# Changes of Geographical Mortality Differences in the three Baltic Countries during the Period of Socio-Economic Transformation [1]

***Juris Krumins*** (Latvia) - University of Latvia (Riga), Latvia
***Domantas Jasilionis*** (Lithuania) – Max Plank Institute for Demographic Research, Rostock, Germany
***Mall Leinsalu*** (Estonia) – University College of Southern Stockholm, Sweden
***Vlada Stankuniene*** (Lithuania) – Demographic Research Center, Vilnius, Lithuania

## 1. Introduction

The geographical variations in public health and mortality in the Baltic countries in historical context have until now received little attention. Individual studies have been conducted on the regional disparities of mortality and morbidity in each country, especially starting from the 1990s. In Estonia the Tallinn Institute of Experimental and Clinical Medicine published an atlas of mortality in Estonia (Baburin *et al.*, 1997) and a study on cancer mortality (Thomson *et al*., 1996), which marked the first attempt by Estonian epidemiologists to identify the geographical differences in mortality patterns for the period 1983-1992.

In Latvia Krumins published several articles at the beginning of the 1990s on the geographical variations in life expectancy and mortality from the main groups of cause of death in Latvia over the last twenty years (Krumins, 1992, 1993). Data on regional cancer incidence by region have also been collected and published by the Latvia Cancer Register (LOC, 1994, 1996). Finally, Eglite and Klintaja (1990) presented an analysis of the geographical variations of infant mortality and cancer mortality in Latvia. Many aspects of socio-economic development and human capability in the regions are analyzed since that (Bauere, Eglite, Nordregio, UNDP, Vanags et al.). In Lithuania regional differences in causes of death at the end of the 1980s have been analyzed by Kasnauskiene (1992), and several articles have been published on cancer and cardiovascular diseases (Kalediene and Petrauskiene, 1995; Kurtinaitis et al, 1995; Kairiukstis, 1997).

Conversely, very little has been published on the three Baltic countries together (Jozan and Prokhorskas, 1997; Zaborskis *et al*., 1995). The WHO, in collaboration with the Hungarian Statistical Office, has published an atlas of causes of death in Central and Eastern Europe, including the Baltic countries, (Jozan and Prokhorskas, 1997). The maps contained in this atlas are extremely informative and give valuable indications of the variations in mortality from some causes of death within individual countries. However, because the maps have been established using different scales and, more seriously,

[1] This paper is continuation of analysis, basic results of which were presented in the IUSSP International seminar in Kiev (12-14 October 2006) "Mortality in countries of the former USSR. Fifteen years after break-up: change or continuity?" by adding new life tables, SMR calculations and other materials. Regional life expectancies by gender, SMR calculations for respiratory diseases are presented in the Poster session of the IUSSP 26th International Population Conference. Authors are thankful to F.Meslé and J.Vallin (France) for their input to analysis which is part of collaborative research project.

different data distributions, they cannot provide any information about the continuity or discontinuity of these national mortality patterns across international boundaries. Several good reasons exist, however, for studying these three small northern European countries as a single unit.

The aim of this paper is to analyze the geographical differentials of mortality from the late 1980s till the beginning of XXI century in the three Baltic countries – Estonia, Latvia and Lithuania. Firstly, authors want to stress historical heredity of some regional dimensions in mortality. Secondly, continuities and discontinuities in the mortality patterns with the neighborhood are searched. Thirdly, analysis is focused on changes over the transition period during the 1990s, when huge socio-political transformations occurred. Due to small numbers of population and deaths in the administrative units of three Baltic countries analysis is conducted for both sexes together for all causes and the main categories of causes of death. The present study will use indicators that are comparable from one country to another and analyses the variations observed on a scale that is the same for all three countries.

## 2. Data

Currently the Baltic countries have a total of 7 million inhabitants and a surface area of 142 thous. $km^2$. From the beginning of 1990s a number of population declined almost by one million. Three countries have a total of 181 towns and cities. Eight of these have a population of over 100 thousand, and two, Riga and Vilnius, have more than 500 thous. Due to its historical role in the region Riga with 717 thousand inhabitants (almost one million inhabitants in 1989), is the largest city of the three Baltic countries. The other two capital cities are smaller: Tallinn in Estonia has 396 000 inhabitants and Vilnius in Lithuania has 543 thousand. However, Lithuania also has a second large city, Kaunas, the former capital, which has slightly over 400 thousand inhabitants.

At the time of the 1989 Population Census the three Baltic countries comprised a total of 85 basic administrative units: 26 rayons in Latvia, 44 rayons in Lithuania, and 15 maakonds in Estonia. To this must be added the towns and cities under republican jurisdiction (6 in Estonia, 7 in Latvia and 11 in Lithuania). For the purposes of the present analysis, however, the 15 capital towns of maakonds in Estonia are considered instead of the 6 towns under republican jurisdiction. The analyses are performed in two ways. First approach is based on the entire administrative units including towns. This approach is used for extended regional analysis of the three Baltic countries with their neighborhood. According to the second approach, which mainly is used in this paper, towns are considered separately to pay more attention to the role of urbanization in geographical variations of mortality. Around the Population census 1989 there are 118 geographical units included in analysis, but around censuses of 2000 and 2001 - 123 in the total.

After the 1989 Population Census changes in administrative division have occurred in all Baltic countries. In Estonia after the 1989 Population Census republican city administrations were liquidated and cities and towns belonging to them were

included in counties. During the 2000 Population Census the territory of Estonia was divided between 15 counties (maakonds) like in 1989, city municipalities numbered 42 and rural municipalities – 205. On the basis of Law of the Republic Lithuania on territorial Administrative Units and their borders (1994, 1999) at the first stage of the reform of territorial administrative units 56 municipalities and 10 counties were establishes. The territorial-administrative structure of Lithuania was partially changed at the beginning of 2000 with the establishment of some new municipalities, abolition of some existing ones and by redistributing some minor territories between the counties. For years around 2001 Population Census in Lithuania 60 municipalities (savivaldybes) in are included in analysis, 7 of which are town municipalities, 10 rural municipalities and 43 district municipalities (Statistics Lithuania, 2005).

Results of computations on maps for the years around the 2001 Population Census in Lithuania are presented according to the new administrative division of the territory, which is principally comparable with territorial division in 1989. The reform of territorial administrative division in Latvia was performed in 2009. Only minor changes in borders between territorial administrative units occurred between the Population Censuses 1989 and 2000. Regional analysis in this paper is performed in the frame of administrative units existed in the periods studied.

The basic administrative units vary in surface area and in population. They also differ by their socio-economic characteristics. Table 1 presents ranges of values for the proportion of urban population and the proportion of nationals in the total population of the administrative units. The latter figure varies widely, falling as low as 10% in Salcininku municipality in Lithuania, and 18-22% in Estonia and Latvia. The non-national population of these counties comprises mainly Russians. Lithuania also has a large Polish minority.

*Table 1. Size of variations in territory, population, proportion of urban population and proportion of nationals in the geographical units under review, Population Censuses 1989 and 2000/2001*

| Indicators | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Population Census 1989 | | | | | | |
| Territory ($km^2$) | 1023 | 4806 | 1633 | 3654 | 906 | 4507 |
| Population (thous.) | 4.1 | 527 | 28.9 | 1122 | 21.7 | 671 |
| Urban population ( %) | 29 | 89 | 21 | 90 | 13 | 88 |
| Nationals (%) | 18 | 96 | 19 | 90 | 47 | 99 |
| Population Census 2000 (Lithuania – 2001) | | | | | | |
| Territory ($km^2$) | 1023 | 4807 | 1604 | | 90 | 2530 |
| Population (thous.) | 10.4 | 526 | 26.4 | 964 | 2.4 | 643 |
| Urban population ( %) | 15 | 88 | 20 | 91 | 20 | 89 |
| Nationals (%) | 20 | 98 | 22 | 92 | 10 | 99.6 |

Note: The towns and cities under republican jurisdiction are not treated separately in this table but included along with surrounding county.

Very clear from the Table 1 is the great variation in the size of the basic administrative units. In 1989, the number of inhabitants per basic unit ranged from 4.1 thous. for Hiiu maakond (Estonia) to over a million for Riga (Latvia), representing a differential of 1 to 250. In 2000 that proportion decreased till 1 to 93. Neringos municipality (Lithuania) is the smallest municipality in the Baltic countries with only 2.4 thous. inhabitants.

Due to EU enlargement the European Parliament and Council Regulation was adopted on 26 October 2005 common classification of the territorial units (NUTS - Nomenclature of Territorial Units for Statistics of the EU). In connection with accession to the EU the Central statistical bureaus of the three Baltic countries compiles regional statistics according to 26 NUTS 3 regions: five in Estonia (Northern, Western, Central, Northeastern, Southern), five in Latvia (Vidzeme, Kurzeme, Zemgale, Latgale, Riga) and 10 in Lithuania. Geographical variation of mortality and life expectancy in the three Baltic countries by the NUTS 3 regions are not included in this analysis.

Data on death for the period 1987-1990 are available for six main groups of causes (coded according to the Soviet classification system, whose item numbers are given in brackets): infectious diseases (1–44), cancer (45–66), cardiovascular diseases (84–102), respiratory diseases (103–114), other diseases (67–83, 115–159), violent deaths (160–175). The available statistics also distinguish three particular components of violent deaths: road vehicle accidents (160–162), suicide (173) and homicide (174). Comparative analysis in this paper for both periods is performed for all deaths and for three categories of causes of death (codes are given according to ICD-10): neoplasms (C00-D48), diseases of the circulatory system (I00-I99) and external causes of mortality (V01-Y89).

## 3. Methods

The following analyses of geographical variations in mortality begins with the presentation of a number of classic indicators of general mortality levels (standard mortality ratio, life expectancy) or by age (infant mortality), before going on to use a cause-specific standard mortality ratio (SMR) and 95% confidence intervals by administrative units, in order to explore in greater detail the mortality contours specific to these three countries. Finally extending the same type of analysis to the neighboring countries, it will be possible to see if the geographical profiles of mortality by cause in the Baltic region has or has not any continuities beyond its own borders.

Computerized individual-level data on deaths by cause exist in all three countries for the recent years, so in theory it should be possible to obtain any distribution of deaths by cause, age, sex and administrative units as required. In practice, however, matters are less straightforward. First, it is not certain that this data exists for Lithuania and Latvia for the years around the Population census 1989. Second, access to this data is restricted,

and having them specially processed at short notice was only possible for Estonia. For this reason, we have had to make with the data already computed by the statistical institutions. There is no distribution of deaths by sex, age, cause and administrative area.

What are available for each area, however, are the population distributions by sex and by five-year age groups in the census and the distributions of deaths by some groups of causes (with no age and sex distinction). By taking a standardized mortality by age and sex for these same groups of causes *c*, a cause standard mortality ratio $SMR_C$ is calculated for each administrative unit:

$$SMR_c = \frac{D_c}{4 * \sum_{s=1}^{2} \sum_{x=0}^{\omega} m_{s,x,c} * P_{s,x}},$$

where

- $D_C$ is the total deaths observed in the administrative unit for cause *c*, in the period 1987–1990,
- $m_{S,x,C}$ is the reference mortality rate for sex *s*, age *x* and cause *c*,
- $P_{S,x}$ is the size of the population of the administrative unit of sex *s* and age *x* in the Population census.

To study the geographical variations in the three countries treated as a whole, we have taken as reference mortality the mortality rates for periods around the Population censuses by sex, age and cause calculated for this group from the sum total of deaths registered and the populations counted in the census in the three countries. For the first period, taken as a baseline for further socio-economic changes after a break-up of the former USSR, Population census data from 12 January 1989 and deaths during the years 1987-1990 were used for calculations. For the second period around the last Population censuses, data were not so comparable due to following reasons: 1) changes in the administrative division of Lithuania took place from the year 2000; 2) Population censuses in Estonia and Latvia took place on 31 March 2000, but in Lithuania one year later – on 5 April 2001.

