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# PATTERNS AND TRENDS IN SURVIVAL: KAZAKHSTAN AND POST-COMMUNIST COUNTRIES CONFRONTED WITH LOW MORTALITY POPULATIONS

Dissertation thesis

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I declare that this thesis is my own work under the supervisor of Prof. RNDr. Jitka Rychtaříková CSc. Where other sources of information have been used, they have been acknowledged.

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In Prague, Mgr. Zhanyl Mukhtarova

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## Patterns and trends in survival: Kazakhstan and post-communist countries confronted with low mortality populations


### Abstract

This research primarily addresses mortality patterns and trends by main causes of death in the post-communist countries of Central Asia, Central Europe and the Baltic region together with low mortality populations such as those of France, Spain and the USA. The aim of this study is to analyze the changes in the mortality levels and its structure by the main causes of death by sex and age, and confronted with low mortality populations between the period of 1985 and 2005, respectively.

The first (and main) part of the work therefore focuses on cause-specific mortality levels and its relative structure by main causes of death in the selected countries. Moreover, the different patterns of excess male mortality were also observed. The second part is concentrated at the age-standardized mortality levels by main causes of death. The research identified several important issues encasing the field of mortality, especially in the cause-specific mortality situation in Central Asian republics.



**Keywords**: cause of death, Kazakhstan, post-communist countries, low mortality populations, excess male mortality


## Модели и тенденции выживания населения: Казахстан и пост-коммунистические страны в сравнении со странами с низким уровнем смертности


### Абстракт

Данное исследование охватывает в первую очередь модели и тенденции по основным причинам смерти в посткоммунистических странах Центральной Азии, Центральной Европы и Балтийского региона в сравнении со странами с низким уровнем смертности среди которых: Франция, Испания и США. Целью данного исследования является анализ изменений уровня смертности и ее структуры по основным причинам смерти по полу и возрасту в Центральной Азии, в сравнении со странами с низким уровнем смертности в период с 1985 по 2005 годы.

Первая (и основная) часть работы сосредотачивается на анализе основных причин смерти а также на изучении структуры смертности по основным причинам в выбранных странах. Кроме того, исследование затрагивает основные тенденции связанные с избыточной смертностью среди мужчин. Вторая часть работы сфокусирована на анализе коэффициентов смертности по основным причинам, стандартизованных по возрасту. Кроме того, по результатам данного Исследования была выявлена важность изучения смертности, особенно по основными причинам смерти в республиках Центральной Азии.



**Ключевые слова:** причина смерти, Казахстан, пост- коммунистические страны, сравнение со странами с низким уровнем смертности, избыточное смертности мужчин

# CONTENTS

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ASDR | Age-standardized Death Rate |
| CDR | Crude Death Rate |
| CIS | Commonwealth of Independent States |
| EU | European Union |
| EU27 | EU-27 Member States: EU15 plus Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia |
| GDP | Gross Domestic Product |
| HIV | Human Immunodeficiency Virus |
| ICD | International Classification of Diseases |
| ICD9 | 9th revision of the ICD |
| ICD10 | 10th revision of the ICD |
| MDB | Mortality Database |
| MDG | Millennium Development Goal |
| NIS | New Independent States |
| SDR | Standardized Death Rate |
| UN | The United Nations |
| USSR | The Union of Soviet Socialist Republics |
| WHO | World Health Organization |

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# Chapter 1

# Introduction

## 1.1 Problem definition

The break up of the Soviet Union was the most important historical event at the end of the 20th century. The sudden integration of the former Soviet Union countries into mainstream capitalism has heightened uncertainties in all facets of life regarding the individuals concerned. In the early 1990s after the fall of the socialist regime, many countries in this region experienced economic and social transformations. Virtually every aspect of life was affected, and a health and mortality crisis was experienced. In these countries, the macroeconomic situation has stabilized, with inflation falling and the economy growing once again, the short- and long-term consequences for individual health and welfare are not well documented. Following the collapse of the Soviet Union, the changing political and socio-economic systems brought many problems, such as rising unemployment, falling living standards, growing poverty and socio-economic differentiation. These factors contributed to a significant deterioration of the already poor situation of Soviet public health, but their magnitude and impact of crisis mortality varied from country to country (Cockerham 1997). In some countries, this worsening of mortality was short-lived. This was followed by improvements in health, which were rapid in areas such as Central Europe. In contrast, the steady deterioration in Central Asian republics was continuing.

