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Recent Life Expectancy Divergence in Baltic Countries

Récentes divergences d'espérance de vie dans les pays Baltes

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Abstract Until the end of the 1990s, mortality patterns and trends in Estonia, Latvia and Lithuania were remarkably similar. However, from the year 2000 onwards, life expectancy trends in the three countries started to diverge. In particular, sustainable progress in Estonia over the period 2000–2007 contrasts with stagnation in Latvia, and even worsening trends in Lithuania. These contradictory changes seem to be mainly explained by contrasting dynamics in mortality from cardiovascular diseases, external causes of death and digestive system diseases. Whereas cardiovascular and external-cause mortality declined in Estonia and Latvia, worsening or stagnation of mortality from these causes of death was observed in Lithuania. The negative mortality changes in Lithuania were also reinforced by a striking increase in mortality from alcohol-related digestive system diseases. The findings suggest that the divergence in health trends between the three countries may be attributable to their varying degrees of success in implementing structural health care reforms and specific health policy measures. By contrast, the very recent improvement (since 2008) is parallel in the three countries and is largely because of the introduction of rather similar anti-alcohol measures.

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Résumé Jusqu'à la fin des années 1990, les évolutions et structures de mortalité en Estonie, Lettonie et Lituanie étaient remarquablement similaires. Cependant, à partir de l'année 2000, les tendances de l'espérance de vie ont commencé à se différencier. Plus particulièrement, les progrès soutenus en Estonie au cours de la période 2000–2007 contrastent avec la stagnation en Lettonie et la détérioration en Lituanie. Des dynamiques différentes de la mortalité par maladies cardio-vasculaires et du système digestif et par morts violentes semblent être les principales causes de ces évolutions divergentes. Alors que la mortalité cardiovasculaire et par morts violentes diminuait en Estonie et en Lettonie, une aggravation ou une stagnation de ces causes de décès étaient observées en Lituanie. Ces changements négatifs de mortalité en Lituanie ont été renforcés par une importante augmentation de la mortalité par maladies du système digestif liées à l'alcool. Ces résultats suggèrent que les divergences de mortalité entre les trois pays peuvent être attribuées à des degrés variables de succès dans la mise en place de réformes structurelles des systèmes de soins de santé et de mesures spécifiques de santé publique. A l'opposé, la très récente amélioration (depuis 2008) est similaire dans les trois pays et repose largement sur l'introduction de mesures contre l'alcool assez semblables.

Mots-clés Évolutions de la mortalité · Espérance de vie · Divergence · Causes de décès · Pays Baltes · Estonie · Lettonie · Lituanie

1 Introduction

Since the end of the 1980s, a growing divergence in life expectancy trends has been observed between the countries of Central Europe and those of the former USSR (Meslé 2004). The most recent data also suggest an increasing trend divergence between these latter countries that already gave rise to several descriptions and discussions (Gaumé and Wunsch 2010; Grigoriev et al. 2010). Over recent years, the three Baltic countries have experienced similar socioeconomic and political developments, as all have enjoyed strong economic growth and benefited from membership of the European Union, which they all joined in 2004. However, at the turn of the millennium, Estonian, Latvian and Lithuanian life expectancy trends started to deviate from the parallel path they had followed during the chaotic previous years. From 1988 to 2000 (Fig. 1) all three countries followed trajectories almost perfectly parallel to that of Russia. At the end of the 1980s, life expectancies started to fall as the Gorbachev anti-alcohol campaign was abandoned, and in the early 1990s this deterioration accelerated because of the severe socioeconomic crisis that followed the brutal transition to a market economy. By contrast, in the second half of the 1990s, after recovering from that crisis, the three Baltic countries looked set to move in sustainable upward direction whilst Russia reverted back to the long-term negative trends that had characterised the Soviet Union since the mid-1960s.

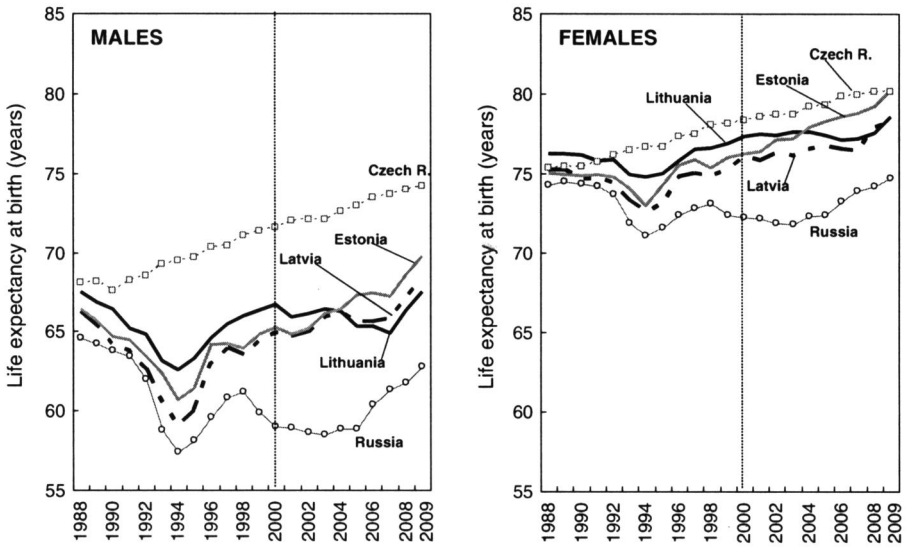

Fig. 1 Trends in life expectancy at birth in three Baltic countries, Russia and the Czech Republic, 1988–2009. *Data source* Human Mortality Database (2010), Statistics Lithuania (2010a), Statistics Estonia (2010a), Central Statistical Bureau of Latvia (2010)

All that has been thoroughly demonstrated and discussed by many authors (Krumins 1994, 1997; Stankuniene 1995; Hertrich and Meslé 1997; Katus and Puur 1997; Stankuniene et al. 1999; Krumins and Usackis 2000; Leinsalu 2004; Meslé 2004). However, certain new and still unexplained changes started to occur from 2000. The Baltic trends were no longer parallel and, within the space of a few years, Lithuania lost its advantage and Estonia took a clear lead over the two other countries (Fig. 1). Until the very last years of the decade, only Estonia seemed to be in a position to follow the path of Central Europe, here represented by the Czech Republic, possibly converging towards the lower levels of mortality achieved in Western countries. But since 2008, the three countries have finally returned to parallel and very positive trends.

Potential explanations for the divergence in life expectancy trends observed in Estonia, Latvia and Lithuania during the period 2000–2009 will be examined here by addressing two research questions. First, can the differences in health systems and/or specific health measures explain the divergence in life expectancy trends observed since 2000? Second, is there some new common denominator that explains the sudden convergence in trends seen in 2008–2009?

In the first section, life expectancy changes will be analysed via the main groups of medical causes of death, and the leading causes (digestive diseases, external causes and circulatory diseases) will be examined in greater detail to identify the most important specific causes responsible for the mortality changes. Section 2 will be devoted to an extensive discussion of the relations between these trends and the health system reforms recently implemented in the three countries, as well as the impact of more specific health measures targeting alcohol abuse and traffic accidents.

We will examine the potential role of health care and health policies using several criteria. We will assess the basic changes in the health care systems by analysing the timeline, content, and certain outcomes of health care reforms. Using 'amenable mortality' as a criterion of health care system effectiveness, we will assess its impact on diverging life expectancy trends between 2000 and 2007, and between 2007 and 2009. Finally, we will examine the effectiveness of anti-alcohol policies by describing potential relationships between the timeline of changes in alcohol-related policy measures and mortality.

2 What Causes of Death are Mainly Responsible for the Recent Changes in Life Expectancy?

To understand what has happened since the year 2000, it is necessary to distinguish two periods:

- 2000–2007, when life expectancies followed opposite trends;
- 2007–2009, when they resumed parallel and very positive trends.

2.1 Large Groups of Causes

Figure 2 depicts cause-specific contributions[1] to overall changes in life expectancy at birth in Lithuania, Latvia and Estonia for each period. Seven large groups of causes are considered: infectious diseases, respiratory diseases, cardiovascular diseases, digestive diseases, cancers, other diseases and external causes.

From 2000 to 2007 (Fig. 2a), not only did Estonian males gain 2 years of life expectancy whilst Lithuanian males lost 1.9 years, but the causes of death responsible for these changes were not the same. The remarkable improvement in male life expectancy in Estonia was mainly because of the reduction in cardiovascular mortality and external causes of death. These two causes alone account for almost all the net growth in male life expectancy at birth (+0.9 and +1.0 years respectively). Figure 8 shows that the contributions of both groups of causes of death were highest at adult working ages (20–65 years). All other groups of causes were found to play minor roles (the most important being respiratory diseases, which contributes only 0.2 years of life expectancy gain).

Cardiovascular diseases also played a major (but exactly opposite) role in Lithuania, where the increase in male mortality because of that group of causes explains almost a half of the net decline in life expectancy (−0.9 year). Like their positive effect in Estonia, the negative role of these causes is mainly seen at adult ages in Lithuania (Fig. 8). In contrast to Estonia, the second most important contributor to the life expectancy decrease in Lithuania is digestive diseases. Very strikingly, this negative contribution (mainly because of alcohol-related digestive diseases) is almost as large as that of cardiovascular diseases (−0.7 years). By

[1] Age- and cause-specific contributions to life expectancy changes were calculated according to Andreev's method (Andreev et al. 2002).