Therefore it was decided to use for Estonia and Latvia data on deaths during the four year period 1998-2001 and Population census 2000 data on age composition of population, while for Lithuania data on deaths during the three year period 2000-2002 and Population census 2001 data on age composition of population where used in calculations. Reference mortality for the three countries altogether was calculated on the basis of population at the beginning of the year 2000 and number of deaths during the period 1998-2001. These peculiarities could not substantially influence the main conclusions, made for mortality of all causes of death and main categories of causes of death. Consequently, a $SMR_C$ that is higher than 1 indicates that mortality for cause *c* in the administrative unit under review is higher than in the three countries together, and vice versa.

The mean values of the SMR for each cause are further from unity than was the case for mortality from all causes (Table 2). Thus while the mean SMR (cities included) for mortality from all causes was 1.013, it is 0.926 for cancers and 1.18 for violent deaths. These disparities result of course, as for total mortality, from the heterogeneity of the population size in each administrative unit, but they are amplified (and in some cases their direction changed) by the fact that the geographical contours of mortality from each group of causes is different and more highly contrasted than that of total mortality which is the result of compensations between the contours for individual causes which, as we shall see, are sometimes symmetrical.

*Table 2. Extreme and central values of the SMR by groups of causes for the three Baltic countries, 1987-1990 (85 administrative units)*

| Group of causes | Minimum | | Maximum | | Mean | Standard deviation |
|---|---|---|---|---|---|---|
| | AU (country) | Value | AU (country) | Value | | |
| Infectious diseases | Sirvintu (Lit) | 0.266 | Dobele (Lat) | 1.870 | 0.971 | 0.312 |
| Cancer | Ogres (Lat) | 0.745 | Rigas (Lat) | 1.168 | 0.926 | 0.088 |
| Cardiovascular system diseases | Alytaus (Lit) | 0.767 | Laane-Viru (Est) | 1.284 | 1.016 | 0.126 |
| Respiratory diseases | Valga (Est) | 0.423 | Balvu (Lat) | 2.640 | 1.138 | 0.484 |
| Other diseases | Skuodo (Lit) | 0.600 | Balvu (Lat) | 2.614 | 1.038 | 0.325 |
| Violent deaths (total) | Ida-Viru (Est) | 0.679 | Polva (Est) | 2.267 | 1.182 | 0.302 |
| *Road accidents* | *Varenos (Lit)* | *0.500* | *Aizkraukes (Lat)* | *1.979* | *1.144* | *0.287* |
| *Suicide* | *Tukuma (Lat)* | *0.635* | *Kaisiadoriu (Lit)* | *1.804* | *1.129* | *0.230* |
| *Homicide* | *Hiiu (Est)* | *0.000* | *Valkas Lat)* | *1.691* | *0.881* | *0.358* |
| Total | Varenos (Lit) | 0.828 | Balvu (Lat) | 1.226 | 1.013 | 0.088 |

The standard deviation also varies widely between the groups of causes. Whereas it was 9% for the total of all causes, it ranges here from 9% for cancers to 48% for respiratory diseases. This reflects the fact that the geographical variations by cause are on the whole much more sharply contrasted than that for total mortality. The geographical pattern of the least contrasted cause will be as contrasted as that of total mortality.

When plotting the maps by cause, it might be thought that it is better to use the same classes of values of SMR for all the causes. However, because of the wide range of standard deviations, this would have the effect of making the geographical variations of cancers and cardiovascular diseases appear very slight compared with those of respiratory diseases and infectious diseases. At the level of total mortality, the two former groups of causes in fact have a much greater role than the other two. For this reason it seemed

better to use for each map a scale of values adapted to the size of the statistical series, based on the same principle as that used for mortality from all causes (3 classes of 2/3 standard deviations centered on the mean, plus two open classes at the extremes) and taking in account the information on cities as well.

## 4. Historical background

The three Baltic countries – Estonia, Latvia and Lithuania have a shared history which has been deeply influenced, first, by their inclusion in the Russian Empire in the eighteenth century[2], second, by a short period of independence between the World Wars, in the 1920s and 1930s, and lastly by almost fifty years of Soviet domination (1940-1991), excluding time of occupation by Nazi Germany (1941-1944), until they regained independence in 1991. This shared history has had the effect of homogenizing a number of the factors which influence changes in health and mortality.

However, each of the Baltic countries possesses its own distinctive cultural core identity. Through its language and customs, Estonia has strong affinities with the Finnish world. Latvia, however, compared with the other two countries, has been more marked by the Germanic influence, notably during the period of domination by the Teutonic Order. In the more recent past, following heavier losses during the Second World War, Latvia was more affected by Russian immigration during the period of Soviet rule. Lithuania, meanwhile, was associated with Poland under the reign of the same dynasty for several centuries and its present-day frontiers include a large area of territory (including the capital, Vilnius) formerly under Polish control. Finally, while Protestantism is the main religion in Estonia and Latvia, Catholicism is dominant in Lithuania.

### 4.1 Baltic provinces in the Russian Empire

According to crude death rates for the Baltic provinces (Table 3), a mortality decrease began in Latvia and Estonia (Kurland, Livland, and Estland provinces) approximately half a century earlier than in Lithuania (the Kovno and the Vilno provinces) and in European Russia, where it began at the turn of the 1890s and intensifiedat the beginning of the XX century. During the second half of the XIX century, infant mortality in the Baltic provinces was the lowest among all provinces of the European Russia, and was relatively low when compared to other European countries (Krumins et al, 1991).

[2] Estonia and a great part of Livonia (Eastern Latvia) were conquered by Russia from Sweden in 1721, after the Poltova battle. The rest of Livonia was annexed to Russia at the time of the first cut of Poland, in 1772, and the rest of present Latvia (the Curland) as well as Lithuania were annexed to Russia at the time of the third cut of Poland.

*Table 3. Mortality transition in the European Russia and the Baltic region (crude death rate, ‰)*

| | 1861-1865 | 1881-1885 | 1911-1913 | Average, 1861-1913 |
|---|---|---|---|---|
| 50 guberniyas of European Russia | 36.5 | 36.4 | 27.1 | 34.0 |
| Estland (Est) | 25.3 | 23.0 | 18.5 | 21.9 |
| Kaunas (Lit) | 26.1 | 24.3 | 18.1 | 23.9 |
| Kurland (Lat) | 22.0 | 19.2 | 16.8 | 19.1 |
| Livland (Est and Lat) | 26.3 | 22.5 | 17.8 | 21.7 |
| Vilnius (Lit) | 28.2 | 26.7 | 17.7 | 24.6 |

*Source: A.Rashin. Population of Russia over 100 years. Moscow, 1956. Pp.187-188.*

*Table 4. Life expectancy at birth in the Baltic provinces, 1896-1897 (years)*

| | Estland + five counties of Livland (93% Estonians) | Kurland + three counties of Livland (88% Latvians) | Kovno/ Kaunas (72% Lithuanians) |
|---|---|---|---|
| Males | 41.6 | 43.1 | 41.1 |
| Females | 44.6 | 46.9 | 42.4 |
| Both sexes | 43.1 | 45.0 | 41.8 |

Note: Indicator for both sexes is calculated as an average from male and female life expectancy.
Source: Ptuha M. Ocherki po statistike naselenyia. M: 1960. P.261.

A relatively high standard of public health care, sanitary culture, and economic development in the Baltic region determined a higher level of life expectancy in comparison with other regions of the European Russia at the end of the XIX century. Life expectancy in the Kovno, the Kurland, and the Livland provinces, with 72-93% of the native population, was the highest among all of the 11 nationalities living in the administrative territorial districts of the former European Russia in 1896-1897. The highest indices both for males and females were in Kurland and three counties of Livland (Table 4) followed by Estland and Kovno provinces.

### 4.2 Three independent countries

During the period of independence, after three Baltic countries proclaimed a political independence in 1918, life expectancy increased remarkably, keeping historically inherited variation. Life expectancy was higher in Latvia, followed by Estonia and Lithuania (Table 5).

*Table 5. Life expectancy at birth in the three Baltic states and selected countries in the 1920s (years)*

| | Years | Males | Females |
|---|---|---|---|
| Estonia | 1922-23 | 48.7 | 54.9 |
| Latvia | 1925-26 | 50.7 | 56.9 |
| Lithuania | 1925-26 | 49 | 52 |
| Finland | 1921-30 | 50.7 | 55.1 |
| France | 1928-33 | 54.3 | 59.0 |
| Germany | 1924-26 | 56.0 | 58.8 |
| Greece | 1926-30 | 49.1 | 50.9 |
| Japan | 1926-30 | 44.8 | 46.5 |
| Sweden | 1921-30 | 61.0 | 63.2 |
| USSR, European part | 1926-27 | 41.9 | 46.8 |

Between world wars Eastern part of Latvia – Latgale continued to lag behind other regions of country. Infant mortality in Latgale over the twenty year period exceeded 100 deaths per thousand births (Table 6). That was by 21 per cent higher than national average. Age-specific death rates in the Eastern part of Latvia was higher than in other regions in all age groups, excluding age 75 and older (Table 7).

Capital cities Riga and Tallinn had for that time comparatively low infant mortality rates – accordingly 50.1 and 67.0‰. Top level of infant mortality during 1930-1934 in Estonia was in the South-East – Petseri maakond (182‰), which with relatively high proportion of Russian minority population at the beginning of Soviet domination was incorporated into Russian Federation. Infant mortality significantly exceeded Estonian country average in Saaremaa island (118‰) as well.

*Table 6. Geographical variation of infant mortality rates in Latvia and Estonia during 1921-1939 (‰)*

*A) Latvia, 1921-1939*

| Years | Latvia - total | including regions (apgabals) | | | | |
|---|---|---|---|---|---|---|
| | | Riga-city | Vidzeme | Kurzeme | Zemgale | Latgale |
| 1921-25 | 96,1 | 94.0 | 80.1 | 80.9 | 96.5 | 106.9 |
| 1926-30 | 95.1 | 85.4 | 70.9 | 81.0 | 93.2 | 113.1 |
| 1931-35 | 85.2 | 67.8 | 61.3 | 73.0 | 84.8 | 106.1 |
| 1936-39 | 75.7 | 50.1 | 61.5 | 64.6 | 72.2 | 99.7 |
| **1921-39** | **88.0** | **74.3** | **68.5** | **74.9** | **86.7** | **106.5** |

Calculated from: Latvijas PSR statistikas tabulas 1940.g. Rīga: CSB. 1940. Pp. 10,11,30.

*B) Estonia, 1930-1934*

| | Infant mortality rate, ‰ |
|---|---|
| **Estonia – total** | **96.2** |
| **Urban areas**, of which | **80.9** |
| 100 thous. and more inhabitants | 67.0 |
| 10-100 thous. inhabitants | 93.0 |
| less than 10 thous. inhabitants | 73.5 |
| **Counties**, of which | **99.9** |
| Viru | 95.1 |
| Järva | 77.3 |
| Harju | 88.5 |
| Lääne | 99.6 |
| Saare | 117.8 |
| Pärnu | 73.8 |
| Viljandi | 70.1 |
| Tartu | 95.3 |
| Valga | 83.0 |
| Võru | 94.7 |
| Petseri | 182.0 |

Source: Rahvastikuprobleeme Eestis. Vihik IV. Tallinn, RSK, 1937. P.35.

