republic in the year 2002. These data reflect the monitoring of natural changes in the population of the Slovak Republic in 2002, and were obtained from the Statistical Office of the Slovak Republic.

Educational level, rate of unemployment and income were used as socioeconomic indicators potentially influencing the mortality rate. All indicators were calculated for each district. Educational level by gender, using the percentage of inhabitants with tertiary education aged 20–64 years, was based on the 2001 population census from the Statistical Office of the Slovak Republic. Their mean proportion in the Slovak Republic was 12.6% for men (ranging from 5.2 to 45.0%) and 11.2% for women (ranging from 5.0 to 42.0%). The number of unemployed by gender was obtained from the tally of the Office of Labour, Social Affairs and Family of the Slovak Re-

Gender	Indicators				
	Mortality (aged 20–64 years)	Education tertiary*	Unemployment rate	Income	Roma*
Males	6.30‰	12.6 %	15.4 %	16,363 SKK (€503)	2.8 %
Females	2.41‰	11.2 %	12.4 %	12,065 SKK (€371)	2.7 %
Total	4.33‰	11.9 %	13.9 %	14,203 SKK (€437)	2.8 %

**Table 1.** Basic data for the Slovak population in the year 2002.

\* Population census, 2001



**Figure 1.** Standardised mortality rates for males aged 20–64 years by districts in the Slovak Republic.

public. The rate of unemployment was expressed as the proportion of the number of unemployed inhabitants aged 20–64 years to the total number of inhabitants by gender, and the mean values per district in the year 2002 were 15.4% for men (ranging from 2.8 to 33.1%) and 12.4% for women (ranging from 2.7 to 26.7%). Income level (average monthly gross income in Slovak Crowns (SKK)) was based on the data of the Statistical Office of the Slovak Republic. At the district level income data are available only for gross income (net income is about 75% of gross income) and only for companies with 20 and more employees (about 60% of all companies in the country). The mean monthly income in the districts of the Slovak Republic was 16 363 SKK (€503) for men and 12 065 SKK (€371) for women in the year 2002; ranging from 10 294 to 25 480 SKK (€316 – €784) for men and from 8 913 SKK to 18 954 SKK (€274 – €583) for women.

The percentage of the Roma population as an indicator for ethnicity was obtained from the 2001 population census of the Statistical Office of the Slovak Republic. The average percentage of the Roma per district was 2.8% for men (ranging from 0.0 to 16.3%) and 2.7% for women (ranging from 0.0 to 15.9%).

Using the regional mortality data, the annual standardised mortality rate was calculated. For each region the mortality by 5-year age-groups (20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64) and total mortality rate by gender were calculated. Regional mortality rates were standardised by age using the Slovak population as standard. Mortality rate is expressed as the number of deaths per 1000 inhabitants.

To describe the associations between regional mortality, educational level, unemployment rate, income and the Roma