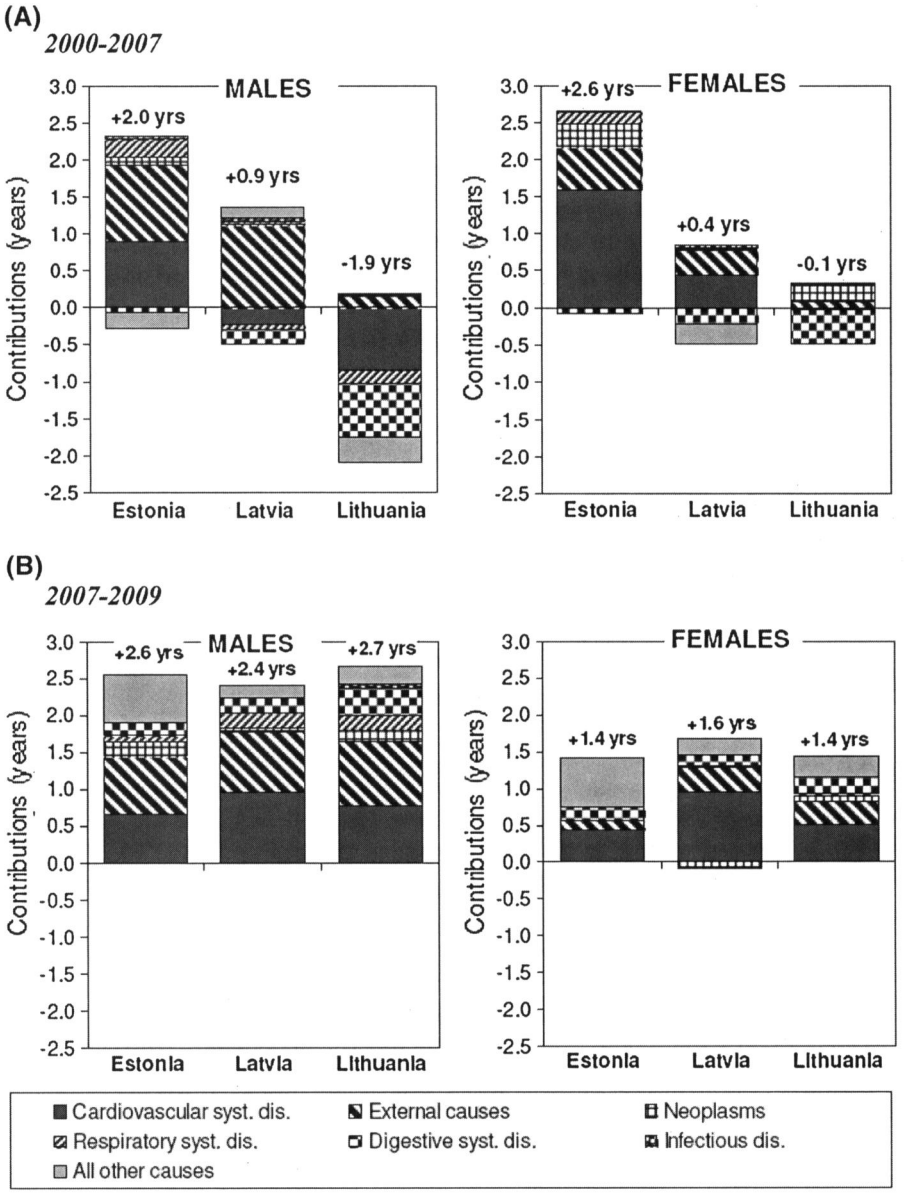

Fig. 2 Contributions of the major groups of causes of death to the total change in life expectancy at birth in Estonia, Latvia and Lithuania from 2000 to 2007 (**a**); and from 2007 to 2009 (**b**). *Data source* WHO Mortality Database (2010), Statistics Estonia (2010b), Statistics Lithuania (2010b), Central Statistical Bureau of Latvia (2010)

contrast, in Lithuania, the role of external causes is surprisingly low (+0.2 years), and is cancelled out by the negative effects of respiratory diseases (−0.2 years) and 'other causes' (−0.3 years).

In Latvia, the only major factor of change is the positive effect of the decrease in external causes, which produced a 1.2 year gain in male life expectancy, only slightly counteracted by the small negative effects of cardiovascular and digestive mortality (Fig. 2a). The contrasting roles of cardiovascular diseases and external causes are particularly marked at working ages. But at older ages, cardiovascular mortality change has a positive effect, whilst external causes are neutral (Fig. 8).

Thus, for males, the much more rapid life expectancy increase in Estonia than in Latvia can be attributed to contrasting effects of the change in cardiovascular mortality, which produced a big gain in the former country, and small loss in the latter one. Meanwhile, in Lithuania, male life expectancy decreased because of the huge negative effect of cardiovascular and digestive diseases, which was only slightly counteracted by a very small decrease in mortality from external causes.

In comparison with the male patterns, cardiovascular diseases play a quite different role amongst females. In Estonia, female gains because of the decrease in cardiovascular mortality (+1.6 years) are almost twice those of males, whilst in Latvia, a significant gain (+0.4) is observed in contrast to the small losses for males. In Lithuania, this cause is neutral for females whilst very negative for males. Gains are mostly because of the decrease in cardiovascular mortality at old ages, and the deterioration at adult ages typical of the former USSR is quite small or nil.

Between 2007 and 2009, all groups of causes of death contribute to the dramatic jump in life expectancy for males and females (around +2.5 years for males and +1.5 for females in just 2 years). In males, both external causes of death and cardiovascular diseases played the most important role in all three countries (Figs. 2b, 9). These two groups account for more than half of the net growth in male life expectancy (57% in Estonia, 75% in Latvia and 62% in Lithuania). In Estonia, the 'other causes' group is also an important contributor whilst in Lithuania digestive diseases rank third. Everywhere, all other groups play a non-negligible positive role.

It is not surprising that recent gains are less spectacular for females than for males since they are largely explained by the decline in man-made diseases that played the greatest role in the life expectancy deterioration during the Soviet era. They also show more varied cause-of-death patterns from country to country. The improvements in Latvia are mainly attributable to cardiovascular diseases (75%), whereas this cause of death plays a much smaller role in Estonia and Lithuania (30 and 36%, respectively). In Estonia, the 'other causes' group makes the largest contribution (47%). In Lithuania, more than half the increase in female life expectancy is attributable to the impacts of external causes (22%), digestive system diseases (15%) and 'other causes' (20%).

In the period 2000–2007, the main changes were driven by three groups of causes: cardiovascular diseases, digestive diseases and external causes. For the years 2007–2009, the 'other causes' group also plays an important role. Unfortunately, detailed data by single cause are not yet available for the last period, so we cannot examine the specific causes included in these groups. The rest of this section covers the first period only.

2.2 Cardiovascular Diseases

Cardiovascular diseases are responsible for large numbers of deaths, but it is difficult to divide this broad group of causes into many specific items, since the distinctions used are often subject to miscounting because of the uncertainty of definitions and/or diagnoses. The group can nonetheless be divided into three broad sub-groups: ischaemic heart diseases, other heart diseases and all other cardiovascular diseases (including cerebrovascular diseases and other diseases of the circulatory system).

Figure 3 displays annual trends in standardised mortality rates (SMR) for the whole group of circulatory diseases and its three components. We will first compare male cardiovascular mortality in Estonia and Lithuania, which show the largest contrast in terms of life expectancy trends. Whilst Lithuania had the lowest cardiovascular mortality in 2000, the situation is reversed in 2007 (Fig. 3a). The two mortality curves cross over in the middle of the period. This is the consequence of a strong divergence in ischaemic heart disease mortality (Fig. 3b), whose level was similar in the two countries in 2000, combined with a convergence in mortality from cardiovascular diseases other than heart diseases (Fig. 3d), which was higher in Estonia in 2000 but had reached almost the same level in the two countries by 2007. However, the impact of these two trends is tempered by the reversal of the situations in the two countries observed for the 'other heart diseases' group (Fig. 3c), for which mortality trends are worsening in Estonia whilst stagnating in Lithuania. But the latter phenomenon is mainly because of a faster improvement in diagnostic practice in Estonia. Ischaemic heart diseases include the item 'atherosclerotic cardiosclerosis' which was traditionally used in the Soviet era to classify a variety of ill-defined cardiovascular diseases. It seems that Estonia is abandoning this practice more rapidly than Lithuania. Consequently, the apparent increase in mortality from 'other heart diseases' is exaggerated, but the decrease in ischaemic heart diseases is also exaggerated. In total, in Estonia, the decline in ischaemic heart diseases apparently added 0.9 years to male life expectancy at birth, whilst the increase in 'other heart diseases' produced an apparent loss of 0.5 years. The actual gain for all heart diseases is 0.4 years, versus a loss of 0.6 years[2] in Lithuania.

