



Socioeconomic Inequalities in Mortality of the Population of Large Czech Towns – Spatio-Temporal Perspective



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Abstract:

The research on spatial distribution of population mortality/morbidity conditions and its social and economic determinants occupies an important position within both social and epidemiological science, especially because of the implications for practice. As processes of demographic revolution and urbanisation have been affecting Czech population since several decades, research on (socioeconomic) differences within an urban population gains on importance.

The aim of the paper is to evaluate structural and spatial mortality distribution of selected Czech urban populations (Capital City of Prague, Brno, Plzeň, and Ostrava) and determine its socioeconomic conditionality within the inter-censal period of 2001-2011. Both structural and spatio-temporal perspectives were applied on the analysed phenomena. In the separate case of the Capital City of Prague, further intra-urban spatial differences of mortality were investigated, applying advanced statistical methods based on principles of the generalised linear mixed modelling (so-called Bayesian mapping methods).

Results revealed significant spatial differences in mortality associated with the (local) socioeconomic environment between selected large Czech towns (inter-urban perspective), as well as within the Capital City of Prague (intra-urban perspective).

Keywords:

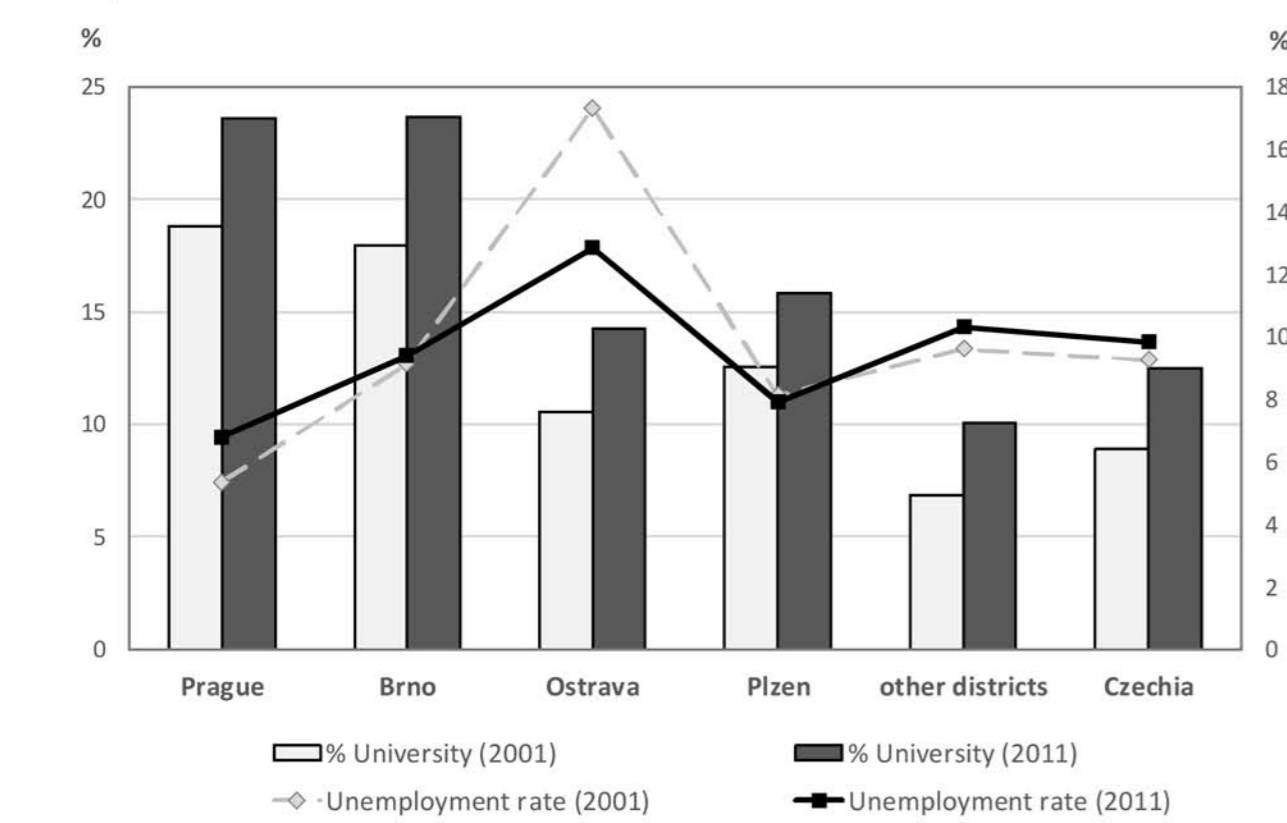
mortality, urban population, socioeconomic inequalities, spatial analysis, Bayesian mapping

