Original Research Article

Trends and regional inequalities in mortality from stroke in the context of health care reform in Lithuania

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ABSTRACT

Background and objective: The objective of the study was to analyze mortality from stroke in Lithuania the context of health care reform with particular interest in urban/rural and regional inequalities. Based on the analysis of trends in mortality, and to detection of break-points over two decades of socioeconomic transition, it focused on the challenges in stroke care provision.

Materials and methods: The analysis covered the entire country. Information on deaths from 1991 to 2012 was gathered from death certificates held by the Lithuanian Department of Statistics. The joinpoint analysis was used to identify the best-fitting points, wherever a statistically significant change in mortality occurred. Age-standardized mortality rates were calculated for 60 municipalities of Lithuania.

Results: The positive break-points in mortality from stroke were registered in 2007 for females and 2008 for males, when the increasing trends reversed to the declining. More positive changes occurred in urban areas, where stroke mortality is lower compare to rural since 1996. Considerable inequalities were disclosed among administrative regions of Lithuania: ratio between the highest and the lowest rates in different municipalities reached 4.88 for males and 3.35 for females.

Conclusions: There are good reasons to expect the favorable stroke mortality trends observed will follow the same direction in the future. Stroke centers are growing up in their competence while networking is also under the development. The new strategies in stroke care should result not only in the declining mortality rates and numbers of severely handicapped stroke patients, but also in diminishing regional and urban/rural inequalities.

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1. Introduction

The rapid political and economic changes in Lithuania exerted a great influence on the health of the population. Mortality could be considered as one of the major indicators reflecting the changes in health outcomes. Over the last few decades, several studies analyzed trends in major cause mortality in Lithuania [1–5]. The only published data on stroke mortality in Lithuania came from the Kaunas Register of Stroke [6]. While being population based, stroke register, however, provides data for a limited age range (25–64 years) and just for urban population making extrapolation to the total population questionable. For the entire country, trends in mortality from stroke were not analyzed over the period of transition, no analysis was done to identify the calendar years in which changes occurred. Furthermore, no assessment has been made of the urban/rural and regional inequalities in mortality from stroke for Lithuanian population.

The aim of this study was to look at the situation of mortality from stroke in the context of health care reform with particular interest in urban/rural and regional inequalities in stroke mortality. Based on the analysis of trends in mortality and on detection of break-points over two decades of socioeconomic transition, it focuses on the challenges in stroke care provision.

2. Materials and methods

The analysis for this study covered the entire country. Information, gathered on deaths from 1991 to 2012 for the population, was from death certificates, held by the Lithuanian Department of Statistics. The established cases of stroke – International Classification of Diseases (ICD-9) codes 98–99 for 1991–1992; 430–438 for 1993–1997; and ICD-10 codes I60–I69 since 1998 – have been analyzed. The changes in classification throughout the period of investigation, did not affect statistics of cerebrovascular diseases. Throughout the period under investigation, the population size declined from 3.7 in 1991 to 3.0 million people in 2012.

Trends in mortality from stroke were assessed for the total population, as well as for the urban and rural populations, separately for males and females. Definitions of urban and rural areas are based on the Law on the Territorial Administrative Units of the Republic of Lithuania and their Boundaries. Mortality rates were age-standardized using the European standard, as recommended by the World Health Organization. The joinpoint regression model was applied to describe data on trend changes [7]. Joinpoint regression is a Windows-based statistical software program that enables a user to test the statistical significance of an apparent change in trend. In this analysis, the best fitting points, where the rate changes significantly (increase or decrease) are chosen [8]. The analysis started with a minimum number of joinpoints, and tested whether one or more cut points were statistically significant, and whether or not they could be added to the model. In the final model, each joinpoint indicated a statistically significant change in a trend; computed next was the annual percent of change for each of those trends. For Joinpoint analysis, the overall significance level was set at $P = 0.05$. Significant changes included changes in direction or rate of the trend. The permutation test – testing the number of joinpoints 0 against 2 – was applied in this case, because the 20-year period did not allow obtaining statistically significant results for more joinpoints. Coefficients of regression, multiplied by 100, were presented as average annual changes (AAC), which were considered to be statistically significant at the $P < 0.05$ level. This methodology assisted in identifying the occurrence of changes in mortality form stroke during distinct periods.

