LONG-TERM MORTALITY TREND IN THE BALTIC COUNTRIES

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Being a part of the collaborative research project of French and Baltic demographers aimed at comparative analysis of mortality in Baltic countries, the paper is concentrated on long-term mortality development in Estonia, Latvia and Lithuania.

Considering the need for reconstruction of continuous mortality indicators, the paper discusses principal sources of relevant data in three Baltic countries, particularly the input for calculation of the new set of annual life tables. The analysis is mainly based on the new set of reconstructed life-tables of 1897-1998, supplemented by the dynamics of basic indicators for the previous decades.

The long-term mortality development in all Baltic countries could be roughly divided into two large periods: mortality decrease up to the early 1960s, and the following stagnation period during the following four decades. Furthermore, the mortality stagnation could be characterised not only by the absence of progress in mortality levels but more importantly by the deterioration in age-specific mortality.

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1. INTRODUCTION

The ongoing collaborative research project of the Baltic and French demographers, headed by INED, is aimed at analysing the cause-specific mortality trend in the three Baltic countries: Estonia, Latvia and Lithuania. Studies of the same kind have previously been carried out for the Russian Federation [Meslé et al 1996] and for the Ukraine [Meslé et al 2000].

In addition to the scientific results, the coherent time series of the cause-specific mortality reconstructed since 1965, deserve particular acknowledgment. In the case of the Baltic countries, the reconstruction component of the study has been planned more widely, with the coherent time series of the cause-specific mortality covering the period from the middle of the 1950s up to the end of the 20th century. Additionally, it was planned to cover more than a century by the mortality indicators not desaggregated by causes of death. The analytical component of the project has also been extended to include, among others, sex differentials in mortality [Meslé, Hertrich 1998] and regional mortality variations [Krumins, Jasilionis, Vallin 1998].

In the framework of the project, the analysis of the long-term trend has a particular purpose. The Baltic countries are known to have the mortality trend for the last three decades rather similar to that in Russia and other CIS countries. Moreover, the mortality crisis in the 1990s and the following recovery have also been similar [Hertrich, Meslé 1999; Katus, Puur 1997; Katus, Zaharov 1997; Meslé, Hertrich 1997]. On the other hand, the mortality development of the 19th century and early 20th century has been noticeably different in the Baltic countries [Coale, Anderson, Härm 1979; Novoselski 1916; Ptuha 1960; Rashin 1956 etc]. It has been considerably more comparable to the mortality patterns of the north and west European nations up to WW II [Katus, Puur 1992; Krumins 1993; Krumins et al 1991]. The coverage of the longer time period by the analysis would allow to specify the timing of convergence and divergence tendencies of the Baltic mortality development between long-lasting east-west differences, and provide the information for formulating hypotheses for the future trends in the region.

Also, in the case of the Baltic countries it is important to include the 1950s. It is widely known that the population data in the USSR for the period from WW II up to the first postwar census in 1959 has been very scarce. War casualties, large-scale forced migration flows after the war and so forth, together with strict restrictions set on population statistics for that period have made that decade, together with the 1940s, one of the less covered by mortality data [Andreev, Darski, Harkova 1998]. In the Baltic countries, the vital registration has been traditionally good, at least concerning the coverage. The accuracy is much lower for the population stocks for that period, but there is still a relatively good basis to try and reconstruct the pre-1959 age-specific mortality indicators. Those results could be, *inter alia,* useful for the analyses of mortality patterns in other USSR successor states, including the Russian Federation, in which case similar reconstruction is not possible.

The paper's aim is to discuss the long-term mortality trend in the Baltic countries. As part of a wider project it is limited to age-specific analysis, covering, however, a noticeably longer period than available for a cause-specific approach. The first part of the paper discusses the principal sources of data and methods applied in constructing the consistent time series of the mortality indicators. It pays particular attention to the new set of annual life tables calculated in the framework of the project: 1923-1938 and 1950-1997 for Estonia, 1955-1997 for Latvia and 1955-1997 for Lithuania. The second part of the paper discusses the main patterns of the mortality trend, and compares the three countries. The long time series allow to distinguish the end of the transition period with continuous mortality decrease, and the beginning of the stagnation period that has lasted until today in the Baltic countries. Recent fluctuations in mortality are also analysed from the age-specific point of view.

2. AVAILABLE DATA

2.1. Advanced vital registration and poor mortality statistics

Civil registration of vital events has a long tradition in the Baltic region. In 1686, the Swedish king Karl IX enforced the Church Act according to which all deaths (burials), births (baptisms) and marriages should be registered by parish authorities. The regulation was also introduced in Estonia as well as in the northern and western parts of Latvia which were under the Swedish rule at that time. Naturally, in some parishes the registration of vital events dates back far longer but from the referred year all the Lutheran parishes began to keep the church books. In Catholic (Lithuania and south-eastern Latvia, Latgalia) and the Orthodox parishes of the Baltic region, the registration became regular later.

The Estonian civil registration reform of 1926 ordered all the church books to be gathered into the central state archive. According to Heldur Palli, the complete coverage of the modern Estonian territory by vital registration of deaths goes back to 1834 [Palli 1995]. Many parishes have earlier information by an additional 150 years, but in others not all church books have survived and records may not be continuous before that time. The latter situation is similar in northern and western Latvia. The vital records about Riga population also date back to the late 17th century. There is no systematic research carried out on Lithuanian data sources known to the author to establish the time-span of complete coverage of the country by vital registration.

The availability of individual records on paper does not necessarily mean that the data are easily accessible for research. In the case of the Baltic countries one can even conclude a contradiction between the good registration system of vital events and a poor mortality statistics in a long-term perspective. There are two particular reasons for that kind of contradiction.

First, the administrative boundaries have been extensively changed several times from the start of the registration of vital events. The modern boundaries of Estonia, Latvia and Lithuania are relatively new, established mainly in the early 1920s, with some additional changes in the 1940s. It should be stressed that the difference with the

previous *gubernia* boundaries of the Russian Empire is considerable. Tackling the periods before 1918 usually involves the need to introduce data at county or even community level: with the help of geographically more detailed data, it is possible to summarise them disregarding the *gubernia* boundaries. All three Baltic countries have to consider the regions that had belonged to four or five *gubernias*. For that reason the use of the existing statistics of the Russian Empire, if summarised at *gubernia* level, requires relatively laborious recalculations into the modern boundaries of the Baltic countries.

Secondly, and much more importantly, the geopolitical changes in the region have had an impact on mortality statistics. When Estonia (1710), Latvia (1710 and 1795) and Lithuania (1795 and 1815) were incorporated into the Russian Empire, the church registration was poor or non-existent in the Empire. Correspondingly, there were no statistical organisations to systematically summarise any information either at state or regional (*gubernia*) level. Also in the Baltic region, although vital registration was maintained by church authorities, no statistics as such was produced on the data collected.

In the second half of the 19th century a statistical organisation began to emerge in the Russian Empire, including offices at *gubernia* level. The statistical offices in the Baltic provinces were clearly more advanced, partly fulfilling the tasks above their direct competence. The full census in the Baltic *gubernias* was carried out in 1881, 15 years before the all-Russian, as well as several earlier censuses in major cities of the region. Those offices, however, had limited mandate to produce statistics. Moreover, the preference was naturally given to those activities covering all the *gubernias* (or 50 European *gubernias*) of the Empire. The official statistics consequently summarised the parish registration of vital events usually by absolute numbers only, without any desaggregates and/or adequate quality checks.

The relatively abundant information from parish registration mainly remained statistically unused until the end of the Russian rule in the Baltic countries in 1918. During the years of independence, the newly established statistical offices of Estonia, Latvia and Lithuania built up national statistics, and made an attempt to harmonise the data from the previous periods into longer trends. It should be noted that the latter task of harmonising the previous population data was not viewed in a similar way in the three countries; the existing possibilities had to be taken into account as well. In the framework of this task, the Estonian Statistical Office in particular, has taken the pioneering steps [RSKB 1924-1925; 1937]. Among other things, the census statistics from the 19th century was recalculated into the comparable boundaries of the 1922 census at county level.

Needless to say – the statistical offices in the Baltics like everywhere else at that time had no resources to go back to individual records in parish registers, and reconstruct the vital statistics on that basis. Nor was that issue, understandably, raised during the Soviet rule. Consequently, the vital registration in Estonia and Latvia, rather similar in scope and quality to Scandinavian countries, was and still is in sharp contrast with poor population statistics built on that material for longer time periods. To fill in that gap constitutes an enormous task even in the modern PC era. The existence of individual records of good or excellent quality for a long period nevertheless encourages to

undertake the task, particularly in the Baltics when the necessary funds become available. Considering individual death records, coding and entering the data was alas not possible within the current project.

2.2. Available life table indicators

The age-specific analysis of mortality trend should be based on life table indicators if these are available. The section gives a short evaluation of the existing life tables in the Baltic countries, particularly for the 20th century. As shown below, the availability and quality of the data confirms the need to prepare a new set of life tables for analysing the long-term mortality development in the Baltic countries.

