Cause specific mortality convergence and divergence tendencies among selected European countries: methods of analysis and current trends of development

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Background

The most important theoretical concepts in demography (e.g. theory of demographic transition, epidemiologic transition) expect convergence of mortality in their final stages. However, according these concepts, in previous stages the divergence of mortality also appears as a consequence of different onset and tempo of these processes in various populations. Studies focused on convergence and divergence tendencies of any indicator provide unique information about its development in time and space (among populations). With ongoing changes in demographic behavior and development in Europe and in the world (Vrdoljak et al, 2011; Bongaarts, 2014) and with newly formulated theoretical concepts or modern stages of traditional concepts (Olshansky, Ault, 1986; Vallin J, Meslé, 2004), there is still need of study of convergence in demography with consideration of various aspects of demographic processes.

Goals of the paper

There are two main goals of the paper:

(1) Describe the main convergence-divergence tendencies of mortality in Europe, above all within the Central and Eastern European countries which are often not studied in detail in similar research. In the meantime a possible method of measuring and analyzing the convergence tendencies of selected country to other countries with lower mortality is introduced.

(2) Study the convergence-divergence tendencies in more detail taking into account the main groups of causes of death. This part of analysis is again more focused above all on the Central and Eastern European countries during the last two decades.

Data

In the paper, the main research is focused on European countries as "Europe is the main 'laboratory' to test theories" (Vallin, 2013, pp. 156) in terms of mortality. Data from 1959–2009 from the Human Mortality Database for 28 selected European countries are used, life expectancy and temporary life expectancy are selected as studied indicators. Data for cause-specific analysis are extracted from WHO Mortality Database[4] using the VBA program for data extraction from the WHO Mortality Database (Andreev, 2010). Analysis includes only the time period of the 10th revision of International Classification of Diseases.

Methods

For description of the main convergence-divergence tendencies of mortality in Europe, analytic tools neglecting the size of each population as well as considering the size of each population (Wilson, 2001; Kašpar, 2014) are performed. For analysis of the convergence tendencies of mortality of a selected country to other countries the "*Hypothetical number of years necessary for equalization of the values of the (temporary) life expectancy in the selected country and other analyzed countries with higher value of this indicator"* is calculated (more details e.g. in Kašpar, Hulíková Tesárková, Zimmermann, 2014; Kašpar, 2014; Hulíková Tesárková, Kašpar, Zimmermann, 2015). Study the convergence-divergence

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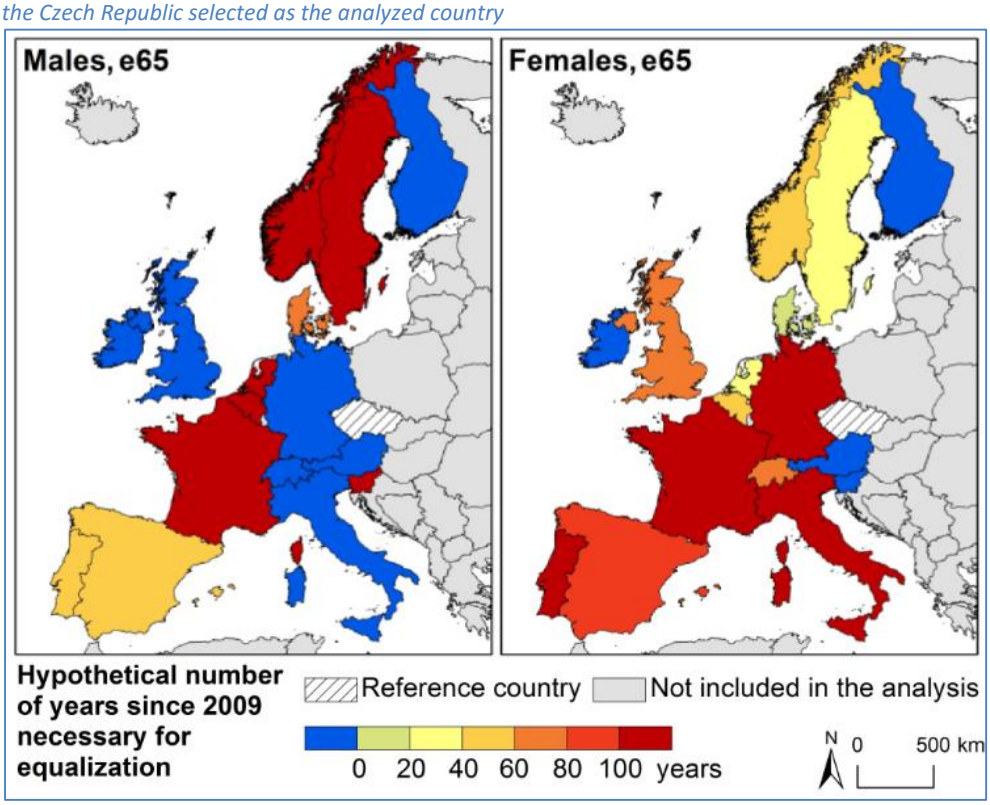
[4]http://www.who.int/healthinfo/statistics/mortality_rawdata/en/