Furthermore, changes in mortality from other cardiovascular diseases resulted in a gain of 0.5 years in Estonian life expectancy compared to a loss of 0.2 years in Lithuania. By contrast, in Lithuania, increases in male and female mortality from this cause produced significant losses in life expectancy (−0.4 and −0.2 years, respectively). Finally, neither Estonian progress nor Lithuanian deterioration in cardiovascular diseases can be attributed more to one specific disease than to another. We can only underline the importance of the total impact of cardiovascular mortality on the contrasting life expectancy trends between Estonia and Lithuania. Much the same can be said about female cardiovascular mortality (Fig. 3e–h). Latvia differs from the other two countries by the fact that throughout the period 2000–2007, total cardiovascular mortality remained at the highest level for males and the trend was almost the same for females (Fig. 3a and e). This specificity is

[2] −0.38 Years for ischaemic heart diseases and −0.26 for other heart diseases (Table 3).

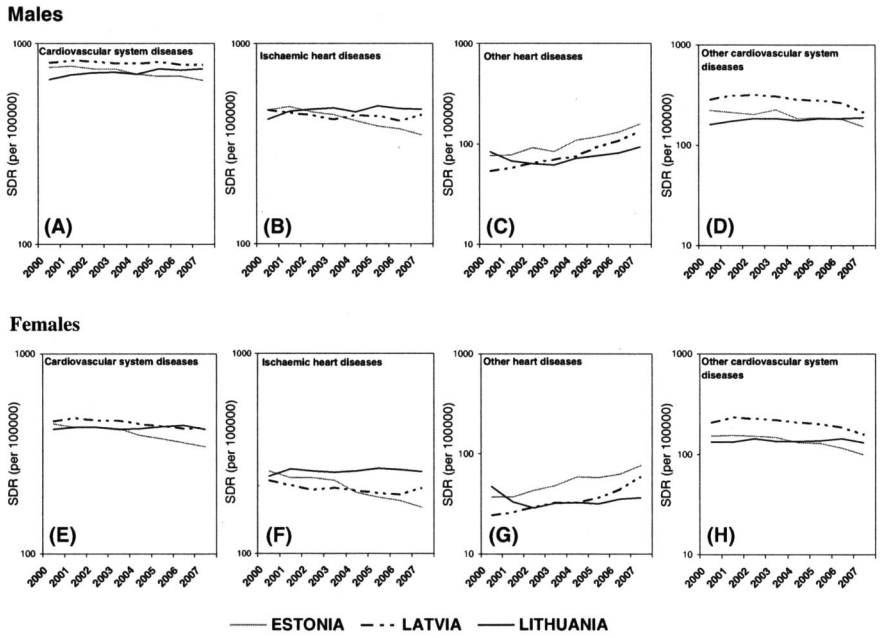

Fig. 3 Annual trends in SMR from selected cardiovascular diseases in Estonia, Latvia and Lithuania, 2000–2007. *Data source* as in Fig. 2

mainly because of the particularly high level of mortality from other cardiovascular diseases (Fig. 3d and h).

2.3 External Causes of Death

Since these causes are much more important for male mortality, we restrict our comments here to males. To provide more detail for our analyses, the group of causes was split into the following 10 smaller sub-groups of causes: traffic accident, suicide, homicide, accidental poisoning by alcohol, other accidental poisoning, accidental fall, accidental drowning and submersion, excessive cold, violent death of undetermined intent and all other (remaining) external causes of death.

The total contributions of the group of external causes of death to the changes in male life expectancy between 2000 and 2007 were substantial in Estonia and Latvia (+1.0 years and +1.1 years, respectively). Almost all external causes of death contributed to the improvements in male life expectancy (Table 3). The most significant gains in Estonia were produced by decreases in homicide (+0.3 years), suicide (+0.2 years) and accidental poisoning by alcohol (+0.2 years). The largest contributions in Latvia came from reductions in suicide (+0.4 years), traffic accidents (+0.3 years) and violent death of undetermined intent (+0.2 years).

At the same time, external causes of death were found to have little impact on mortality amongst Lithuanian males (+0.1 years). The only significant positive

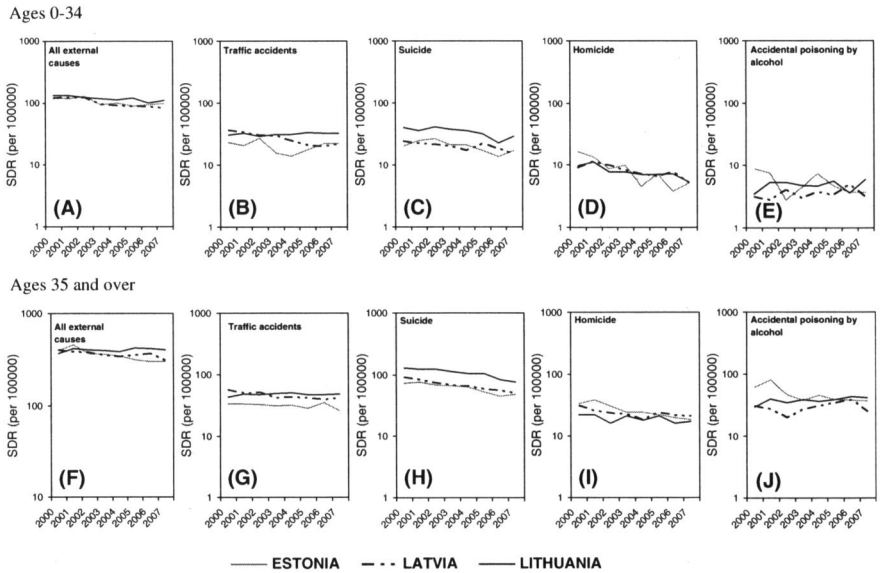

Fig. 4 Annual trends in male SMR from selected external causes of death in Estonia, Latvia, and Lithuania, 2000–2007. *Data source* as in Fig. 2

contribution came from a decrease in suicide mortality (+0.5 years, more than in the two other countries). This gain was counterbalanced by increasing mortality because of accidental poisoning by alcohol at ages 30–59, and by a striking increase in mortality because of excessive cold amongst older adult males (the joint contribution of these causes was −0.4 years) (Tables 3, 4). In contrast to the decline observed in Latvia, no progress was made in reducing mortality because of traffic accidents amongst Lithuanian men. Moreover, it is only thanks to the large decrease in suicide that the total effect of external causes is not negative.

Figure 4 displays trends in mortality due to the four main causes amongst the ten external causes studied, as well as for the whole group of external causes, for two age groups (0–34, 35+). At ages 0–34, Lithuania had the highest initial mortality level and the slowest rate of improvement throughout the period (Fig. 4a). At the same time, Latvia made notable progress, with SMR for external causes of death decreasing by about one-third. Estonia, whose situation was slightly better than that of Latvia at the beginning of the period, showed a slowdown in recovery, and even a reversal in trends after 2003. At ages 35+, the leader in mortality reductions was Estonia, whereas Latvia saw short-term worsening during 2004–2005. Once again, mortality in Lithuania remained stagnant throughout the period (Fig. 4f).

Turning to more specific external causes of death, a very illustrative example concerns traffic accidents (Fig. 4b and g). Despite having the weakest starting position, Latvia became a clear vanguard amongst the Baltic countries in reducing the number of traffic accidents amongst children and young adults (SMRs at ages 0–34 almost halved between 2000 and 2007). Meanwhile, Estonian children and

young adults have experienced less favourable trends in the most recent years. However, at ages 35+, Estonia has kept its initial leading position, as mortality reductions in that country were as rapid and almost as regular as in Latvia. The favourable trends in both countries contrast with stagnating or even increasing trends in Lithuania for both age groups.

Trends in homicide are quite similar for the three countries but the decrease is slightly faster in Estonia than in the other two countries and more pronounced at age 0–34 than at age 35+ (Fig. 4d and i).

At the beginning of the period, Estonia had a higher level of mortality by accidental alcohol poisoning than the other two countries, especially at age 35+, but the level soon converged with those of Latvia and Lithuania. Apart from annual fluctuations, mortality has since stagnated at almost the same level in all three countries (Fig. 4e and j).

Suicide is the only external cause which does not contribute to the gap between Lithuania and the other two countries. Indeed, mortality by suicide is highest in Lithuania over the period, but has decreased at the same pace, or even a little faster, than in Estonia and Latvia (Fig. 4c and h).

Finally, the large gain in Estonian life expectancy at birth because of a decline in mortality from external causes shown in Fig. 2 is attributable to all specific causes for both age groups, except traffic accidents at ages 0–34. At the same time, Latvia gains only from decreases in suicide and homicide mortality in both age groups but also from traffic accident mortality in the youngest age group. Finally for Lithuania, each age group contributes to the balance between the favourable trends in suicide and the unfavourable trends in traffic accidents and accidental poisoning.