As for earlier periods, some life tables are also available for the pre-census era. Among those, the life tables calculated by Heldur Palli call for particular attention. He has used the family reconstruction method to prepare the input data which should be regarded as the most appropriate approach from the data quality point of view. Life tables have been calculated for two Estonian parishes: Karuse for the local birth cohort of 1712-1724, as well as the period table of 1783-1794; period tables for the Otepää parish are calculated for 1775-1779 and 1780-1784 [Palli 1984; 1988]. The existing mortality statistics formed the basis for life table calculation for some Lithuanian regions at the 18th century [Birziska 1922; Jasas, Truska 1972] as well as for Riga in Latvia.

During the 19th century, the vital statistics slowly improved in the Baltic region, and the availability, for example, of crude death rates became a norm. The calculation of life tables, however, was not attempted by the statistical institutions until the first population censuses. Data obtained by the first Baltic census in 1881 was used by Ballod and Besser to calculate male and female life tables for the Baltic region as a whole [Besser, Ballod 1897]. On the basis of the 1897 census data, Ptuha prepared life tables for the three Baltic nations (defined by mother tongue) separately [Ptuha 1960].

After gaining independence, the population statistics in the Baltic countries improved considerably, but the life table calculations have still not become a routine task. In Latvia, the official life tables were calculated for 1929-1932 and 1934-1936, and in Estonia for 1934-1936 [RSKB 1937]. There were no life tables known to the author calculated for Lithuania at that time.

WW II and the following geopolitical changes halted the continuity of statistical system in the Baltic countries. The next life tables were calculated already under the Soviet occupation. The first set was based on the 1959 census data, and covered all three Baltic countries, but published only for Latvia (for official use only) [TsSU Latvii 1964].

From the referred life tables onwards up to 1991, the unified statistical system provided similar mortality statistics for all regions of the Soviet Union. And most importantly, the development of computers made the previously laborious calculations fast and easy. Starting from 1962, life tables became regular statistical exercises. The calculations were performed by the Moscow Central Statistical Office, with the main computing centre established first in Riga, then in Rezekne, Latvia, and transferred to Moscow in the early 1970s. Life tables by both sexes were calculated for almost every year, using

the mortality data of two subsequent years. Starting from 1971, the programme already includes the calculation of full tables. Those life tables, with only a small number of exceptions, remained unpublished even in the issues of restricted use up to the collapse of the Soviet Union.

The societal changes in the late 1980s released the data for publication, and the Moscow Central Statistical Office published several issues containing life tables, covering also the Baltic countries. Among others, a set of life tables has been published by ethnicities including the titular ethnicities of the Baltic countries [Goskomstat 1989]. After the restoration of independent states, the Estonian, Latvian and Lithuanian statistical publications have presented smaller or larger fragments of these Soviet tables. The full set of the Soviet life tables, however, were never published in any of the three countries. In the 1990s, naturally, the life tables are calculated and available on regular basis. It should be noted that the methodology of life table calculations in the three countries has gradually become quite different [CSB 1998; ESA 1999; LSD 1999].

Taking into account the scarcity of the official life tables for the first half of the century, the absence of mortality statistics for immediate postwar period, and especially various restrictions on the use of mortality statistics, any age and cause-specific research accomplished on mortality in the Baltic countries should be considered valuable. Among these works, Mercaitis has calculated the life table for Lithuania, 1926 [Mercaitis 1973]. He has combined the 1923 Lithuanian census and the Klaipeda census (1926) data to get the population stock. At that time, deaths by broad age groups were already available from the vital statistics. The life table is important mainly because it has remained the only attempt of its kind dealing with the first part of the 20th century in Lithuania.

In Latvia, the research on mortality has been more thorough than in the other Baltic countries. The age-specific statistics for previous periods has been summarised and analysed, including a comparative perspective for the three Baltic countries [Krumins 1990; 1993; 1994; Krumins, Zvidrins 1992; 1993; Krumins et al 1991]. From the viewpoint of the present study, however, no attempt to calculate life tables posterior for the Soviet and/or prewar period has been made. The latter task was once undertaken in Estonia in the framework of a special project where life tables were provided for all census years starting from 1897, and the mortality trend analysed [Katus, Puur 1990; 1991]. It should be noted that in some cases the new life tables provided significantly different results compared to the existing official tables, whereas in other cases the recalculation came up with rather similar results. Additionally, the regional life tables for all 15 Estonian counties have been prepared around the last census [EKDK 1994a].

The availability and quality of the existing life table indicators in Estonia, Latvia and Lithuania, not discussed in detail in the preceding short overview, can be summarised as follows. First, several periods of the 20th century, important from the point of the mortality development, are still uncovered by the life table indicators in the Baltic region, including the years when the necessary mortality and population stock statistics are readily available or could be compiled without a need to go back to individual data. In some cases, the necessary harmonisation and recalculation programme, as shown below, could still be rather extensive and time-consuming. Second, the series of life tables from the Soviet period, available for most of the 1962-1991 period, cannot really

be compared in time in any of the countries even if that comparability is fine in definite time points between the three countries. The main reason is the inconsistent population stock statistics, and only on a lesser extent the different methods used in preparing life tables throughout the period.

2.3. Data sources for new life tables

As for the sources of population data in the Baltic countries, one should remember the geopolitical history. During the Soviet period, the statistical systems in all countries were rather similar, if not coinciding. The data quality and accessibility, however, varies surprisingly, considering the formally unified methodology and definitions. The referred period covers the years 1944-1991. During the period of independence (1918-1940) Estonia, Latvia and Lithuania had its own, very different national statistical systems. The differences did not diminish from one occupation to another during the war period.

Before independence, as part of the Russian Empire, mortality statistics in the Baltic region was closely connected to parish registration which was not exactly similar between the Roman Catholic, Lutheran and Orthodox church. Also, the success of local statistical institutions in collecting and summarising vital statistics varied between *gubernias*, particularly concerning the quality check. It should be mentioned that the population stock statistics based on census data is more similar between the Baltic countries of that time than vital statistics including data on mortality. Furthermore, contemporary Estonia and Latvia bear more resemblance, leaving Lithuania somewhat aside. The latter's territory was not included into the Baltic provinces and not covered by the Baltic autonomy laws at that time.

After the restoration of independence in the 1990s, differences in national statistical systems in the Baltic countries have emerged again. Considering the analysis of a longer mortality trend, an individual approach to each country should be preferred, and the most appropriate reconstruction methods applied when analysing the population data, including the calculation of life tables. The latter task especially involves the collection and harmonisation of data on population stock and death cases which both will be shortly discussed below.

2.3.1. Data on death cases

In the framework of the Baltic mortality project, the data on deaths by sex and age (at least 5-year age groups) have been collected from the primary statistical sources. In Estonian case, the continuous series starts from 1923, and with the gap 1940-1945, proceeds to the present date. In the case of Latvia, the period covered by the continuous series is starting from 1924, and has a gap for the period of 1940-1951. In the case of Lithuania the continuous series starts from 1953, but the age-specific mortality statistics is also available for the period of 1928-1939. Additionally, Ptuha has reconstructed the age-specific mortality data around the 1897 census for all three Baltic countries which is also used in the project [Ptuha 1960].

The quality of death statistics, particularly in Estonia and Latvia is generally rather good. The coverage had been nearly complete already in the last century, including infant deaths. Like everywhere, a fraction of death cases has been registered with a missing date of birth or, less frequently, with a missing date of death. Those cases have introduced the line of unknown age in the age-specific tabulations. This segment has still been quite small in the Baltic countries during the entire 20th century. Correspondingly, the impact of unknown age in mortality statistics is minimal for life table calculations.

To identify possible problems, it is advisable for example to examine the date of birth in death records. The birth date is usually derived from official documents like the passport, and depends on the quality of those documents. Väino Kannisto has checked the data quality for the oldest old deaths in Estonia (from age 80 and more), from 1950 onwards, separately for the native-born and immigrant population. The outcome of his inquiry show that the birth date was considerably better recorded for the native population [Kannisto 1993]. The difference stems from the fact that the date of birth was carefully checked in Estonia when issuing passports in the early 1920s. The immigrant population of Soviet origin, however, received passports during a prolonged time period up to the end of the 1970s which inevitably caused more mistakes.

There are several other data quality issues involved when dealing with death certificates in the Baltic region for a longer time period, but most of them are connected with other variables than coverage and age (date of birth and date of death). Those issues are not tackled in the present article as they have no impact on life table calculations. The available data on death cases in the Baltic countries are on the whole of much higher accuracy than the data on population stocks discussed later. The most important shortcoming is the lack of consistent data before the independence, because of large-scale boundary changes, and for the period of WW II. The mortality statistics could be reconstructed for those periods, but only when going back to the individual data.

2.3.2. Data on population stock

The data on population stock is supported by census statistics and intercensal estimations. The latter is naturally less accurate, particularly in case when censuses are not regular and the methodology applied by different political regimes has varied. In the Baltic countries there has been four unified censuses during the Soviet period: in 1959, 1970, 1979 and 1989. Also the Russian census of 1897 has covered all three Baltic states simultaneously.

