

# Influences of public health policies on life expectancy in Eastern European countries

How is the life expectancy of the Eastern European countries Czech Republic, The Russian Federation and Ukraine influenced by governance?

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*Course: Bachelor's Project*

*Date: 11-06-2019*

*Words: 6589*

## Abstract

For this research, of interesse was to see why Czech Republic could make rapid developments in life expectancy after the fall of the Soviet Union, and why Russian Federation and Ukraine could not. Aim of the research was to determine the impact of governance policies on the different developments of life expectancy. Methods that are used to see if differences in governance policies were responsible are a literature research on implemented policies with respect to healthcare and a decomposition of mortality rates. Results show that both reforms directed at the functioning of the healthcare system as well as strengthening the existing model can have drastic effects on life expectancy. Although, smaller policies do impact mortality rates occasionally, these are often overshadowed by social-economic factors. Policies that restrict alcohol- and tobacco consumption can impact preventable mortality rates. However, little policies that restrict this consumption are made.

## Table of contents

|                             |    |
|-----------------------------|----|
| Abstract .....              | 3  |
| Table of contents.....      | 4  |
| Introduction.....           | 5  |
| Theoretical framework.....  | 6  |
| Conceptual model .....      | 8  |
| Hypothesis .....            | 9  |
| Methodology .....           | 9  |
| Ethics .....                | 10 |
| WHO database.....           | 10 |
| Results .....               | 11 |
| Healthcare transition.....  | 11 |
| Czech Republic.....         | 11 |
| Russian Federation .....    | 11 |
| Ukraine .....               | 12 |
| Behavioural policies.....   | 12 |
| Spending on healthcare..... | 13 |
| Decomposition analysis..... | 14 |
| Conclusion .....            | 17 |
| Discussion .....            | 18 |
| References.....             | 19 |
| Appendices .....            | 22 |

## Introduction

After a period of rapid convergence in life expectancy between western- and eastern European countries, the mid-1960s mark the start of a new period of divergence according to Vallin and Meslé (2005). They argue that whereas all western countries re-established a new period of rapid life expectancy growth from the late 60s, in many eastern European countries a period of stagnation and deterioration in life expectancy began. This goes especially for Russia, which has been facing the worst situation of the eastern European countries.

Grigoriev et al. (2014), argue that with the fall of the Soviet Union, an enormous geopolitical phenomenon was happening. New countries emerged and other countries such as East Germany, Czech Republic and Poland were no more under influence of the Soviet Union. Free state-controlled healthcare was no longer available, which increased divergence in life expectancy between eastern European countries after 1990. Whereas Czech Republic and Poland made a significant upswing in life expectancy, Russian Federation experienced a decline, which was caused by degradation of the healthcare system. Figure 1 illustrates the life expectancy of Russian Federation Czech Republic and Ukraine. Life expectancies of the three countries stay close to 1990, from whereon differences started to grow. Life expectancy rised in Czech Republic and declined in Russian Federation. Ukraine shows a more tempered but equal trend that follows the Russian Federation.

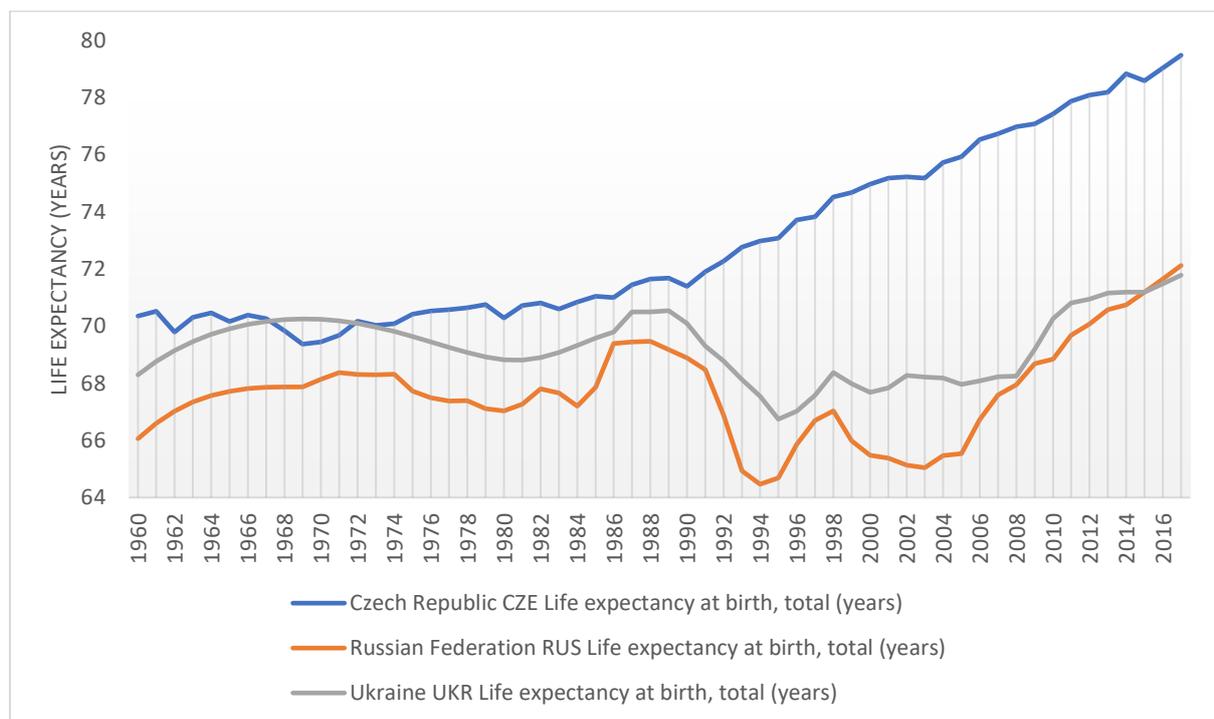


Figure 1 Life expectancy 1960-2016 created with data from World Bank (2019)

Of interest, is to see why Czech Republic did remarkably better than Ukraine and Russian Federation after 1990. Changes in life expectancy after geopolitical happenings, like the fall of the Soviet Union, suggest that governance plays an important role in changes of life expectancy. The central question that arises, is:

*“How is the life expectancy of the Eastern European countries influenced by governance?”*

To answer this question - Czech Republic, Russian Federation and Ukraine – are compared. These countries are chosen because they represent most Eastern European countries, and their health system, according to the World Health Report (WHO, 2000). This report made an overall health system

attainment of member states. The WHO Index is a composite measure of achievement in health distribution, health level, responsiveness level/distribution and fairness of financial contribution, and gives an overall score on the level of healthcare. Czech Republic, placed 30<sup>th</sup> at the overall health system attainment, is highest ranked Eastern European country on the list. Ukraine, placed 60<sup>th</sup>, is midrange. The Russian Federation, placed 100<sup>th</sup>, is on the lower side. Other countries could be used, based on their WHO index rank. However, Czech Republic, Russian Federation and Ukraine are well distributed and show more similarities than for example Czech and Turkmenistan. This allows for better comparison (WHO, 2000). In order to answer the main question, reformations that were made, together with other policy changes need to be examined. This will be done by answering two sub-questions:

- “What governmental policies have been made in regard to behavioural changes & quality and access to healthcare, in Czech Republic, Russian Federation and Ukraine? use?”
- *“How is the quality of healthcare for Czech Republic, Russian Federation and Ukraine distributed and how changed this since the fall of the Soviet Union?”*

It is important to note that the concept of healthcare used for this thesis includes hospital care, primary care, community health services and public health programmes. This is done in order to not only measure the quality of hospitals but also the impact of life style (Nolte and McKee, 2004). The first sub question will set a framework that can be used to interpret the results that are gathered in the second sub-question.