2.4 Digestive Diseases

The negative impact of digestive diseases, which is quite significant in Latvia and in Lithuania for both sexes (though much less so in Estonia) is overwhelmingly attributable to liver cirrhoses[3] (Tables 3, 4). In all three countries, liver cirrhoses caused losses in life expectancy. Their impact is particularly high in Lithuania (−0.5 years for males and −0.3 years for females), but is much lower in Latvia (about (−0.1 years for males and −0.2 for females), and in Estonia (about −0.1 for both sexes). The deterioration is concentrated at working ages (30–65 years). Other digestive diseases also produced small life expectancy losses in Latvia and Lithuania, whilst in Estonia their effect is positive.

Mortality because of liver cirrhoses in Lithuania increased throughout the period 2000–2007 (Fig. 5b and f). The speed of mortality increase accelerated after 2003, and SMRs practically doubled in 3 years. For most of the period, mortality due to liver cirrhoses stagnated, with some fluctuations in Estonia and in Latvia. In 2007, it was about 1.5–2 times higher in Lithuania than in Latvia and Estonia. In Lithuania and Latvia, increases in mortality from liver cirrhoses were associated with a

[3] For simplicity, we call 'Liver cirrhoses' the group including ICD-10 items K70 (Alcoholic liver disease) and K74 (Fibrosis and cirrhosis of liver), which includes mainly alcohol-related cirrhoses, even if they are not specified as such.

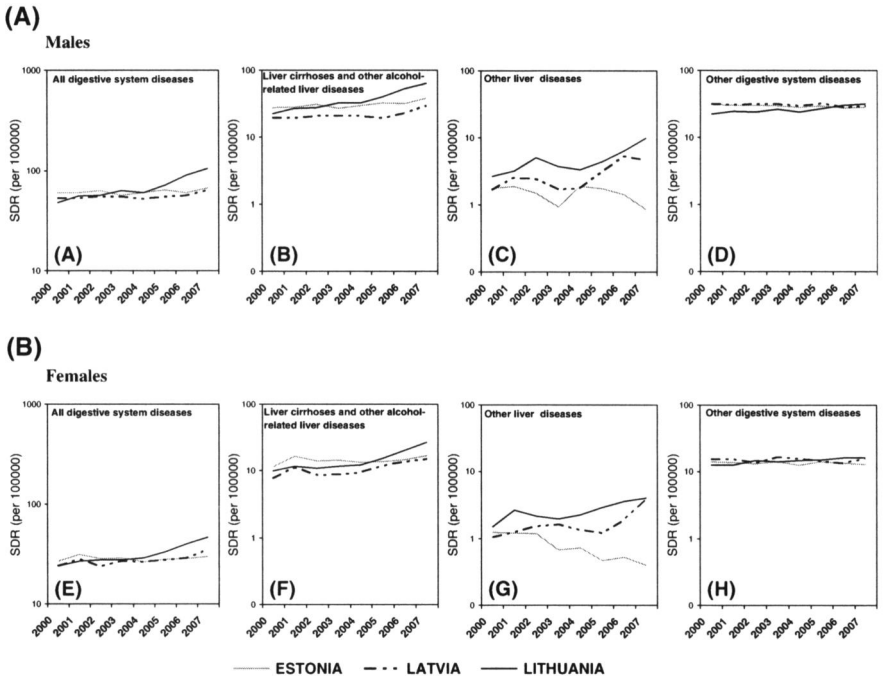

Fig. 5 Annual trends in SMR from selected digestive system diseases in Estonia, Latvia and Lithuania, 2000–2007. *Data source* as in Fig. 2

notable worsening in mortality because of other liver diseases, whilst the reverse was true in Estonia. In sum, however, the prominent role of liver cirrhoses amongst all other digestive diseases suggests that alcohol consumption appears to be an important factor in the diverging mortality trends of the three Baltic countries.

3 Possible Explanations of the Divergence in Life Expectancy Trends

Before trying to explain mortality trends, it is necessary to eliminate the problem of potential data bias. We shall then examine the differential changes in the health systems of each country as possible contributors to these trends, and see whether reasoning in terms of amenable diseases helps to explain them. Finally, we shall see that it is probably more informative to focus on policies targeting alcohol consumption.

3.1 An Artefact Due to Data Quality Problems?

Possible biases could result from difficulties in assessing population changes in countries where the registration of migration flows had been inadequate since the dissolution of the USSR. The official population estimates for the period since the last round of censuses (2000 in Estonia and Latvia, 2001 in Lithuania) are the

post-census population estimates. Studies on the quality of international migration statistics for Lithuania and Estonia suggest that the official migration figures tend to underestimate true emigration levels (Statistics Lithuania 2008; Anniste 2009). This problem occurs because many people in these countries emigrate without officially declaring this fact to the authorities. In addition, an undercount of immigrants who work and live illegally is also possible. The official migration figures have been used to calculate the population estimates for Latvia and Lithuania, whereas Statistics Estonia has completely excluded migration from its estimates (Tammur et al. 2009). The use of such data (affected by undercount of emigration) results in overestimated population exposures and underestimation of true mortality levels.

Statistical offices in Lithuania and Estonia have taken several steps to improve migration data and have produced adjusted net migration figures (partly) accounting for unregistered migration flows. Statistics Lithuania conducted a study on international migration and attempted to improve official migration statistics by including additional data on undeclared emigration. The volume of undeclared emigration in Lithuania in 2001–2007 was estimated indirectly from household surveys conducted in 2006–2008 using reported information on household members who had emigrated (Statistics Lithuania 2008). It has been estimated that a total of about 195,000 people (including undeclared emigrants) emigrated from Lithuania during the period 2001–2007. The estimated share of undeclared emigrants amongst total emigrants was very substantial (about 48–68%), with a notable peak of 68% in 2005 (Statistics Lithuania 2008). Statistics Estonia also has released adjusted international migration estimates for all years after the 2000 census (Statistics Estonia 2010c). The adjusted statistics are based on the population register data supplemented by additional data from the Citizenship and Migration Board (the institution responsible for issuing residence and work permits).

Using adjusted migration figures for Estonia and Lithuania, we were able to assess the possible impact of unregistered migration on life expectancy estimates. For Estonia, the adjusted data on emigrants and immigrants were available by 5 year age groups for the period 2004–2007 (Statistics Estonia 2010a). For Lithuania, we used the published data for total number of emigrants above age 15 (including estimated undeclared emigrants) for 2003–2007 which were redistributed by age group using the officially registered migration counts. The corrected population exposures were applied to calculate life tables for both countries. The results of these simulations suggest that the effects of such adjustments are quite small. The maximal difference between the unadjusted and adjusted life expectancies at birth is observed amongst Lithuanian males in 2005 (0.1 years for an adjusted life expectancy of 65.2 years) and for the other years it never exceeds 0.05 for males and 0.03 for females, whatever the country. Therefore, using official population exposures leads neither to a significant underestimation of true mortality levels nor to a bias in observed trends.

3.2 Differences in Recent Health Care System Reforms?

It is clear that changes in health policies are not the only drivers of mortality trends, but they can play important roles. Of course, a part of their impact is deferred, which

makes it difficult to estimate their full effect. However, in many examples, it has been shown that some policy measures can have an almost immediate effect on mortality trends, not only for acute diseases but also for chronic illnesses. For example, Gorbachev's anti-alcohol measures immediately lowered the incidence of acute alcohol poisoning in Russia because of their effect on binge drinking that is widely spread there (Shkolnikov and Nemtsov 1997). But it is also well known that during World War II, the drop in alcohol consumption had an immediate impact on mortality from liver cirrhosis in France (Ledermann 1964). Even a sudden rise in the price of red wine, widely consumed in France, was sufficient to produce a similar effect in 1958 (Meslé and Vallin 1993). In the same way, changes in the health system (such as improvements in medical treatment) led to immediate reductions in cardiovascular mortality in the Czech Republic just after the fall of the Berlin Wall (Rychtaríková 2004), as well as in East Germany after German reunification (Nolte et al. 2002; Kibele and Scholz 2009).

In the three Baltic countries, sweeping reforms of the health care systems were introduced after these states regained their independence in 1991 and adopted democratic political systems and market economies. The Baltic countries also sought to join the Western European institutions, especially the European Union. Naturally, one important goal for reforms was to meet the criteria of the EU, and, in the area of health care, Baltic states were largely inspired by Western European experiences. However, the health care systems in these Western European countries differ considerably, as they result from different historical processes. Each Baltic state drew its own lessons from this diversity, and they did not coordinate their approaches for transitioning out of the Soviet system. Thus, whilst the general objectives were the same, the paths taken to reach these goals, and the pace of change, varied. This raises the question of whether it is even possible to assess the influence of political changes on differences in mortality trends through an analysis of differential changes in diseases 'amenable to medical care'.

3.2.1 Different Approaches to (and Speeds of) Health Care Reform

All three Baltic countries started to undertake reforms of their health care systems in the early 1990s, but the content of these reforms, and the speeds at which they were implemented, differed significantly. When moving from a centralised state system of theoretical free access to health care towards a decentralised one permitting independent funding institutions, individual freedom of choice and the official financial participation of patients, two main areas of change are concerned: the structures of health care delivery and the types of financial coverage.