Methods:

- 1.) In order to reveal socioeconomic differences between populations living in selected towns, two simple indices were constructed: % with university education (share on those in age 15 yrs. and more); unemployment rate (%; share of unemployed on economically active population) - data from Census 2001 and 2011
- 2.) Life expectancies at birth in selected towns during the period of 2001-2011 were calculated and compared to the general Czech population.
- 3.) In order to reveal structural differences in mortality between selected towns, age-standardized mortality rates for 5 main groups of causes of death were calculated and compared to the general Czech population.
- 4.) In the separate case of Prague, age-standardized mortality ratios were calculated in 57 municipal districts for two 5-year periods: 2001-2005; 2007-2011. Subsequently, mortality ratios were smoothed by the Poisson-Gamma model (Clayton - Kaldor, 1987) in order to control for overdispersion in the data.
- 5.) In Prague, index of relative deprivation in (N=57) municipal districts was derived from previous 2 indices (% university and unemployment rate): $[\text{Rank}(\text{university}) + \text{Rank}(\text{unemployment})] / 2 * N * 100 (\%)$
- 6.) The association between relative deprivation and mortality ratios in municipal districts was examined for both 5-year periods, applying 3 distinctive statistical approaches: i) ordinary least square (OLS); ii) spatial lag (SAR); iii) spatial error (SER)

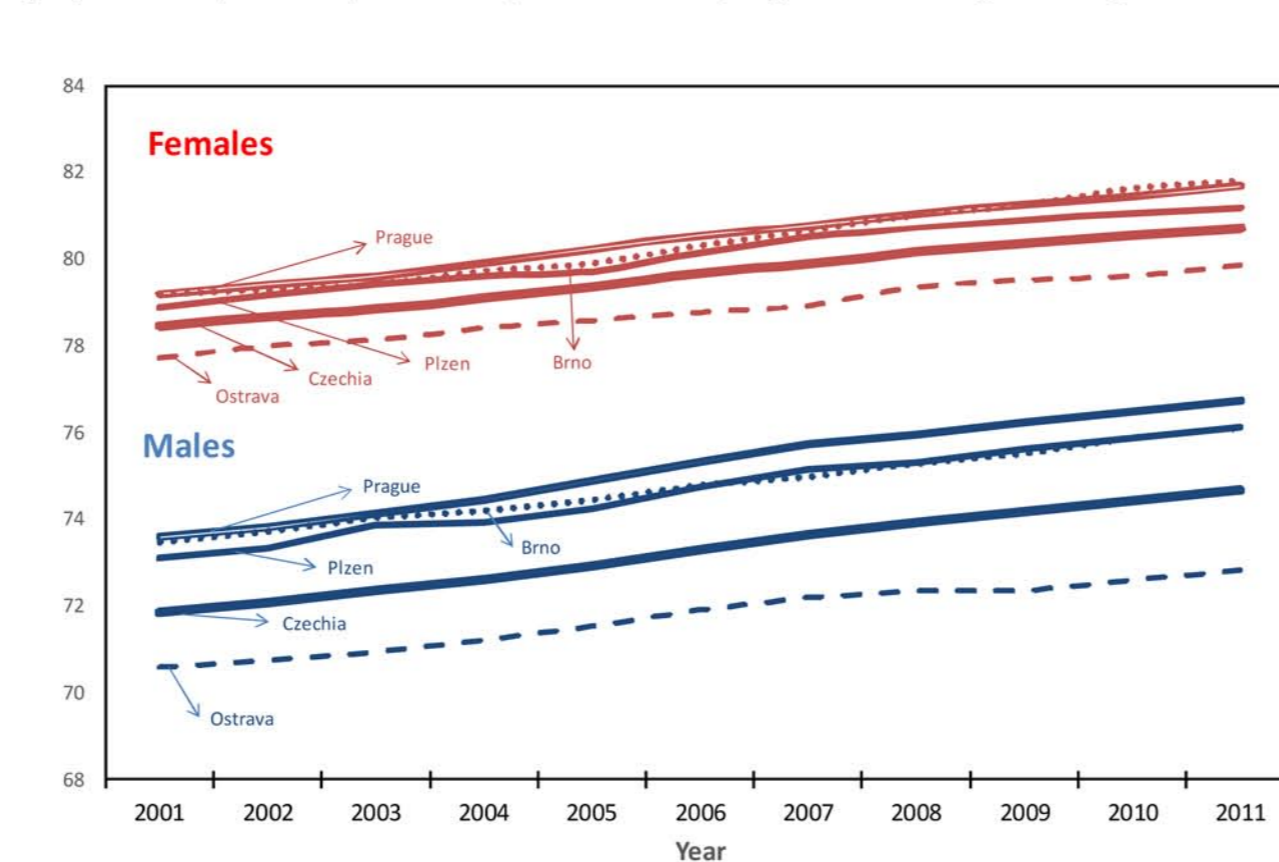
Results:

Graph 1: Socioeconomic differences between selected Czech towns, 2001, 2011



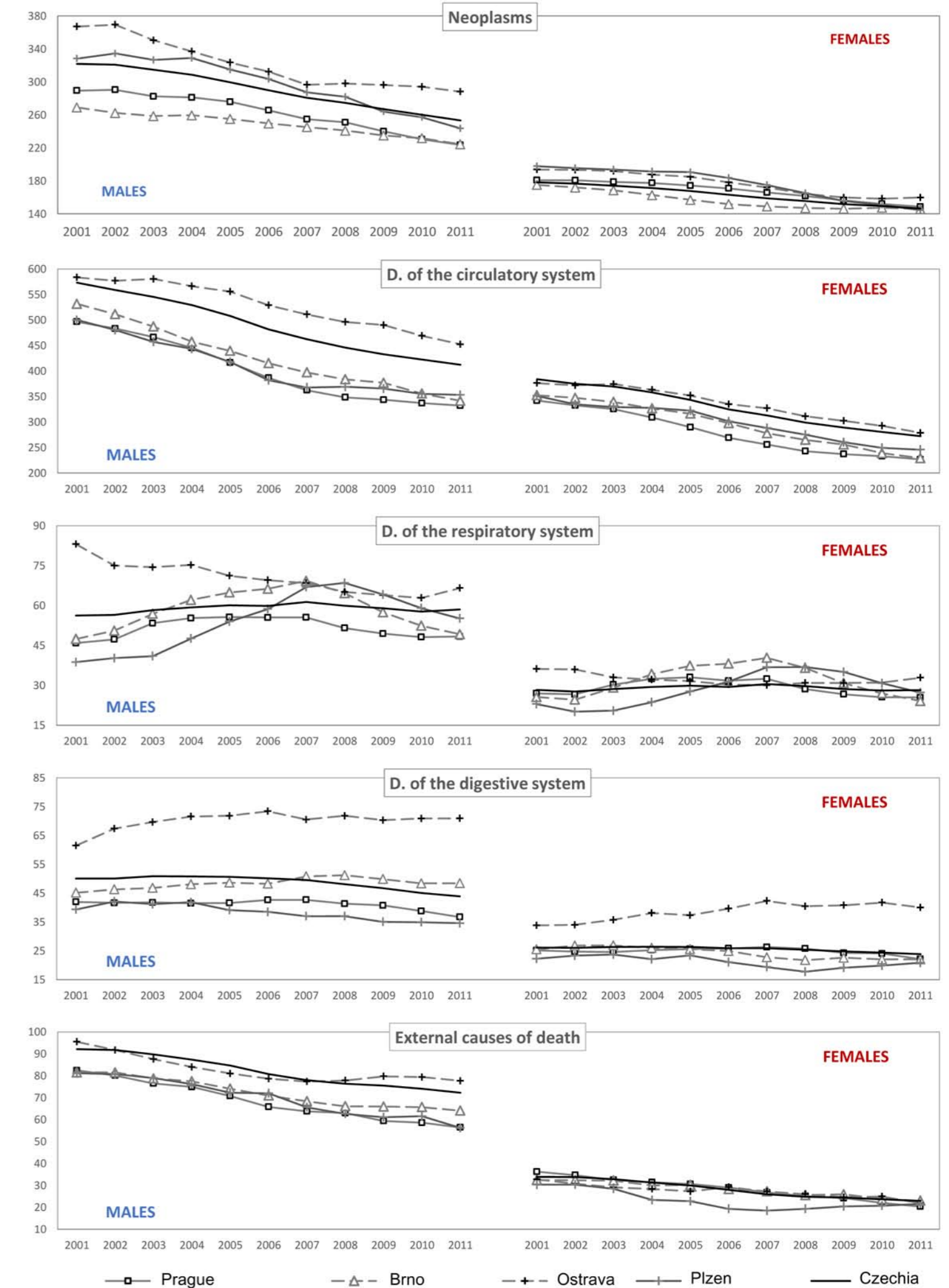
Source: Census 2001, 2011

Graph 2: Life expectancy at birth, selected Czech towns vs. total population, males, females, 2001-2011, 5-year moving averages