This collapse of economic output has had negative effects on population health indicators throughout Central Asia, such as lowered life expectancy and rising adult death rates. The situation in Central Europe was much better. The reasons for this diversity in patterns of changing mortality are multifaceted, reflecting a complex interplay of factors, ranging from underlying economic and political circumstances to more proximal risk factors, such as lifestyle related determinants of health. However, we can expect that changes in health care associated with the socio-economic transition also contributed to changes in population health in central Europe. Recent research suggests that some of the more economically successful former socialist countries have seen tangible improvements in outcomes attributable to health care.

After the collapse of the Soviet Union the Baltic states started to experience the gradual decline in mortality that had been observed in all of the European nations during the past century. But, as part of the now defunct the Union of Soviet Socialist Republics (USSR), they were also subjected to the abrupt changes accompanying the move in and out of Socialism and the policies of the latter. The impact of the increased use of new medications, modern medical procedures, and surgery (in particular regarding diagnostics and therapy of circulatory diseases) is investigated as well as the role of risk factors and related lifestyles. In the low mortality populations, such as France, Spain and the USA the mortality levels showed similarities and it was lower compared with the other selected countries. How these dramatic changes regarding to the collapse of the Soviet Union influenced to the mortality levels in the post-communist countries? Especially, how did these changes in the case of the cause-specific mortality levels in these countries. Nowadays, we have an opportunity to analyze the changes in mortality over time based on the datasets from the international data source, for instance, like in our case from the World Health Organization Mortality Database. The analysis of the mortality rates among the selected countries started from the period of the restructuring of the Soviet political and economic system (perestroika) and pre-dissolution time (1985). The end of the study period is time of relative economic stabilization in these regions (2005).

## 1.2 Relevance of research

Analysis of mortality development, especially, cause-specific mortality levels in the selected countries has a curiosity in demography. Nowadays, less literature regarding to the mortality levels by main causes of death in the case of the Central Asian region can be found. This issue is open and attractive to discussion for researchers. As mentioned before in the post-communist countries mortality crisis was experienced. The timing of this demographic crisis coincided with the introduction of market reforms in the former Soviet Union, suggesting that rising mortality was related to the transition to a market economy. But mortality trends in the transition countries of post-socialist Europe differ markedly from those of the former Soviet Union. Despite a declining gross domestic product (GDP) and sharply rising unemployment rates in many post-socialist European countries in the early – to mid-1990s, mortality rates fell and life expectancy rose throughout the region. The novelty of this study is analysis of the mortality situation in the countries of Central Asian region, which is less known, especially in cause-specific case.

## 1.3 Research goal and objectives

The research contrast the cause-specific mortality levels in selected post-communist countries with those of low mortality populations such as France, Spain and the United States of America between the period of 1985 and 2006, respectively. This include former Soviet Union countries from Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan), Central Europe (the Czech Republic, Slovakia, Poland and Hungary), and the Baltic states (Estonia, Latvia and Lithuania). The aim of this study is to analyze the changes in the mortality levels and

its structure by the main causes of death by sex and age, and confronted with low mortality populations such as those of France, Spain and the Unites States between the period of 1985 and 2005. Implementation of the aim involves the following objectives:

- to analyze differences in total mortality measured by life expectancy at birth;
- to focus on differences in cause-specific mortality levels by main causes of death;
- to consider relative frequency (in %) of the standardized death rates by main causes of death;
- to analyze excess male mortality by main causes of death;
- to describe age-standardized (15–64 and 65+) death rates by main causes of death.