In the three countries, reforms were introduced with a view to establishing a modern primary health care delivery system in which general practitioners (GPs) are the primary gatekeepers of health care. The goal was to reduce the role of hospitals, allowing them instead to concentrate on modernising their facilities to provide more efficient secondary and tertiary services (Bankauskaite and O'Connor 2008; Tragakes et al. 2008; Koppel et al. 2008). In both areas, Estonia seems to have been the most successful and Lithuania the least, with Latvia's performance falling in the middle.

3.2.1.1 Primary Health Care In all three countries, substantial efforts were made to clearly distinguish primary and specialised health care levels by creating effective networks of family medical practices. However, whilst all three countries succeeded in introducing modern family medicine programmes into medical schools as early as the early 1990s (Bankauskaite and O'Connor 2008), notable differences can be seen across the three countries in terms of implementing networks of GPs.

In Estonia, the GP-based primary care system was fully launched in 1998 (Koppel et al. 2008). The laws and regulations adopted in 1997–1998 foresaw substantial changes in the remuneration and legal status of GPs. Most of them became private providers working under independent contracts with the Estonian Health Insurance Fund (EHIF) (Koppel et al. 2003). The newly established GP practices also received special financial support from the government of Estonia, which also notably accelerated the spread of GP practices. By 2006, the share of private providers of family GP services was close to 100% (Ministry of Social Affairs 2008). In 2000, the network of primary health centres with GPs covered almost the entire country. The expansion of the GP network was followed by a notable increase in the number of consultations (53% increase from 2000 to 2003) (Atun et al. 2006).

In Latvia, the process was slower and less successful (Tragakes et al. 2008). Despite the adoption of a law on general medical practice in 1997, and the creation in 2000 of the Health Compulsory Insurance State Agency (HCISA) for financing primary health care services, the actual establishment of independent GPs was slowed by a number of problems, such as a lack of resources and state support, an inadequate legal basis, a poor health insurance system, a complex payment system for medical services and numerous inconsistencies in the laws regulating health care (Tragakes et al. 2008).

The transition to family medicine based primary health care has been even slower in Lithuania, despite the fact that, as early as 1996, the GP's role was legally defined, and the first primary health care centres were established on an experimental basis (Černiauskas and Murauskienė 2000). The development and administration of primary health care became the responsibility of the municipalities, and, because of a lack of financial resources and limited administrative capacities, the establishment of new GP practices was slow. Meanwhile, the infrastructure of existing primary health care institutions remained poor (SAM 2003; Jakušovaitė et al. 2005). In 2004, 66% of the patients were receiving primary health services from GPs, whilst 34% of patients still received these services from internists (Jankauskienė 2007). It has also been suggested that lobbying of state institutions (such as former polyclinics) also contributed to the slowdown in the spread of private practices (Jakušovaitė et al. 2005).

3.2.1.2 Secondary and Tertiary Health Care In the field of secondary and tertiary care, likewise, the most radical and consistent reforms were implemented in Estonia. Important steps for modernizing hospital activities were passed by introducing commercial law into the management of public hospitals, and by changing their legal status to that of joint stock companies or foundations. The main result of these changes was the transfer of administrative decisions from publicly elected officials to corporate management, which led to substantial gains in efficiency, and to independence from local political influences (Fidler et al. 2007; Koppel et al. 2008).

Following the reforms of the hospital network (between 1993 and 2001), the number of hospitals declined from 115 to 67, whilst the number of hospital beds and average length of hospital stay decreased from 14,400 to 9,200 and from 15.4 to 8.7 days, respectively (Atun et al. 2006). Another goal in optimising the secondary care sector was to develop specialised outpatient care (especially, day care) institutions. As a result, there was a notable shift from inpatient to outpatient care in the 2000s (the proportion of total spending on specialized care devoted to outpatient care increased from 27% in 2001 to 35% in 2007). Finally, the private sector now plays an important role in providing hospital services (one-third of the hospitals were private in 2006) (Ministry of Social Affairs 2008).

In Latvia, the reforms in secondary and tertiary health care were slow and inconsistent. There was an expansion of outpatient services and institutions (Tragakes et al. 2008), but even though the numbers of hospitals and hospital beds were decreasing, they remained well above the EU average (WHO Health for All Database 2010). Due to poor coordination between different health care levels and inconsistencies in legislation, many hospitals continued to provide primary health care and social care services (Tragakes et al. 2008), whilst poor management and rationing of the majority of services resulted in long waiting lists to get specific treatments (Müller et al. 2005). Widespread formal and informal payments for the services also contributed to growing socioeconomic inequalities in access to the tertiary health care (Müller et al. 2005).

In Lithuania, reforms in the secondary and tertiary health care levels began quite early, in the 1990s, but mainly concerned small and medium-sized hospitals, which fell under the administration of municipalities (Černiauskas and Murauskienė 2000). Changes were slow and ineffective because municipalities were struggling to allocate adequate resources for health care and lacked authority and administrative capacities (Jakušovaitė et al. 2005). As a result, Lithuania continued to maintain an ineffective and expensive network of hospitals suffering from overcapacity, lack of funds and poor infrastructure (Černiauskas and Murauskienė 2000).

The differing degrees of success of the reforms can be illustrated by using a couple of indicators. Reforms produced notable divergences in the trends in health care resources. Estonia has been a firm leader amongst the Baltic countries in both creating the network of family doctors and in reducing hospital beds. By contrast, Lithuania was a laggard in both areas. Hospital sector management was also more efficient in Estonia, whereas Latvia and Lithuania showed much longer average lengths of stay in almost all specialities (Table 1). Estonia has also successfully modernized its primary health care system by implementing modern e-health solutions (Dobrev et al. 2008). According to the data for 2007, virtually all GPs were computerised and had access to the Internet and decision support software for diagnosing illnesses. These spectacular achievements contrast with much less favourable situations in Latvia and Lithuania, which had the worst results amongst the EU countries (Dobrev et al. 2008). According to the EU-SILC survey, the largest proportion of people with unmet needs for medical examination was in Latvia (25–30%), whilst Estonia and Lithuania both had levels of 10–13%. The large proportion of the population with unmet needs in Latvia was attributable to the high

Table 1 Average length of stay (in days) in hospitals by specialty in Estonia, Latvia and Lithuania, 2007

	Estonia	Latvia	Lithuania
Total	8.0	9.6	9.9
Internal medicine	7.0	8.5	8.0
Rehabilitation	12.1	15.9	24.4
Surgery (incl. orthopedics)	5.5	7.2	6.3
Psychiatry	17.2	56.7	30.1
General and nursing	27.6	10.7	47.8

Source NIHDE, HSMTSA, LHIC (2008)

cost of health care; a problem that was less pronounced in Estonia and Lithuania (European Commission 2009).

3.2.1.3 Health Care Financing Estonia was also the leader amongst Baltic countries in introducing an effective health care financing system that is mainly based on a mandatory and universal health insurance (Bankauskaite and O'Connor 2008). Following the adoption of the Health Insurance Act in 1991, regional sickness funds were rapidly introduced in 1992. To plan and control financial resources, the Central Sickness Fund was established in 1994, and the EHIF was created in 2001. The role of out-of-pocket (private) payments for the financing of health care increased dramatically in the second half of the 1990s (from 7.5% in 1995 to 19.7% in 2000). In the 2000s, the growth in the share of private payments was less rapid (reaching the level of 24% in 2006) (Ministry of Social Affairs 2008). Following the 2002 Health Insurance Act, upper limits were set for all health care services. The public health insurance fund reimburses (fully or partially) all the costs to patients using state or private health care services (for institutions having contracts with EHIF). All the costs of primary care services (with the exception of a small fee for home visits) are also reimbursed. Furthermore, an increasing share of health care expenditures are devoted to prevention programmes (11% in 2006) (Ministry of Social Affairs 2008).

Since the beginning of the 1990s, Latvia has undergone several radical but sometimes contradictory changes in the financing of health care. A particular feature of the recent reforms was the introduction of obligatory out-of-pocket contributions by each patient for the health care services they receive (Müller et al. 2005). As a consequence, Latvia has one of the highest private shares of total health care expenditures amongst the European countries (WHO Health for All Database 2010). Special fees for services (to be paid by patients themselves) and a complicated reimbursement points system were introduced in 1993. Under the rule adopted in July 1995, it became possible to charge patients for up to 25% (out of pocket) of the total costs of medical services (Tragakes et al. 2008). This maximum share was reduced to 20% in 1997. In 1998, these purely market-oriented policies were tempered by the creation of the health insurance system (Central Account Fund, later renamed the HCISA), which had the goal of redistributing financial resources to regional sickness funds. These financial resources represented about 28% of total income taxes until 2005. Since that date, they directly came from the state budget. However, a significant proportion of health care costs are still borne by the patients, including frequent unofficial out-of-pocket payments (Müller et al. 2005; Tragakes et al. 2008).