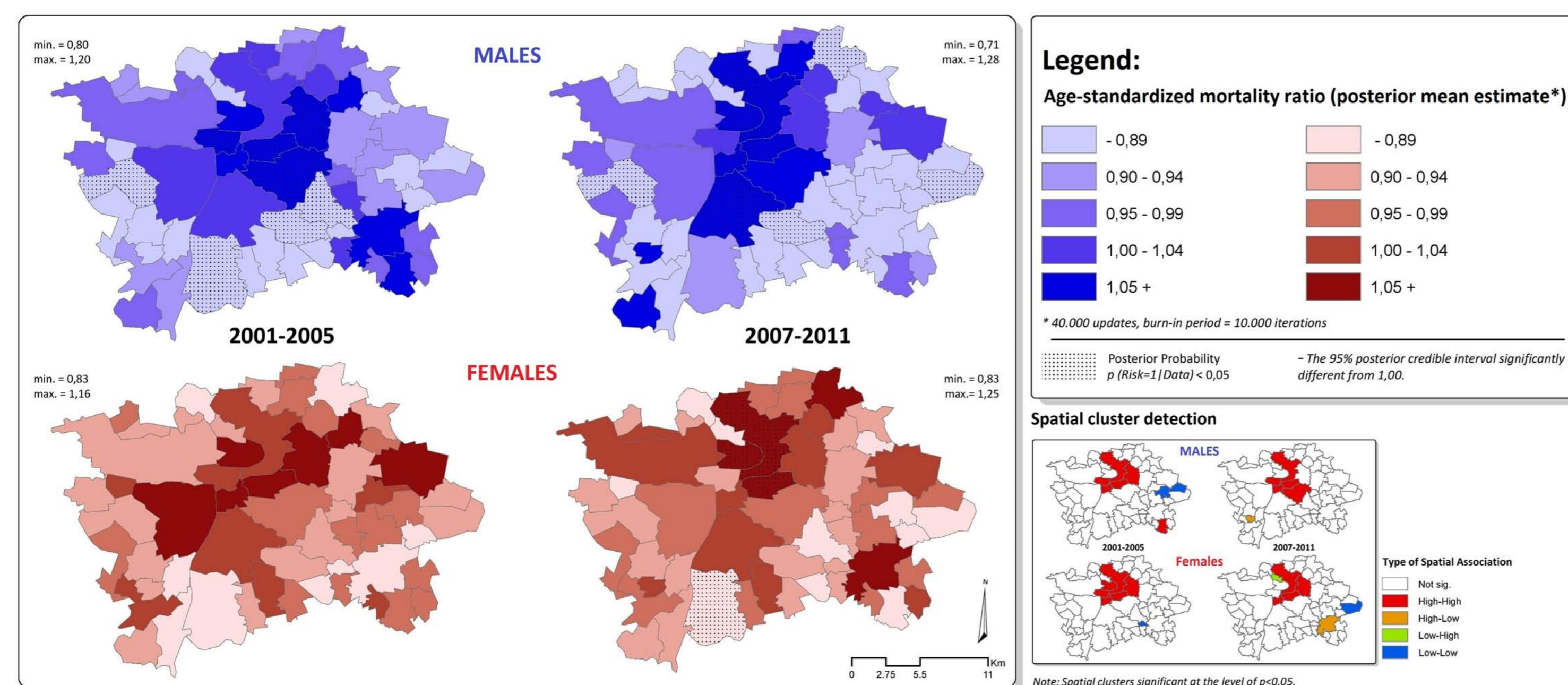
Source: Czech Statistical Office, own calculations in DeRAS software

Graph 3: Age-standardized mortality rates by causes of death (per 100 000 inhabitants, European standard population 1976), 5-year moving averages, selected Czech towns vs. total Czech population, males, females, 2001-2011



Source: Czech Statistical Office, own calculations

Graph 4: Economically active population mortality, municipal districts of the Capital City of Prague (N=57), males, females, 2001-2005, 2007-2011



Source: Czech Statistical Office, own calculations in WinBUGS and ArcGIS softwares

Table: Outputs of 3 distinctive forms of the regression analysis between mortality (standardized mortality ratios) and indices of the socioeconomic environment, Capital City of Prague, city districts (N=57), 2001-2005, 2007-2011