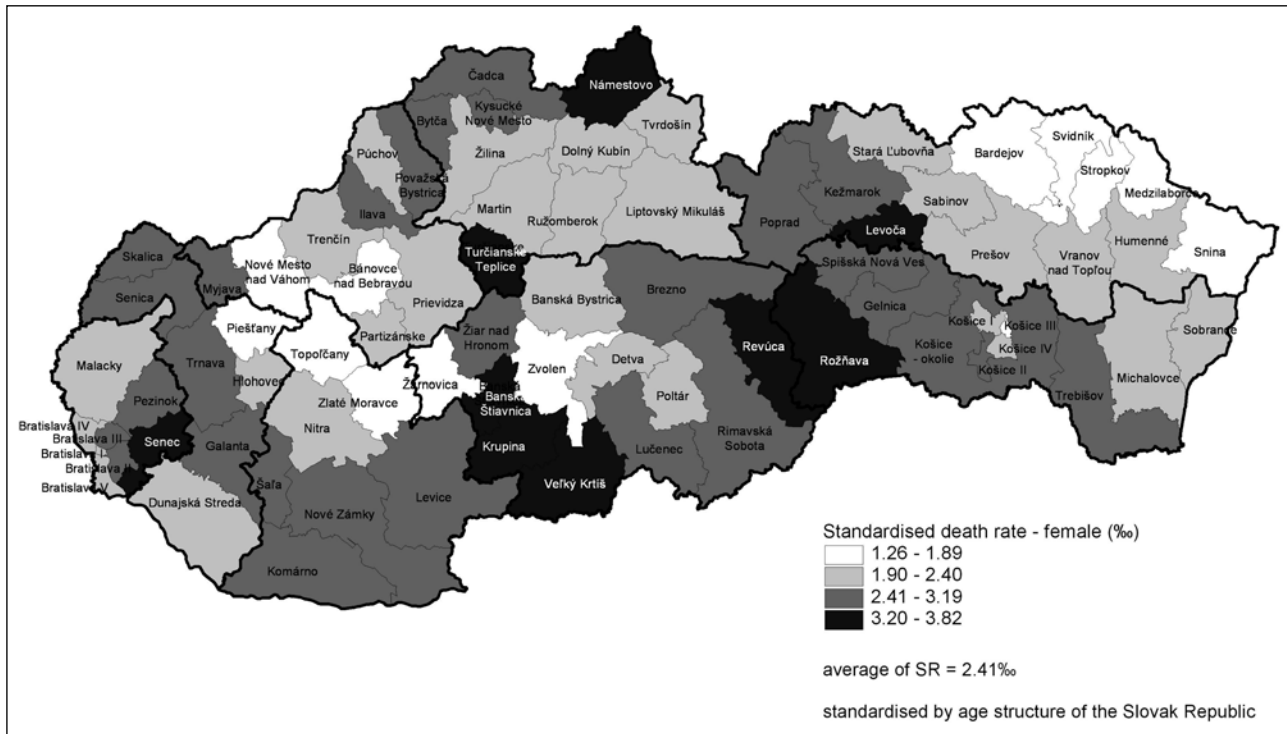


Figure 2. Standardised mortality rates for females aged 20–64 years by districts in the Slovak Republic.

population, two statistical methods were used – linear regression analysis and Pearson and Spearman correlations. Analyses were conducted separately for males and females. Analyses were done using SPSS version 12.0.

## Results

The mortality of the inhabitants aged 20–64 years in the Slovak Republic is characterised by a gentle downward trend during recent years; compared to the year 1997 the mortality rate decreased from value 4.51% to 4.34% in the year 2002, for males from 6.46% to 6.30% and for females from 2.61% to 2.41%.

The standardised mortality of the inhabitants aged 20–64 years by sex in the districts of the Slovak Republic in the year 2002 is shown in Figures 1 and 2. In the districts of the southern part of the country the standardised mortality rate appears to be higher for both sexes.

The male population attains a greater range of mortality rates, as the difference between minimum (4.45‰) and maximum value (10.98‰) is 6.53‰. Districts in the southern parts of Central and Eastern Slovakia are among those with the highest standardised mortality rate for males aged 20–64 years. In contrast, districts in the northern part of Eastern Slovakia and

the central part of Western Slovakia are among those with the lowest standardised mortality rate for males in that age-group. Compared with the standardised mortality rate for males aged 20–64 years at the national level, which reached a value of 6.30‰ in the year 2002, the majority of the districts (43 out of 79) achieved a higher mortality rate than the average rate for the Slovak Republic (Figure 1).

The standardised mortality rate for females aged 20–64 years in the examined districts showed less marked disparities; the difference between the marginal values is 2.56‰ (minimum value 1.26‰, maximum value 3.82‰). Higher mortality rates for females are markedly evident in the districts of Southern and Central Slovakia. The majority of the districts (42 out of 79) attained a lower standardised mortality rate for females aged 20–64 years than the average national mortality rate, being 2.41‰ in the year 2002 (Figure 2). There are markedly smaller differences compared to males, and the variance between the district with highest standardised mortality rate and the average for the Slovak Republic was only 1.41‰ for females (4.68‰ for males).