## Theoretical framework

Omran (1971) was the first to explain structural advances in healthcare, with his epidemiologic transition model. According to this model, societies experience three “ages” in the process to modernization. This model was later integrated into a broader scheme that encompasses new advances in health and the different situations in the world. Stages used, are infectious diseases, the cardiovascular revolution and the fight against ageing. According to Vallin and Meslé (2005), Russia is still in the beginning of the second stage. Reason for this is Russia relying too exclusive on the centralized administration of modern healthcare and a lack of means, due to the arms and space race with western countries. A shift towards the next stage requires significant changes in individual behaviour and active responsibility for personal health.

In 2004, 60 percent of Russian male deaths and 25 percent of Russian female deaths occurred under the age of 65. Major causes of deaths were chronic-, respiratory- and infectious diseases. Traditionally these causes have not been linked to alcohol consumption. However, they all demonstrate significant fluctuations coinciding with Gorbachev’s anti-alcohol campaign (Shkolnikov et al., 2004). Excess mortality from external causes like accidents, poisoning and violence, play a crucial role at ages between 20 and 50. At older ages circulatory diseases play the major part. Although contribution by cancer is considerable, cardiovascular mortality shows to be more significant (Shkolnikov et al., 2004). Although Czech Republic is doing better when life expectancy is considered, there are still hold backs when compared to western countries according to Andel (2014). He argues that cardiovascular diseases still account for about 50 percent of all mortality. This is one of the highest rates in Europe and should therefore be a major concern. Comparable with Russian Federation, lifestyle habits are key reason to premature mortality. Alcohol and tobacco consumptions are high, compared to other European countries and the US. Low expenditures on health promotion plays an important role in the context of high cardiovascular mortality.

Grigoriev et al. (2014) argue that an unhealthy lifestyle, exceptional alcohol consumption and psychological stress, which has been caused by the social and economic reforms, were responsible for the reduction in life expectancy in Russia after the fall of the Soviet Union in 1991. The importance of good governance on the impact of life expectancy is stressed by Klomp and Haan (2008). They argue that good governance has an indirect influence on health through the positive impact on income and the quality of the healthcare sector. The significance of these effects is different across countries. In countries with a relative healthy population, governance has an indirect positive effect through the quality of the healthcare sector and not via income. In countries with poor health, the influence of governance goes through income and not the healthcare sector. According to Greer et al. (2016) health is a political choice. For good health, important and difficult political choices need to be made, which have consequences on access to health services, finances and the quality of healthcare. However, political choices are not always implemented because patient centredness is not always prioritized. Informal payments and corruption cause problems and remain a barrier to efficient health systems in some countries. Furthermore, analytical and policy failures are not unknown. Political choices can be improved by strengthening the health system governance. Building blocks of the governance are transparency, accountability, integrity, participation and policy capacity.

The impact of healthcare on life savings has been criticized. Commentators such as Illich (1976) and McKeown (1980) argued that it played very little part and that healthcare might even be harmful. However, Nolte and McKee (2004) argue that these writings were about a period where healthcare had relatively little to offer, in comparison with today. Safe and effective drugs for many chronic diseases for example, only became widely available during the 1960s and 1970s. Furthermore, they describe improvements in death rates from diseases for which interventions have been found. They state that the debate on the impact of healthcare has continued. In this debate some argue that healthcare makes an increasing impact on overall health, while others state that the realm of broader policies such as education, housing and transport are more explaining for future advances in health.

Rutstein et al. (1976), implemented a method to measure the quality of medical care, by counting unnecessary- disability and disease, and untimely deaths. By selecting conditions of these avoidable deaths, counting can serve as index of the quality of care. Distinctions are made between preventable and amenable death. Preventable deaths are “responsive to actions beyond healthcare” and amenable deaths are “responsive to medical intervention through treatment and secondary prevention”. Indexes can be used to determine the general populations health level. Furthermore, they can measure effects of political, economic and other environmental factors. Looking at avoidable deaths helps evaluating the quality of medical care provided, both within and without the hospital, to maintain health and prevent treat disease (Rutstein et al., 1976).

Fihel & Pecholdova (2017), Identified three main factors that influence life expectancy. These are institutions, behavioural changes and the economy. Institutions can change life expectancy by determining the spending on healthcare and making health policies. Besides the government, other institutions such as NGOs have their influence on the healthcare system. For NGOs these contributions lie in the development of healthcare service where state provisions are inadequate. Grigoriev et al. (2014), state that behavioural changes, like shifting attitudes towards smoking, diet and alcohol consumption can have impact on life expectancy. Especially in Eastern European countries, where these factors have shown to be relevant. According to Fihel & Pecholdova (2017), education on the impact of tobacco, diet and alcohol consumption can change the amount of consumption and thus life expectancy. Cornia and Panicià (2000), argue that economic and institutional changes can influence individual behaviour and cause stress, which is one of the main drivers behind manmade diseases.

## Conceptual model

The conceptual model gives an overview of the theoretical framework and shows how theories are interrelated (figure 2). Central in this thesis is the role of the government and how it influences the life expectancy. Governance can be both positive and negative on life expectancy. Good governance increases life expectancy and is determined by transparency, accountability, integrity, participation and policy capacity. Policy failures and corruption are drivers for bad governance and will have a negative impact on life expectancy (Greer et al., 2016)

Social-economic reforms determine life expectancy through two processes. Through spending on healthcare and stimulating integration with modern western healthcare, quality and accessibility of healthcare can be increased (Klomp and Haan, 2008), (Nolte and McKee, 2004). Quality and accessibility of healthcare determine amenable mortality (Rutstein et al., 1976).

The other process that can be used, is steering behaviour. Behavioural changes determine and are determined by the level of stress (Cornia and Panicià, 2000). With reforms levels of stress can be changed and thus consumption. In this research stress also contains restrictions and prices. The amount of stress determines preventable mortality. Rises and declines in preventable and amenable mortality are key causes for a change in life expectancy.