*Table 7. Life expectancy (years) and probabilities of death by age groups in Latvia's regions, 1924-1927 and 1935*

| Age | Latvia | Regions | | | | |
|---|---|---|---|---|---|---|
| | | Riga - city | Vidzeme | Kurzeme | Zemgale | Latgale |
| Life expectancy, 1924-1927 | | | | | | |
| 0 | 51.9 | 53.9 | 58.5 | 57.7 | 56.0 | 41.3 |
| Life expectancy, 1935 | | | | | | |
| 0 | 58.9 | 61.1 | 60.7 | 60.0 | 59.5 | 56.2 |
| Probabilities of death by age groups, 1935 (% to Latvia's average) | | | | | | |
| 0-14 | 100 | 74 | 85 | 87 | 95 | 123 |
| 15-24 | 100 | 77 | 109 | 96 | 105 | 104 |
| 25-34 | 100 | 88 | 113 | 104 | 85 | 107 |
| 35-44 | 100 | 97 | 92 | 99 | 103 | 110 |
| 45-54 | 100 | 104 | 90 | 95 | 98 | 110 |
| 55-64 | 100 | 107 | 90 | 92 | 97 | 111 |
| 65-74 | 100 | 106 | 92 | 100 | 93 | 110 |
| 75+ | 100 | 101 | 104 | 101 | 98 | 97 |

Calculated from: for 1924-1927 – Bite, J 1929, Latvijas iedzivotaju mirstibas tabulas. Riga.; for 1935 calculations by J.Krumins, based on – Latvijas statistikas gadagramata 1939, p.26.

Historically higher life expectancy in Livland (Vidzeme) and Kurland (Kurzeme) in comparison with other parts of Latvia existed in the mid 1920s. This sequence was changed in mid 1930s, when Riga city took over a leading place due to the most radical decline in infant mortality and adult mortality. Geographical differences in life expectancy diminished during that period. If in mid 1920s range between regional life expectancies constituted 17.2 years, than in mid 1930s it decreased to 4.9 years. Life expectancy in the Eastern Latvia – Latgale was 80 per cent of national average in mid 1920s, but it was only 95 per cent in mid 1930s.

**5. Continuities and discontinuities with the neighborhood**

Cross-frontier continuities clearly exist for some important groups of causes of death all over the Baltic region. The explanation is no doubt to be sought in the lifestyle and behavioral differences which change gradually according to the cultural influences that cross national boundaries. In particular, moving from the north of Estonia to the south of Lithuania corresponds to moving from populations who are close to the Finnish

world to populations whose history has been closely linked to that of Poland. In the same way, it is possible that the huge historical Russian influence progressively weakens from East to West.

To see if the geographical profiles of mortality by cause of the Baltic region has or has not any continuities beyond its own borders, data similar to those used for Baltic countries have been gathered on the neighbouring ones: Finland, Russia, Belarus, and Poland. For Finland all the 12 lääns have been considered[3] while for Poland information on all the 49 voivodies has been collected[4]. Unfortunately, for Russia it has not been possible to get data for units smaller than the oblasts, in spite of the fact that the closest of them are almost as large as a whole Baltic country. Obviously, only the four closest oblasts have been selected here: Pskovskaya, Leningradskaya, St.Petersburg city in the East and Kaliningradskaya in the West. For Belarus too, data were only get at the oblast level, for six among seven of them[5]. For all these units SMRs have been computed from total numbers of deaths by cause and population by age and sex of each unit, taking as standard mortality the total mortality by cause of the three Baltic countries. The period covered varies with country, depending on the size of the units, but it is always centered on the year 1989, as for Baltic countries[6].

At the level of all-causes mortality (Figure 1), Russian oblasts appear to have the highest mortality in the region. All of them, including the western Kaliningradskaya, are in the upper category, together with a few number (5) of Estonian maakonds, some more (9) Latvian rayons and only one Polish voivody. No one Lithuanian rayon nor Belarussian oblast belongs to this category. At the opposite, all Finland belongs to the lower category, to wich only very few (4) rayons of Lithuania belong, all other units of the other countries entering categories of higher mortality.

Finland is definitely in a much better situation than all the rest of the region and, in terms of causes of death, the comparison with this country will be biased by this overall advantage. However, all the other countries taken as a whole, a strong link appears here, across Russian border, between western Russian oblast and north-eastern Estonian maakonds as well as north-eastern Latvian rayons, while the Russian enclave of Kaliningrad clearly belongs to this pattern of Russian higher mortality. The latter contrasts with a rather large and continuous zone of lower mortality including most of Lithuania, eastern Poland (Reszow excepted), and western part of Belarus.

---

[3] Thanks to Tapani Valkonen who kindly provided us with statistical data.
[4] Thanks to Ewa Tabeau who kindly provided us with unpublished data.
[5] Data by oblast were kindly provided by Vladimir Shkolnikov, for Russia and Belarus as well.
[6] Pologne: 1988-1991 (population at 31-12-1988); Russia and Belarus: 1988-1989 (population at 1989 census); Finland: 1987-1990 (population at 1-1-1989).

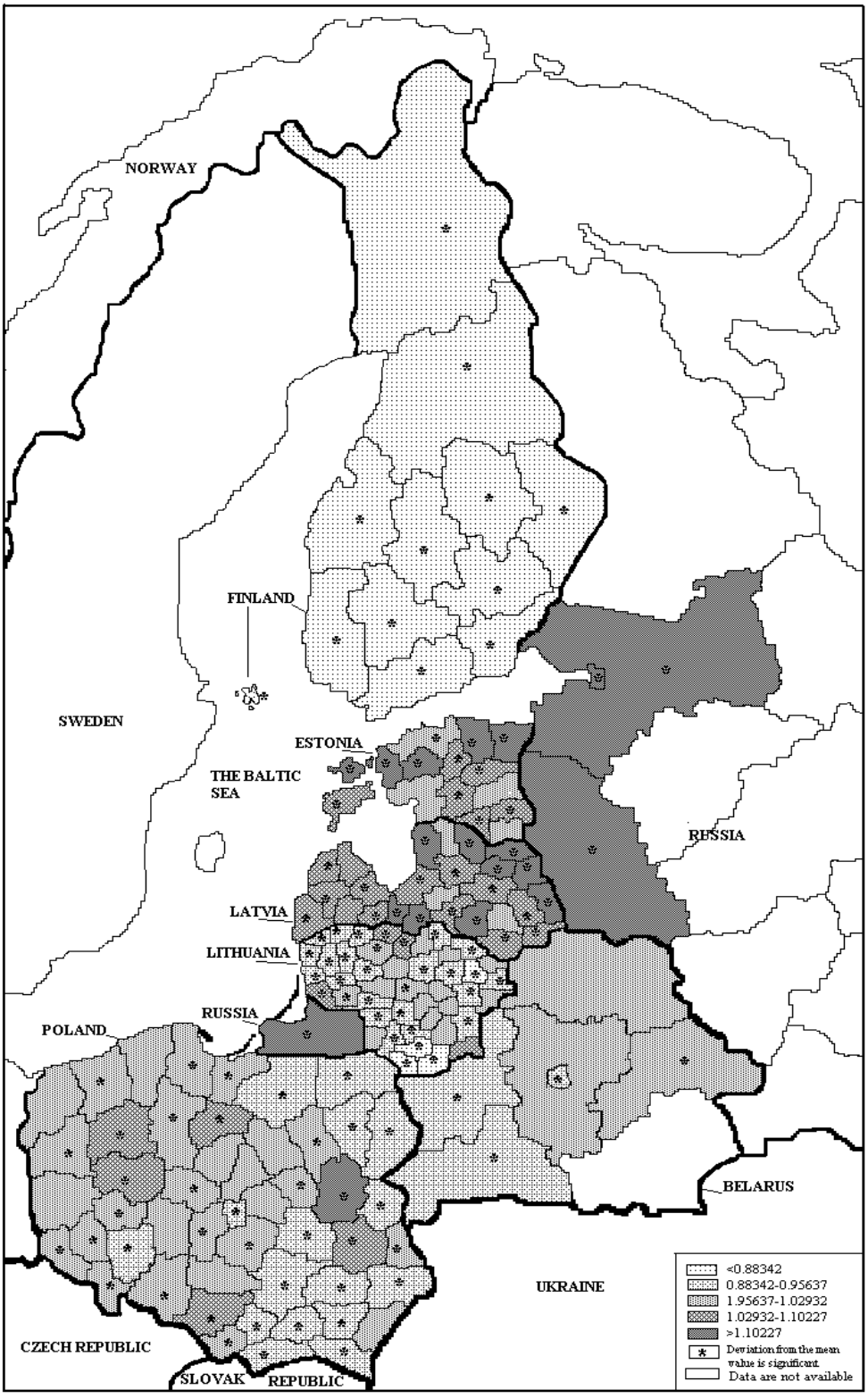



*Figure 1. Geographical distribution of the standard mortality ratio (all causes of death) in the Baltic countries and their neighborhood, 1987–1990*

What about causes of death? We only review here some of the groups of causes.

Not surprisingly, due to their major role in total mortality, cardiovascular diseases (Figure 2) show a geography rather similar to that of the total mortality. All Finland is very low, Russian oblasts are very high. However some features appear more pronounced. The links between Russian oblasts and Estonian and Latvian units are extending to almost all the Estonian maakonds and Latvian rayons, while lower level experienced in Lithania and Belarus extends to almost all Poland. Of Course, Finland remains at the lowest levels, but apart from this country a clear north-south opposition appears with high cardivascular mortality in Russian oblasts, Estonia, Latvia, and a few Lithuanian rayons at the Latvian border, while Lithuania, Belarus and Poland (except Reszow) experience lower mortality for this group of cause.

This feature, once again, contrast with that of respiratory diseases (Figure 3). For that group of causes, the higher Lithuanian mortality above mentioned joins here not only very high mortality observed in Belarus, some south-eastern Latvian rayons and Pskov oblast, but also rather high levels displayed among most of Polish voivodies. On the other side, low respiratory mortality experienced in the rest of Latvian rayons and in all the Estonian maakonds finds some extension toward Leningradskaia oblast and Petersbourg city. More striking is the fact that Finland shows rather high level of mortality for that group of causes.

Cancer mortality (Figure 4) shows a totally different geographical profile. The presence of high levels of mortality in the units including larg cities (St.Petersburg, Minsk, Varszow) confirms the link between cancer and urbanisation. Clear trans-border affinities appear here. The highest mortality observed in the St.Petersburg region on one hand and in all western and northern Poland on the other have extensions across the border, towards northern Estonia for the first and towards Kaliningradskaya for the second one. In the same time, lower levels of cancer mortality observed in Belarus join those of western Poland, Lithuania and Latvia.

Finally, very high Russian mortality by external causes (in western oblast as well as in Kaliningradskaya) has clear extension through Baltic borders, especially in Latvia, while western Belarus and Poland constitute a rather separate area of lower frequency of violent deaths (Figure 5).