The first elements of the health insurance scheme were implemented in Lithuania in 1991. However, between 1991 and 1995, the scope of the health insurance system was very limited (covering only pharmaceuticals and rehabilitation care). Until 1997, health care was funded mainly through the municipal and state budgets (Černiauskas and Murauskienė 2000). Due to major socioeconomic inequalities across municipalities, and large disparities in territorial resource allocations for health, this funding system was ineffective (Jakušovaitė et al. 2005). Following the adoption of the 1996 Law on Health Insurance, the State Patients Fund (SPF) became responsible for maintaining the compulsory health insurance system (Černiauskas and Murauskienė 2000). Until recently, the SPF fully covered the majority of health services, and most official out-of-pocket payments were for pharmaceuticals (Jakušovaitė et al. 2005). In reality, however, patients had to pay for most private health services, since the SPF was very slow in signing contracts with private providers (Jakušovaitė et al. 2005). Furthermore, the SPFs resources were insufficient to cover the expenses which the fund was supposed to cover (Chawla 2007), and rationing and quotas were set for services and reimbursements of pharmaceuticals. This created further problems, such as long waiting lists and an increase in unofficial out-of-pocket payments to avoid having to wait for the services (Jakušovaitė et al. 2005).

Over the period 2000–2007, all three countries spent quite similar proportions (5–6%) of total GDP expenditures on health (WHO Health for All Database 2010). However, the share of public health expenditures was 74–77% in Estonia and 68–73% in Lithuania, but only 51–61% in Latvia (WHO Health for All Database 2010). The biggest differences between the countries therefore concern the shares of private out-of-pocket payments with respect to total public expenditure: the proportion was highest in Latvia and lowest in Estonia.

These differences in health care system reforms seem to be sufficient to explain differences in mortality trends. This can be confirmed by analyzing the trends in the diseases 'amenable to health care' (Nolte and McKee 2004)?

3.2.2 Is the Impact of Policy Change Visible through Amenable Diseases?

The *amenable* mortality approach suggests that a distinction can be made between deaths that could have been avoided if timely and effective health care had been available, and deaths that could not have been avoided (Nolte and McKee 2004). According to the authors, the classification of ischaemic heart diseases is questionable since these conditions are partially *amenable to medical care*, but also partially *avoidable through inter-sectorial health policies or prevention* (Simonato et al. 1998; Nolte et al. 2002). Thus, we identify here three major groups of causes: 'amenable' causes of death,[4] ischaemic heart diseases and 'other causes'.

Figure 6 and Table 3 display the respective contributions of the mortality changes in these three groups of causes to the changes in life expectancy between 2000 and 2007, in the three Baltic countries. The results do not give a clear answer.

[4] The list of 33 causes of death amenable to health care was taken from Nolte and McKee (2004) (see Table 10).

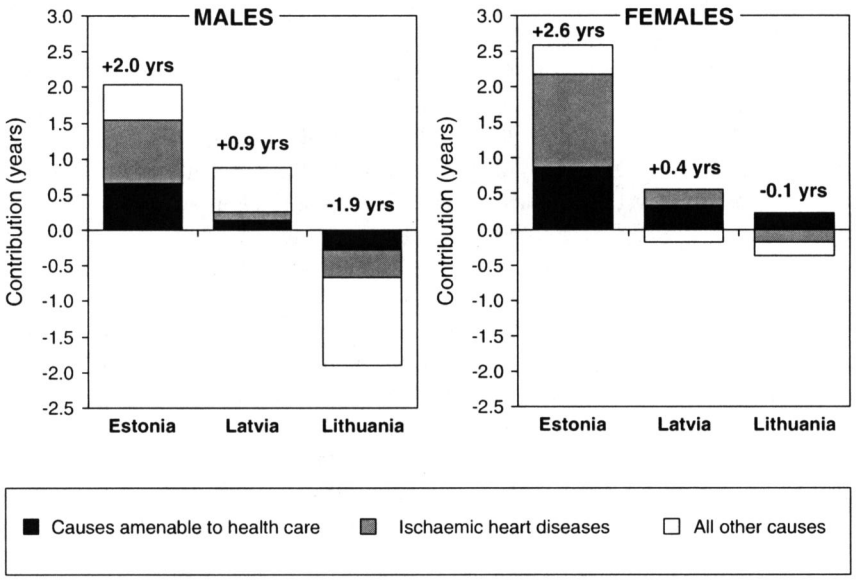

Fig. 6 Contributions of causes amenable to medical care to the total change in life expectancy at birth in Estonia, Latvia and Lithuania from 2000 to 2007. *Data source* as in Fig. 2

On the one hand, it is true that the amenable causes of death play a non-negligible role in the mortality trend differences observed between the three Baltic countries, at least amongst males, since they are responsible for an increase of half a year in Estonian male life expectancy, a decrease of about 3 months in Lithuanian life expectancy, and almost no change in Latvian life expectancy. However, this is only a very small part of the explanation for the 2-year total Estonian improvement relative to the 2-year Lithuanian decline. Amongst females, amenable causes of death are responsible for gains in life expectancy in the three countries.

If the concept is extended to ischaemic heart diseases, the role of the two first groups of causes together becomes more prominent. However, the reduction in ischaemic heart diseases does not depend on health care entirely and, moreover, as already mentioned, in the case of Estonia their apparent decrease is largely overestimated by the improvement in coding practices. More important is the fact that for Lithuania, the overwhelming share of the decrease in life expectancy is because of neither amenable nor ischaemic causes of death.

The data on causes of death amenable to health care for 2009 were available only for Lithuania and Estonia. The decomposition analyses suggest that reductions in amenable mortality between 2007 and 2009 explain only a small part of the remarkable rise in male and female life expectancy in both countries (Table 4). Ischaemic heart diseases explain almost a quarter of the female total life expectancy improvements in both countries. The contribution of this cause of death was also significant for Estonian males, but was smaller for Lithuanian males (Table 4).

Finally, whilst a non negligible share of the rapid progress in Estonia was because of improvement of the health care system, changes in Lithuanian health care were unable to prevent a deterioration due mainly to other factors, and especially the negative role of alcohol abuse.

3.3 The Decisive Role of Alcohol?

The previous sections on digestive system diseases and external causes of death have suggested that there are notable differences in alcohol-related mortality trends across the three countries. This section systematically explores trends in all alcohol-related causes, combined in a group including accidental poisoning by alcohol, liver cirrhosis, alcoholic liver disease, chronic alcoholism and alcohol psychosis. Once again, we focus here only on males, since alcohol has been shown to be a significant determinant of male mortality in all three countries (McKee et al. 2000).

Figure 7 shows that during 2000–2007, alcohol-related mortality trends were not favourable in any of the three countries. But the worsening was much more significant in Lithuania, where mortality more than doubled from 2000 to 2007, than in Latvia, where it was stable, and in Estonia, where it increased only slightly. Increasing mortality for this group of causes resulted in a loss of 0.6 years of life expectancy at birth in Lithuania, compared with −0.2 years in Estonia and only −0.04 years in Latvia (Table 3). Thus, the contribution of this cause broadened the gap between Lithuanian and Estonian male life expectancies by 0.4 years. Since 2007, the trends in the three countries have reversed dramatically, with acceleration of mortality decrease in 2009.[5]

Are such contrasting changes in alcohol-related mortality attributable to differences in anti-alcohol policies implemented during the 1990s and the 2000s?

In Estonia, two successive anti-alcohol acts were passed to reduce alcohol consumption by increasing taxes and reducing the number and the opening hours of places that sold alcohol: the Alcohol Excise Act of 1995 (Vails 2008) and the Estonian Alcohol Act of 1999, which first took effect in 2002 (Riigikogu 2002a). These measures were reinforced by the complete ban on alcohol consumption amongst persons below age 18, the prohibition of daytime alcohol advertising in the media (2003) and stronger penalties (up to imprisonment) for the sale of alcohol to minors (2004) (Vails 2008) or for driving a car whilst under the influence of alcohol (Riigikogu 2002b). The alcohol excise tax was increased in 2005 (by 5% for strong alcohol). However, the implementation of the main anti-alcohol measures was a municipal responsibility, and the enforcement of these rules varied greatly from one municipality to the next (Hein et al. 2008). Furthermore, the increase in alcohol excise duty had little impact on access to alcohol because alcohol prices have remained low relative to the income of the population, which has been rising much faster than prices (Hein et al. 2008). By contrast, in 2008, a much larger increase in taxes (20% for strong alcohol and 10% for beer) seems to have contributed to the trend reversal.

Latvia did not start to introduce specific anti-alcohol policies until the end of the 1990s. As in Estonia, the increase in excise duty for alcohol was accompanied by

[5] At least for Estonia and Lithuania since data for 2009 are not yet available for Latvia.

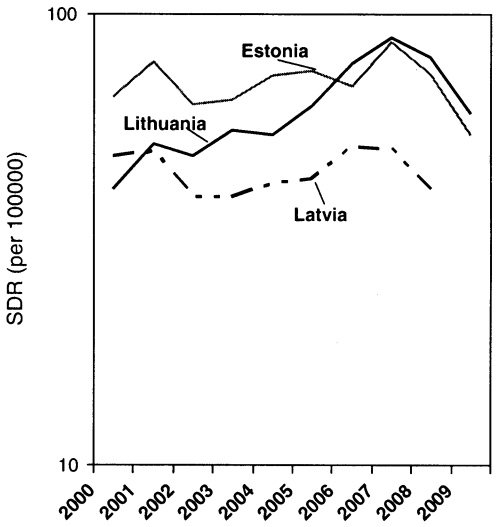

Fig. 7 Annual trends in male SMR from alcohol-related causes of death in Estonia, Latvia and Lithuania, 2000–2009. *Data source* as in Fig. 2

increasing criminalisation of alcohol-related offences (including driving under the influence of alcohol, illegal storage or transportation of alcohol, or even alcohol consumption in public places) with severe penalties and restrictions on alcohol advertising (TTC 2007a, b; STAP 2007). These measures were backed by an increase in excise taxes on alcohol in 2006, and an even larger one in 2009. Rather stricter than in Estonia, these measures possibly explain why alcohol-related mortality did not increase at all in Latvia between 2000 and 2007.