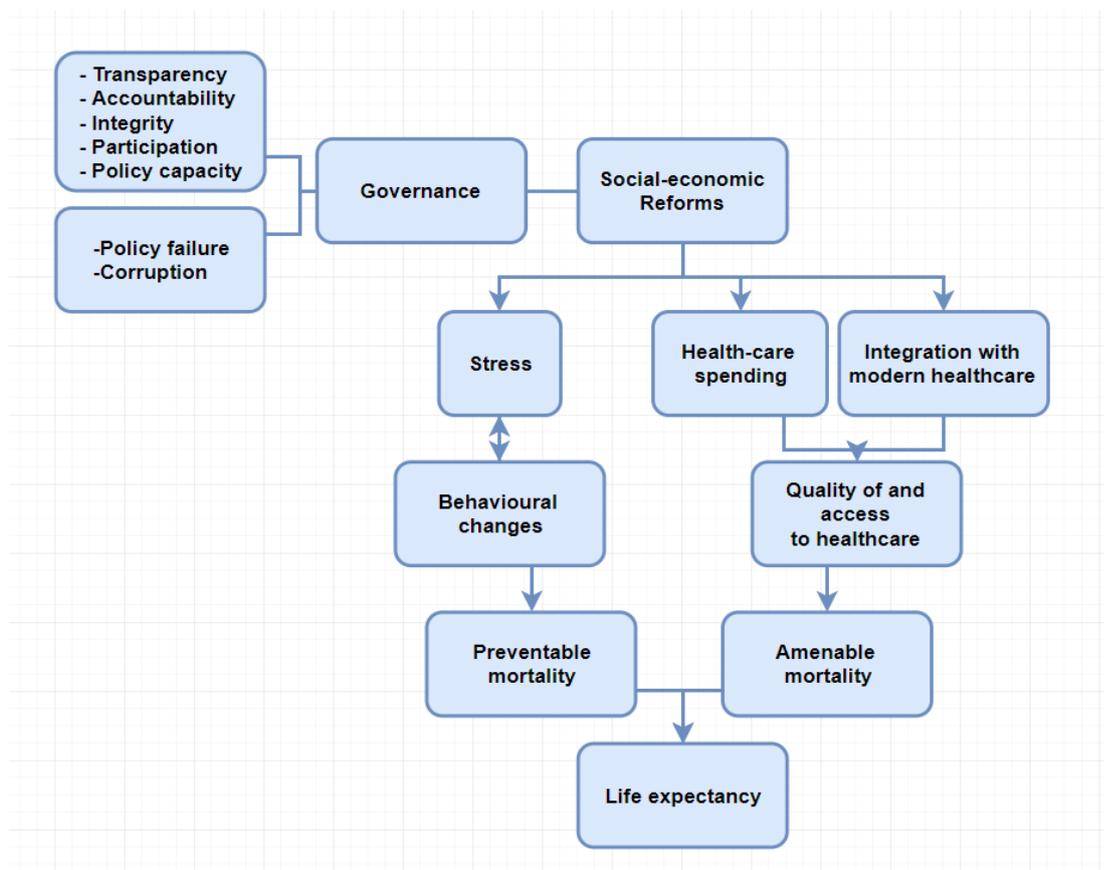


Figure 2 Conceptual model

## Hypothesis

Klomp et al. (2008), state that governance plays an important role in changes of life expectancy. Therefore, it is expected that changes in preventable- and amenable mortality are related to governance. Integration with modern western healthcare (Nolte and McKee, 2004) and increased healthcare spending (Klomp and Haan, 2008) are expected to influence amenable mortality through changes in health care quality and accessibility. Policies that improve behaviour are expected to increase life expectancy through preventable mortality (Cornia and Paniccià, 2000).

Figure 1 shows diverging of life expectancy between the period of 1991-2003. It is predicted that Czech Republic had the most positive reformatations between the first period and Russian Federation the least. Between 2003-2015 life expectancies converged. Therefore, it predicted that Russian Federation made the most positive reformatations during this period.

## Methodology

To answer the research question, both quantitative analyses and a literature review will be executed.

For the first sub-question a literature research will be executed. Focussed will be on the Income, healthcare spending, integration with modern western healthcare and behavioural change. Happenings in certain years, such as income rise, will be compared to changes in life expectancy.

The second sub-question will be answered with quantitative research. This will provide a closer look at preventable- and amenable mortality. This will be done with a decomposition of differences in life expectancy. This analysis has been found by Arriaga (1984). The analysis shows the age-specific contribution to the difference in life expectancy by cause of death proportional to the difference in difference in proportion of this cause. The formula for this decomposition:

Meanings of the symbols in this formula are:

$${}_i e_x = \frac{T_x - T_{x+i}}{l_x}$$

|       |   |
|-------|---|
| i     | The cause of death  |
| $e_x$ | The average number of years of life remaining at age x  |
| $T_x$ | Person years lived by cohort members after age x divided by the number of persons in the cohort |
| $L_x$ | The number of person-years lived between exact ages x and x+1                                   |

Table 1 Definition of life table functions

The decomposition method will be used to compare mortality rates of countries a time. It will decompose differences in mortality rates by five causes of death, consisting of two preventable- and three amenable causes. The years that will be compared are 1991,2003 and 2015. 1991, as it is the last year in which the Soviet Union exists, and life expectancies were still close at this point (figure 1). 2003, as it marks the start of a sustainable rise in life expectancy for Russian Federation. 2015, since it is the most recent year where data is available for.

## Ethics

Only secondary data, consisting of literature and mortality data, is used. Since the mortality data is aggregated, it cannot be used to trace individuals. Therefore, ethical problems should not arise.

## WHO database

Secondary data used in this thesis comes from the WHO mortality database (WHO, 2019). The database is a collection of mortality data by cause of death, age and sex which are reported by every member state of the WHO annually. The ICD system (International Classification of Diseases and related health problems) is used for coding. Different versions of ICD are used over the years (table 2). All three countries used ICD version 9 in 1991. However, Russian Federation and Ukraine both used ICD9N while Czech Republic used the much broader ICD9B. Therefore, comparison problems occur. In order to analyse the data, all data needs to be converted into one classification system (WHO, 2019). This problem is also prevalent for 2003 and 2015. Here Czech Republic is using the ICD10.4 dataset whereas Ukraine is using respectively ICD9N and ICD10.1 and Russian Federation is using ICD 10.1 for both years. Since the mortality datasets of Ukraine and the Russian Federation are of limited categories, there is a limitation in available mortality causes. Therefore, broader categories need to be used and multiple mortality causes from ICD9B up to ICD10.4 need to be combined. This results in the unavoidable loss of more specific data. Furthermore, by grouping mortality causes other diseases that do not fall under the category of preventable or amenable diseases might be added. This should be considered, when interpreting the results.

Two categories of death causes are compared. Preventable diseases (table 3) will be used to decompose the diseases that are responsive to actions beyond healthcare. Death causes that will be used for preventable mortality are derived from the work of Nolte et al. (2002). Amenable mortality causes will be used to decompose diseases that are responsive to medical intervention through treatment and secondary prevention. Death causes used for amenable diseases are derived from the work of Mackenbach (2000) and shown in table 4.

Used mortality causes are a selection of preventable and amenable causes. Mackenbach et al. (1990), describe that there are variations on what mortality causes are included in lists with preventable and amenable diseases. Included causes are likely to reflect different views on avoidability of death from certain conditions. Furthermore, availability of data and variations in frequency of mortality rates determine the selection of causes. In this thesis, conditions are included that are considered relevant for Eastern Europe. The used data is not perfect. In a survey on mortality data from the WHO (2005), an attempt was made to determine the quality of collected data. However, Ukraine did not respond. An overview of the most important characteristics is placed in table 5. Czech Republics' data is most trustworthy, with 100% registering of deaths by certified medical doctors. For Russian Federation and Ukraine, it is unclear how much percent this is. Russian Federation does show data on the registered deaths occurring in a hospital or other medical institution. However, this number is quite low. Other ways to increase the quality of the data are used, such as follow-up enquiries.

## Results

### Healthcare transition

Fundamental changes in the political map of Europe and central Asia were made with the fall of the Soviet Union. Countries experienced economic collapse and new national identity needed to be built. Important for this identity are the provision of health services. Sheiman (2013), explains that during the time of the USSR, Soviet countries had inherited the Semashko healthcare system. This was a multi-tiered system, with differentiated network- and service providers. In this system the severity of the disease corresponds with one of five levels, which were connected by a referral system. The model was efficient since activities of other medical services could be integrated. The model had achieved in ensuring universal coverage of basic healthcare services for everyone, free of charge. However, from the 1970s, the availability of new medical technologies and the demand for better healthcare caused people to by-pass district physicians and go to specialists directly. This has resulted in a system that became inefficient, poor of quality and lacking in responsiveness. Therefore, many Eastern European governments called for change. Due to fiscal constraints and lack of people trained in concepts of medicine it was not possible for all countries to make this transition (McKee et al., 2014). Different paths of development, for Eastern European countries, are taken. This is caused by wider socioeconomical and political context. However, it is also argued that differences in developments result from conscious political decision making. Reformations of the healthcare system of Czech Republic, Russian Federation and Ukraine will be overviewed, to see if policies were causing changes in life expectancy.

### Czech Republic

Janík (2010), explains that although Czech Republic never was part of the Soviet Union, they were influenced by it. The overthrowing of the Communist government in 1989 made way for a free market, based on democratic values. A transformation from a centrally planned market to a free one happened during the 1990s. Speculations that happened during the transfer of ownership from state to private ownership went unchecked due to absence of laws. This exposes the policy failures and corruption of the old system. Notable is that the start of a stable rise in life expectancy happens as the transition from a closed communistic system to a more open and transparent democratic system takes place.