Tables 2 and 3 show the basic statistical information about all variables included in the analyses, and differences in tertiary education, unemployment, income and Roma population by gender at district level of the Slovak Republic. There is significantly higher proportion of higher education, unemployment

**Table 2.** Socioeconomic indicators and ethnicity by gender.

Indicators	Males				Females			
	Mean	Median	Range	Variance	Mean	Median	Range	Variance
Education tertiary (%)	11.8	9.0	39.8	50.3	10.4	8.2	37.0	37.7
Unemployment rate (%)	16.2	16.0	30.3	52.1	13.1	12.7	24.0	30.9
Income (SKK)	14,614	13,956	15,186	9,679,248	11,090	10,802	10,041	3,394,267
Roma (%)	3.0	1.6	16.3	13.6	2.9	1.5	15.9	13.1

**Table 3.** Differences in tertiary education, unemployment, income and Roma by gender.

		Mean	N	Std. Deviation	Paired Differences		t	df	Sig. (2-tailed)
					Mean	Std. Deviation			
Pair 1	Education tertiary – male	11.814	79	7.0941	3.1316	2.5392	10.962	78	.000
	Education tertiary – female	10.362	79	6.1407					
Pair 2	Unemployment rate – male	16.200	79	7.2184	3524.051	1509.535	20.750	78	.000
	Unemployment rate – female	13.068	79	5.5613					
Pair 3	Income – male	14613.99	79	3111.149	1.4519	1.3655	9.451	78	.000
	Income – female	11089.94	79	1842.354					
Pair 4	Roma – male	2.992	79	3.6865	.1013	.2579	3.489	78	.001
	Roma – female	2.891	79	3.6243					

rate, income and Roma population among males in comparison to females within districts of Slovakia.

The results of the Pearson and Spearman correlations are presented in Table 4. This shows the correlations between standardised mortality rate, the percentage of inhabitants with tertiary education, the unemployment rate, average income and the percentage of Roma inhabitants for males and females aged 20–64 years in all districts of the Slovak Republic. For males, correlations between standardised mortality rate and tertiary education, unemployment rate and income were significant at the 0.001 level (2-tailed), but correlations with the Roma population were not significant; relationships shown by Spearman correlation between standardised mortality rate and tertiary education and unemployment rate were significant at the 0.001 level (2-tailed), while average income was significant at the 0.01 level (2-tailed). Tertiary education had the strongest association with standardised mortality rate for males aged 20–64 years in the examined districts. For females, Spearman correlation between standardised mortality rate and tertiary education was significant at the 0.05 level (2-tailed). Other correlations between standardised mortality rate and the mentioned socio-economic indicators were not significant.

The relationship between standardised mortality rate for inhabitants aged 20–64 years by sex and socio-economic in-

dicators together in the districts of the Slovak Republic is presented as revealed by linear regression in Table 5. The dependent variable is the individual standardised mortality rate by districts separately for males and females (continuous); the independent variables are selected socioeconomic indicators by districts separately for males and females (all continuous). The model explains 32.9% of the variance in standardised mortality rate among districts for males, and 7.6% of the variance in standardised mortality among districts for females. The proportion of males with tertiary education and unemployed males contributed to the prediction of the standardised mortality rate for males in the districts of the Slovak Republic; however, none of the four selected socio-economic indicators contributed to the prediction of the standardised mortality rate for females in the examined districts.

## Discussion

This study demonstrates that the standardised mortality rate among districts in the Slovak Republic in the male population aged 20–64 years can be predicted by the proportion of males with tertiary education and the male unemployment rate in any particular district. The average monthly gross income and proportion of the Roma population do not contribute to this

	Indicators			
	Education tertiary	Unemployment rate	Income	Roma
<b>Males</b>				
<i>Pearson Correlation</i>				
Standardised mortality rate	-.499***	.478***	-.404***	.184
Education tertiary		-.586***	.818***	-.278*
Unemployment rate			-.644***	.657***
Income				-.318**
<i>Spearman Correlation</i>				
Standardised mortality rate	-.631***	.471***	-.367**	.216
Education tertiary		-.567***	.634***	-.318**
Unemployment rate			-.672***	.718***
Income				-.403***
<b>Females</b>				
<i>Pearson Correlation</i>				
Standardised mortality rate	-.155	.173	-.083	.214
Education tertiary		-.591***	.901***	-.296**
Unemployment rate			-.587***	.646***
Income				-.294**
<i>Spearman Correlation</i>				
Standardised mortality rate	-.242*	.157	-.102	.080
Education tertiary		-.645***	.815***	-.390***
Unemployment rate			-.592***	.747***
Income				-.381**

**Table 4.** Correlations between standardised mortality rate, indicators of socioeconomic status and Roma population by gender (Pearson and Spearman Correlations) – separately.