Lithuania was the first Baltic country to implement a specific anti-alcohol law in 1995, which aimed to reduce overall alcohol consumption and to limit the accessibility of alcohol (LRS 1995). Excise taxes for alcohol were also introduced in that year, but were substantially reduced 5 years later (LRS 1999). In 2000, the new Penal Code considered driving under the influence of alcohol to be a criminal offence (LRS 2000), but 3 years later, the criminal penalties were abolished (LRS 2003). In 2001, new very liberal regulations covering alcohol sales were introduced (Grabauskas et al. 2009). They authorized the sale of alcohol 24 h per day and lifted previous restrictions on alcohol sales in gas stations. This succession of forward and backward moves made all anti-alcohol policies in Lithuania very ineffective (NST 2007). Between 1995 and 2007, the law on alcohol control was modified 24 times (Seimo kontrolierius 2007), and most of these changes were towards liberalisation of the restrictions. Furthermore, Lithuania maintained a liberal policy towards alcohol advertising (STAP 2007). In all, this policy encouraged alcohol consumption rather than limiting it, and alcohol-related mortality increased dramatically as a result (Grabauskas et al. 2009). A strong and effective policy against alcohol started in 2008 only (Veryga 2009): a 20% increase in tax for strong alcohol and 10% for beer, a ban on daytime advertising, and increased fines for driving under the influence of alcohol. In 2009, taxes were again increased by 10–20% and selling hours were restricted. Consequently, alcohol-related mortality started to fall.

In the three countries, beyond the impact of recent stringent anti-alcohol policies on causes of death directly related to alcohol, a positive effect is also observed on other causes of death, especially traffic accidents and other external causes. Between 2007 and 2009, the decrease in alcohol-related mortality and deaths from other external causes contributed by 1.2 years to the male life expectancy increase, i.e. 47 and 45% of the total increase in Estonia and Lithuania, respectively (Table 4).

4 Conclusion

The contrasting changes in life expectancy at birth in the three Baltic countries over 2000–2007 are mainly explained by differences in the dynamics of cardiovascular diseases, external causes of death and digestive diseases. Whereas cardiovascular and external-cause mortality fell systematically in Estonia and (to a lesser extent) in Latvia, deterioration or stagnation was observed in Lithuania. In addition, these negative changes in Lithuania were reinforced by a striking growth in mortality because of alcohol-related digestive diseases.

Several possible explanations for the diverging life expectancy trends during 2000–2007 have been examined. First, it has been shown that potential inaccuracies of population exposure data cannot explain the cross-country differences in both mortality levels and trends. Second, the overview of developments in the health care systems and their outcomes suggests that the health divergence between countries may be attributable to notable variations in structural health care reforms, and in the effectiveness of specific health policies. Thanks to rapid and systematic reforms, Estonia became a vanguard amongst the Baltic countries in building effective health insurance based on a health care financing system. In addition, Estonia successfully built a modern family-doctor-based primary care system covering the whole population. Structural reforms were less systematic and much slower in Latvia and Lithuania. Differences in the reforms seem to have affected trends in amenable mortality. This indicator of health care performance confirms the Estonian advantage: causes amenable to medical care and ischaemic heart diseases (partially amenable and partially avoidable through prevention) explain the major part of total health improvement between 2000 and 2007. These causes had an opposite effect in Lithuania, suggesting persistent problems of health care system effectiveness in this country. However, the greatest contribution to the life expectancy deterioration in Lithuania was neither amenable causes nor ischaemic heart diseases. Latvia, which showed little success in reducing amenable mortality, took an intermediate position. It should be kept in mind, however, that amenable mortality is only an indirect (albeit widely used) indicator and only partly reflects health care effectiveness (Nolte and McKee 2004). This concept has been criticized because of the arbitrary selection of amenable (or avoidable) causes of death, the setting of an upper age limit for amenable causes of death, and the poor comparability of amenable mortality estimates across countries and in time (Gaižauskiene and Westerling 1995).

Third, the analyses of external and alcohol-related causes of death and anti-alcohol policies suggest that until 2007, Lithuania implemented more measures favourable to alcohol consumption than policies to restrict it.

Clearly, many other potentially important factors remain outside the main scope of this article. In particular, differences in the pace of political reforms and in economic trends have certainly played a role in giving an advantage to Estonia, where reforms started earlier and were implemented more quickly than in other two countries (Hellman 1998; Bankauskaite and O'Connor 2008). But we showed here that at least some specific health measures had a major impact.

It is even clearer that non economic factors are at play in the sudden positive change in life expectancy observed in Estonia, Latvia and Lithuania in 2008 and 2009, at a time of severe economic crisis. At least a large share of the total health gain is attributable to notable decreases in mortality because of alcohol-related and external causes of death, even if progress cannot be entirely attributed to new anti-alcohol measures introduced in the three countries in early 2008 and 2009. The rest of the progress achieved seems to be related to more complex changes that cannot yet be clearly identified.

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Appendix

See Figs. 8, 9 and Tables 2, 3 and 4.

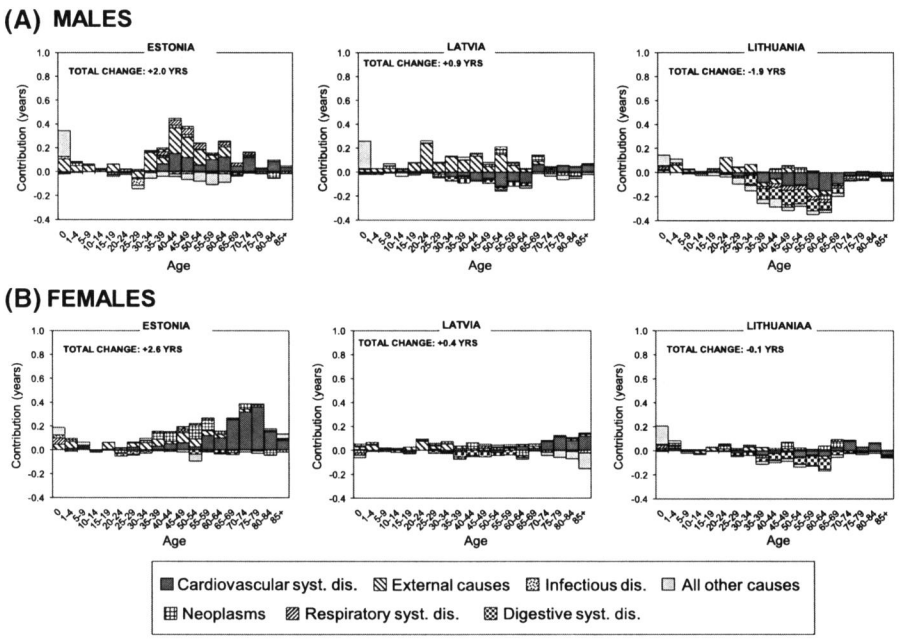

Fig. 8 Age- and cause-specific components of the total change in life expectancy at birth in Estonia, Latvia and Lithuania from 2000 to 2007. *Data source* As in Fig. 2

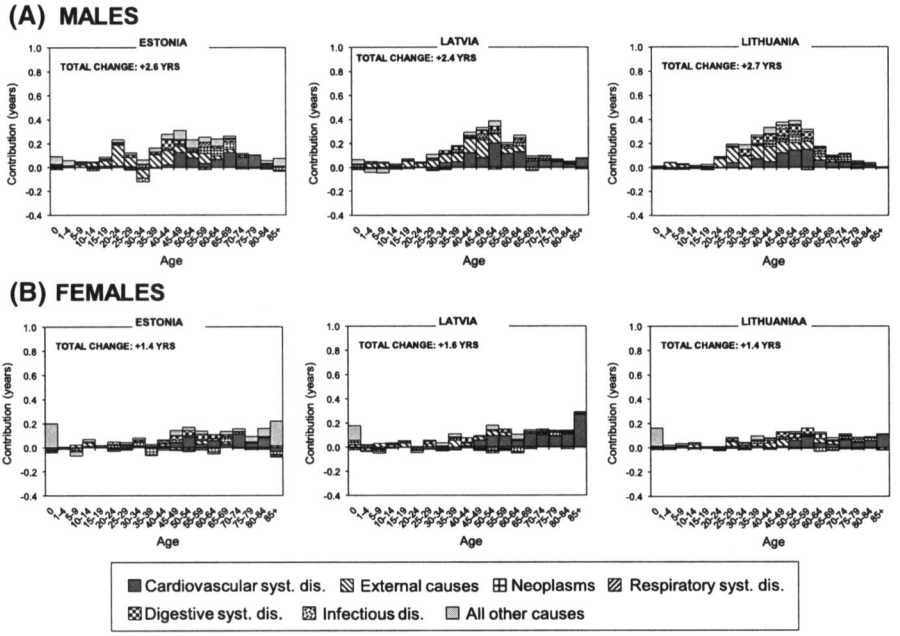

Fig. 9 Age- and cause-specific components of the total change in life expectancy at birth in Estonia, Latvia and Lithuania from 2007 to 2009. *Data source* As in Fig. 2