tendencies, taking into account the main groups of causes of death, is based on almost the same methodological approaches as mentioned above.

Main results

The main results confirm the generally known existence of various stages of convergence and divergence tendencies of mortality in Europe after the World War II. Moreover, it is possible to illustrate the contemporary and recent development within the Central and Eastern European countries, where divergent tendencies started to prevail already in the 1980s and 1990s. This was caused above all by mortality crises in the Eastern European countries and rapid positive development in the Central Europe.

Figure 1: Hypothetical number of years since 2009 necessary for equalization of the values of life expectancy at age of 65, the Czech Republic selected as the analyzed country



Calculation of the hypothetical number of years needed for equalization of the life expectancy at selected age is based on the assumption of extrapolation of the observed recent trends. The result cannot be taken as a forecast but rather as a possible way of illustration of the convergence tendencies of the studied country to countries with higher value of this indicator (see Figure 1). For life expectancy at age 65 the convergence for the Czech Republic (selected for illustration) could be expected above all to Denmark or Spain, Portugal (for males) and selected Scandinavian countries (for females). Also within the Central European countries, which are often taken as a rather homogeneous region, there are some significant differences which could be observed.

According to selected groups of causes of death, the European countries considered in the analysis form still a rather heterogeneous group of countries when dealing the mortality from cardiovascular diseases, but the overall trend of development is similar (Figure 2).

Figure 2: Hypothetical number of years to equity of values of the logistic function of the age-standardized mortality rates from cardiovascular diseases, the Czech Republic selected as the analyzed country