\*\*\* Correlation is significant at the 0.001 level (2-tailed)  
 \*\* Correlation is significant at the 0.01 level (2-tailed)  
 \* Correlation is significant at the 0.05 level (2-tailed)

Indicators	Males		Females	
	Unstandardised Coefficients (Beta)	Sig.	Unstandardised Coefficients (Beta)	Sig.
Education tertiary	-.076	.011*	-.036	.140
Unemployment rate	.081	.004**	.002	.904
Income	.0001	.271	.000	.203
Roma	-.062	.156	.028	.220
R Square	.329		.076	

**Table 5.** Linear regression between standardised mortality rate, indicators of socioeconomic status and Roma population by gender – together.

Dependent Variable: Standardised death rate by gender  
 \*\* Correlation is significant at the 0.01 level (2-tailed)  
 \* Correlation is significant at the 0.05 level (2-tailed)

prediction. The proportion of females with tertiary education, the female unemployment rate, the average monthly gross income and the proportion of the Roma population do not predict the differences in standardised mortality rate between districts.

The analysis included all causes of death, since the age structure of mortality by causes of death on district level is not available. With regard to the Slovak population in the year

2002, the higher proportion of deceased in terms of causes of death for male and female aged 20–64 years was for diseases of the circulatory system and neoplasms.

Most of the published studies dealing with spatial analysis of mortality refer to the significant relationship between socioeconomic indicators and mortality rates for both sexes<sup>2, 4–5, 8, 10–11, 14, 16, 20, 23, 30</sup>. There are also studies, however, which came to similar conclusions as we do in ours. In these stud-

ies, the relationship between socio-economic indicators and mortality is significantly higher for men than for women<sup>4-5, 8, 11, 23</sup>. These analyses come predominantly from European countries (Hungary, Spain), US metropolitan areas and from Japan. However, there is a limitation in these studies. Most of them concern the whole population from birth to death. This significantly distorts the results because of the higher mortality among older people, which in turn increases the general mortality rate. In our study we tried to avoid this limitation by including only people aged 20–64 in our analyses. This part of the population suffers from the lowest values of mortality as a consequence of the typical u-curve of mortality by age, so extrinsic factors (especially socioeconomic and health conditions) have greater influence on mortality in the 20–64 years age-group compared with the elderly group, where the effect of diseases on mortality is more predominant.

Accompanying the changes in political and social conditions in the Slovak Republic starting in 1990, there was a strong change in the demographic trend, which may be termed as transition to a new model of reproductive behaviour. Since that time, the period of mortality stagnation has ended and life expectancy for both sexes has increased. The relationships between socioeconomic factors, health and mortality indicators in the population and its selected groups have started being much more intensively studied and analysed. A similar situation has also emerged in the Czech Republic, where two studies concerning spatial analyses of mortality and socio-economic status have been performed<sup>19, 30</sup>. However, the spatial analyses studying these dependencies are still lacking in the Slovak Republic. We believe therefore that the present study brings important knowledge to fill the information gap about the Slovak Republic, as a necessary part of the whole picture of developments in Central Europe.

The available analyses from Slovakia focus mainly on the health status of the population, the majority of them are applied only at state level and compare Slovakia as a whole with other countries<sup>34-35, 40</sup>, and very little analysis has been done at district level<sup>6</sup>. The results of these analyses show, similar to European studies, that social and economic conditions (educational level, poverty, unemployment) strongly influence the health of inhabitants in the country.