Table 2 Groups of causes used for the decomposition of life expectancy changes and calculations of standardised death rates

Nr.	Main groups and subgroups	Corresponding ICD-10 items
1	Infectious diseases	A00-B99
2	Neoplasms	C00-D48
3	Cardiovascular system diseases	I00-I99
3.1	Ischaemic heart diseases	I20-I25
3.2	Other heart diseases	I00-I19, I26-I52
3.3	Other cardiovascular system diseases	I53-I99
4	Respiratory system diseases	J00-J98
5	Digestive system diseases	K00-K92
5.1	Digestive but liver diseases	K00-K69, K78-K92
5.2	Liver cirrhoses (alcoholic or unspecified) and other alcohol related liver diseases	K70, K74
5.3	Other liver diseases	K71-K73, K75-K77
6	External causes of death	V01-Y89
6.1	Traffic accidents	V01-V89, V98-V99
6.2	Suicide	X60-X84
6.3	Homicide	X85-Y09

Table 2 continued

Nr.	Main groups and subgroups	Corresponding ICD-10 items
6.4	Poisoning by alcohol	X45
6.5	Other accidental poisonings	X40-X44, X46-X49
6.6	Accidental falls	W00-W19
6.7	Accidental drowning and submersion	W65-W74
6.8	Cold (exposure to excessive natural cold)	X31
6.9	Event of undetermined intent	Y10-Y34
6.10	All other external causes of death	V90-V97, W20-X64, W75-W99, X00-X30, X32-X39, X50-X59, Y35-Y89
7	Alcohol-related causes of death	F10, K70, K74, X45
7.1	Liver cirrhosis	K74
7.2	Alcoholic liver disease	K70
7.3	Chronic alcoholism and alcoholic psychosis	F10
7.4	Poisoning by alcohol	X45
7.5	Alcoholic cardiomyopathy[a]	I42.6
8	All other (remaining) causes of death	–

[a] Data on this cause of death are available for Lithuania only

Table 3 Cause-of-death components of changes in male and female life expectancy at birth in Estonia, Latvia and Lithuania, from 2000 to 2007

Nr.	Cause of death	Males			Females		
		Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
1	Infectious diseases	0.04	0.06	0.01	−0.01	0.04	0.02
2	Neoplasms	0.09	0.04	0.02	0.32	0.02	0.21
3	Cardiovascular system diseases	0.9	−0.22	−0.85	1.59	0.43	−0.02
3.1	Ischaemic heart diseases	0.88	0.12	−0.38	1.29	0.23	−0.17
3.2	Other heart diseases	−0.51	−0.68	−0.26	−0.51	−0.43	0.13
3.3	Other cardiovascular system diseases	0.53	0.35	−0.21	0.81	0.63	0.03
4	Respiratory system diseases	0.24	−0.07	−0.19	0.17	0.01	0.01
5	Digestive system diseases	−0.07	−0.19	−0.73	−0.07	−0.22	−0.44
5.1	Digestive but liver diseases	0.02	0	−0.11	0.02	−0.02	−0.06
5.2	Liver cirrhoses (alcoholic or unspecified) and other alcohol related liver diseases	−0.11	−0.14	−0.52	−0.11	−0.15	−0.34
5.3	Other liver diseases	0.02	−0.05	−0.09	0.01	−0.06	−0.05
6	External causes of death	1.04	1.12	0.16	0.58	0.35	0.1
6.1	Traffic accidents	0.07	0.33	−0.05	0.05	0.08	−0.07
6.2	Suicide	0.23	0.37	0.5	0.14	0.08	0.18
6.3	Homicide	0.26	0.12	0.08	0.04	0.07	0.05
6.4	Poisoning by alcohol	0.22	0.03	−0.11	0.11	−0.01	−0.03
6.5	Other accidental poisonings	0.04	0.06	−0.07	−0.07	0	0.02

Table 3 continued

Nr.	Cause of death	Males			Females		
		Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
6.6	Accidental falls	0.07	−0.02	−0.07	0.02	0.04	0.02
6.7	Accidental drowning and submersion	−0.01	0.03	0.04	0.02	0.03	0
6.8	Cold	0.15	0	−0.18	0.03	−0.04	−0.07
6.9	Event of undetermined intent	−0.05	0.18	−0.04	0.01	0.09	−0.01
6.10	Other external causes of death	0.06	0.03	0.05	0.22	0.01	0.02
7	Causes amenable to medical care	0.63	0.14	−0.26	0.87	0.31	0.18
8	Alcohol-related causes of death	−0.23	−0.04	−0.63	−0.10	−0.10	−0.37
9	All other causes of death	−0.20	0.13	−0.32	0.02	−0.26	−0.01
10	Total	2.03	0.87	−1.89	2.59	0.37	−0.14
Minimal number of deaths by cause in 2000		10[a]	18[a]	40[a]	9[a]	15[a]	29[a]
Minimal number of deaths by cause in 2007		5[a]	41[b]	150[a]	4[a]	12[b]	50[c]
Maximal number of deaths by cause in 2000		4,296	7,710	9,077	5,686	10,156	11,853
Maximal number of deaths by cause in 2007		4,066	8,056	10,990	4,991	9,987	13,317

The maximal number of deaths by cause always refers to cardiovascular system diseases

Data source As in Fig. 2

Notes Due to rounding, age- and cause-specific figures do not always add up to the stated totals. The stated totals for all causes of death do not include alcohol-related causes already counted as digestive system diseases and external causes of death (for more details see Table 2). The stated totals also do not include amenable causes already counted in other groups of causes of death

[a] Deaths due to other liver diseases

[b] Deaths due to event of undetermined event

[c] Deaths due to other accidental poisonings. The maximal number of deaths by cause always refers to cardiovascular system diseases

Table 4 Cause-of-death components of changes in male and female life expectancy at birth in Estonia, Latvia and Lithuania, from 2007 to 2009

Nr.	Cause of death	Males			Females		
		Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
1	Infectious diseases	0.00	−0.01	0.05	0.00	−0.03	0.00
2	Neoplasms	0.20	0.06	0.15	0.00	−0.06	0.08
3	Cardiovascular system diseases	0.66	0.98	0.78	0.42	0.97	0.51
3.1	Ischaemic heart diseases	0.43	NA	0.35	0.33	NA	0.33
3.2	Other cardiovascular system diseases	0.23	NA	0.42	0.09	NA	0.18
4	Respiratory system diseases	0.08	0.20	0.20	0.01	0.03	0.03

Table 4 continued

Nr.	Cause of death	Males			Females		
		Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
5	Digestive system diseases	0.17	0.19	0.35	0.18	0.14	0.21
5.1	Liver cirrhoses (alcoholic or unspecified) and other alcohol related liver diseases	0.16	NA	0.29	0.15	NA	0.21
5.2	Other digestive system diseases	0.01	NA	0.06	0.03	NA	0.00
6	External causes of death	0.79	0.80	0.87	0.14	0.32	0.31
6.1	Traffic accidents	0.26	NA	0.38	0.06	NA	0.16
6.2	Suicide	−0.01	NA	−0.07	−0.01	NA	−0.02
6.3.	Homicide	0.06	NA	0.05	0.01	NA	0.01
6.4	Poisoning by alcohol	0.12	NA	0.11	−0.01	NA	0.03
6.5	Other external causes of death	0.36	NA	0.41	0.09	NA	0.14
7	Causes amenable to medical care	0.04	NA	0.25	0.18	NA	0.22
8	Alcohol-related causes of death	0.53	NA	0.42	0.18	NA	0.25
9	All other causes of death	0.66	0.17	0.24	0.66	0.22	0.28
10	Total	2.55	2.38	2.65	1.40	1.58	1.42
Minimal number of deaths by cause in 2007		76[a]	194[b]	183[a]	19[a]	100[b]	59[a]
Minimal number of deaths by cause in 2009		56[a]	195[b]	145[a]	25[a]	92[b]	54[a]
Maximal number of deaths by cause in 2007		4,066	8,056	10,990	4,991	9,987	13,317
Maximal number of deaths by cause in 2009		3,743	7,180	10,116	5,053	8,898	13,176

The maximal number of deaths by cause always refers to cardiovascular system diseases

Data source As in Fig. 2

Notes Due to rounding, age- and cause-specific figures do not always add up to the stated totals. The stated totals for all causes of death do not include alcohol-related causes already counted as digestive system diseases and external causes of death (for more details see Table 2). The stated totals also do not include amenable causes already counted in other groups of causes of death. The detailed data on causes of death for Latvia for 2009 were not available (these causes are marked as "NA")

[a] Deaths due to homicide

[b] Deaths due to infectious diseases

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