Kinkorová & Topolčan (2012), argue that during Czechs democratisation process, liberalisation of the healthcare system took place. This enabled free choice of healthcare facility. New laws were implemented and caused the healthcare system to move towards a compulsory health insurance model. From the 1990s on, considerable changes have been made in the healthcare system and most of these planned changes have gone through a remarkably smooth process. The reconstruction of healthcare authorities and facilities has been achieved, together with the creation of a health insurance system. With these reformations, Czechs' healthcare system moves towards the European model. This based on reducing costs while preserving quality and equity, by using market mechanisms (Belien, 2000). Further integration took place with Czech Republic joining the European Union in 2004 (OECD and EOHSP, 2017).

### Russian Federation

Russian Federation inherited the centralized Semashko system after the fall of the Soviet Union. However, quick reforms were made in health financing, by adopting the mandatory health insurance model in 1993. Reason for this was the necessity of healthcare funding in face of the fiscal constraints that happened because of economic decline. Although the organization and governance around the Russian health system has evolved since the independence, the legacy of the centralized system that focused on universal access to basic healthcare, still decides much of the discourse and practises of

the system. Although healthcare coverage is a free, guaranteed constitutional right, in reality healthcare financing is a mix of compulsory sources and out-of-pocket payments (Mathivet et al., 2011). Sheiman (2013), states that the compulsory health insurance model helped to dampen overall reductions in funding for healthcare. However, it could not contribute much to building a more rational system of service delivery. Furthermore, explains the shortcomings in primary healthcare. Although, important steps such as the medical equipment project (World Bank, 2003) are taken to improve the primary healthcare infrastructure and equipment, this is still lagging behind secondary healthcare. Therefore, it is often bypassed. Inefficiencies are caused by a lack in coordination between primary healthcare clinics and hospitals. The last decennia healthcare has been given a higher priority in terms of funding and attention. New health preventive and health promoting activities caused the life expectancy to rise from 66,6 to 70,3 between 2006 and 2012. However, underfunding of the health system remains a problem. Therefore, structural disproportions remain. Sheiman (2013), expresses the risks of the growing share of out-of-pocket payments, which are caused rising costs of medicines. Although at present the relatively affluent middle-class can afford private health services, this might change with the development of new technologies.

## Ukraine

Most post-communist countries undertook efforts to develop a health insurance model, eradicate informal payments and transform the highly centralized and outdated healthcare system. However, Ukraine's health-system remained virtually unchanged. Changes that have been applied, have shown to be apparent and inferior. The private sector can participate in the health system on a limited scale. However, outside of the scheme of public financing, these private facilities are mostly based on out-of-the-pocket payments and informal (Romaniuk and Semigina, 2018).

In 2010 a health reform programme attempted to strengthen primary and emergency care in Ukraine. This should be done through rationalizing hospitals and changing healthcare finance from a model based on inputs to one that is based on outputs. However, fundamental issues such as conflicts and political instability have caused the programme to be abandoned in 2014. Therefore, a system remains where there is little incentive for rational use of resources and little cost control over healthcare facilities. Further problems are a lack of transparency in the system, which are caused due to limited benefit packages. These have been defined by the government but left it to facilities to determine which services should be covered by budget and which ones are subject to user charges. This has contributed to an expansion of informal payments (Lekhan et al., 2015).

## Behavioural policies

Czech Republic, Russian Federation and Ukraine all experience high preventable mortality rates. Alcohol- and tobacco use are among the highest worldwide. Measures such as the anti-alcohol campaign, led by Gorbachev in the mid 1980's had big impact. However, with the fall of the Soviet Union gains that were made were wiped out, as consumption of alcohol rapidly increased again (Shkolnikov, 1997). Deregulation of the alcohol industry, together with the transition to a market economy lead to a sharp decline in alcohol prices. Gil et al. (2010) state that governments in the post-Soviet era have contributed to the alcohol problem, by distributing cheap alcohol and setting weak alcohol control policies. Although ministries recognize the drinking problem, little measures are taken. either because they are conflicted due to revenue that is provided by the alcohol industry or because they feel it is not their responsibility. However, Shkolnikov et al. (2013) argue that the Russian Federation has imposed a new law on the manufacturing and distribution of alcohol, in 2006. This has helped with the sustained reduction in alcohol-related mortality and shows what can be achieved. Ukraine has implemented price increases. However, McKee et al. (2014) explain that more concerted actions are required to really impact demand and supply. Dobiášová et al. (2017), explain the situation

in Czech Republic. Here the effort was made to minimize restrictions on individuals' rights, after the fall of communism. Individual responsibility was emphasized. In 1997 the power of administrative and medical authorities to impose alcohol abuse treatment on addicted people was even abolished. Until 2005, alcohol consumption ceased to be a topic of interest on the political agenda. A combination of becoming more liberal, the expiring of former government regulations and stress that was associated with economic- and political reconstructions, created an environment favourable for alcohol consumption. The adoption of a new law in 2005 should have dealt with drug abuse and alcohol consumption. Although it was declared that it was intended to reduce alcohol consumption, the law was even more liberal, and the affordability of alcoholics was minimally restricted. The little measurements that were made are emphasises on the treatment of addicted individuals and the ban on sales in schools and health facilities. School-based preventive programmes were the only long-term measures that were implemented.

The excessive amount of tobacco use is another factor that influences preventable mortality rates of Eastern European countries. Mckee et al. (2014) indicate that a levelling off, of smoking rates has been reached within post-Soviet countries. Smoking rates slightly declined over the 2000s. They further state that these improvements may reflect the intensification of tobacco control measures. All post-Soviet countries became parties to the WHO Framework Convention on Tobacco Control. To varying degrees, they all implemented a variety of measures such as advertising restrictions, warnings and tax increases. Czech Republic, Russian Federation and Ukraine all participated in the WHO Framework Convention on Tobacco Control. Participation in this program happened respectively in 2012, 2008 and 2006 (United Nations, 2003).

### Spending on healthcare

Figure 6 gives an overview of the health expenditures per capita. The years shown, reach from 2000 until 2016, since older data was not available. From 2000 onwards all three countries have increased the amount of healthcare spending per capita. However, there are big differences in the amount that has been spent. Czech Republic is by far the highest per capital spender, whereas Russian Federation is more moderate, and Ukraine is far below. Figure 7 zooms in on the rises of life expectancy and compares the same period. In both figure 6 and 7 Czech Republic is at the top. Russian Federation is spending more per capita and has lower life expectancy rates than Ukraine. This can be explained by the cost-effective health system of Russian Federation (Sheiman, 2013). However, the continent higher spending on healthcare than Ukraine eventually allowed Russian Federation to catch up, and even overtake them in life expectancy. Figure 8 shows the GDP per capita. Interesting is that the pattern is quite similar to the one of health spending per capita (figure 6). This indicates that cuts in healthcare spending are often made in times recession.

## Decomposition analysis

In order to get a more detailed view of changes in life expectancy, an age specific decomposition of life expectancy between the three countries - Russian Federation, Czech Republic and Ukraine - is executed. Figure 3 shows the decomposition of life expectancy for the year 1991. The similar pattern of Russian Federation and Ukraine compared to Czech Republic exposes that Czech Republic in 1991 already had a very different decomposition of mortality than Russian Federation and Ukraine. This might reflect the different background of Czech Republic but might also be caused by reformation that Czech Republic already made in 1989 (Kinkorová & Topolčan, 2012). Reformations were not made by Russian Federation and Ukraine at this time (Mathivet et al., 2011) & (Romaniuk and Semigina, 2018).

Noteworthy is that almost all gains that Russian Federation has compared to Czech Republic are from other causes than preventable and amenable mortality causes. On the other hand, a constant loss is experienced due to preventable mortality cause. However, these only have a minor influence compared to other- and amenable causes. Amenable losses in life expectancy compared to Czech Republic start from the age of 45 and go up all the way to 85+.