Other census points vary between the countries. In Estonia there have been censuses in 1922, 1934 and 1941, during the short interrim between the Soviet and Nazi-German occupations. In Latvia, censuses were held in 1925, 1930 and 1935. In Lithuania there has been only one census in 1923 (without the Klaipeda region), and a special census for Klaipeda region in 1926. Additionally, there has been the Baltic census in 1881 covering Estonia and northern and western Latvia, but not Lithuania. All these censuses support the single-year age structure which has also been the basis for calculation of the continuous set of stock statistics.

It is important to note that the intercensal estimations of population stock have partly been prepared by statistical authorities already in the Soviet period. These estimations were based on regular postcensal computations of population stocks which had to be recalculated after every next census, because of the low quality of migration statistics. The work was accomplished by statistical authorities in Moscow for 1970-1979 and 1979-1989 intercensal periods for all the Baltic countries. The Moscow calculations were produced exclusively on the basis of the data on two census points without considering vital statistics during the intercensal period. In the case of Estonia, these calculations have been evaluated, and noticeable disproportions discovered, particularly at regional level, including urban/rural disaggregation. Due to the poor quality of the existing estimations of intercensal population stocks, it is considered inadvisable to use them.

In the framework of the Recalculation Programme of the Population Statistics, the harmonisation of population age structure has been completed in Estonia for three intercensal periods: 1959-1970, 1970-1979 and 1979-1989. The last two periods have been subjected to recalculation on the county level (NUTS3). The results as well as methods of calculation are presented in earlier publications [EKDK 1994b; 1994c]. It is moreover important to notice that the new set of population stocks refers to "permanent population" for the whole period of 1959-1989, when the previous estimations embedded the discontinuity: the concept of "present population" was changed to "permanent population" in the 1970s without data harmonisation.

In Latvia and Lithuania, no similar recalculation of population stocks has been undertaken. Relying on the Estonian experience, however, it was decided to accomplish the work covering intercensal periods of 1959-1970 and 1970-1979. The existing population stock statistics for the intercensal period of 1979-1989 has demonstrated higher consistency and thus used as it stands. Understandably, the task of recalculating the population stocks proved to be rather laborious. The same methods already used in Estonia were applied with some simplifications, particularly concerning the movements of military personnel [EKDK 1994b; 1994c]. Also, the recalculation programme was carried out only on national level.

The Baltic mortality project introduced some additional requirements for population stock statistics. It was interesting to proceed backwards from the 1959 census, because of the large-scale changes in mortality, particularly in the 1950s. This was also the era of societal discontinuity in the Baltic countries. It should be noted that the previous mortality research, besides the presentation of crude rates, has never covered that particular period in the Baltic countries. Moreover, in the framework of the project, the age- and cause-specific data on deaths has already been collected.

The population stocks 1950-1959 were calculated by the author for all three Baltic countries. The basic tool was the backwards component method by 1-year step using all the vital statistics available. The quality of vital statistics varied considerably. As already stressed, the data on deaths has had complete coverage and are of rather good quality for the 1950s. The migration statistics, on the other hand, appears very poor. This has not only been a period of mass immigration to the Baltic countries from other regions of the Soviet Union, but also the era of repressions, including mass

deportations, and return of the survivors in the second half of the 1950s. Migration statistics, however, covers only part of all these flows.

Among the various coverage problems in migration statistics, two should be particularly outlined. First, the registration of the 1950s did not cover the residential moves of rural population in Latvia and Lithuania. In Estonia, that coverage was restored in 1956, being the first in the Soviet Union, but the previous years of the most intensive migration are not covered either [Katus 1989; Sakkeus 1996]. Second, in- and out-migration flows are given in total, not broken down to internal and international, i.e. across the boundary of the given country. It should also be noted that the number of population of the Baltic countries before the 1959 census, published by the soviet authorities, has no relation to population development and proved useless for the calculations.

The results of the calculation of population stocks (1-year age groups) in the Baltic countries for the 1950s should be taken as preliminary, and need for further elaboration to satisfy all the statistical requirements. The results seem to be better for Estonia, and the most ambiguous in the case of Lithuania. From the viewpoint of the Baltic mortality project, however, the population stocks by 5-year age groups could be regarded sufficient for life table calculations. That evaluation was proved by analysing the mortality trends in the Baltic countries discussed below.

Additionally, the population stocks have been calculated for the prewar years. In Estonian case, the reconstruction covers the period of 1922-1939, and is based on the 1922 and 1934 census data, as well as relevant vital statistics. Similar work is planned for Latvia 1925-1939. The accurate statistics of that period, and small-scale international migration compared to the after-war years form the solid basis of quite accurate outcome. In Lithuania, there has unfortunately been only one census (1923) in the prewar period without full coverage of the country's territory (without the Klaipeda region) which makes the reconstruction of the population stocks impossible in the framework of the current project.

Last but not least, several discussions have taken place concerning the population stock statistics for the 1990s, i.e. after the last censuses in the Baltic countries. New calculations have recently been accomplished in Estonia at national level, demonstrating ca 5 per cent difference in population number and as high as 10 per cent in some specific 5-year age groups. New figures were published by the Statistical Office [ESA 1998]. This new series is also adapted for the life table calculations. There has been no similar recalculation programme in Latvia and Lithuania, but the population stock statistics is estimated by the national experts to be of higher quality in both countries than in Estonia.

2.4. New set of life tables

A new set of life tables covers the period of 1923-1939 and 1950-1997 for Estonia, 1925-1939 (not yet completed) and 1952-1997 for Latvia, and 1953-1997 for Lithuania. The calculations are based on central mortality rates by sex and 5-year age groups (m_x). The importance of the new calculations of life tables lies mainly in the resulting

comparability between the three countries, and particularly regarding time. This gives a good basis to analyse the long-term mortality trends in the Baltic region in comparative perspective.

3. MORTALITY DEVELOPMENT: EARLIER PERIODS

The mortality development of the 19th century (at least the second part) and the first half of the 20th century was dominated by the epidemiological transition among those European nations, who pioneered in demographic transition [Caselli 1993; Schofield, Reher, Bideau 1991 etc.]. The same is characteristic of the Baltic region at that time. In the northern part of the Baltic region, covering the modern territory of Estonia and Latvia (with the exception of Latgale), the early timing of the demographic transition should, once again, be underlined [Katus 1982; 1990; Stankuniene 1989; Zvidrins 1983; 1986]. Concerning the general mortality trend, the corresponding decline in mortality levels occurred more or less simultaneously with other North European nations.

Compared to the Eastern and South-European countries, Estonia and Latvia continuously came first in the low level of mortality throughout the whole period [Krumins 1993]. In Lithuania, the mortality transition took place with a certain time lag compared to northern neighbours in the Baltics, and the mortality levels were somewhat higher in the region in every given time point in the 19th-early 20th centuries [Stankuniene 1989].

In the current status of data availability, the beginning of the epidemiological transition and its development for several decades in the Baltic countries occurred in the pre-life-table era, tehnically speaking. Age-specific mortality indicators are usually available not at continuous basis, but for some restricted territories and time periods and/or points. From another angle, the data reconstruction has supported the age-specific mortality indicators going back, for example, as far as the 5th –7th centuries in the case of Lithuania [Cesnys 1997].

Starting from the 18th century, a rapid expansion of data occurred, particularly concerning Estonia, based on family reconstruction applications on several parishes [Palli 1984; 1988; 1997]. Ironically, there is less in-depth data reconstruction accomplished for the 19th century, i.e. covering the period of demographic transition, particularly on the early stages of the process. The mortality development in that period has been discussed in several publications, but typically without involving primary individual data and/or introducing new age-specific mortality statistics reconstructed by advanced techniques for any of the Baltic countries [Katus 1990; Krumins 1993; Stankuniene 1989; Vahtre 1976; Zvidrins 1986].

Among the mortality indicators, the crude mortality rate is usually supporting the longest time series. In the Baltic region this rate is continuously available at least from the 1850s in *gubernia* boundaries [Rashin 1956]. For some larger cities, the series could be much lengthier, like for Riga, Tallinn and Tartu [Pullat 1997]. From another angle, the attempts to calculate the time series of mortality rates in modern boundaries of the

Baltic states are not know to the author, except in the case of Estonia. The latter, however, is prepared for a rather general illustrative purpose without detailed accuracy concerns [Katus 1990].

The referred series together with similar data for Viljandi county, Estonia, are presented in Figure 1. The county rates are derived from the dissertation by Mats Nõges [1925]. Viljandi county is interesting to take into account, being the pioneering region of demographic transition in Estonia, and probably in the Baltic region as a whole, i.e with one of the lowest relative mortality levels at given time points throughout the transitional period. Summarising the cited papers, the start of the continuous mortality decrease, i.e. epidemiological transition in Estonia and Latvia, was somewhere in the middle of the 19th century, although mortality had already declined by that time compared with traditional society. The continuous decline in the Baltic countries, interrupted by the two wars, has been in the progress up to the end of the 1950s as shown below.