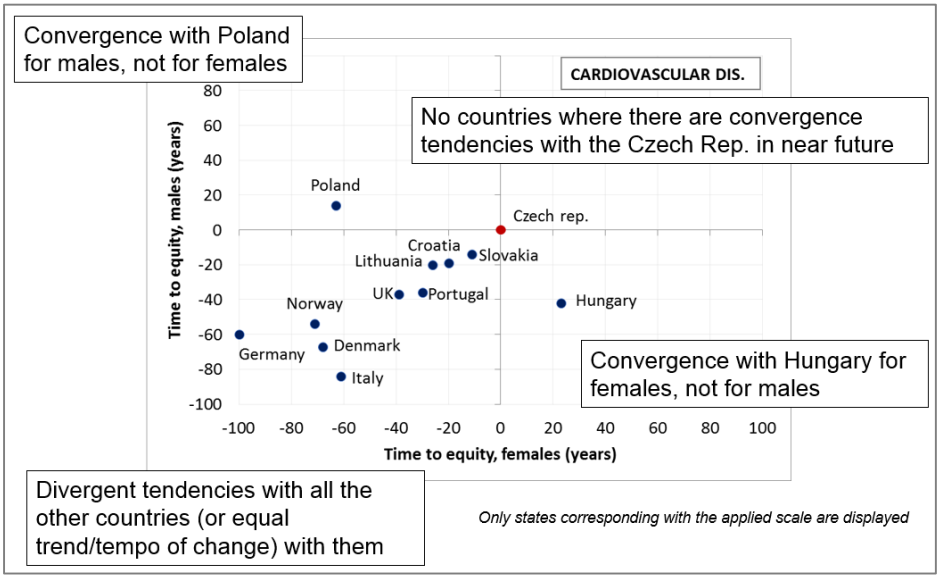
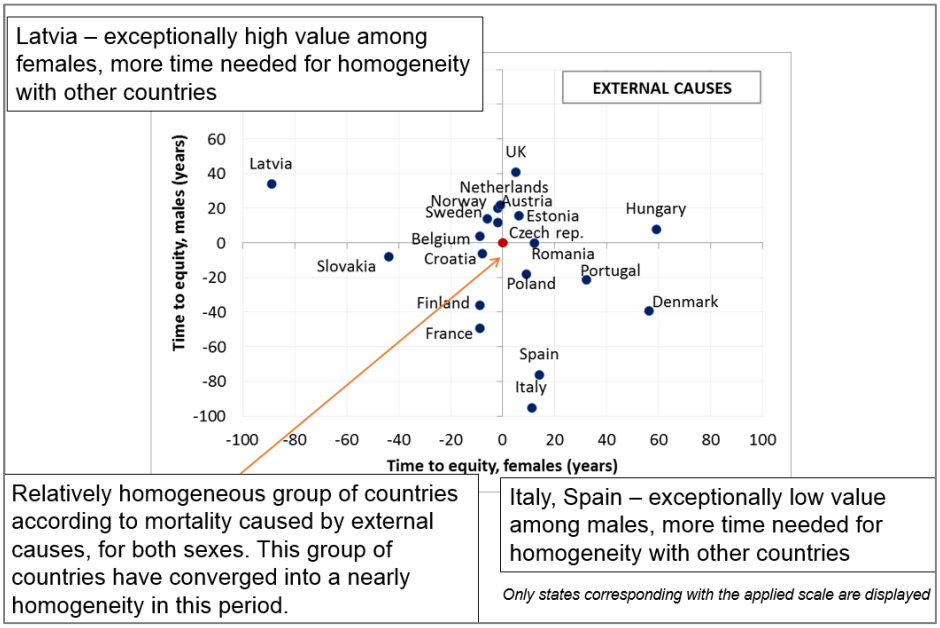


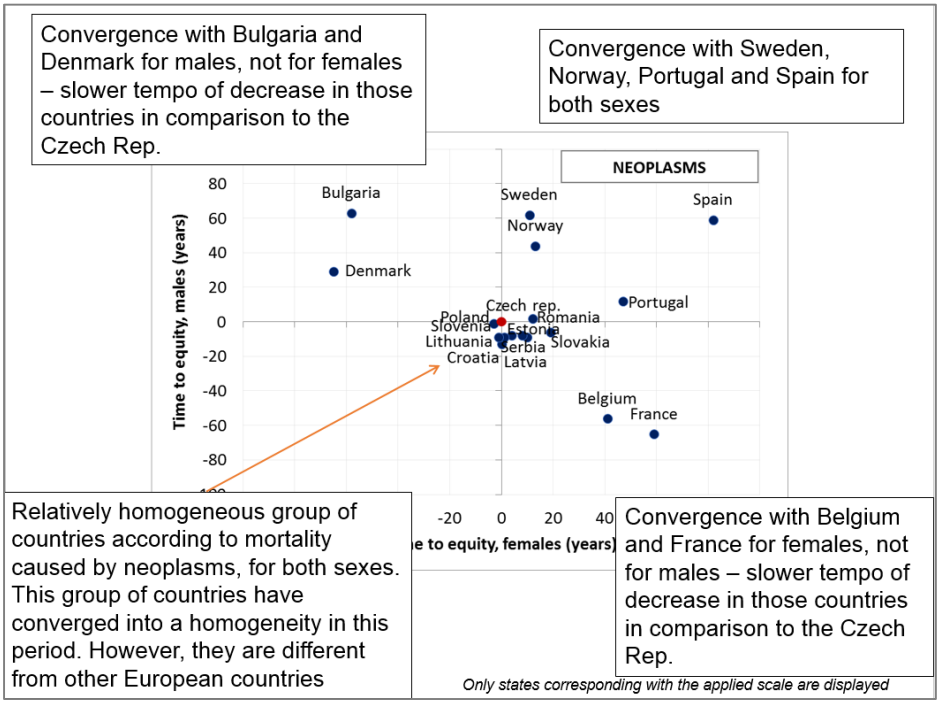
Figure 3: Hypothetical number of years to equity of values of the logistic function of the age-standardized mortality rates from external causes, the Czech Republic selected as the analyzed country