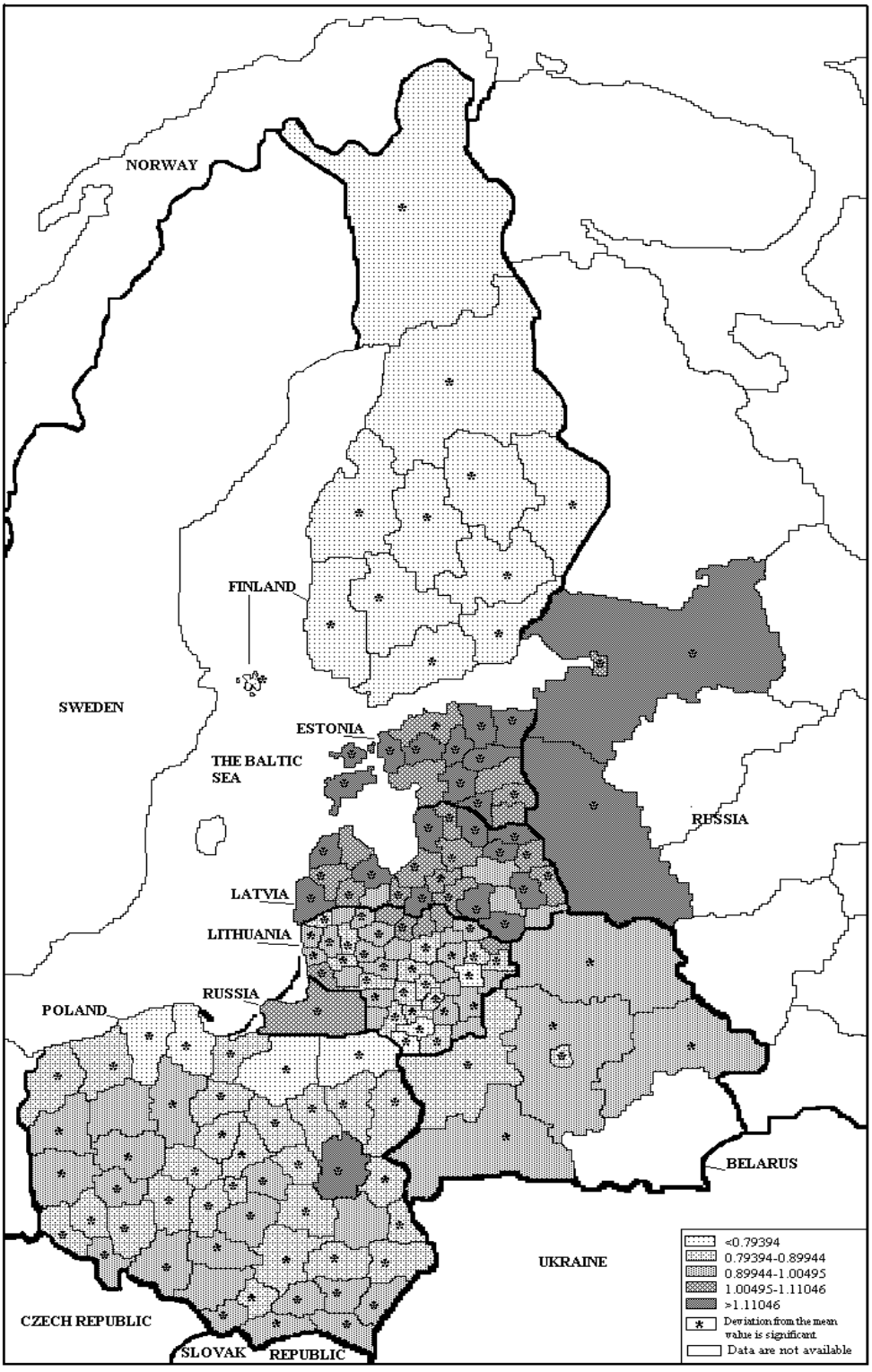



*Figure 2. Geographical distribution of the standard mortality ratio from cardiovascular diseases in the Baltic countries and their neighbourhood, 1987-1990*

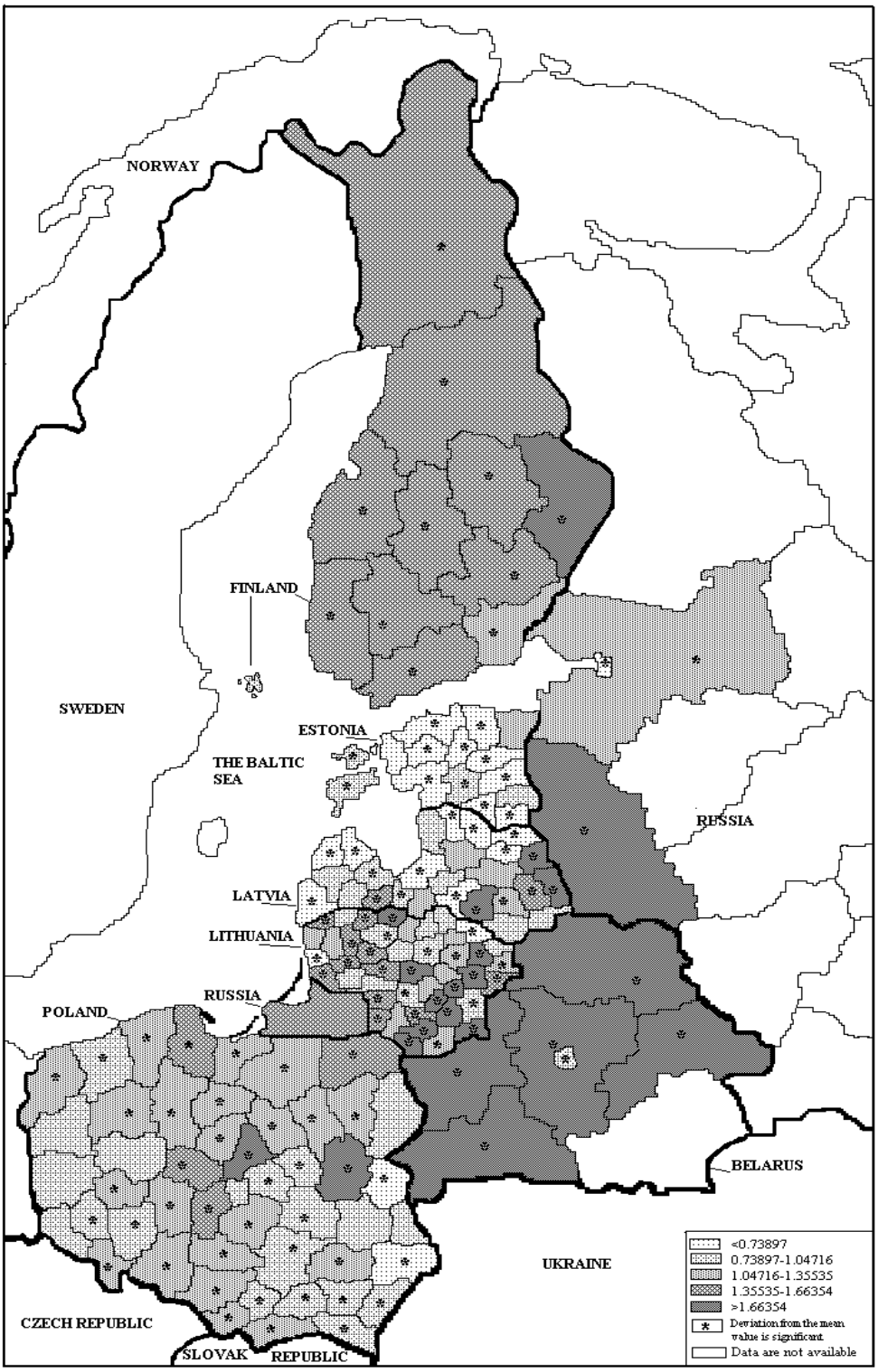



*Figure 3. Geographical distribution of the standard mortality ratio from respiratory diseases in the Baltic countries and their neighbourhood, 1987–1990*

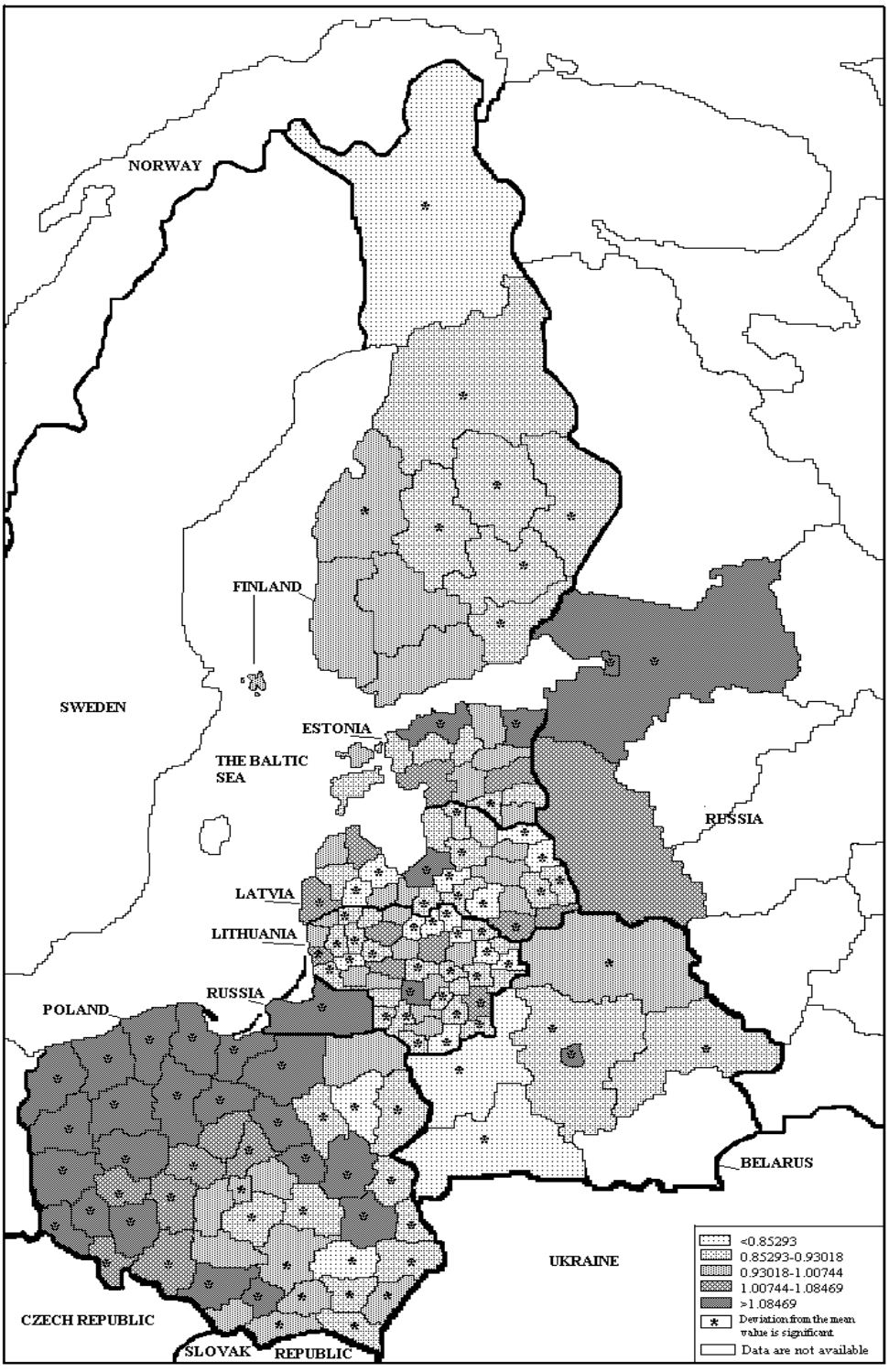



*Figure 4. Geographical distribution of the standard mortality ratio from cancer in the Baltic countries and their neighbourhood, 1987–1990*