4. MORTALITY DEVELOPMENT IN THE 20TH CENTURY

4.1. Distinction of two periods in mortality development

Life table indicators, if available, offer much more adequate data basis for the analysis of the mortality transition. The most important generalisation, however, is rather simple and could be detected also by crude rates: in all three Baltic countries the mortality transition was in progress during the first part of the 20th century. The declining mortality had the trend-forming influence up to the end of the 1950s, disregarding several short-term fluctuations as well as differences between the countries. In all three countries the life expectancy at birth has increased roughly by 25 years for males and 30 years for females during the period of 60 years (Figure 2). In sharp contrast, the following four decades have not introduced any noticeable change in the general mortality level. The current female life expectancy is only very slightly higher than in the early 1960s, and the male mortality is somewhat lower.

As for the differences of long-term mortality development between the Baltic countries, the older periods seem rather more interesting. Although Estonia and Latvia present very close mortality development, those countries have been slightly ahead compared to Lithuania in epidemiological transition. This difference has been stated and analysed in some previous research papers [Krumins et al 1991; Krumins, Zvidrins 1993]. The following period of stagnation in mortality development is surprisingly similar in all three Baltic countries.

In the following, some additional characteristics of the long-term mortality trend in the Baltic region are discussed. In an earlier paper, it was stated that the transitional increase of life expectancy, from the end of the 19th century onwards, appears relatively even in Estonia except the years of WW I and WW II [Katus, Puur 1991]. In the case of WW I and the ensuing War of Independence it seems to hold true for Latvia as well. There is no evidence that the mortality level in post-war period has been higher compared to the early 1910s.

The new data on the 1950s, however, allow to revise the statement in connection of WW II. The male life expectancy in Estonia in 1950, i.e. 5 years after the war, has still been lower compared to the level in the late 1930s. The life expectancy for females has slightly grown, however, with a much lower rate than typical for the transition period. There is no data available for Lithuania and Latvia at this stage of the analysis, but close correspondence of mortality trends during the following decades suggests that most probably the statement could be true also for the other Baltic countries.

It is noticeable that the infant mortality rate, for males as well as for females in the Baltic countries has not grown between the late 1930s and the post-war period. This indicator has become available in Estonia immediately after the war from 1945 [Katus, Puur 1991]. Its level as an average of three years of 1945-1947 has been higher ca 50 per cent compared to the late 1930s. The difference is even larger with the wartime period as the infant mortality continued to decrease during the war years like in some other European countries. Judging upon the infant mortality and the available number of death cases recorded, the serious mortality crisis in the Baltic countries culminated in 1944-1947. In any case, the decrease of life expectancy during WW II has been more pronounced in the Baltic region compared to WW I which is contrary to the experience of many other European countries [Caselli, Egidi 1990].

Against the background of sharp mortality increase in the second half of the 1940s, the following decline during the 1950s was also rather marked in all Baltic countries. Taking the decade of the 1950s as a separate period, it has demonstrated the most rapid increase of life expectancy during the whole century despite the ongoing repressions up to at least the middle of the decade, and low living standards.

In long-term perspective, however, the contradictory years of 1940-1960 could be regarded as a period of opposing short-term fluctuations, and correspondingly, the mortality development characterised by the continuation of a relatively even decline. This notation is particularly important in analysing the possible causes of the rapid improvement of mortality levels in the 1950s in the Baltic region. It could be explained by the ongoing mortality transition but certainly not by improving the living standards and/or medical care of society. In general, the social environment and policies including medical care as well as nutrition were of much lower standard during the sovetisation of the 1950s compared to the pre-war time, with a particularly large difference in Estonia and Latvia [Misiunas, Taagepera 1983].

One hypothesis to explain the disagreement between trends in societal conditions and mortality in the Baltic countries in the 1950s is the time-lag approach. It would seem likely that it takes a decade or more before changes in social conditions will reveal any impact on the population health. It is evident that despite heavy human losses during the violent sovetisation in the Baltic countries, the immediate deterioration of health of the surviving population was not observed, including those deported and imprisoned. As shown above, the situation was quite the opposite. That does not indicate the absence of such negative effect in principle. Under the prevailing endogenous cause-pattern of mortality, the causal impact of societal deterioration on population health takes time to accumulate. It should be noted that the mortality crises in transitional societies with prevailing exogenous causes of deaths were definitely based on other mechanisms.

Starting from the end of the 1950s or early 1960s, the dynamics of life expectancy in the Baltic countries could be summarised as mortality stagnation. Like the previous period of decrease, there have also been several fluctuations in mortality levels, including rather significant ones during the last decade. These should be considered separately, but the long-term trend is evidently stagnation [Katus, Zaharov 1997]. In this respect the mortality development has been rather similar in all three Baltic states. Compared to the countries of Central and Eastern Europe, the early demographic transition has contributed to a particularly prolonged mortality stagnation in the Baltic region. It has been one of the longest or even the very longest in Europe up to the present day.

The phenomenon of mortality stagnation has been internationally well documented and addressed by extensive scientific discussion. Nevertheless, its principal cause still remains hypothetical [Bourgeois-Pichat 1984; Meslé, Vallin 1993]. The current Baltic mortality project, together with similar undertakings in other countries of the former Soviet Union, is partly designed to search for the answer. It should be stressed that the explanation for mortality stagnation should be sought in the change of mortality pattern rather than in its level. It thus seems too simple to seek causal linkages from any concrete socio-economic indicators proceeding alongside the age-profile and therefore cannot explain the change in the pattern.

One of the consequences of the prolonged mortality stagnation has been a noticeable transformation of the position of the Baltic countries in population health patterns among European nations. Due to the lack of progress in the region, all the Western, Northern as well as South-European countries, characterised by comparable or higher mortality levels to those in the Baltics at the end of the 1950s, have noticeably surpassed the Baltic countries one after another. Additionally, in most of the East-European countries characterised by the mortality stagnation, life expectancy reached somewhat higher levels compared to the Baltic states [CoE 1999]. Many developing nations are currently showing higher life expectancy than in the Baltics, particularly for male population. In cross-country comparison, the female mortality in the Baltic countries holds a slightly better position, but still the deteriorating trend is clearly evident.

4.2. Age-specific insight into mortality development

Life expectancy at birth is a sufficient indicator to outline the prolonged mortality stagnation as the principal feature of the Baltic demographic development. The next step is to look for the age-specific patterns of that process. In some earlier papers it has been noted that the mortality stagnation in the Baltic countries is characterised not as much by the absence of progress in mortality levels, but rather the deterioration in age-specific mortality pattern [Katus, Puur 1991; 1998; Krumins 1993]. This outcome is based, *inter alia*, on the comparison of the Baltic age-specific mortality patterns to the Coale-Demeny and UN model patterns. The Baltic mortality pattern increasingly combines very high adult mortality and relatively advanced levels of life expectancy at infancy and childhood. This pattern is particularly profound for males, and developed throughout the period of stagnation.

An age-specific mortality pattern could be presented by applying the simple methods of potential demography, and the number of person-years lived is the indicator chosen to summarise the development in the age pattern. The index is calculated for aggregated age intervals concerning those of surviving to the beginning of that age interval. Four age intervals were defined, and in order to make the estimation more comparable, age brackets were taken 20 years of length each: 0-19, 20-39, 40-59 and 60-79. On the one hand, the index of person-years lived is understandably repeating the presentation of general mortality trend by adding the age dimension. On the other hand, the index outlines the years lost by population in each age group, and demonstrates the potential of improvement across the life cycle. The indices of person-years lived are calculated separately for males and females (Figure 3).

The most obvious result is that the above discussed two periods of mortality trend, and particularly the prolonged mortality stagnation in the Baltic countries is even more explicitly outlined by the person-years lived compared to life expectancy at birth. Also, the main reason of that stagnation, i.e. the diversing trend in mortality age-pattern compared to Western and Northern European countries has become evident. Namely, there are no obvious signs of improvement in the oldest age group of 60-79, or in other words, the fourth stage of epidemiological transition has not emerged in the Baltic countries [Olshanski, Ault 1986]. During the last 40 years there is no growth in the index for females, and among the male population even a decrease is revealed. The situation is roughly the same in all three Baltic countries.

Peter Laslett has described the fourth stage of the epidemiological transition from the point of population ageing. He pointed at the emergence of the Third Age population, attributing an important social dimension to the rapidly decreasing old-age mortality [Laslett 1993]. The previous analysis has shown, particularly for Estonia, that the Third Age population is demographically and socially weak and their role underdeveloped in the Baltic countries which is not typical to the current stage of demographic development [Katus, Põldma, Puur, Sakkeus 1999]. Therefore, the mortality stagnation is not limited to the health problems in society, but has resulted in specific features of population development in general.