There may be several reasons why this study has revealed different correlations between standardised mortality rate and all four indicators for socio-economic position for males and females, and also why there is different explained variance in the standardised mortality rates per district by gender. Firstly, the distribution of standardised male mortality rates among the districts of the Slovak Republic is markedly different from female mortality. Women are characterised by much lower values for mortality, and their range is lower as well.

The influence of particular socioeconomic factors on female mortality rate is then less striking.

Secondly, the indicator of average monthly gross income should be an important factor, but at present this is available only for companies with 20 and more employees at the district level in Slovakia, which is a limitation of the present study, because the proportion of smaller companies and self-employed is relatively high (about 40%), and we do not have data showing the income rates for male and female employees in the smaller companies. Figures for the proportions of smaller companies and self-employed are more inaccurate at smaller territorial level. This shortage of data probably explains the lack of significance in our results regarding the relationship between average monthly gross income and mortality rate for both sexes.

Thirdly, concerning the rate of unemployment in the districts of the Slovak Republic, noticeable differences between males and females can be seen. The rate of unemployment for males has a wider range between districts than for females. At the same time the number of districts with a higher rate of male unemployment is evidently larger than for female unemployment. The phenomenon of unemployment among females is artificially reduced by household work or maternity and parental leave, which lasts for three years in the Slovak Republic. Furthermore, it has been found that females experience their unemployment less negatively than males, which could lead to lower mortality rates<sup>3, 10, 25, 27, 29</sup>. These could be the reasons why the overall influence of female unemployment on their mortality is reduced.

According to the UNDP report<sup>36</sup>, in Slovakia the health of the Roma population is assessed as being worse compared with that of the majority, which might be due to their poor socio-economic situation (low educational level, high unemployment rate, high proportion of poverty) and the related unsuitable living conditions and infrastructure in their places of abode, especially in the settlements. Results from published literature on Roma health in Central Europe show several differences between the Roma population and the general population. Among the Roma higher birth and fertility rates are found, but also higher death rates, earlier start of reproductive activity and longer reproduction period, lower life expectancy and higher rates of illness<sup>36-38</sup>. The Roma population is also disadvantaged by lower education levels and greater illiteracy, which represent a major barrier to successful involvement in the labour market<sup>36</sup>.

The strengths of our study are the area-based design and age specification of the population. In many countries individually-based data on mortality by age are not available, while area-based data are mostly available and comparable. Focusing on lower geographical level (e. g. areas, regions, districts)



seems to be more accurate than country comparisons or state level analysis, but studies based on sub-national entities are less common<sup>2–6, 10–11, 14, 16, 18, 20, 23–24, 28, 30, 32–33, 38</sup>. Some of these studies focus only on analysis of a given area and do not include spatial comparison between them<sup>28, 32–33</sup>.

The limitations of the present study are lack of data on income and on the proportions of Roma population. The indicator of income (average monthly gross payment) is available only for companies with 20 and more employees at the district level in Slovakia. The proportion of such enterprises is about 60%. However, the total number of small enterprises can not be determined due to unavailable data. Its determination is further impaired with decreasing size of the territorial units assessed. This phenomenon probably explains the lack of significance in our results regarding the relationship between income and mortality rate for people aged 20–64 years in the districts of the Slovak republic. As for the data on the population with Roma ethnicity, our source was the national population census, in which everybody may freely claim their own ethnic background. The majority of the population links their ethnic background with their ethnic affiliation. There is an exception in the Roma ethnic group, however, as they mostly claim ethnic backgrounds other than Roma. Most frequently they associate themselves with the majority ethnic group in a given territory (which means in most cases either Slovak or Hungarian backgrounds).

Some previous studies dealing with mortality and socio-economic inequalities in European countries have examined this association primarily at the individual level. In the present study, we wanted to explore regional differences, so we carried out the analyses using data at the district level. This study is a spatial analysis of mortality, which includes all deaths in a particular period in all districts of the Slovak Republic.

By and large, the results indicate the great need for continuation with further analyses of mortality and its determinants. In a following study the population mortality should be analysed in relation to other socio-economic factors. Furthermore, it

would be interesting to study the relationships between mortality and separate factors in the context of their change over time.