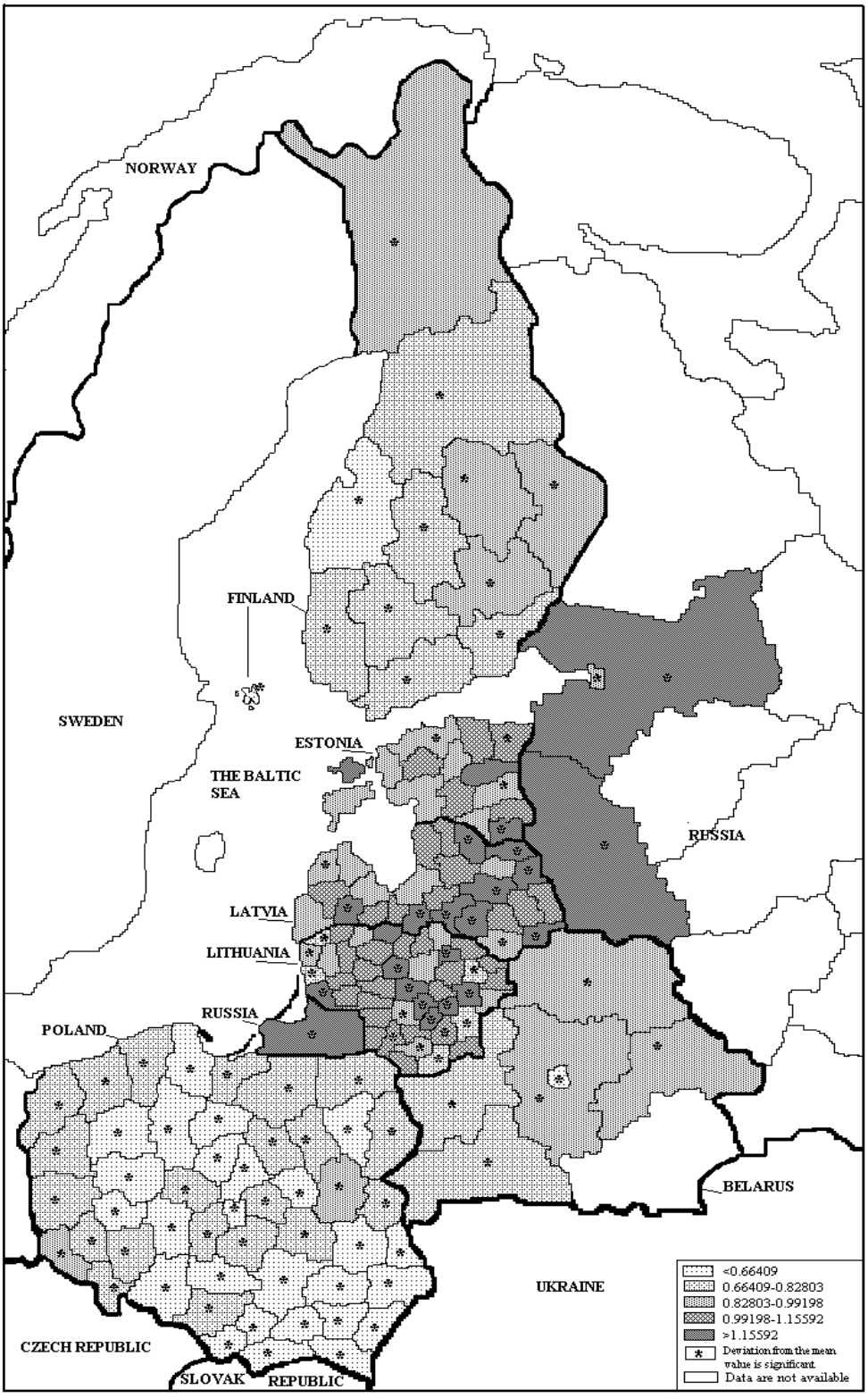



*Figure 5. Geographical distribution of the standard mortality ratio from external causes in the Baltic countries and their neighbourhood, 1987–1990*

## 6. Time of transition and socio-political transformations

From the indicators of variation it is clear that geographical variation of mortality in the three Baltic countries is larger among exogenous causes of death (infectious diseases, respiratory diseases, violent deaths) than among two main groups of diseases – diseases of the circulatory system and cancers (Table 8).

*Table 8. Indicators of variation of SMR by administrative units in the three Baltic countries, 1987-1990*

| Causes of death | Range | Standard deviation |
|---|---|---|
| Infectious diseases | 1.60 | 0.31 |
| Cancer | 0.42 | 0.09 |
| Cardiovascular diseases | 0.52 | 0.13 |
| Respiratory diseases | 2.22 | 0.48 |
| Other diseases | 2.01 | 0.33 |
| Violent deaths | 1.59 | 0.30 |
| Road accidents | 1.48 | 0.29 |
| Suicide | 1.17 | 0.23 |
| Homicide | 1.69 | 0.36 |

### *a) Opposite sequence of countries*

On the turn of XXI century three Baltic countries demonstrate an opposite sequence of national mortality indicators as a century ago. Latvia has lost its leading position and has the highest SMR followed by Estonia (Table 9). Now the lowest value of the SMR and the highest life expectancy is in Lithuania.

*Table 9. Extreme and mean values of the SMR for all causes of death in the three Baltic countries*

| Country | Number of AU | Minimum | | Country total | Maximum | | Mean value | Standard deviation |
|---|---|---|---|---|---|---|---|---|
| | | AU | Value | | AU | Value | | |
| Estonia | 30 | Põlva city | 0.74 | 1.05 | Narva city | 1.33 | 0.99 | 0.14 |
| Latvia | 33 | Talsu r. | 0.97 | 1.07 | Ludzas r. | 1.41 | 1.12 | 0.10 |
| Lithuania | 60 | Alytus city m. | 0.80 | 0.94 | Šalčininkai r.m. | 1.22 | 0.97 | 0.09 |
| Total | 123 | Põlva city | 0.74 | 1 | Ludzas r. | 1.41 | 1.02 | 0.12 |

Note: r. – rayon (Latvia), r.m. – rayon municipality (Lithuania), m. – Lithuanian municipality (after 2000).

***b) Cardiovascular and respiratory diseases: two north-south contrasts in opposite directions***

Among the most interesting results of this study is identification of the existence of two very clear north-south contrasts, one for cardiovascular diseases and other for respiratory diseases (Figure 6).

Cardiovascular mortality at the beginning of transition period was especially high in Estonia. The SMR for this group of causes (when cities are included into districts) was 1.10 in this country, as against 1.07 in Latvia and only 0.91 in Lithuania. The map reveals a clear continuum running from the regions of high mortality in the north down to the regions of low mortality in the south. A high cardiovascular mortality is general in Estonia, except in the maakonds where are the main cities, which accounts for the lighter areas formed on Figure by the maakonds of Harju (including Tallin), Parnu and Tartu. Almost all the other Estonian maakonds are in the highest class of mortality. This high Estonian mortality continues into the northern rayons of Latvia, but the map then becomes lighter towards the centre and the south, with mortality levels comparable to those observed in some rayons in the north of Lithuania, thereby forming the transition with the regions of particularly low mortality of the rest of Lithuania.

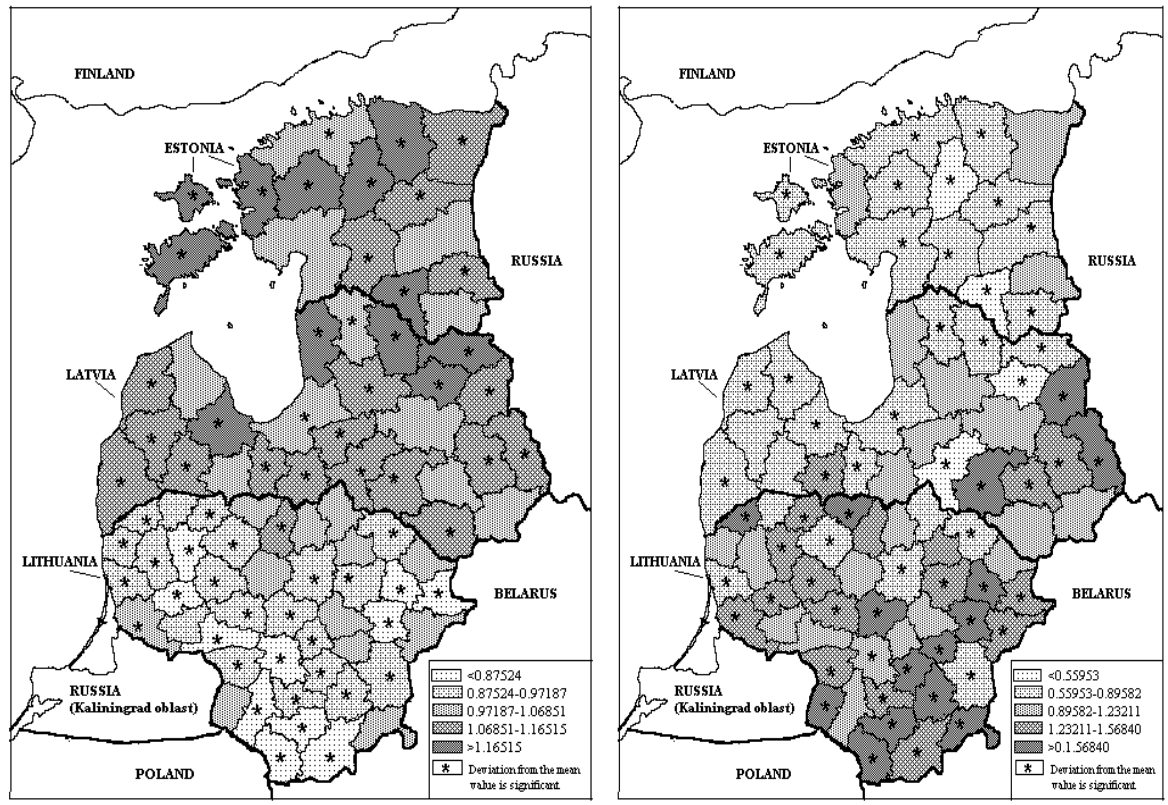
Mortality from respiratory diseases varies in exactly the opposite direction. The SMR goes from 0.7 in Estonia to 0.9 in Latvia, and to 1.2 in Lithuania. It can be noted that for this group of causes, Lithuania in fact occupies the opposite position to that which it occupies for total mortality. For although Lithuania enjoys the highest life expectancy, respiratory diseases are responsible here for much higher mortality than in the other two countries. In this case too, the cross-border continuity is clear. The high Lithuanian mortality is continued towards the south-east of Latvia, while the rest of the country makes the transition with the low mortality regions of Estonia.

*Table 10. Extreme and mean values of the SMR for cardiovascular system diseases in the three Baltic countries*

| Country | Number of AU | Minimum | | Country total | Maximum | | Mean value | Standard deviation |
|---|---|---|---|---|---|---|---|---|
| | | AU | Value | | AU | Value | | |
| Estonia | 30 | Jõgeva city | 0.55 | 1.08 | Ida-Virumaa | 1.32 | 1.00 | 0.19 |
| Latvia | 33 | Talsu r. | 0.82 | 1.08 | Ludzas r. | 1.61 | 1.14 | 0.15 |
| Lithuania | 60 | Kaunas r. m. | 0.79 | 0.93 | Šalčininkai r.m. | 1.28 | 0.97 | 0.10 |
| Total | 123 | Jõgeva city | 0.55 | 1 | Ludzas r. | 1.61 | 1.02 | 0.16 |

Note: r. – rayon (Latvia), r.m. – rayon municipality (Lithuania), m. – Lithuanian municipality (after 2000).

On the turn of XXI century general pattern of north-south divide has not changed: cardiovascular mortality still is higher in Estonia and Latvia, but the lowest in Lithuania (Figure 8 and Table 10).




Cardiovascular diseases Respiratory diseases

Figure 6. Geographical distribution of the SMR in the Baltic countries, 1987-1990

### *c) Cancer: a town disadvantage*

Mortality from cancers, like cardiovascular mortality, appears to be slightly lower in Lithuania than in the other two countries, the national SMR being 0.97 in Lithuania in 1987-1990 as against 1.03 in Latvia and 1.05 in Estonia. Difference between national SMR diminished during transition.

The maps of cancer mortality (Figure 9) does not reveal a geographical progression like that observed in the two previous cases, but instead a number of dark patches dotted over a relatively light background. This is because cancer mortality is higher in the towns and cities than in the countryside. Each of the dark patches in fact corresponds to an administrative unit containing a relatively large urban centre. The urban disadvantage in the field of cancer may be artificially magnified because of a better registration of deaths from cancer in urban zones. Many authors are of the view that in the countries of the former-USSR mortality from cancer is under-estimated, notably at high ages (Shkolnikov *et al*., 1999), resulting instead in a corresponding overestimation of cardiovascular

diseases (Belenkov *et al*., 1987). The same phenomenon may have affected the Baltic countries, with a greater impact in the countryside than in the urban area[7].

### *d) Violent deaths: excess mortality in the east*

Violent deaths considered as a group present much less variation between the three countries than any other group of causes. The national SMR are fairly similar, though with a slight disadvantage for Estonia and Latvia: 1.03-1.02 as against 0.97 in Lithuania (Table 11). But the standard deviations are quite large, especially in Estonia. A clear east-west divide is apparent in Estonia and Latvia, with a higher mortality in the east of the country (Figure 10).