Three outcomes of the analysis deserve additional attention. First, during the period of 1940-1950 the person-years lost among male population had increased in three older age groups and remained stable only in the youngest one. This indicates, once again, that the mortality increase has an impact on more or less the entire male population, not selectively for some specific groups as typical of war periods. That increase is not expressed among the female population, and *inter alia,* the war and sovetisation have caused the widening of the gender gap in life expectancy. The gender difference in the Estonian mortality was considerably larger already in 1950 compared to the pre-war time, although the life expectancy for both sexes has been roughly at similar level. Also, the following improvement of mortality levels in the 1950s has not made the gender gap grow any smaller.

Second, the trend of male person-years lived in the age group 40-59 is specific, and moreover, closely similar in all three Baltic countries. Reaching the level of about 18.5 years in the early 1960s, the trend has turned to decline and never reached that level until now. In Estonia and Latvia, the index in the first half of the 1990s has even

dropped below the level of the 1920s. It should be stressed that the age bracket of 20 years is rather broad, it is by no means a narrow age selection with specific linkage to Soviet life-style. Here lies also the answer why the mortality stagnation is not so much related to levels, but more importantly to the changing age pattern. In other words, mortality stagnation could be defined as the increasing male mortality in adult age. The stagnating general levels, as well as an increasing gender gap, are results of that particular development.

Third, the index of male person-years lived in the age group 60-79 is nearly the only one demonstrating a somewhat different trend between the Baltic countries. Leaving aside the decrease in the early 1990s, the Estonian index has fluctuated around the more or less stable level. In Latvia, the person-years lived has reached the highest level in the 1960s but has been decreasing to the Estonian one with a relatively similar trend since the middle of the 1970s. The index was the highest for Lithuania, but it also had the sharpest decrease. In recent years there is no longer any major difference between the countries.

There could be at least two explanations to that dissimilarity in the trend. If to take the data as statistically correct, one should seek the explanation in the continuous deterioration of health among the elderly in Lithuania without similar processes in other countries. Another explanation lies in data quality: in Lithuania the date of birth has probably been recorded with lower accuracy when personal documents issued, particularly for older population, and the continuous improvement of data quality of those records onwards in time. Further investigation is needed to find the right answer, but the described differences certainly deserve attention, particularly for the cause-specific analysis.

4.3. Age components of life expectancy in the first half of the century

It has been stressed that mortality stagnation in the Baltic countries is closely related to the change in the age pattern of mortality. The deterioration in population health has been in progress for at least 40 years. Moreover, there are some signs of the age pattern transformation already in the pre-stagnation period. The continuous series of life tables calculated for the pre-war time under the Baltic mortality project could be useful to test the hypothesis. The current paper focuses on the mortality patterns of the Estonian population, but the data on Latvia could also support similar insight at further stages of the project.

Age decomposition of the total change in life expectancy has been accomplished by 5-year age groups, separately for males and females. The Andreev method was applied for the task [Andreev 1982]. In Figure 4, three time periods are compared with the first two being of similar length: 1922-1930, 1930-1938 and 1938-1950. According to these figures the general conclusion is obvious: with the exception of age-specific change 1938-1950 for male population there is no evidence of any change in the mortality age pattern before WW II.

As expected for the period of mortality transition, the dominant impact on the growth of life expectancy comes from the continuous decrease of infant, and to a lesser extent of

child mortality. In most of the older age groups, leaving aside the fluctuations, there has been some growth with the exception of the very oldest ages. The average increase has been higher in the period 1930-1938 compared to the previous years of 1922-1930. The continuous growth of the same pattern is demonstrated also for females 1930-1950; the infant mortality, however, has increased. The age components of the mortality change in the latter period among the male population are different. In addition to a noticeable negative impact in ages 20-30, which could have resulted from the violent sovetisation, a negative impact in the age interval 45-65 could also be traced. This is more or less the life period characterised by continuous increase of mortality during the stagnation period.

4.4. Growing sex differential in mortality

The comparison of male and female mortality development reveals an extensive sex difference which is another important feature of the Baltic mortality pattern throughout the last five decades. Most research papers published on mortality in the region are referring to that obvious feature. In the framework of the current project, a study of the issue has also been prepared, including a cause-specific analysis [Meslé, Hertrich 1998]. The results will not be repeated here; the following outlines the development from the long-term perspective.

Before WW II there was no divergent trend of sex differential in the Baltic region compared to other countries at a similar stage of demographic development. As everywhere else in the years of mortality transition, alongside with the growth of life expectancy, the sex gap emerged and widened with the progress in population health. It is also supposed that particularly the male mortality increase during the war period supported a temporary (or what seemed temporary at that time) increase of the gender gap.

At the same time, the health improvements after the war have usually been higher among the male population in Europe but not in the Baltic countries. As noted earlier, the post-war male mortality remains even higher for at least five years, compared to the pre-war level. Whatever the reason, this has given start to the diversing trend of sex differential in the Baltic region. The gap widened during the 1950s, i.e. in the period of rapid mortality decline. Moreover, the same tendency continued in the following stagnation period. In other words, there is a good ground for the hypothesis that the large sex differential in mortality in the Baltic countries is not a simple result of the mortality stagnation, but a somewhat more complicated process. It should be noted that the large sex differential, unusual in the European context, emerged before the mortality stagnation began.

4.5. Mortality fluctuations during the stagnation period

Many publications of recent years have shown interest in the mortality increase in Central and Eastern Europe in the first half of 1990s which has been very sharp in many countries of the region. In the Baltic states, the increase followed the previous mortality decrease in the second half of the 1980s making the new trend even more pronounced.

Among others, the European Population Conference held in Budapest 1998, outlined the diversity of mortality development as one of the most important demographic issues of the UNECE region [Jozan 1998].

In recent years most of the countries of transition economies have demonstrated an improvement of population health and an increase in life expectancy, which in some cases has been rather rapid. At present time enough evidence has accumulated to support the hypothesis that the mortality development in the 1980s-1990s has been of temporary and fluctuate origin, rather than a phenomenon of long-term importance, at least in some of the East European countries. Even if true, nevertheless, the fluctuations demand careful attention.

The period of stagnation in the Baltic countries has been characterised by three large-scale fluctuations in the mortality trend during the 1980s-1990s. All these changes have been particularly pronounced in male mortality, and similar in the three Baltic as well as in many other countries of the former USSR. The usual approach to analyse these fluctuations is to apply the cause-specific study, trying to find the specific cause and/or group of causes explaining the change in mortality. In the framework of the current project this approach is applied elsewhere [Meslé, Hertrich 1997]. However, the age-specific approach could also reveal some interesting results.

In the following, the probabilities of death (q_X) by 5-year age groups are compared throughout the stagnation period of 1960-1997. The relative series of those age-specific probabilities are grouped according to the predominate trend during the 40-year period. The figures are presented for each Baltic country separately.

Figure 5 presents the trend of death probabilities for those age groups which explicitly experienced the mortality fluctuations. The referred age interval is 35-54. The amplitude of the fluctuation of the trend is very large: within less than ten years, the minimum (1985-1987) and maximum (1994) values differ up to 225 per cent in Lithuania, 250 per cent in Estonia and as much as 300 per cent in Latvia. The fluctuations of that scale are quite unprecedented in the peacetime years. It is also important to stress that the trend has been nearly identical in all Baltic countries with some variation in their scope.

There is one really important additional feature which is often overlooked in the majority of publications dealing with the health crises in the 1990s. The sharp mortality increase in the early 1990s has namely been carried out exactly by the same age groups that have been characterised by a distinctly increasing trend of mortality throughout the stagnation period. For example, even the lowest levels of death probabilities in that age interval in the late 1980s were still somewhat higher compared to the situation in the early 1960s. It is also noteworthy that the same age groups are responsible for the mortality decline in the late 1980s. Analysing the outlined age groups separately, the trend probably looks interesting, but not contradictory to the general development. The picture will be much more complicated when compared with other age groups in similar way.

Figure 6 shows the age groups representing the predominantly declining trend of death probabilities during the stagnation period. These ages concentrate at the beginning of

the life cycle: usually up to the age of 20, or 25 in some of the Baltic countries. Despite the large annual fluctuations due to the small numbers of death cases in these age groups, except infant deaths, a divergent trend compared to the age groups in the previous Figure is obvious. These age groups did not represent any significant increase of mortality in the early 1990s, nor any special decline in the 1980s. In other words, the age groups of declining death probabilities have not been characterised by large fluctuations under consideration.

Let us now move to older population groups covering the age interval 70-84 (Figure 7). The trend of the death probabilities throughout the stagnation period has been relatively stable for those groups, and once again, have had rather similar pattern in all Baltic countries. Surprisingly, those age groups are not characterised by any mortality fluctuations: either by the decrease in the 1980s or by the increase in the early 1990s. In summary – all the fluctuations in general mortality trend in the 1980-1990s are caused by specific age groups only when other age groups of the life cycle are not affected. At the same time these are the age groups representing an increasing mortality during the whole stagnation period.