The last decade has seen major developments in public health policy in a number of societies. The traditional focus on improving the population's overall health has been widened to include a commitment to reducing health differences between population groups<sup>7</sup>. No official policy focusing on mortality and reducing regional differences has been developed yet in the Slovak Republic; although policy on the studied variables exists. The important concerns are currently labour market policy, education policy and income policy; there is also some social reform in progress with impact on senior citizens (pension reform). These policies are focused on individual groups within the population with regard to the given issues; they are not focused on regional proportions, but it might be expected that the combined effects of such policies will contribute in the end to reducing regional differences in mortality. In the Slovak Republic there is a lack of well-developed family policy with support for the function of the family and services for families; the interconnectedness of the educational system with the labour market is weak; and policies focusing on better solutions for problems of the Roma population and their integration in society are still underdeveloped.

In conclusion, the results of this study point out a striking mortality differentiation in relation to selected socio-economic indicators (educational level, unemployment rate and income) by gender in the Slovak Republic. In males, educational level and unemployment rate contributed to the prediction of the standardised mortality rate in the districts of the Slovak Republic in the population aged 20–64 years. In females, no significant connection was found.

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#### References

1. Carr-Hill R, Chalmers-Dixon P. The Public Health Observatory Handbook of Health Inequalities Measurement. Oxford: South East Public Health Observatory, 2005.
2. Domínguez-Berjón MF, Borrell C, López R, Pastor V. Mortality and Socioeconomic Deprivation in Census Tracts of an Urban Setting in Southern Europe. *J Urban Health* 2005;82:225–36.
3. Fukuda Y, Nakamura K, Takano T. Municipal socioeconomic status and mortality in Japan: sex and age differences, and trends in 1973–1998. *Soc Sci Med* 2004;59:2435–45.

4. Fukuda Y, Nakamura K, Takano T. Wide range of socioeconomic factors associated with mortality among cities in Japan. *Health Promot Int* 2004;19:177–87.
5. García-Gil C, Cruz-Rojo C, Álvarez-Girón M, Solano-Parés A. Health inequalities in Seville, Spain: use of indicators of social deprivation and mortality in small areas. *Public Health* 2004; 118:11–20.
6. Ginter E, Hulanska K. Social determinants of health in Slovakia. *Bratisl Lek Listy* 2007;108: 477–9.

7. Graham H. Social determinants and their unequal distribution: Clarifying policy understandings. *Milbank Q* 2004;82:101–24.
8. Kopp M, Skrabski Á, Réthelyi J, Kawachi I, Adler NE. Self-Rated Health, Subjective Social Status, and Middle-Aged Mortality in Changing Society. *Behav Med* 2004;30:65–70.
9. Mackenbach J. Health Inequalities: Europe in Profile. Independent expert report commissioned by the UK Presidency of the EU. Rotterdam: University Medical Center, Department of Public Health, 2006.