Once again cities have a much lower mortality than the rest of administrative units. Everywhere in the towns, mortality for external causes is low, with a very narrow range of differences between them all over the three Baltic countries. The geographical variation of this group of causes depends typically on rural areas.

*Table 11. Extreme and mean values of the SMR for external causes of deaths in the three Baltic countries*

| Country | Number of AU | Minimum | | Country total | Maximum | | Mean value | Standard deviation |
|---|---|---|---|---|---|---|---|---|
| | | AU | Value | | AU | Value | | |
| Estonia | 30 | Kuressaare city | 0.59 | 1.03 | Valga city | 1.55 | 0.95 | 0.26 |
| Latvia | 33 | Ventspils city | 0.69 | 1.02 | Ludzas r. | 1.66 | 1.06 | 0.22 |
| Lithuania | 60 | Druskininkai m. | 0.64 | 0.97 | Ignalina r. m. | 1.62 | 1.08 | 0.22 |
| Total | 123 | Kuressaare city | 0.59 | 1 | Ludzas r. | 1.66 | 1.04 | 0.23 |

Note: r. – rayon (Latvia), r.m. – rayon municipality (Lithuania), m. – Lithuanian municipality (after 2000).

### *e) Changes in geographical variation of mortality*

Geographical variation of mortality during transition period (1987/1990 - 1998/2002) has been increased, particularly from diseases of circulatory system and slightly from neoplasms (Table 12). But it has been declined for external causes of death.

*Table 12 . Absolute changes in geographical distribution of SMR in the three Baltic countries between 1987-1990 and 1998–2001 ( + increase; - decrease)*

| | Range | Standard deviation | Coefficient of variation |
|---|---|---|---|
| All causes | 0.27 | 0.03 | 2.9 |
| CVD | 0.54 | 0.03 | 3.0 |

[7] Furthermore, deaths are supposed to be classified according to the residence of the deceased person (and not to the place of death) in agreement with the official rule. However, most of deaths by cancer probably take place at the hospital and it is possible that the place of residence is not always clearly identified.

| | | | |
|---|---|---|---|
| Neoplasms | 0.49 | 0.01 | 0.5 |
| External causes | -0.52 | -0.07 | -3.3 |

Mortality, as well as assessment of general public health status by region still strongly depends on level of economic development of the regions (Table 13). Model of a country's health care system significantly influence people's health and mortality, too (Karaskevica, 2005). Latvia's residents particularly complain about long queues, transport problems, distances to medical institutions and rare opening hours.

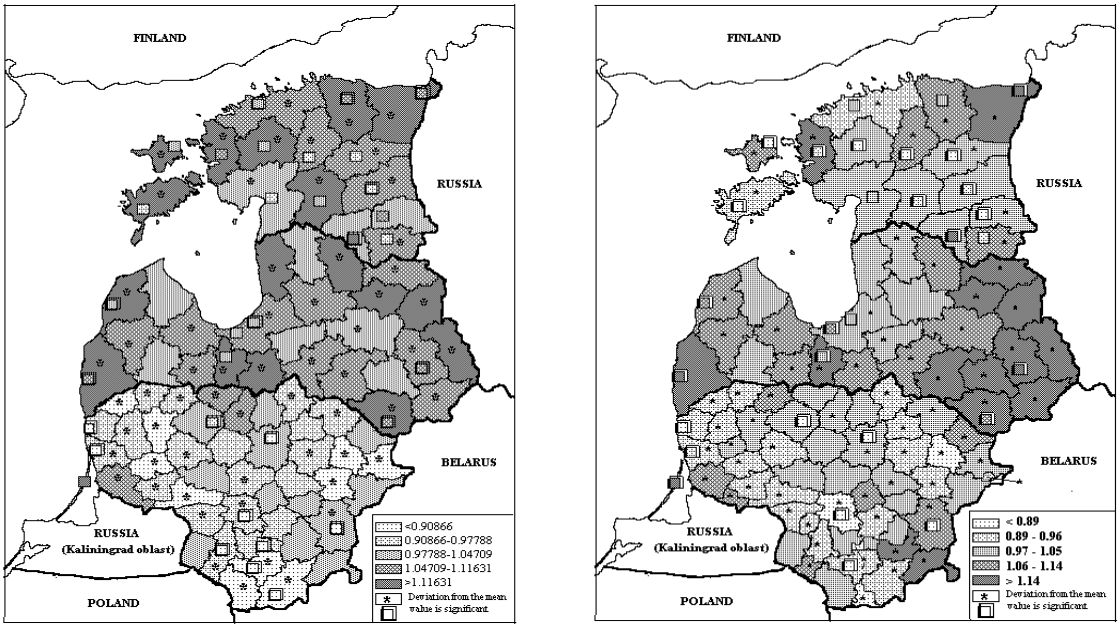
Geographic gradient in mortality historically exist in Latvia: mortality was and still is higher in the Eastern part of Latvia – Latgale than in other parts of country. Latgale is lagging behind the rest of the country in economic development, standard of living and supply of health services (Zvidrins and Krumins, 1991; Peipina, 2002). Big difference in life expectancy existed at the end of 1970s and 1980s among population of central towns and other parts of districts (Krumins, 1992).

*Table 13. GDP per capita (LVL) and self-assessment of health in general as bad or very bad by regions, Latvia 2003*

| | Riga | Vidzeme | Kurzeme | Zemgale | Latgale |
|---|---|---|---|---|---|
| GDP per capita, LVL | 3855 (1) | 1646 (3) | 2412 (2) | 1574 (4) | 1418 (5) |
| Health: bad and very bad, % | 12.9 (5) | 14.6 (2) | 13.5 (3) | 13.0 (4) | 18.3 (1) |

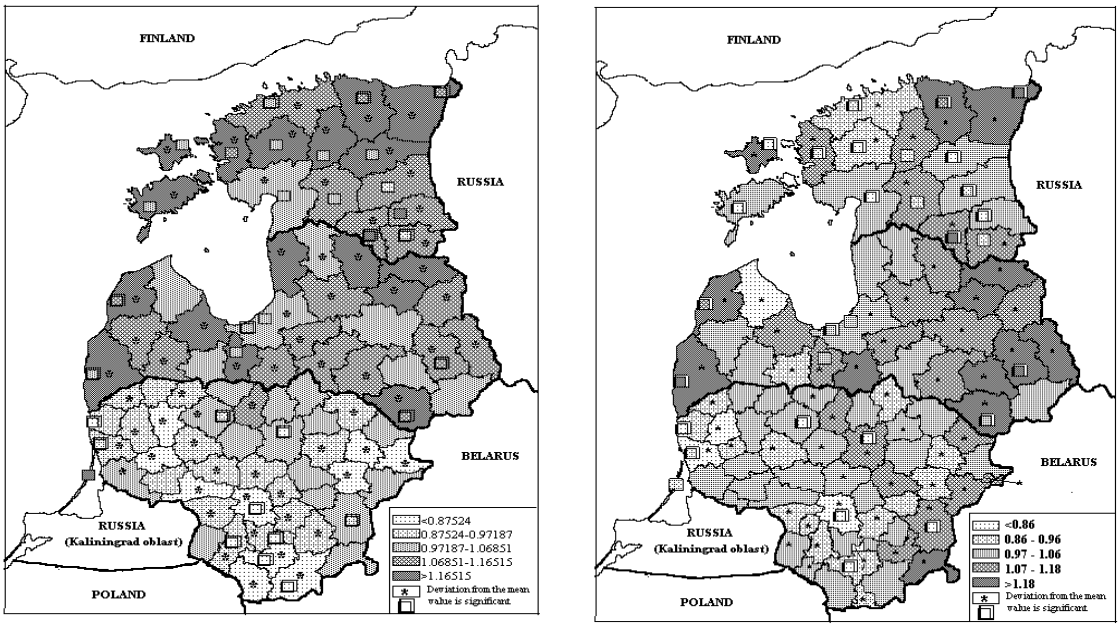
Calculated from: CSB, 2004. Health survey results of Latvian population in 2003. P.125; CSB, 2005 (B). Latvia's regions in figures. P.12-13, 63, 68.

On the eve of integration of three Baltic countries into the EU (2004), regional GDP per capita (PPS) constituted in Latgale less than 12 per cent of the EU average, which was the lowest indicator among 20 regions of the three Baltic countries.




*1987-1990* *1998–2001[a]*

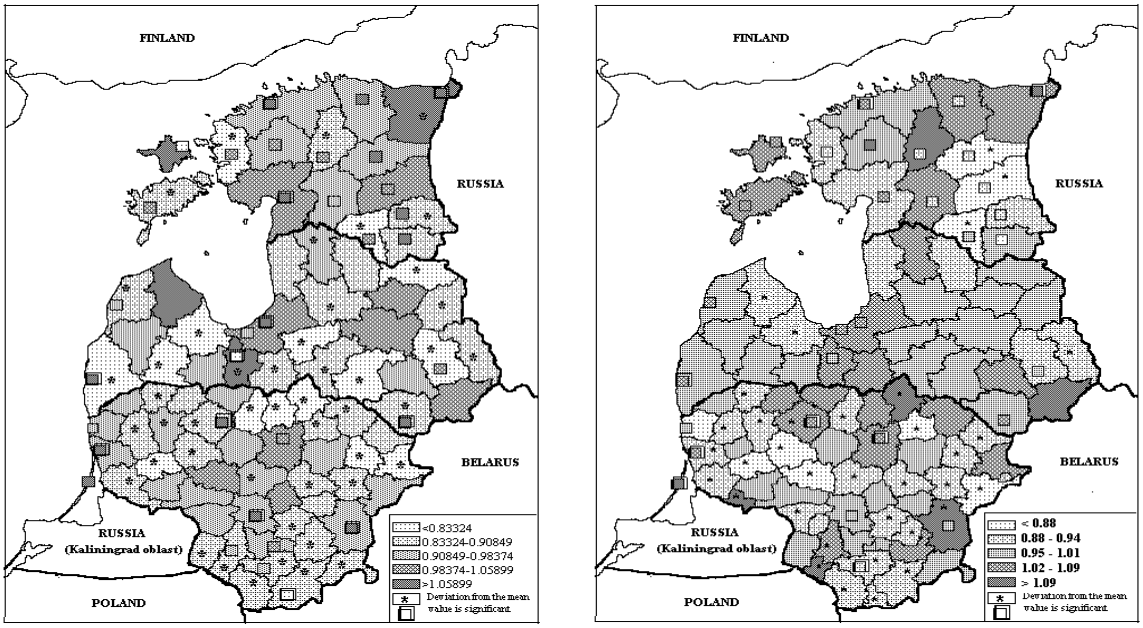
*Figure 7. Geographical distribution of the SMR in the Baltic countries for all causes of death*




*1987-1990* *1998–2001 [a]*

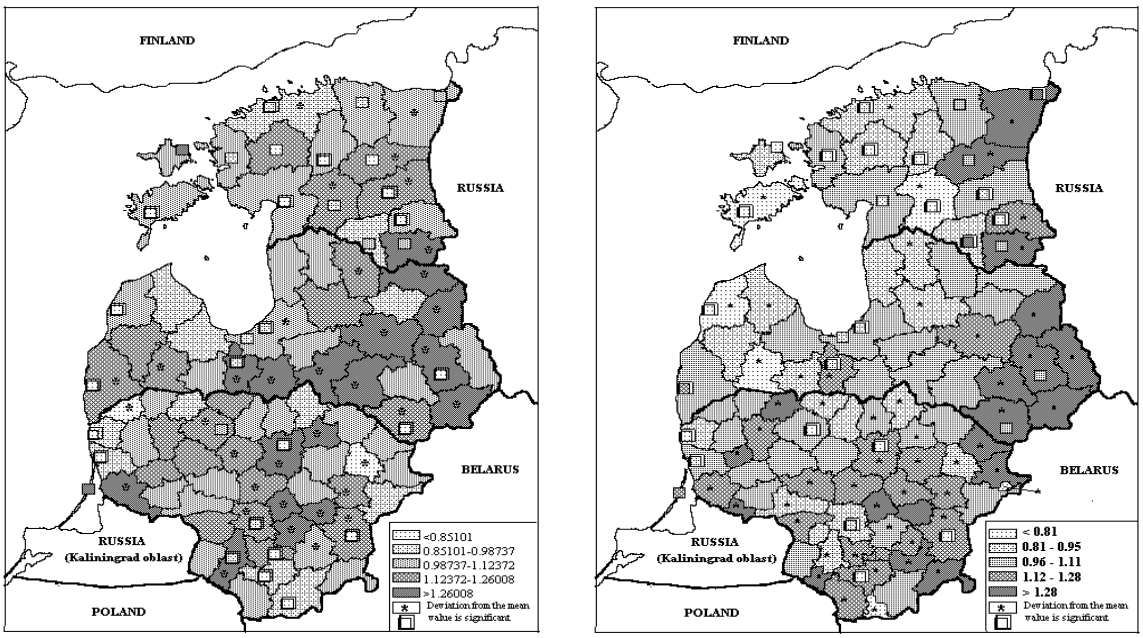
*Figure 8. Geographical distribution of the SMR for cardiovascular diseases in the Baltic countries*