Ukraine shows a similar pattern as Russian Federation when it is compared to Czech Republic. Almost all the gains that are made in life expectancy compared to Czech Republic are due to other causes. Preventable mortality causes play an insignificant role in declaring the diverging movement of life expectancy around 1991. Similar as in the comparison with the Russian Federation, losses in life expectancy for Ukraine compared to Czech Republic seem to be predominately caused by amenable mortality that starts from the age of 45.

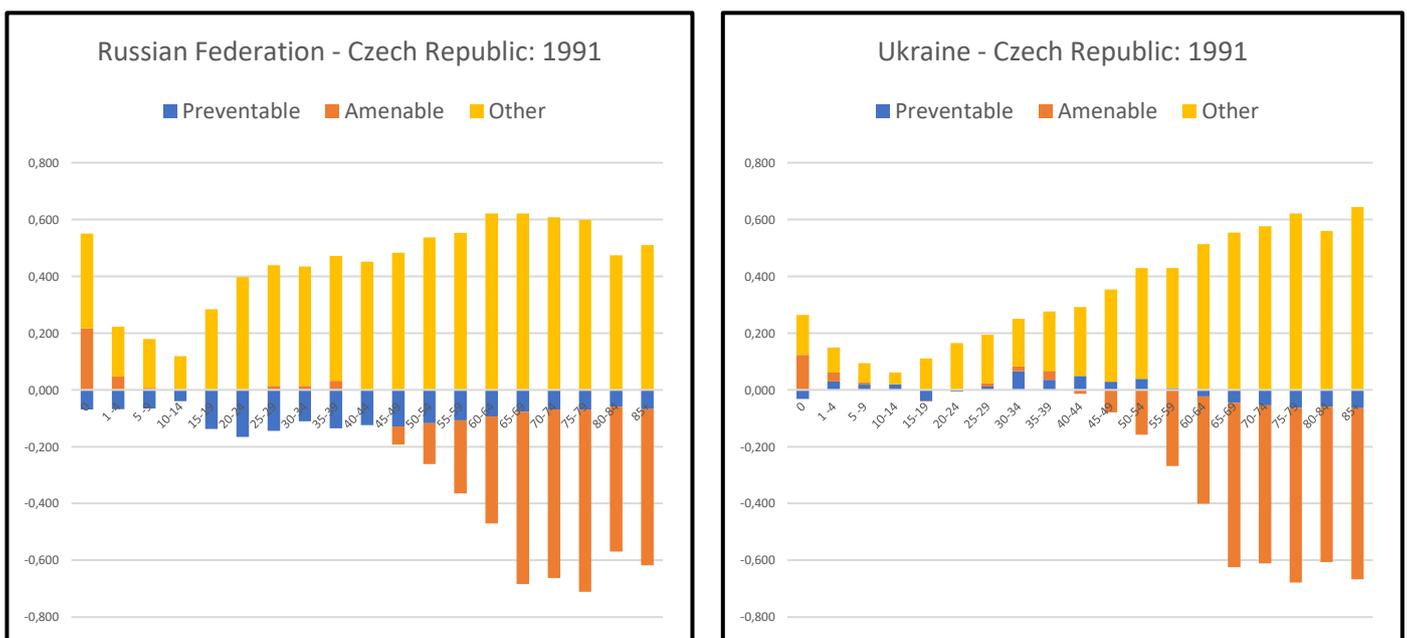


Figure 3 Age specific decomposition of life expectancy 1991 (created with data from WHO, 2019)

The decomposition for 2003 can be seen in figure 4. Again, the pattern that is shown in the comparison between Russian Federation - Czech Republic and Ukraine – Czech Republic is quite similar. However, the pattern that is shown in 2003 is totally different from the one of 1991 (figure 3). Both Russian Federation and Ukraine made severe relative improvements in preventable mortality decline at younger ages, and amenable mortality decline at older ages. although relative mortality rates of other causes are still higher for Czech Republic, big improvements in the relative influence of other mortality rates are made by Czech Republic when compared to 1991. Therefore, decline in other mortality causes explain the gains in life expectancy that were made by Czech Republic between 1991 and 2003.

In 2003 none of the three countries had made any significant reforms with regards to prevention of alcohol and tobacco consumption (Dobiášová et al.,2017), (United Nations, 2003), (McKee et al.,2014). Therefore, relative gains in preventable mortality rates that are made by Russian Federation and Ukraine cannot be addressed to regulations. However, the liberalization of Czech Republic that was responsible for the increase in alcohol consumption (Dobiášová et al.,2017) might partially explain the relative gains in preventable mortality that are made compared to Czech Republic.

Reforms with regards to healthcare quality and accessibility have been made by Russian Federation from 1996 till 2001 (World Bank, 2003). The gains in amenable mortality decline compared to Czech Republic might be explained by these reformations. However, Ukraine did not make such reformations (Romaniuk and Semigina, 2018), but shows relative gains in amenable mortality as well. However, these gains are much less than the ones of Russian Federation. Since Ukraine has experienced a drop-in life expectancy between 1991 and 2003, it is likely that relative gains have been caused by rises in amenable mortality rates of Czech Republic and cannot be contributed to amenable mortality decline in Ukraine.

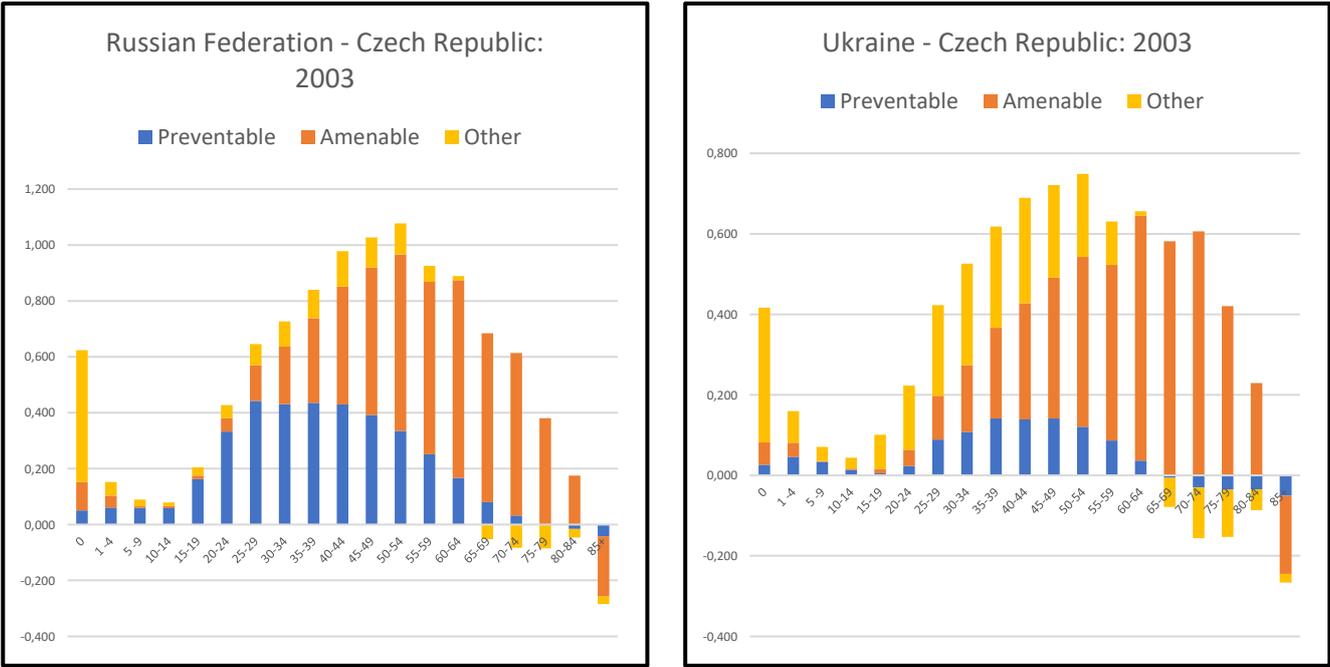


Figure 4 Age specific decomposition of life expectancy 2003 (created with data from WHO, 2019)

The decomposition of 2015 is shown in figure 5. The comparison of Russian Federation and Czech Republic shows a pattern that seems similar to 2003. The main changes here seem to be an overall drop in rates. For the comparison of Ukraine and Czech Republic in 2015 the pattern is roughly the same as it was in 2003. However, some differences are made.