Dependent ¹⁾	Independent ²⁾	OLS		Spatial Lag (SAR)		Spatial Error (SEM)		
		Beta (10 ³)	Moran I (Error)	Beta (10 ³)	Rho	Beta (10 ³)	Lambda	
2001-2005	Total standardized mortality	A)	-3,33	0,114*	-2,61	0,284*	-2,51	0,260
		B)	3,29	0,149*	-0,55	0,331*	-5,19	0,368*
		A) + B)	3,55	0,093	0,22	0,282*	-2,40	0,305*
	Economically active population mortality	A)	0,85*	0,051	0,60	0,253	0,43	0,228
		B)	-1,03	0,360***	-0,62	0,570***	-1,15	0,573***
		A) + B)	27,95*	0,314***	21,33*	0,535***	19,41*	0,536***
	Premature mortality	A)	-1,15	0,308***	-0,73	0,534***	-0,42	0,535***
		B)	1,27*	0,324***	0,90*	0,541***	0,88	0,549***
		A) + B)	-1,71	0,356***	-1,06	0,586***	-1,04	0,589***
	Senior population mortality	A)	25,33*	0,273***	16,09*	0,543***	11,21	0,551***
		B)	-1,81	0,256***	-1,18	0,538***	-0,65	0,549***
		A) + B)	25,48*	0,269***	16,27*	0,543***	10,93	0,556***
2007-2011	Total standardized mortality	A)	-5,46***	0,220**	-5,10***	0,321*	-5,56***	0,349*
		B)	15,60*	0,222**	15,12*	0,355*	15,45*	0,348*
		A) + B)	10,14*	0,218**	9,58*	0,324*	9,93*	0,346*
	Economically active population mortality	A)	2,75	0,187*	3,51	0,324*	1,62	0,308*
		B)	1,00**	0,187*	0,93**	0,321*	0,93**	0,308*
		A) + B)	-3,80	0,229**	-4,28	0,394**	-4,69	0,388*
	Premature mortality	A)	23,15*	0,201**	21,77*	0,367*	20,72*	0,345*
		B)	-0,64	0,204**	-1,70	0,377**	-2,26	0,359*
		A) + B)	21,52	0,204**	17,40	0,423**	14,67	0,396*
	Senior population mortality	A)	1,31*	0,207**	1,27*	0,375**	1,22*	0,344*
		B)	-2,80	0,276***	-3,23	0,445**	-3,65*	0,442*
		A) + B)	23,36*	0,253**	22,17**	0,42**	21,81**	0,397*
Total standardized mortality	A)	1,00	0,246***	0,07	0,419**	-0,02	0,397*	
	B)	25,90*	0,252**	22,35*	0,423**	21,76*	0,396*	
	A) + B)	1,01*	0,187*	0,97*	0,321*	0,93**	0,308*	
Senior population mortality	A)	-4,91***	0,011	-4,84***	0,037	-4,83***	0,022	
	B)	7,93	0,101	8,02	0,160	8,53	0,173	
	A) + B)	-5,98**	-0,009	-5,97***	0,003	-6,01***	-0,019	
Total standardized mortality	A)	-7,26	0,061	-7,23	0,117	-7,39	0,113	
	B)	0,63*	0,061	0,60*	0,117	0,60*	0,113	
	A) + B)	-6,63	0,061	-6,63	0,117	-6,79	0,113	

Note:
1) Smoothed standardized mortality ratio (posterior mean estimate), 50,000 iterations
2) Notation: A) % University, B) Unemployment rate, C) Deprivation index
* p<0,1; ** p<0,05; *** p<0,01; **** p<0,001

Source: Czech Statistical Office, own calculations in GeoDa software

Conclusions:

The study provides a detailed analytical view at the distribution of mortality in the Czech cities in its structural, temporal and spatial aspects. Mortality condition improved during the analysed period, as in the case of selected towns as well as in the general population of the country. The major improvement was due to the further reduction in mortality from diseases of the circulatory system. However, the intensity and temporal changes are significantly different between the largest Czech urban populations. Population living in the Capital City of Prague had the most favourable mortality conditions within all the analysed urban structures. Further investigation revealed that local socioeconomic conditions play an important factor for such inter-urban differences in mortality in the Czech Republic. In the separate case of the Capital City of Prague, analysis from the intra-urban spatial perspective revealed areas with significantly distinctive mortality conditions. Especially people living in northern areas of the city had poorer mortality conditions within both genders and during the whole inter-censal period. Poor socioeconomic environment of the area was positively associated with higher mortality as well, especially during the period of 2007-2011.

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