*[a] 2000-2002 for Lithuania*




*1987-1990* *1998–2001* [a]

*Figure 9. Geographical distribution of the SMR for cancers in the Baltic countries*




*1987-1990* *1998–2001* [a]

*Figure 10. Geographical distribution of the SMR for external causes of death in the Baltic countries*

[a] *2000-2002 for Lithuania*

## CONCLUSION

Even in small countries like those of the Baltic, there are significant geographical variations in mortality which are clearly distinguishable. The pattern that results for each country is of interest in its own, but the individual patterns acquire additional interest when combined in such a way that they can be interpreted using the same scale of values. What then emerges, especially when the influence of the main groups of causes of death are examined individually, are divisions and continuities which appear to transcend international frontiers. Indeed, the different groups of causes are found to possess their own geographies, whose forms are often contradictory.

These geographical patterns appear to be influenced more by the gradual transitions between different socio-economic and/or cultural areas than by the fact of belonging to a particular national territory. It is quite clear that the three Baltic countries are structured by a north-south axis. During the XIX century mortality transition started earlier on the territory of Estonia and Latvia than Lithuania. It determined higher level of life expectancy in Latvia and Estonia until the mid XX century.

It could have been expected that such axis corresponds to a shift from the Finnish to the Polish spheres of influence. However, when extending the analysis to the neighborhood, the geographical variation observed in Finland hardly fit we such an assumption. The transition from north-east to south-west (from western Russian oblasts to eastern Polish voivodies) is much more obvious. The Russian influence is rather strong in eastern parts of Latvia and Estonia, while Lithuanian profile finds some extension in eastern Poland and western Belarus.

Geographical variation of mortality in the three Baltic countries is larger among exogenous causes of death (infectious diseases, respiratory diseases, violent deaths). Geographical variation of mortality during transition period (1987/1990 - 1998/2002) has been increased, particularly from diseases of circulatory system and slightly from neoplasms. But it has been declined for external causes of death.

**References**

BABURIN A., GORNOI K., LEINSALU M., and RAHU M., 1997. – *Atlas of Mortality in Estonia*. – Tallinn, Institute of Experimental and Clinical Medicine, 103 p.

Bauere A. (ed.), 2004. Developments of regions in Latvia 2004. Riga: VRAA (in Latvian).

BELENKOV Y., JDANOV V., PICHUGIN V., MARCHENKO O., YUROVA I., and SIDORENKO B., 1987. – Совершенствование диагностики причин смерти от основных болезней системы кровообращения. [The improvement of the diagnosis of causes of deaths for the main diseases of the circulatory system]. In: CHAZOV E.I. *et al.* (éd.), *Болезни сердца. Медико-демографические исследования* [Heart diseases. A medico-demographic study], p. 12-15. – Moscou, Soviet Scientific Centre for Cardiology, Academy of Medicine of the USSR.

Bite J., 1929. Latvijas iedzivotaju mirstibas tabulas. Riga:University of Latvia.

CSB, 1939. Latvijas statistikas gadagramata 1939. Riga.

CSB, 1940. Latvijas PSR statistikas tabulas 1940.g. Riga.

CSB, 2002. Results of the 2000 population and housing census in Latvia. Collection of statistical data. Riga.

CSB, 2004. Health survey results of Latvian population in 2003. Statistical data collection. Riga.

CSB, 2005 (A). Demography 2005. Collection of statistical data. Riga: 2005.

CSB, 2005 (B). Latvia's regions in figures 2005. Collection of statistical data. Riga.

EGLITE P., and Z. KLINTAJA, 1990. – *Tracing the Ecologically Unfavourable Regions According to Territorial Differentiation of Mortality in Latvia*. – Vilnius, 13 p. (Paper presented at the International Conference " Health, Morbidity and Mortality by Cause of Death in Europe ", Vilnius, 3-7 décembre, 1990).

EKDK, 1994. – *Rahvastiku elutabelid : maakonnad 1986-1991 / Life tabes : counties 1986-1991*. – Tallinn, Eesti Korgkoolidevaheline Demouuringute Keskus, 60 p. (Rahvastiku-Uuringud / Population Studies, Seeria C, n° 4).

GOMOLIAKO I., MISCHENKO A., DMITERKO O. *et al.*, 1990. – O dostovernosti pokazatelja smertnosti ot boleznej organov dihanija [Sur la fiability des taux de mortalité par maladies de l'appareil respiratoire], *Sovetskoje Zdravoohranenie*, n° 4, p. 27-31.

Portrait of the regions. Vol.8. Estonia, Latvia, Lithuania. European Communities, 2000.

JOZAN P., and R. PROKHORSKAS (ed.), 1997. – *Atlas of leading and « avoidable » causes of death in countries of Central and Eastern Europe.* – Budapest, OMS and KSH, 323 p.

KAIRIUKSTIS L. (project leader), 1997. – *Ecological Sustainability of Lithuania. ECOSLIT 1996 Annual Report.* – Vilnius, ECOSLIT, 113 p.

KALEDIENE R., and PETRAUSKIENE J., 1995. – Coronary heart disease mortality in Lithuania: Trends in time and space, *Lithuanian Journal of Cardiology*, vol. 2, n° 2, p. 2-8.

KASNAUSKIENE G., 1991. – Tendencie w umieralnosci na Litwe. *Studia Demograficzne*, n° 1, p. 73-80.

KASNAUSKIENE G., 1992. – *Tendentsii i prognozi smertnosti naseleniya v Litve* [Trends and prospects in Lithuanian mortality]. – Moscou, Université de Moscou, 26 p. (Summary of Ph.D. dissertation).

Karaskevica J., 2005. Latvia's health care system in transition // *Humanities and Social Sciences. Latvia*. Riga. No.1.

Katus K. and Allan Puur (eds.), 2003. Unity and Diversity of Population Development: Baltic and South-Caucasian Regions. RU Series D, No.3. Tallinn, 2003.

KLINTAJA, 1990 – Ossobennosti dinamiki i territorialnoy differenciacii detskoy smertnosti v Latvii (Characteristics of dinamics and territorial differentiation of infant mortality in Latvia), *Proceedings of the Latvian SSR Academy of Sciences*, vol. 5, p. 84-89. (In Russian).

KRUMINS J., P.ZVIDRINS, K.KATUS and V.STANKUNIENE, 1991. – Mortality trends in Latvia, Lithuania, and Estonia in the 19th and 20th centuries. [Mortality trends in Latvia, Lithuania, and Estonia during the XIXe and XXe centuries]. *Proceedings of the Latvian Academy of Sciences*, n° 11, p. 53-63. (Summary in Russian).

KRUMINS J., 1992. – « Territorialnaya i etnicheskaya differenciaciya smertnosti i prodolzhitelnosti zhizni naseleniya » [Geographical and ethnical variations of mortality and expectation of life in Latvia], *Zinatniskie raksti* [Scientific proceedings], n° 571, p. 52-72. – Riga, Latvijas Universitate, 176 p. (Summary in English).

Krumins J., 1993. Suicide mortality in Latvia: current trends and differentiation // Proceedings of the Latvian Academy of Sciences. A. No 1 (546). Pp. 9-12.

Krumins, J 1993, *Iedzivotaju muza ilgums - tendences un palielinasanas problemas* (Length of life – trends and problems of increase), Latvijas Universitate, Riga (in Latvian, English summary)

Krumins, J, Jasilionis, D, Stankuniene, V, Meslé, F & Vallin, J., 1999 'Geographical variations in mortality and causes of death in the Baltic countries', *Revue Baltique*, no.14, pp. 68-102.

Krumins J. and U.Usackis, 2000. The Mortality Consequences of the Transition to Market Economy in Latvia, 1991-1995. In: The Mortality Crisis in Transitional Economies. Edited by Giovanni Andrea Cornia and Renato Paniccia. Oxford University press. Pp. 280-302.

Krumins, J, Jasilionis, D, Stankuniene, V, Meslé, F & Vallin, J., 2000. Do Geographical Differentials of Mortality Overpass National Boundaries: the case of the Three Baltic Republics and Their Neighbouring Countries // The 6th Nordic-Baltic Sea Conference in Regional Science "Nordic-Baltic sea region on the eve of the 21st century", Riga, Oct. 4-7, 2000. Pp.281-286.

KURTINAITIS J., KLIUKIENE J. and I. RAMSIENE, 1995. – Cancer Registration and the Role of Cancer Registry in Lithuania. *Acta medica Lithuanica*, n° 1.

Latvia. Human Development Report 2004/2005: Human Capability in the Regions, 2005. Editor Aija Zobena. Riga: UNDP, University of Latvia, 2005. Chapter 1. People and Places (co-authors B. Krumina, J.Krumins, J.Kursite-Pakule, A.Priedite-Kleinhofa, A.Putnina, P.Skinkis). Pp. 21-47.

Leon D., L.Chanet, V.Shkolnikov, V.Zakharov et al., 1997. Huge variation in Russian mortality rates in 1984-1994. Artefact, alcohol or what? Lancet. Vol.350. Pp.383-388.

LOC (Latvian Onkological Center), 1994. – *Cancer incidence in Latvia (1980-1992).* – Latvian Cancer registry. Riga. 38 p.

LOC (Latvian Onkological Center), 1996. – *Cancer incidence in Latvia (1993-1994).* – Latvian Cancer registry. Riga. 34 p.

Lutz W., S.Scherbov and A.Volkov (editors), 1994. Changing Mortality Patterns in Latvia, Lithuania, and Estonia.- Demographic Trends and Patterns in the Soviet Union Before 1991. Ed. By. IIASA Laxenburg (Austria). Routledge, London and NY. Pp. 403-419.

Mackenbach J. and A.Kunst, 1995. Socio-economic and cultural determinants of regional mortality patterns in the Netherlands. In: Adult mortality in developed countries: from description to explanation. A.Lopez, G.Caselli, T.Valkonen (eds.). Claredon Press, Oxford. Pp.286-303.

Nordregio (Nordic Centre for Spatial Development), 2000. Regions of the Baltic States. Nordregio Report 2000:2. Tallinn.

Ptuha M., 1960. Ocherki po statistike naseleniya. Moskva: Gosizdat.

PURINA G., SOKOLOVA L. and A. MARTINSON, 1991. – Vrozhdonniye poroki razvitiya u detei, prozhivajuschih v ekologicheski neblagoprijatnih regionah Latvii (Congenital malformations of the children living in ecologically vulnerable regions of Latvia). *In : Proceedings of the Latvian SSR Academy of Sciences*, vol. 1. p. 125-129. (In Russian).

Rashin A., 1956. Naselenie Rossii za 100 let. Moskva.

RSK, 1937. Rahvastikuprobleeme Eestis. Vihik IV.