Gains in preventable mortality decline, might be attributed to the implementation of new alcohol policies. In 2006 the Russian Federation implemented a new law, that arranges alcohol production and distribution. This law has helped with sustainable reduction of alcohol consumption (Shkolnikov et al.,2013). Also, Ukraine has made reformations regarding alcohol policy, by implementing price increases (McKee, 2014). Czech Republic also implemented a new law that should reduce alcohol consumption, in 2005. However, this law was limited in restrictions and even more liberal towards alcohol. Focus of this law was set at younger ages (Dobiášová et al., 2017) Therefore, for Czech Republic relative gains in declines of preventable mortality at earlier ages are expected for earlier ages. Whereas, Russian Federation and Ukraine are expected to experience gains at later ages. Furthermore, all three countries participated in the WHO Framework Convention on Tobacco Control (United Nations,2003). However, Ukraine started doing this at an earlier state (2006) than Russian Federation (2008) and Czech Republic (2012). This might lead to relatively more preventable mortality decline for Ukraine.

When figures 4 & 5 are compared, it shows that Czech Republic has made relative gains in preventable mortality rates, compared to Russian Federation (although still having relatively higher preventable mortality rates). On the other hand, Ukraine managed to make some slight gains in relative preventable mortality rates when preventable mortality between 2003 and 2015 are compared. These were mostly around the ages of 25 up to 50 and 65 up to 79. Therefore, Ukrainian policies seems to have been the most successful in reducing preventable mortality rates.

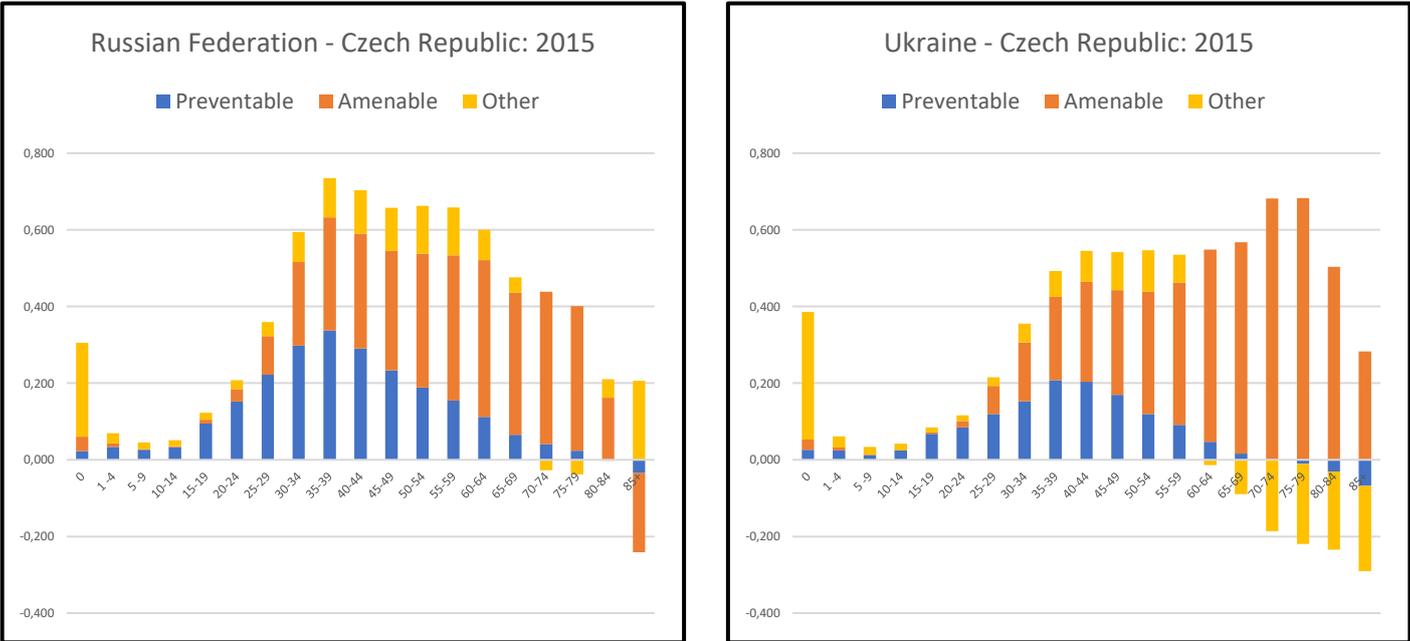


Figure 5 Age specific decomposition of life expectancy 2015 (created with data from WHO, 2019)

For amenable mortality rates Russian Federation has made considerable losses when compared to the situation of 2003. The continuing rise in life expectancy of Czech Republic (figure 1) suggests that this is likely to be caused by amenable mortality decline in Czech Republic. These are likely to be caused by further reformation and integration with the European health market (OECD and EOHSP, 2017). Ukraine, however, has made further progress in declining amenable mortality rates. These declines can explain Ukrainian rise in life expectancy that happened between 2008 and 2015. However, since no significant reforms have been made and healthcare spending has not drastically gone up (figure 6), these gains cannot be attributed to governance.

## Conclusion

The comparison of Czech Republic, Russian Federation and Ukraine has revealed different approaches to improve healthcare. All countries have been heavily influenced by the Soviet Union and consequences can still be seen today. While, Czech Republic was able to make drastic reforms in the healthcare system around 1991, Russian Federation and Ukraine did not. Gains in life expectancy for Czech Republic, are caused by a decline of other mortality causes during the period of 1991 – 2003 and preventable and amenable mortality decline during the period of 2003-2015. Gains in life expectancy can be contributed to strong reformations that have been made after the fall of communism (Kinkorová and Topolčan, 2012) and integration with the European health system. However, lack of alcohol reduction policy has limited Czech Republics' life expectancy growth (Dobiášová et al., 2017). Russian Federation experienced the strongest losses in life expectancy (figure 1). However, reformations made by Russian Federation between 1991 and 2003, to strengthen primary healthcare, contributed to a relative decline in amenable mortality (Sheiman, 2013), (World Bank, 2003). Policies to influence behaviour are implemented between 2003 and 2015 by all three countries. However, Ukraine has made the most improvements in preventable life expectancy during this period. This suggests that Ukrainian policies on the influence of behaviour, were the most effective. Russian Federation experienced relative losses in preventable mortality compared to Czech Republic between 2003 and 2015. This while Russian Federation started Tobacco control measures earlier and had relatively stricter laws on alcohol consumption (United Nations, 2003), (McKee et al., 2014), (Dobiášová et al., 2017). This shows the limitations governance influence. Furthermore, Ukraine experienced the biggest reduction in amenable mortality between 2003 and 2015. This while Ukraine has not made any reformations in the healthcare sector and Russian Federation did.

Based on these findings, the research question *“How is the life expectancy of the Eastern European countries influenced by governance?”* can be answered. Czech Republic and the Russian Federation (at a later stage) have shown that drastic policy changes and enough funding in the health system can make a big impact. Furthermore, policies that influence behaviour can make changes in preventable mortality rates. However, success is not guaranteed, and other causes also heavily influence life expectancy.