5. IN PLACE OF CONCLUSION

It has been stressed by many research papers that, additionally to the increase of violent deaths, the mortality increase in most Central and East European countries in the early 1990s has occurred due to the increase of cardiovascular disease. Comparing other major groups of causes, for example, cancer mortality has been relatively stable. Sometimes this statistical evidence has been used to explain the mortality development in the countries of transitional economies. The above described trends in age-specific probabilities of death, however, are introducing the principal contradiction to that simplification of causal linkage.

If cardiovascular mortality *per se* has increased during the societal transition, why then do the age groups who are most vulnerable to that cause of death — namely the older population age groups — remain almost untouched? Why has the increase in cardiovascular mortality been age-selective, and with that scope of selectivity? A cause-specific mortality analysis can hardly give the answer to this contradiction. It could be that the increase of cardiovascular mortality in Central and East Europe during the 1990s is in fact hiding some essential real cause, may-be of long-term origin.

Whatever the reasons for the strong age-specific selectivity of the mortality fluctuations in the 1980s-1990s, the simple but long-term analysis of mortality stagnation in the Baltic countries is giving an example of how misleading can be the outcome of any research concentrating exclusively on shorter periods when analysing the recent mortality development in the countries of transitional economies. The application of any kind of advanced techniques cannot substitute the long-term information at a cumulative process like mortality.

REFERENCES

Andreev, Evgeni (1982). Metod komponent v analise prodolzhitelnosti zhizni. *Vestnik statistiki,* No.9, pp.42-47.

Andreev, Evgeni, Leonid Darski and Tatjana Harkova (1998). *Demografitsheskaja istorija Rossii: 1927-1959*. Moskva, Informatika.

Besser L. and Karl Ballod (1897). Smertnost, vozrastnoi sostav i dolgovetshnost povoslavnogo naselenia oboego pola v Rossii za 1851-1890 gody. *Zapiski Akademii Nauk*, T.1, No.5. St.Peterburg.

Birziska, V. (1922). Iz Lietuvos gyventoju statistikos XVIII amziaus gale. *Mosu senove,* No.4/5, pp.675-684.

Bourgeois-Pichat, Jean (1984). Mortality trends in the industrialized countries. *Mortality and Health Policy*. New York, United Nations, pp.196-217.

Caselli, Craziella (1993). L'evolution a long terme de la mortalite en Europe. *European Population. Vol.2.* Paris, INED, pp.111-164.

Caselli, Craziella and Viviana Egidi (1990). *A new insigth into morbidity and mortality transition in Italy.* Paper to the conference *Health, morbidity and mortality by causes of death in Europe and Soviet Union*. Vilnius.

Cesnys, G. (1997). Lietuvos zmoniu gyvenimo trukmes dinamika per du tukstantmecius. *Medicinos teorija ir praktika*, No.1, pp.28-29.

Coale, Ansley, Barbara Anderson and Erna Härm (1979). *Human fertility in Russia since the XIX century*. Princeton, Princeton University Press.

CoE (1999). *Recent demographic developments in Europe.* Strasbourg, Council of Europe.

CSBL (1998). *Demographic yearbook of Latvia*. Riga, Central Statistical Bureau of Latvia.

EKDK (1994a). *Population age structure: counties 1979-1989*. RU Series C, No.2. Tallinn, EKDK.

EKDK (1994b). *Population age structure: counties 1970-1979*. RU Series C, No.3. Tallinn, EKDK.

EKDK (1994c). *Life tables. Counties 1986-1991*. RU Series C, No.4. Tallinn, EKDK.

ESA (1998). *Social trends in Estonia*. Tallinn.

ESA (1999). *Statistical yearbook of Estonia*. Tallinn.

Goskomstat SSSR (1989). *Tablitsy smertnosti i ozhidaemoi prodolzhitelnosti zhisni naselenia*. Moskva.

Hertrich, Véronique and France Meslé (1999). *The health crisis in the Baltic countries: a common and varied experience*. Paper to the European Population Conference. The Hague.

Jasas R. and L. Truska (1972). *Lietuvos Didziosios kunigaikitystes gyventoju suraiymas 1790 m*. Vilnius.

Jozan, Peter (1998). *Some features of mortality in the member states of the ECE*. Paper to the Regional Population Meeting. Budapest.

Kannisto, Väino (1993). *Letter and personal discussions*.

Katus, Kalev (1982). *Dolgosrotchnye tendentsii razvitia i upravlenia demografitcheskoi sistemy*. Dissertazia. Moskva.

Katus, Kalev (1989). *(Ed). Podhody k upravleniu migratsionnym razvitiem*. Tallinn, Valgus.

Katus, Kalev (1990). Demographic trends in Estonia throughout the centuries. *Yearbook of Population Research in Finland*, pp.50-66.

Katus, Kalev and Allan Puur (1990). *General mortality trend: case of Estonia 1897-1989.* Paper to the Conference on *Health, morbidity and mortality by causes of death in Europe and Soviet Union*. Vilnius.

Katus, Kalev and Allan Puur (1991). Eesti rahvastiku suremusest elutabelite analüüsi põhjal. *Akadeemia*, No.12, lk.2516-2549.

Katus, Kalev and Allan Puur (1997). *Mortality development and economic transition: case of Estonia*. RU Series B, No.35. Tallinn, EKDK.

Katus, Kalev and Allan Puur (1998). Population and social development in Estonia during the economic transition. *A.Laur, I.Appelquist, T.Kaasik, R.Andersson (Eds). Safe communitie: the application to societies in transition.* Röd rapport, No.380, pp.7-51.

Katus, Kalev, Allan Puur, Asta Põldma ja Luule Sakkeus (1999). *Rahvastikuvananemine Eestis*. RU Sari D, No.1. Tallinn, EKDK.

Katus, Kalev and Sergei Zaharov (1997). *Demographic adaptation to socioeconomic changes in the USSR successor states*. Paper to the IUSSP 23dr General Conference. Beijin.

Krumins, Juris (1990). Formation of the contemporary pattern of mortality. *Proceedings of the Latvian Academy of Science*. No.8, pp. 75-84.

Krumins, Juris (1993). *Iedzivotaju muza ilgums - tendences un palielinasanas problemas*. Riga.

Krumins, Juris (1994). Changing mortality patterns in Latvia, Lithuania and Estonia. *W.Lutz, S.Scherbov and A.Volkov (Eds). Demographic trends and patterns in the Soviet Union before 1991.* London and New-York, Routlege, pp.403-419.

Krumins, Juris, Domantas Jasilionis and Jacques Vallin (1998). *Do geographical variations of mortality overpass national frontiers: the case of the three Baltic countries?* Paper to the International Conference *Regularities and inconsistencies of demographic development: preconditions for the replacement of generations*. Vilnius.

Krumins, Juris and Peteris Zvidrins (1992). Recent mortality trends in the three Baltic repubublics. *Population Studies,* No.46, pp.259-273.

Krumins, Juris and Peteris Zvidrins (1993). Morbidity and mortality in Estonia, Latvia and Lithuania in the 1980s. *Scandinavian Journal of the Sociology of Medicine,* Vol.21, pp.150-158.

Krumins, Juris, Peteris Zvidrins, Kalev Katus and Vlada Stankuniene (1991). Mortality trends in Latvia, Lithuania and Estonia in the 19th and 20th centuries. *Latvijas Zinatnu Akademijas*, No.11, pp.53-63.

Laslett, Peter (1993). *The emergence of the Third Age*. Plenary address to the IUSSP conference. Montreal.

LSD (1999). *Demographic yearbook.* Vilnius, Statistics Lithuania.

Mercaitis, A. (1973). Ar sensta Lietuvos gyventojai. *Mokslas ir gyvenimas*. Vilnius.

Meslé, France and Véronique Hertrich (1997). *Mortality by cause in Baltic countries since 1970: a method for reconstructing time series.* Paper to the International Symposium *Demographic development in the Baltic countries*. Tallinn.

Meslé, France and Véronique Hertrich (1998). *Sex mortality differences in the Baltic countries.* Paper to the International Conference *Regularities and inconsistencies of demographic development: preconditions for the replacement of generations*. Paris.

Meslé, France, Vladimir Shkolnikov, Véronique Hertrich et Jacques Vallin (1996). *Tendances recentes de la mortalite par cause en Russie 1965-1994.* Paris, INED.

Meslé, France, Sergei Piroshkov, Vladimir Shkolnikov, Véronique Hertrich et Jacques Vallin (2001). *Tendances recentes de la mortalité par cause en Ukraine 1965-1994.* Paris, INED. Forthcoming.

Meslé, France and Jacques Vallin (1993). Developpement economique et esperance de vie: la transition sanitaire au tournant des annees soixante. *Proceeding of the International Population Conference, Vol.2*. Montreal, IUSSP, pp.365-383.

Misiunas, Romuald and Rein Taagepera (1983). *The Baltic States. Years of dependence 1940-1980*. Berkeley, University of California Press.

Novoselski, Sergei (1916). *Smertnost i prodolzhitelnost zhisni v Rossii*. St.Peterburg.

Nõges, Mats (1925). *Rahvamuutused Viljandi maakonnas 1801-1923.* Tartu.