The analyzed group of countries is relatively homogeneous according to mortality form external causes. Latvia could be taken as an exception with its value (divergent tendency of mortality development) for females and Italy and Spain are exceptional for their low values for males (Figure 3).

Also in the case of mortality from malignant neoplasms there could be observed a relatively homogeneous group of countries (among the analyzed ones). For females the convergence of mortality could be observed for the Czech Republic and France or Belgium, however this is not true for males. The opposite holds for Bulgaria and Denmark, where the convergence tendency with the Czech Republic could be observed only for males, not for females. The mortality development could be taken as a convergence for the Czech Republic and Sweden, Norway, Spain or Portugal (Figure 4). In case of mortality from malignant neoplasms changes of life style and smoking habits during the 20th century could be taken among the reasons of the observed convergence/divergence trends.

Figure 4: Hypothetical number of years to equity of values of the logistic function of the age-standardized mortality rates from external causes, the Czech Republic selected as the analyzed country



References

Andreev EM. A VBA program for data extraction from the WHO Mortality Database. MPIDR Technical Report TR-2010-004. 2010. Available at WWW: <http://www.demogr.mpg.de/en/projects_publications/publications_1904/mpidr_technical_reports/a_vba_program_for_data_extraction_from_the_who_mortality_database_3840.htm>. [cit. 2015-03-03].

Bongaarts J. Trends in causes of death in low-mortality countries: Implications for mortality projections. Population and Development Review. 2014 Jun; 40(2): 189–212.

Hulíková Tesárková, K, Kašpar, D, Zimmermann, P. Konvergenční a divergenční tendence v Evropě z hlediska úmrtnosti: jaké je postavení Česka? Geografie. 2015; 120(1): 26–49.

Kašpar, D. Konvergenční a divergenční tendence úmrtnosti ve vybraných evropských zemích. Praha, 2014. 108 p. Diploma Thesis (Mgr.). Charles University in Prague. Faculty of Science. Department of Demography and Geodemography.

Kašpar, D, Hulíková Tesárková, K, Zimmermann, P. Convergence and divergence tendencies among European countries: possibilities of study and position of the Czech Republic according to recent mortality development. Poster session. European Population Conference, Budapest, 25–28 June 2014.

Olshansky SJ, Ault AB. The fourth stage of the epidemiologic transition: The age of delayed degenerative diseases. The Milbank Quarterly. 1986; 64(3): 355–391.

Vallin, J. Inequalities in Life Expectancy Between and Within European Countries. In NEYER, G.; ANDERSSON, G.; KULU, H.; BERNANDI, L.; BÜHLER, Ch. (eds.). The Demography of Europe. New York : Springer Science+Business Media B. V.. 2013, p. 139–173.

Vallin J, Meslé F. Convergences and divergences in mortality. A new approach of health transition. In: Demographic Research, Special Collection 2. Rostock : Max Planck Institute for Demographic Research. 2004, p. 11–44. Article 2.

Vrdoljak E, Wojtukiewicz MZ, Pienkowski T, Bodoky G, Berzinec P, Finek J, et al. Cancer epidemiology in Central, South, and Eastern European countries. Croatian Medical Journal. 2011; 52: 478-87.

Wilson, Ch. On the Scale of Global Demographic Convergence 1950–2000. Population and Development Review. 2001; 27(1): 155–171.