## Discussion

The used mortality data is an important factor for this research. Therefore, quality limitations of data are of severe impact. For Russian Federation the quality of data was very limited and for Ukraine it is unknown how trustworthy the data is. Furthermore, combining different version of the ICD's might have influenced the results. Although codes overlapped, already existing risks of making mistakes when working with the data were increased. Figure 9 shows the comparison for Russian Federation – Ukraine. Some inconsistencies with figures 3,4,5 are seen, such as preventable mortality in age group 30-34 (figures 3,9). Furthermore, the availability of data heavenly determined this research. Problems found were the limited number of categories that were present in ICD9N. Therefore, categorizations must be made which might have caused mortality to be placed in the wrong group. The ages groups of 85-89,89-95 and 95+ have been combined, due to lack of data. This convergence contributes to questionability of mortality data of older age groups. Other limitations were unknown age groups. These have been left out of the data that is used. In order to avoid distortion of the age specific data, the choice was made to let these causes out. However, this does impact the analysis since it the actual amount of deaths was higher than used in this research. Furthermore, categorizations were a selection of identified amenable- and preventable mortality causes. However, selections differ between areas and time (Mackenbach et al., 1990). Including other mortality causes in the used categories might have changed the outcome. Further limitations are caused by migration, which influence the used per capita information such as health expenditure, GDP, and life expectancy. Furthermore, it is hard to look at differences in alcohol consumption, since classifications differ per country (Dawson, 2003) this brings implication for the comparison that is done on preventable mortality.

Momentarily, Ukraine is trying to make big changes in the healthcare system (Romaniuk and Semigina, 2018). For future research it is interesting to see if this will bring the same rises in life expectancy as they did for Czech Republic. Furthermore, healthcare spending has dropped since 2015 in all three countries (figure 6). Until now this has not stopped the rise in life expectancy (figure 7). However, it is interesting to see if this will be the case in the future and if the different healthcare systems are impacted more in budget cuts.

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## Appendices

|                    | 1991  | 2003    | 2015    |
|--------------------|-------|---------|---------|
| Czech Republic     | ICD9B | ICD10.4 | ICD10.4 |
| Russian Federation | ICD9N | ICD10.1 | ICD10.1 |
| Ukraine            | ICD9N | ICD9N   | ICD10.1 |

Table 2: overview of ICD datasets used (WHO,2019)

| Cause of death preventable              | ICD9N | ICD9B                    | ICD10.1 | ICD 10.4 |
|---|-------|--------------------------|---------|----------|
| Cirrhosis and other Digestive Disorders | S347  | 570-573, 576,575.2-579.9 | 1078    | K00-K92  |
| Accidents and Adverse Effects           | S47   | B47-B53                  | 1095    | V01-Y89  |

Table 3: overview of preventable mortality causes (WHO,2019)

| Cause of death amenable            | ICD9N | ICD9B    |                                   | ICD10.1 | ICD10.4  |
|------------------------------------|-------|----------|-----------------------------------|---------|----------|
| Infectious and Parasitic Diseases  | Ch01  | B01-B07  | 001-139                           | 1001    | A00-B99  |
| Diseases of the Circulatory System | CH07  | B25-B30  | 390-459                           | 1064    | I00- I99 |
| Diseases of the Respiratory System | CH08  | B31, B32 | 460-465, 470-478 And 466, 480-519 | 1072    | J00-J98  |

Table 4: Overview amenable mortality causes (WHO,2019)

|                    | Registered deaths certified by medical doctors (%) | Registered deaths certified by coroners or other medicolegal authority (%) | Registered deaths occurring in a hospital or other medical institutions (%) | Registered death for which an autopsy/post-mortem was performed | Follow-up enquiries to the certifier in case of doubt or inconsistency about cause of death | Who selects underlying cause of death on the medical certificate and assigns and ICD code? |
|--------------------|--|--|---|---|---|--|
| Czech Republic     | 100  | 0  | 60-69   | 29  | Yes   | Administration officer/clerk   |
| Russian Federation | -  | -  | 19  | 39  | Yes   | The doctor who delivers the death certificate also codes the cause of death                |
| Ukraine            | -  | -  | -   | -   | -   | -  |

Table 5 : Data Quality (WHO,2005)

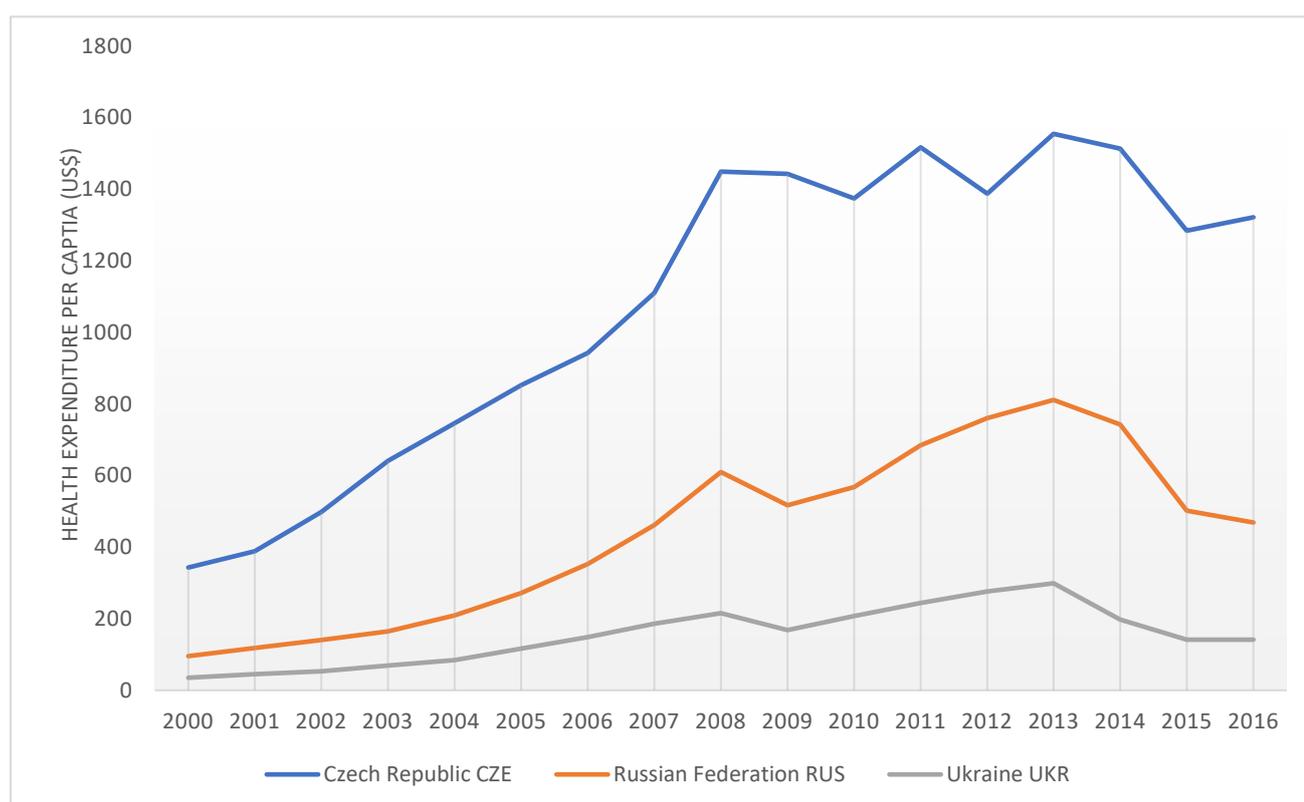


Figure 6 Health expenditure per capita, created with data from world bank (2019).