10. Skrabski Á, Kopp M, Kawachi I. Social capital in a changing society: cross sectional associations with middle aged female and male mortality rates. *J Epidemiol Community Health* 2003;57:114–9.
11. Skrabski Á, Kopp M, Kawachi I. Social capital and collective efficacy in Hungary: cross sectional associations with middle aged female and male mortality rates. *J Epidemiol Community Health* 2004;58:340–5.
12. Starfield B. Pathways of influence on equity in health. *Soc Sci Med* 2007;64:1355–62.
13. Bossuyt N, Gadeyne S, Deboosere P, Van Oyen H. Socio-economic inequalities in health expectancy in Belgium. *Public Health* 2004;118:3–10.
14. Bopp M, Minder CE. Mortality by education in German speaking Switzerland, 1990–1997: results from the Swiss National Cohort. *Int J Epidemiol* 2003;32:346–54.
15. Kunst AE, Mackenbach JP. The Size of Mortality Differences Associated with Educational Level in Nine Industrialized Countries. *Am J Public Health* 1994;84:932–7.
16. Muller A. Education, income, inequality, and mortality: a multiple regression analysis. *BMJ* 2002;324:1–4.
17. Osler M, Prescott E. Educational level as a contextual and proximate determinant of all cause mortality in Danish adults. *J Epidemiol Community Health* 2003;57:266–9.
18. Rognerud MA, Zahl P-H. Social inequalities in mortality: changes in the relative importance of income, education and household size over 27-year period. *Eur J Public Health* 2005;16:62–8.
19. Sobotík Z, Rychtaříková J. Úmrtnost a vzdělání v České republice (Mortality and education in the Czech Republic). *Demografie* 1992;34:97–105.
20. Deaton A, Lubotsky D. Mortality, inequality and race in American cities and states. *Soc Sci Med* 2003;56:1139–53.
21. Shkolnikov VM, Andreev EM, Jasilionis D, Leinsalu M, Antonova OI, McKee M. The changing relation between education and life expectancy in central and eastern Europe in the 1990s. *J Epidemiol Community Health* 2006;60:875–81.
22. Von dem Knesebeck O, Verde PE, Dragano N. Education and health in 22 European countries. *Soc Sci Med* 2006;63:1344–51.
23. Lopez R. Income inequality and self-rated health in US metropolitan areas: A multi-level analysis. *Soc Sci Med* 2004;59:2409–19.
24. Matera E, Cacciani L, Bugarini G, et al. Income inequality and mortality in Italy. *Eur J Public Health* 2005;15:411–7.
25. Artazcoz L, Benach J, Borrel C, Cortes I. Unemployment and mental health: Understanding the interactions among gender, family roles and social class. *Am J Public Health* 2004;94:82–8.
26. Gerdtham U-G, Johannesson M. A note on the effect of unemployment on mortality. *J Health Econ* 2003;22:505–18.
27. Gerdtham U-G, Johannesson M. Business cycles and mortality: results from Swedish microdata. *Soc Sci Med* 2005;60:205–18.
28. Tobiasz-Adamczyk B, Bartoszewska E, Brzyski P, Kopacz M. Long-term consequences of education, working conditions, and health-related behaviors on mortality patterns in older age. A 17-year observational study in Kraków, Poland. *Int J Occup Med Environ Health* 2007;20:247–56.
29. Waters LE, Moore KA. Predicting self-esteem during unemployment: the effect of gender, financial deprivation, alternate roles and social support. *J Employment Couns* 2002;39:171–89.
30. Dzúrová D. Mortality differentials in the Czech Republic during the post-1989 socio-political transformation. *Health Place* 2000;6:351–62.
31. Kunst A. Cross-national comparisons of socio-economic differences in mortality. Thesis. Rotterdam: Erasmus University Rotterdam, 1997.
32. Watson P. Health differences in Eastern Europe: Preliminary findings from the Nowa Huta study. *Soc Sci Med* 1997;46:549–58.
33. Watson P. Unequalizing Citizenship: The Politics of Poland's Health Care Change. *Sociology* 2006;40:1079–96.
34. Ginter E. Health-status of the Slovak Republic population in comparison with countries of Central Europe and European Union. *Bratisl Lek Listy* 2000;101:589–93.
35. Ginter E, Havelkova B, Rovny I, Hlava P, Barakova A, Kudlackova M. Health status of the Slovakia population at its entry to the European Union. *Bratisl Lek Listy* 2005;106:45–54.
36. Filadelfiova J, Gerbery D, Skobla D. Správa o životných podmienkach rómskych domácností na Slovensku (Report on the Living Conditions of Roma in Slovakia). Bratislava: UNDP, Regional Bureau for Europe and the CIS, 2006.
37. Hajioff S, McKee M. The health of the Roma people: a review of the published literature. *J Epidemiol Community Health* 2000;54:864–9.
38. Kosa Z, Szeles G, Kardos L, et al. A comparative health survey of the inhabitants of Roma settlements in Hungary. *Am J Public Health* 2007;97: 853–9.
39. Koupilova I, Epstein H, Holcik J, Hajioff S, McKee M. Health needs of the Roma population in the Czech and Slovak Republics. *Soc Sci Med* 2001; 53:1191–204.
40. Mackenbach JP, Stirbu I, Roskam AJR, et al. Socioeconomic Inequalities in Health in 22 European Countries. *N Engl J Med* 2008;358:2468–81.

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