The next part of the study sought to determine the regional inequalities in stroke mortality. The definition of municipalities was also based on the Law on the Territorial Administrative Units of the Republic of Lithuania and their Boundaries. The municipality is a territorial administrative unit, which is governed by institutions of local authorities. The basic criteria of a municipality are its preparedness to manage and maintain its environment, municipal economy, to provide communal services to local inhabitants and to perform other functions. The size of municipalities varied from 2519 to 538,988 inhabitants in average in 2008–2012. Rural municipalities are called "regional" or "regions," meaning that this population is attributed to the rural. Age-standardized mortality from stroke was calculated for all 60 municipalities of Lithuania. The 5-year period (2008–2012) was selected in order to circumvent annual fluctuations in the data, which may have been occurring in these regions. Mortality rates with 95% confidence intervals were assessed.

3. Results

3.1. Critical points in mortality from stroke throughout the period of 1991–2012

In 2012, stroke accounted for 17.50% of deaths for males and 22.53% for females among all deaths from cardiovascular diseases, while in the overall mortality structure it took 8.14% and 14.69%, respectively. The proportion of stroke decreased slightly since 1991, particularly for females, nevertheless, this cause of death still remains of the great importance.

Throughout the entire study period, mortality from stroke had insignificant declining tendency for males, which was caused by considerable varying transformation during the last two decades. For females, statistically significant decline was observed. Based on joinpoint analysis, the years 1994, 2001, and 2008 can be assumed to be the significant change points of mortality rates for males, while for females, the break-points were observed in 1999, 2002, and 2007 ($P < 0.05$). The most favorable joinpoint was observed in 2008 for males and in 2007 for females, when the increasing trend reversed to the statistically significant decline with an average annual change of −2.34% in males and −2.60% in females (Figs. 1 and 2).

3.2. Urban/rural and regional patterns in mortality from stroke

Mortality from stroke in rural areas was lower both for males and females since the beginning of the study period (1991) till
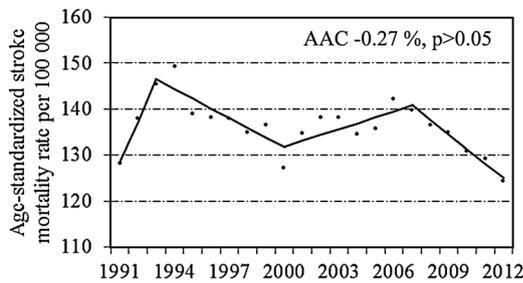
Fig. 1 – Trends in mortality from stroke among Lithuanian males (AAC, average annual change).
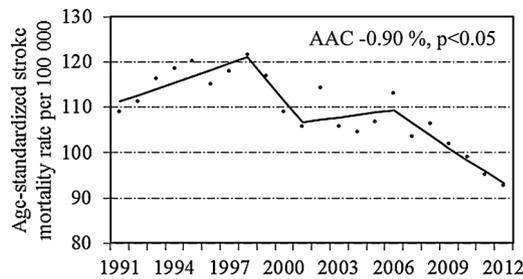

Fig. 2 – Trends in mortality from stroke among Lithuanian females (AAC, average annual change) AAC −0.90%, p < 0.05.

1996, when rural mortality rates became higher in comparison to the urban ones. The most considerable differences were observed in 2010, when the rural-to-urban mortality ratio reached 1.16 in males and 1.29 in females. Trends were not uniform in urban and rural areas. In urban areas, the average annual decline was registered both for males (−0.73%) and females (−1.49%) (P < 0.05), while in rural areas no significant change occurred (Fig. 3).

The break-points in stroke mortality of urban and rural populations also differed, nevertheless, in urban areas the year 2008 for males and 2009 for females could be considered as the change point towards statistically significantly declining trend in mortality. In rural areas, the positive break-point occurred in 2009 in males and 2007 in females, when the growing trend reversed to the declining one. Unfortunately, this positive trend in rural areas was not statistically significant (Table 1).

Analysis of the regional inequalities in mortality in 60 municipalities of Lithuania suggested that the highest mortality both for males and females was observed to be exceptionally prominent in the rural areas (Utena, Šalcininkai, Molėtai municipalities), while the lowest mortality was noted in the resort town of Birštonas (Figs. 4 and 5).