Olshansky, Jay and Brian Ault (1986). The fourth stage of the epidemological transition: the age of the delayed degenerative diseases. *The Milbank Quarterly*, Vol.64, No.3, pp.355-391.

Palli, Heldur (1984). *Lääne-Eesti rahvastiku struktuur ja taastootmine (Karuse 1685-1799)*. Tallinn.

Palli, Heldur (1988). *Otepää rahvastik aastail 1716-1799*. Tallinn, Eesti Raamat.

Palli, Heldur (1995). *Eesti rahvastiku ajaloo allikad*. Tallinn.

Palli, Heldur (1997). *Eesti rahvastiku ajalugu 1712-1799*. Tallinn, Teaduste Akadeemia Kirjastus.

Ptuha, Mihail (1960). *Otsherki po statisitki naselenia*. Moskva.

Pullat, Raimo (1997). *Die Stadtbevölkerung Estlands im 18. Jahrhundert*. Mainz, Verlag Philipp von Zabern.

Rashin, Aleksandr (1956). *Naselenie Rossii za 100 let*. Moskva.

RSKB (1924-1925). *1922 aasta üldrahvalugemise andmed.* Vihk 4-11. Tallinn, Riigi Statistika Keskbüroo.

RSKB (1937). *Rahvastikuprobleeme Eestis.* Tallinn, Riigi Statistika Keskbüroo.

Sakkeus, Luule (1996). Estonia. *T.Frejka (Ed). International migration in Central and Eastern Europe and the CIS states.* New York and Geneva, United Nations, pp.57-69.

Schofield, Roger, David Reher and Alain Bideau (1991). *(Eds). The decline of mortality in Europe.* Oxford, Clarendon Press.

Stankuniene, Vlada (1989). Vosproizvodstvo naselenia Litvy. *Demografitsheskoje razvitie Litvy*. Vilnius, pp.22-59.

TsSU Latvii (1965). *Tablitsy smertnosti i prodolzhitelnosti zhisni naselenia Latviiskoi SSR*. Riga.

Vahtre, Sulev (1973). *Eestimaa talurahvas hingeloendite andmeil*. Tallinn, Eesti Raamat.

Zvidrins, Peteris (1983). Demographic transition in Latvia. *P.Khalatbary (Ed). Demographic transition*. Berlin, Akademie-Verlag.

Zvidrins, Peteris (1986). *Naselenie sovetskoi Latvii*. Riga, Zinatne.

Figure 1. CRUDE DEATH RATES
Estonia and Viljandi county, 1780-1930

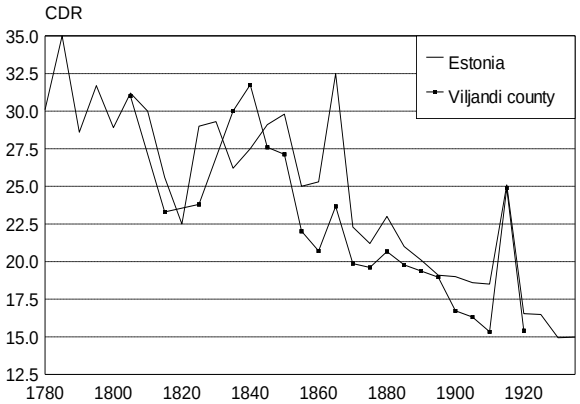


Figure 2. LIFE EXPECTANCY AT BIRTH
Baltic countries 1897-1997

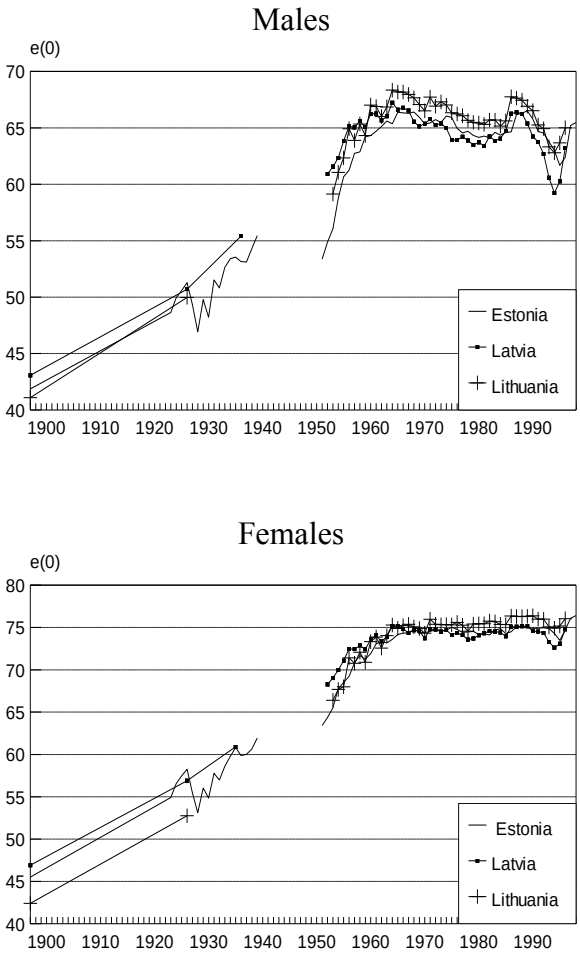
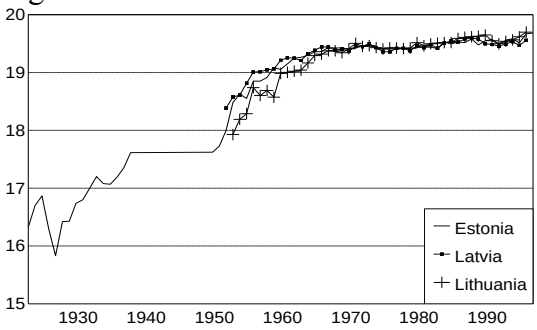


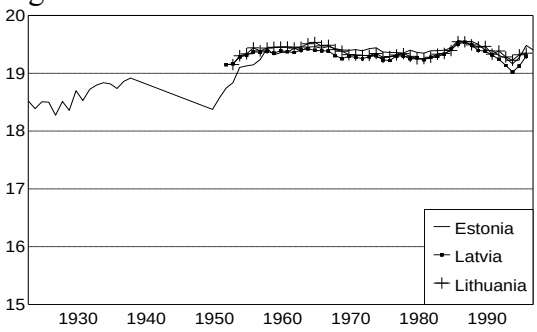
Figure 3. PERSON-YEARS LIVED IN CERTAIN AGE INTERVAL
Baltic countries 1897-1997