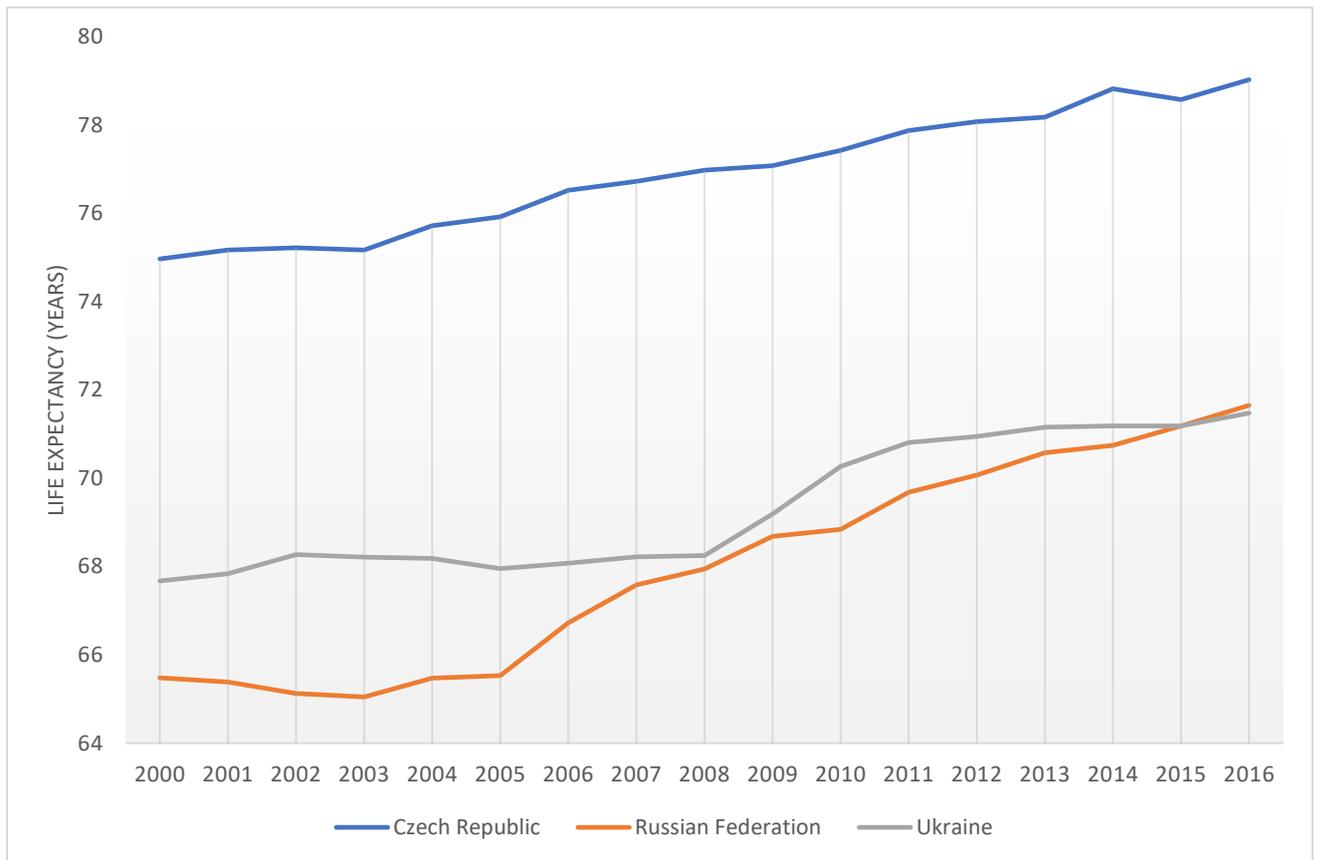


Figure 7 Life expectancy 2000-2016 created with data from World Bank (2019)

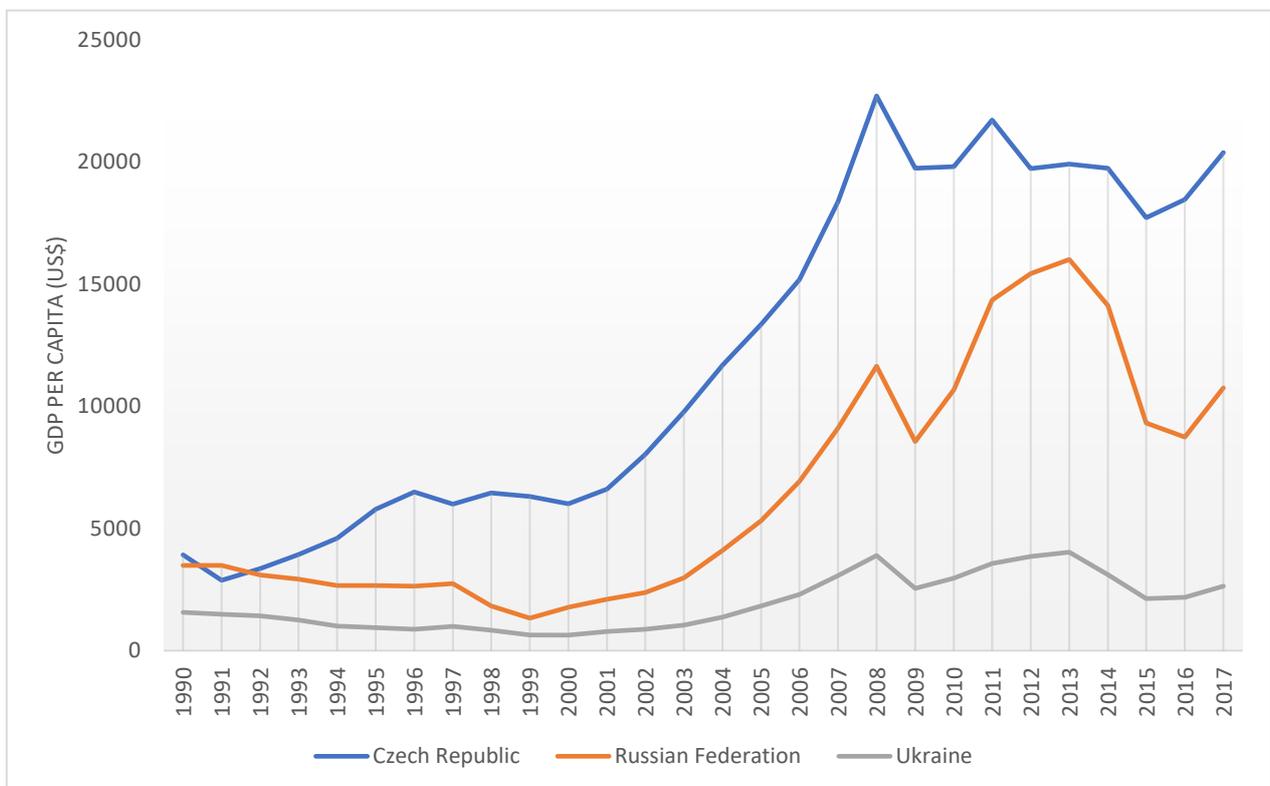


Figure 8 gross domestic product per capita, created with data from world bank (2019)

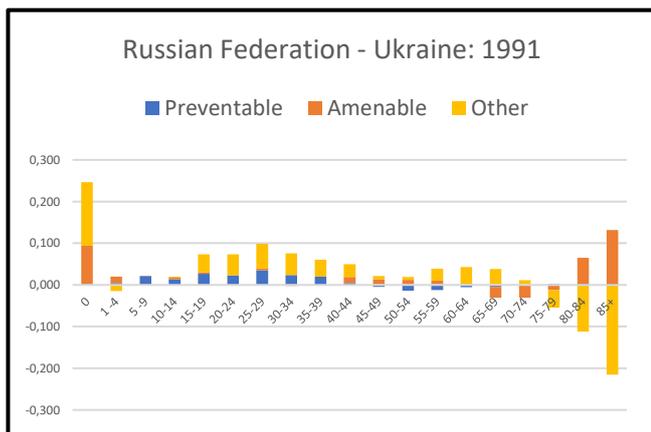


Figure 9 Age specific decomposition of life expectancy Russian Federation - Ukraine (created with data from WHO, 2019)