Mortality varied considerably in the regions. The ratio between the lowest and the highest age-standardized mortality rates from stroke for males was 4.88 and for females 3.35, nevertheless, the difference between regional variation of males and females did not differ statistically significantly (Table 2).
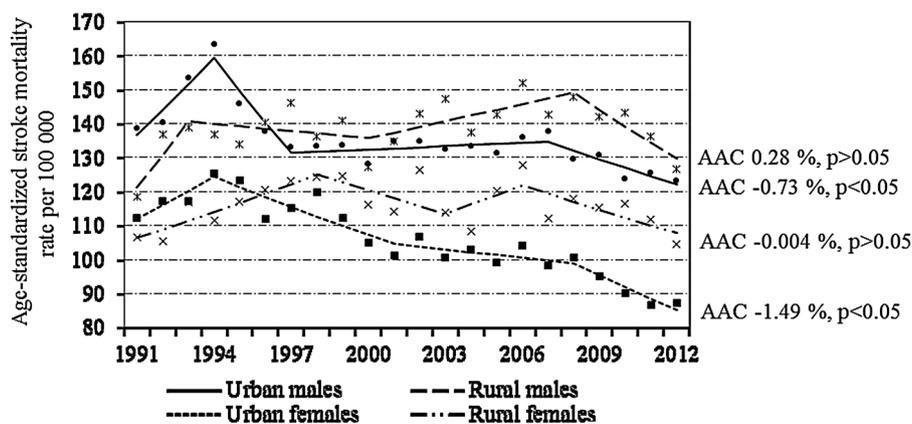

Fig. 3 – Trends in mortality from stroke among Lithuanian urban and rural population (AAC, average annual change).

| Table 1 – Average annual changes (AAC) and joinpoint analysis of mortality from stroke in urban and rural Lithuanian populations (%).								
Trend	Urban population				Rural population			
	Males		Females		Males		Females	
	Years	AAC	Years	AAC	Years	AAC	Years	AAC
Trend 1	1991–1995	5.26[*]	1991–1995	3.55	1991–1994	7.66	1991–1999	2.36[*]
Trend 2	1995–1998	−6.25	1995–2002	−2.45[*]	1994–2001	−0.50	1999–2004	−1.96
Trend 3	1998–2008	0.24	2002–2009	−0.78	2001–2009	1.19	2004–2007	2.45
Trend 4	2008–2012	−1.94[*]	2009–2012	−3.71[*]	2009–2012	−3.47	2007–2012	−2.03
[*] P < 0.05.								
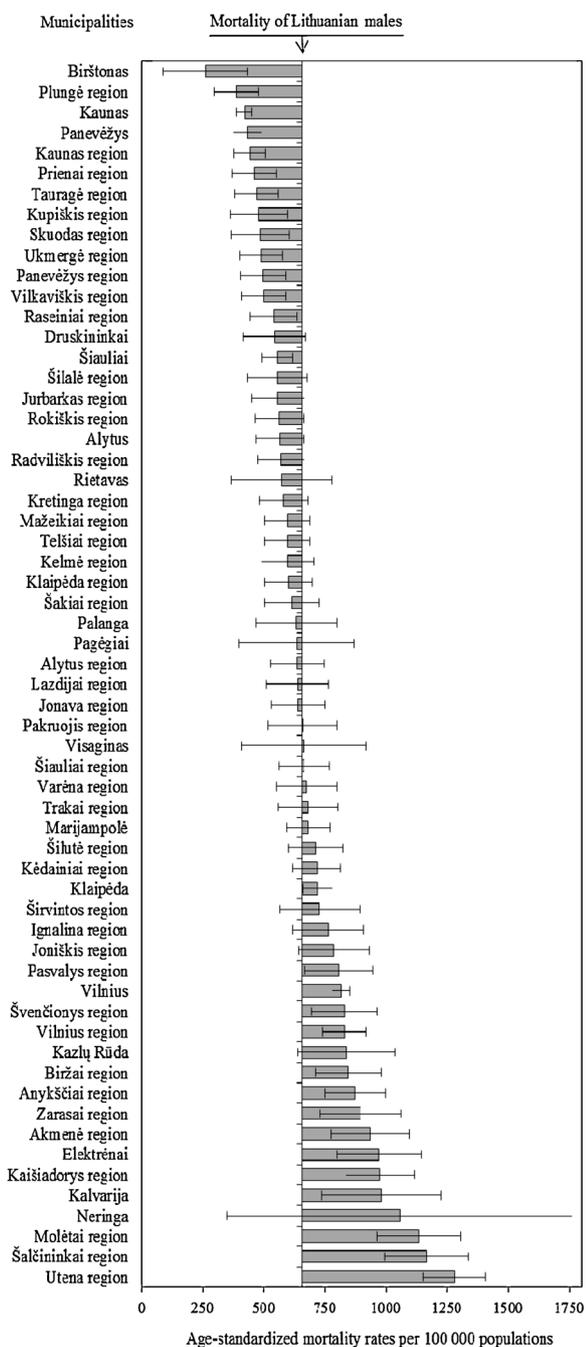
Fig. 4 – Age-standardized mortality from stroke among males in the municipalities of Lithuania.
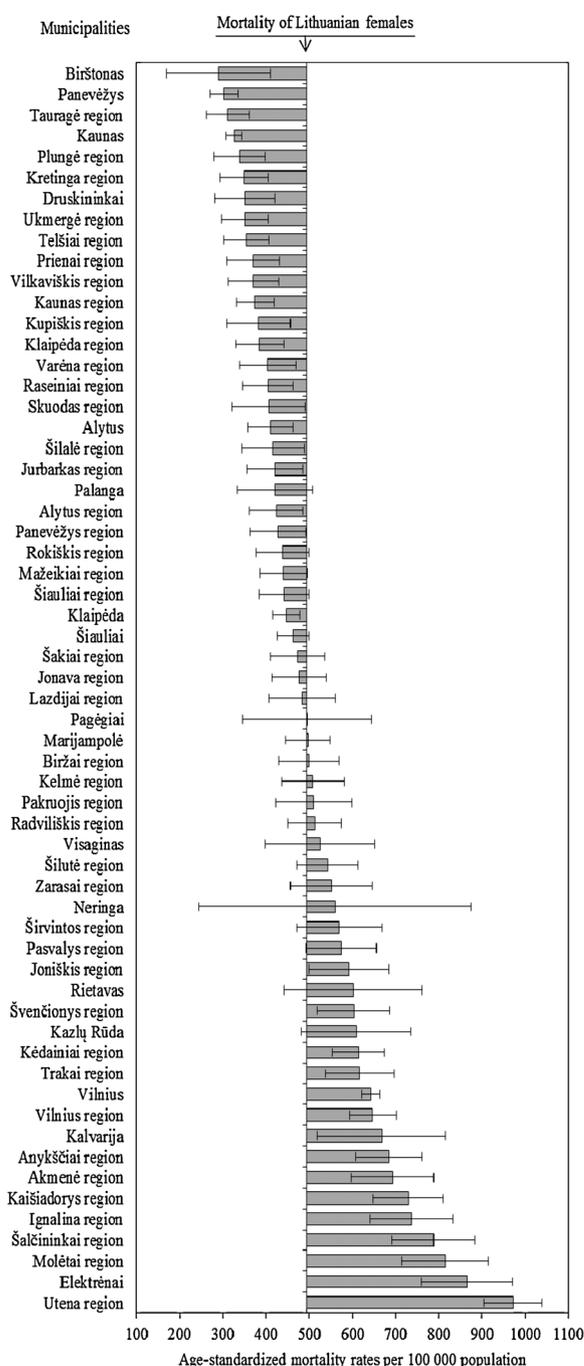