Males

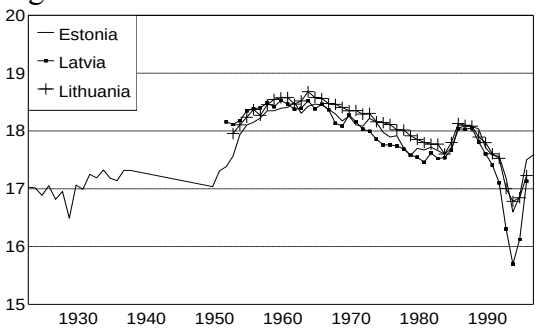
Age interval of 0-19



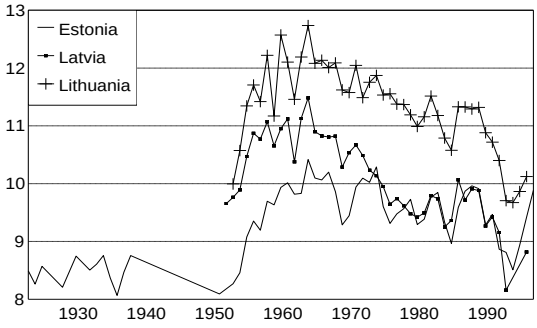
Age interval of 20-39



Age interval of 40-59

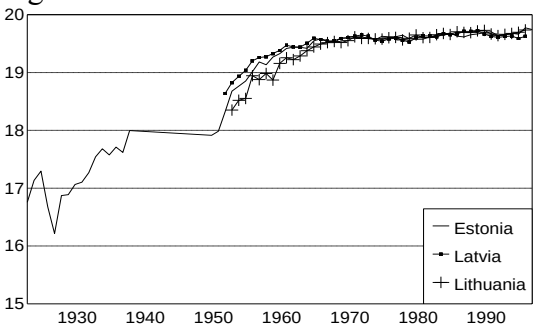


Age interval of 60-79

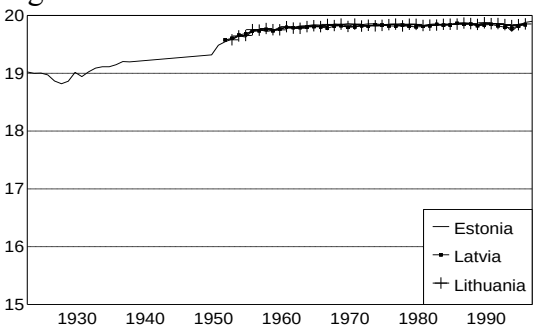


Females

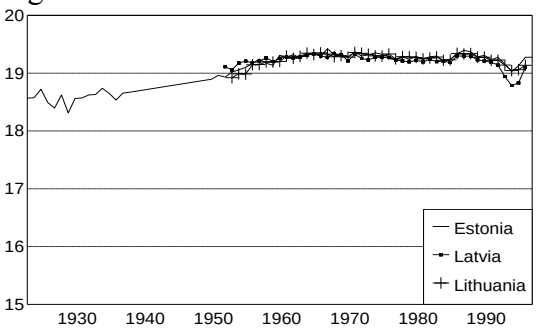
Age interval of 0-19



Age interval of 20-39



Age interval of 40-59



Age interval of 60-79

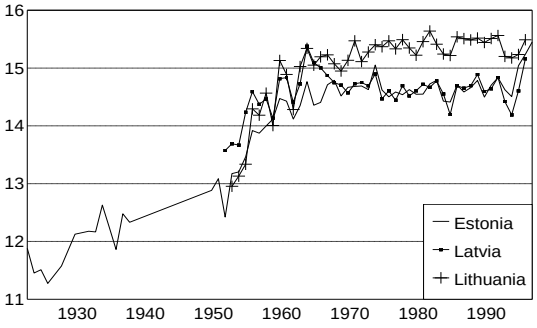
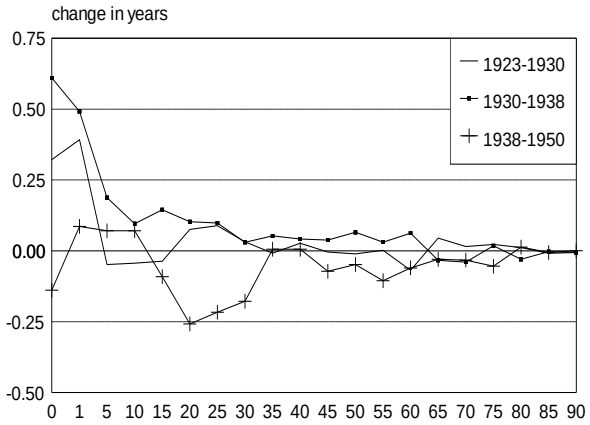


Figure 4. AGE COMPONENTS OF CHANGE IN LIFE EXPECTANCY
Estonia 1923-1950

Males



Females

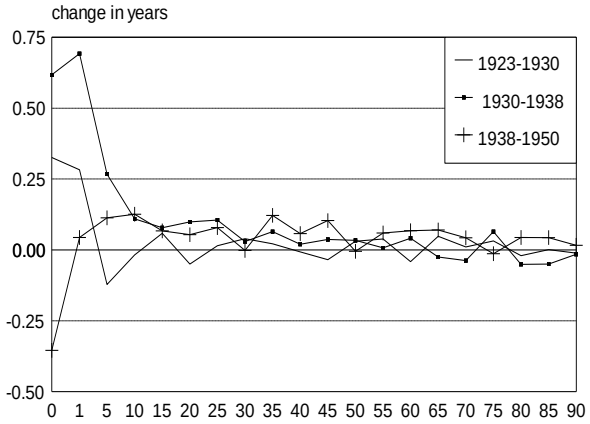


Figure 5. MALE PROBABILITIES OF DEATH (qx)
Age interval of 35-54, 1960-1997

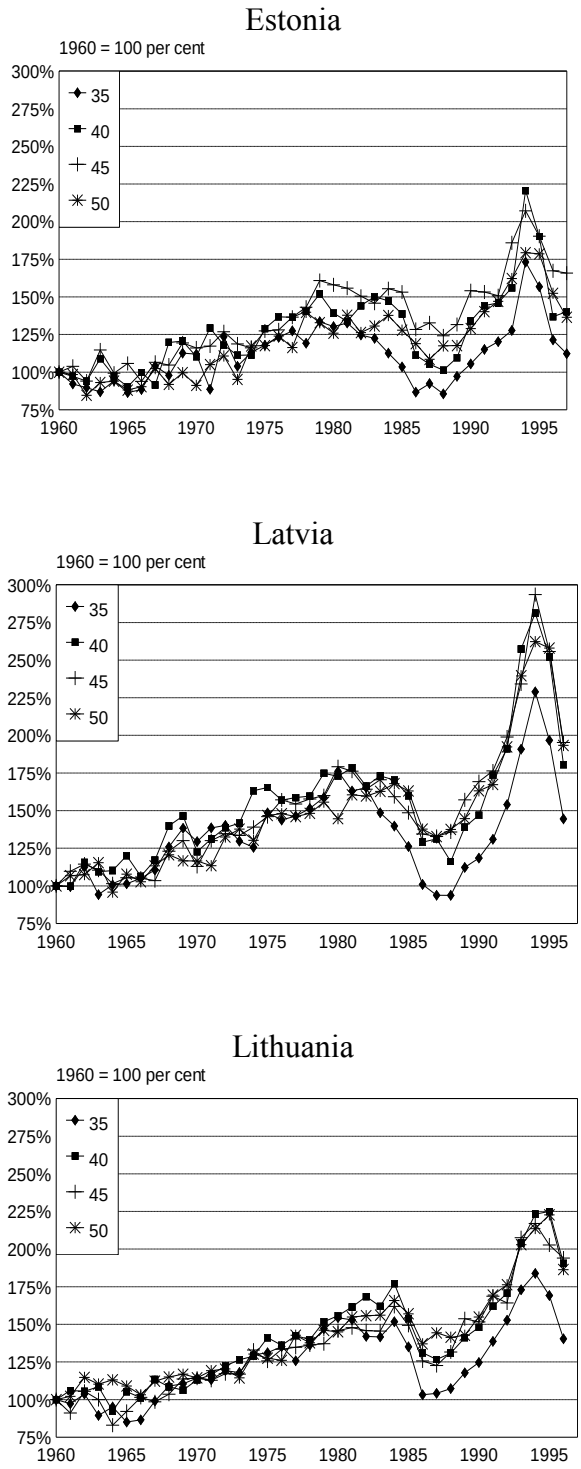


Figure 6. MALE PROBABILITIES OF DEATH (qx)
Age interval of 0-19, 1960-1997

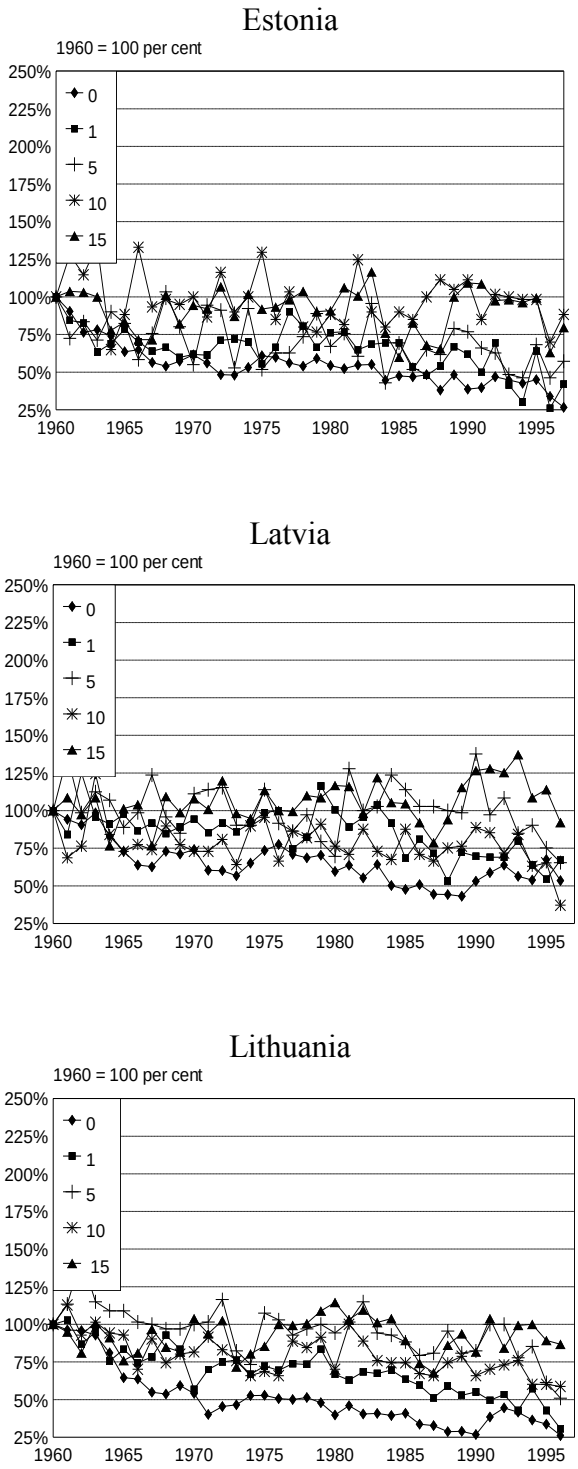


Figure 7. MALE PROBABILITIES OF DEATH (qx)
Age interval of 70-84, 1960-1997