Shkolnikov V. and Vassin S., 1994. Spatial differences in life expectancy in European Russia in the 1980s. In: Demographic Trends and Patterns in the Soviet Union Before 1991. Ed. By W.Lutz, S.Scherbov, A.Volkov. IIASA Laxenburg (Austria). Routledge, London and NY. Pp. 379-402.

SHKOLNIKOV Vladimir M., *et al.*, 1999. – Recent trends in cancer mortality in Russia and Ukraine : validity, competing risks, and cohort effects. *International Journal of Epidemiology*, n° 28, p. 19-29.

Shkolnikov V., E. Andreev and T.Maleva, 2000. Neravenstvo i smertnost v Rossii (Inequality and mortality in Russia). Moskva: Signal.

Spijker Jeroen, 2004. Socioeconomic Determinants of Regional Mortality Differences in Europe. Doctoral thesis. Rijksuniversiteit Groningen.

STALIORAITYTE E., BERNATONYTE E. NEIMANTAS R. and PANGONYTE D., 1990. – *Cardiovascular diseases as cause of death in rural population*. – Vilnius, ***, 14 p. (Paper presented at the International Confernence « Health, Morbidity, and Mortality by Cause of Death in Europe », Vilnius, 3-7 décembre, 1990).

Statistical Office of Estonia, 2001. Population and Housing Census. Vol. 1 and Vol. 2.

THOMSON H., RAHU M., AARELEID T. and GORNOI K., 1996. – *Cancer in Estonia 1968-1992 : Incidence, mortality, prevalence, survival*. – Tallinn, Institute for research in experimental and clinical medicine.

Vallin J. and J.Krumins, J, Jasilionis, D, Stankuniene, F.Meslé, 2000. Variations geographiques de la mortalite et des causes de deces dans pays baltes // Regimes Demographiques et territories: les frontiers en question. Colloque international de la Rochelle (22-26 Sept. 1998). AIDELF. Presses Universitaires de France. Pp. 491-518

Vallin Jacques and France Meslé, Tapani Valkonen, 2001. Trends in mortality and differential mortality. Population studies, No.36. Strasbourg, Council of Europe Publishing.

Vanags E. et al., 2004. Dazada Latvija: pagasti, novadi, pilsetas, rajoni, regioni. Vertejumi, perspektivas, vizijas. Riga: Latvijas Statistikas instituts, VRAA.

ZABORSKIS A., I. RANKA and M. MASER , 1995. – Infant and child mortality in Lithuania, Latvia and Estonia. *Journal of Baltic Studies*, vol. 26, n° 3, p. 185-196.

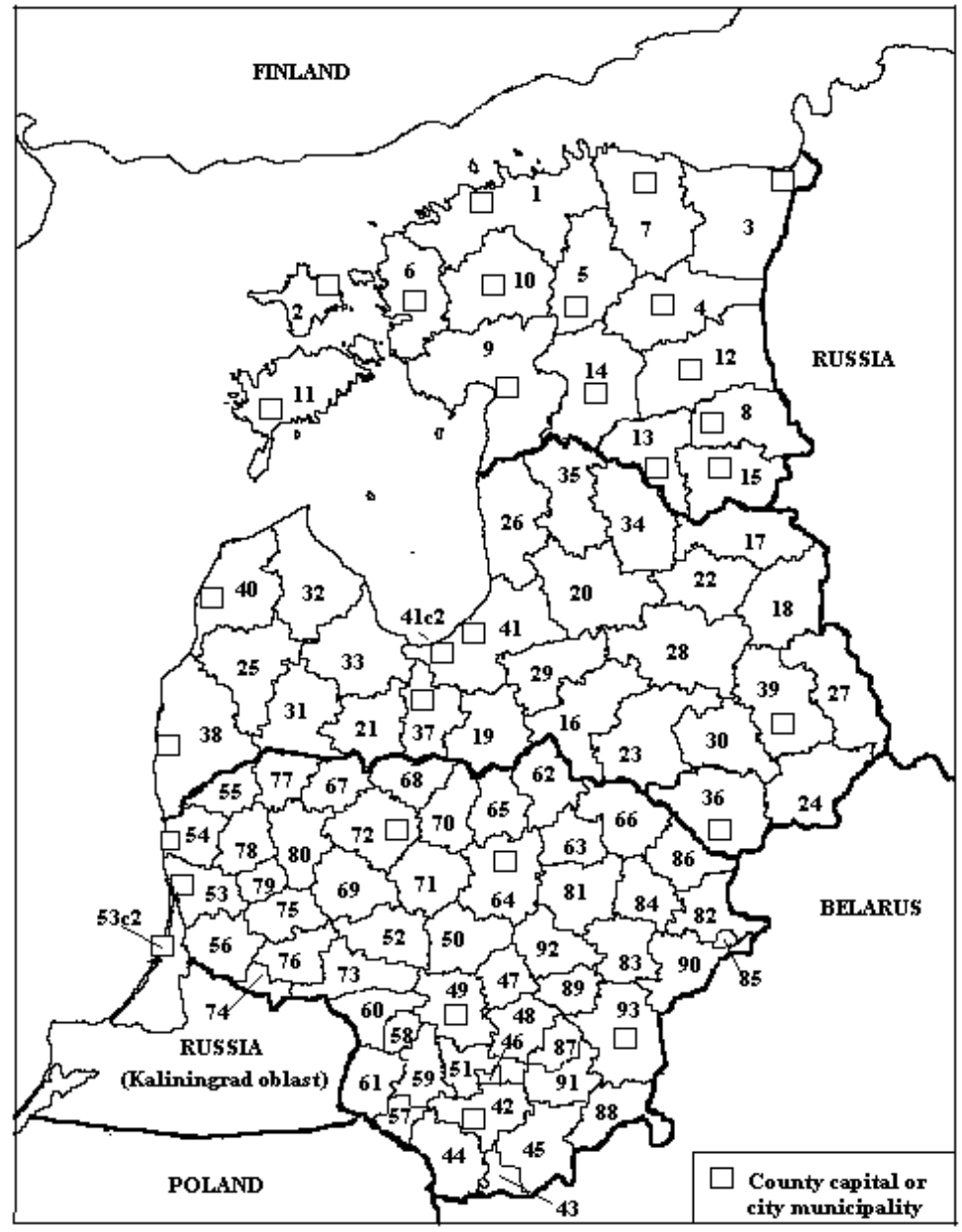
Zvidrins P. and J.Krumins, 1991. Demographic situation in the eastern part of Latvia // *Latvijas Zinatņu Akademijas vestis*. No.1. (522) Pp. 37-44. (in Russian, English summary).

ZVIDRINS P. and J.KRUMINS, 1993. – Morbidity and mortality in Estonie, Lettonie and Lituanie in the 80's, *Scandinavian Journal of Social Medicine*, vol. 21, n° 3, p. 150-158.

Walberg P., McKee M., Shkolnikov V. et al. Economic change, crime, and mortality crisis in Russia: regional analysis. British Medical Journal. 317, 312-318.

## *ANNEX*

*Annex 1. Administrative units of the three Baltic countries*



| **ESTONIA** *Region – maakond and county capital* | |
|---|---|
| 1 | Harjumaa maakond |
| 1c | Tallinn city |
| 2 | Hiiumaa maakond |
| 2c | Kärdla city |
| 3 | Ida-Virumaa maakond |
| 3c | Narva city |
| 4 | Jõgevamaa maakond |
| 4c | Jõgeva city |
| 5 | Järvamaa maakond |
| 5c | Paide city |
| 6 | Läänemaa maakond |
| 6c | Haapsalu city |
| 7 | Lääne-Virumaa maakond |
| 7c | Rakvere city |
| 8 | Põlvamaa maakond |
| 8c | Põlva city |
| 9 | Pärnumaa maakond |
| 9c | Pärnu city |
| 10 | Raplamaa maakond |
| 10c | Rapla city |
| 11 | Saaremaa maakond |
| 11c | Kuressaare city |
| 12 | Tartumaa maakond |
| 12c | Tartu city |
| 13 | Valgamaa maakond |
| 13c | Valga city |
| 14 | Viljandimaa maakond |
| 14c | Viljandi city |
| 15 | Võrumaa maakond |
| 15c | Võru city |
| **LATVIA** *Region – rayon or city* | |
| 16 | Aizkraukles r. |
| 17 | Alūksnes r. |
| 18 | Balvu r. |
| 19 | Bauskas r. |
| 20 | Cēsu r. |
| 21 | Dobeles r. |
| 22 | Gulbenes r. |
| 23 | Jēkabpils r. |
| 24 | Krāslavas r. |
| 25 | Kuldīgas r. |
| 26 | Limbažu r. |
| 27 | Ludzas r. |
| 28 | Madonas r. |
| 29 | Ogres r. |

| **LATVIA (cont.)** | |
|---|---|
| 34 | Valkas r. |
| 35 | Valmieras r. |
| 36 | Daugavpils r. |
| 36c | Daugavpils city |
| 37 | Jelgavas r. |
| 37c | Jelgava city |
| 38 | Liepājas r. |
| 38c | Liepāja city |
| 39 | Rēzeknes r. |
| 39c | Rēzekne city |
| 40 | Ventspils r. |
| 40c | Ventspils city |
| 41 | Rīgas r. |
| 41c | Rīga city |
| 41c2 | Jūrmala city |
| **LITHUANIA** *Region – rayon or city municpality* | |
| 42 | Alytus r. m. |
| 42c | Alytus city m. |
| 43 | Druskininkai m. |
| 44 | Lazdijai r.m. |
| 45 | Varėnos r.m. |
| 46 | Birštonas m. |
| 47 | Jonava r.m. |
| 48 | Kaišiadorys r.m. |
| 49 | Kaunas r.m. |
| 49c | Kaunas city m. |
| 50 | Kėdainiai r.m. |
| 51 | Prienai r.m. |
| 52 | Raseiniai r.m. |
| 53 | Klaipėda r.m. |
| 53c | Klaipėda city m. |
| 53c2 | Neringa m. |
| 54 | Kretinga r.m. |
| 54c | Palanga city m |
| 55 | Skuodas r.m. |
| 56 | Šilutė r.m. |
| 57 | Kalvarija m, |
| 58 | Kazlų Rūda m. |
| 59 | Marijampolė m. |
| 60 | Šakiai r.m. |
| 61 | Vilkaviškis r.m. |
| 62 | Biržai r.m. |
| 63 | Kupiškis r.m. |
| 64 | Panevėžys r.m. |
| 64c | Panevėžys city m. |

| **LITHUANIA (cont.)** | |
|---|---|
| 69 | Kelmė r.m. |
| 70 | Pakruojis r.m. |
| 71 | Radviliškis r.m. |
| 72 | Šiauliai r.m. |
| 72c | Šiauliai city m. |
| 73 | Jurbarkas r.m. |
| 74 | Pagėgiai m. |
| 75 | Šilalė r.m. |
| 76 | Tauragė r.m. |
| 77 | Mažeikiai r.m. |
| 78 | Plungė r.m. |
| 79 | Rietavas m. |
| 80 | Telšiai r.m. |
| 81 | Anykščiai r.m. |
| 82 | Ignalina r.m. |
| 83 | Molėtai r.m. |
| 84 | Utena r.m. |
| 85 | Visaginas m. |
| 86 | Zarasai r.m. |
| 87 | Elektrėnai m. |
| 88 | Šalčininkai r.m. |
| 89 | Širvintos r.m. |
| 90 | Švenčionys r.m. |
| 91 | Trakai r.m. |
| 92 | Ukmergė r.m. |
| 93 | Vilnius r.m. |
| 93c | Vilnius city m. |

Note: r. – rayon (Latvia), r.m. – rayon municipality (Lithuania), m. – Lithuanian municipality (after 2000).

| | | | |
|---|---|---|---|
| 30 | Preiļu r. | 65 | Pasvalys r.m. |
| 31 | Saldus r. | 66 | Rokiškis r.m. |
| 32 | Talsu r. | 67 | Akmenė r.m. |
| 33 | Tukuma r. | 68 | Joniškis r.m. |