Fig. 5 – Age-standardized mortality from stroke among females in the municipalities of Lithuania.

4.   Discussion

Since the start of political and economic reforms in 1989, health care system in Lithuania underwent major reforms, to renovate and create a financially sustainable modern health care system that can provide high quality services. The development of primary health care network was considered a crucial aspect of these reforms. The health care system was decentralized, with management devolved to various government levels. Ownership of and responsibility for health care institutions have passed from the Ministry of Health to the municipalities. At the regional level, most health care providers are governed by the regional administration. The municipalities are responsible for providing primary health care to their local populations. They have been granted property rights for outpatient facilities and nursing homes, and they also run small and medium-sized hospitals in their localities.

According to the Health Insurance Law, all permanent residents of Lithuania must participate in the statutory health

Table 2 – Regional differences in age-standardized mortality from stroke among 60 municipalities in Lithuania (2008–2012).			
	Mortality rate for Lithuania (95% CI)	Maximum mortality rate (per 100,000 population)	Minimum mortality rate (per 100,000 population)	Mortality ratio (95% CI)
Males	655.48 (642.99–667.97)	1280.01	262.23	4.88 (1.61–8.15)
Females	495.28 (487.89–502.67)	973.08	290.09	3.35 (1.95–4.75)
Total	562.71 (556.14–569.27)	1121.22	292.73	3.83 (2.46–5.20)

insurance scheme. Unemployed people and those belonging to certain vulnerable social groups are covered by the State. However, equity in accessibility to comprehensive stroke care has not been sufficiently studied in Lithuania, while in the countries with limited resources, assurance of equity in health and health care of different social and age groups remains particularly relevant.

Stroke prevention, care and management systems experienced a huge improvement during the study period both in terms of policy development and structural changes. Following the establishment of Lithuanian Stroke Association in 1997, the guidelines for the diagnosis, treatment and prevention of cerebrovascular stroke were prepared, approved by the Ministry of Health and published in 1999 [9]. These guidelines had a major impact on the standardized approach to stroke care across the entire country and brought an evidence based recommendations to everyday clinical practice. The guidelines were updated in 2008 and 2012. A fourth revision is on the way. In 2013, the Ministry of Health launched an initiative of establishing six specialized stroke centers across the country. Each of these centers was ordered to create a clinical network (cluster) with regional and local hospitals thus ensuring direct access of the patients to the best stroke care if needed. New effective therapies for ischemic stroke which have emerged at the beginning of the 21st century, i.e. intravenous thrombolysis and mechanical thrombectomy, have raised new requirements for the health care infrastructure, including highly specialized and qualified physicians – neurologists, radiologists, physiotherapists, and other team members, working together to help stroke patients. It was generally acknowledged that for keeping high medical standards and assuring quality of the services provided, a critical number of cases per year have to be seen and diagnosed or treated by a physician. In 2014, the Ministry of Health has started reorganization of patients' flows, in order to concentrate patients who require a specialized care to large size and university hospitals.

National prevention measures for cardiovascular diseases, including stroke, were initiated in 2006, and seem to be effective in terms of mortality [10]. Stroke prevention programs covered the entire country, and family physicians played important roles when implementing these programs both through the direct contact with their patients and through mass media.

Mortality from stroke increased in the beginning of the study period both in urban and rural areas. Gradually inequalities in urban/rural mortality ratios reversed: stroke mortality changed from being more prominent in urban areas to more negative situation in rural areas. The mortality trends were considerably more favorable in urban areas, compare to the rural ones. The health of Lithuanian rural population as compared to the urban population deteriorated significantly more during the period of transition. In the modern societies, health is mainly determined by social stress and lifestyle, which is associated closely with the socioeconomic status of the population [11]. This finding suggests that the rural population might be exposed to less successful health promotion, stroke prevention and care measures. Our previous studies on the regional inequalities in life expectancy in Lithuania demonstrated that cardiovascular diseases make the major contribution to the regional differences in life expectancy of females and is the second major contributor to the regional inequalities in life expectancy of males, following mortality from external causes [12]. Therefore, it is not surprising, that our study disclosed rather significant regional variations in stroke mortality.

Avoidable mortality is a concept, which represents mortality from conditions amenable to medical interventions. Hypertension and cerebrovascular conditions are considered as being amenable causes of death [13,14]. We could hypothesize that inequalities in mortality from stroke are more strongly associated with inequalities in health care use and less with inequalities in common risk factors. Cerebrovascular mortality was considered as being the leading avoidable cause of death, and major contributor to the educational inequalities in avoidable mortality in many countries [14]. The same large European study suggested, that social (educational) inequalities in avoidable mortality are especially pronounced in Lithuania. Nevertheless, a wide-scale European comparative survey, focusing on inequalities in mortality from conditions amenable to medical interventions, in which Lithuania was involved, did not find evidence that inequalities in mortality from these causes are related to inequalities in access or quality of health care [15]. These finding points at life style risk factors, as important contributors to the regional inequalities in stroke mortality, since there are disparities in life style reported between rural and urban populations in Lithuania, placing rural population in more unfavorable position [16,17]. Nevertheless, this hypothesis requires more specific analysis of the Lithuanian case.

Most probably, new measures and technologies in stroke prevention and treatment, as well as rising quality of health care contributed to the declining trends in stroke mortality across the country. Reorganization of health care services should ensure the sustainability of this effect and diminishing regional disparities in stroke mortality. Resistance to follow reorganization of health care provision in the regions, as well as neglecting of territorial inequalities in health related behaviors might result in disparities in stroke mortality rates between urban and rural populations and among different regions of Lithuania in the future.

5. Conclusions

The positive break-points in mortality from stroke occurred in 2007 for females and 2008 for males, when the increasing trend reversed to the declining. However, more positive changes occurred in urban areas, where mortality became lower as compared to the rural areas since 1996. Urban/rural disparities in mortality are still significant. Considerable inequalities in age-standardized mortality from stroke exist among administrative regions of Lithuania. There are good reasons to expect the favorable cerebrovascular mortality trends observed will follow the same direction in the future. Stroke centers are growing up in their competence, while regulation of patients' flows and networking are also under the development. The new strategies in stroke care should result not only in the declining mortality rates and numbers of severely handicapped stroke patients, but also in diminishing urban/rural and regional inequalities.

Conflict of interest

The authors state no conflict of interest.

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