## 1.4 Outline of thesis

The presented research consists of six chapters including introductory part and conclusion. In the **introductory part** the problem definition, goals and objectives, relevance of the theme are introduced.

The **second chapter** is focused on literature review by many well-know authors and research publications as well as by many other available recourses. Also the theoretical background of the thesis can be found in the following chapter. The main attention is paid to epidemiological transition theory, which provides an overall view on the movement of societies from high mortality to a modern society experiencing low mortality levels. Also the gender gap is discussed. In some of the selected countries the narrowing gender gap are observed.

The **third chapter** includes data source, its availability and quality and basic methodological issues for mortality analysis.

From the **fourth chapter** the analytical part of this research started. This chapter is dedicated to the general mortality levels among the selected countries measured by life expectancy at birth between the selected periods. This part of analysis introduces the reader into the general mortality conditions between the selected periods of time. In order to obtain summary measures which take account of compositional effect by main causes of death the decomposition of life expectancy by age and main causes of death was presented in the following chapter.

The core analysis of this thesis is outlined in the **fifth and sixth chapters**. In these chapters are presented the cause-specific mortality analysis and its changes over time. Moreover, the cause-specific mortality level and its relative frequencies are discussed. All of the explanations and commenting of the results of the analysis mainly based on additional information from literature. Moreover, in these chapters age-standardized death rates in selected countries are shown.

In **conclusion** discusses the relevance of the results of the thesis. The list of references and annexes are located at the back of the volume.

# Chapter 2

# Theoretical part

## 2.1 Overview of literature

There is a wide choice of literature related to the epidemiological literature describing mortality. The theoretical background on the topic of the research was based on several pieces of work by demographers and scientists. For instance, Abdel Omran's (1971) theory of "Epidemiological Transition" was the first attempt to account for the extraordinary advances in health care made in industrialized countries since the 18th century. Later on the analysis and comparison of mortality patterns in several economies has led Omran (1971, 1982) to formulate his "Theory of the Epidemiological Transition". The cardiovascular revolution of the 1970s launched a new period of progress. However, work by Jay Olshansky and Brian Ault (1986), Richard Rogers and Robert Hackenberg (1987) followed without criticizing the basic premises of the theory of epidemiologic transition. They introduced the idea of a "fourth stage" during which the maximum point of convergence of life expectancies would seem to increase thanks to achievements in the treatment of cardiovascular diseases.

The essence of health transition research is its multidisciplinary character and openness to broad theory. Theories of health transition provide the context in which classic epidemiological studies can, most effectively, contribute to a population's health improvement. Healthy lifestyles are collective patterns of health-related behavior based on choices from the options available to people according to their life. The "Health Transition" theory was described by authors such as Caldwell and Santow (1991) "Preface. Health Transition Review", Caldwell et al. (1990) "What we know about health transition: the cultural, social and behavioural determinants of health", Vallin and Mesle (2004) "Convergences and divergences in mortality: a new approach of health transition". In the paper of Vallin and Mesle (2004) in the health transition theory, the ages described by Omran are considered as the first stage, characterized by external conditionality of mortality decline – depending, in a broad summary, on the quality and availability of information, sanitation and medicine. For the successful second stage, which

begins with the cardiovascular revolution, apart from medical advances much more individual responsibility with respect to individual's own health is needed (Vallin and Mesle 2004).

Moreover, in the theoretical background of the research another important process regarding the faster decline of old mortality and a narrowing gender gap was stressed. These problems are clearly presented in papers Austad's article "Why women live longer than men: sex differences in longevity" (Austad 2006), Oksuzyan and others "Men: good health and high mortality. Sex differences in health and aging" (Oksuzyan et al. 2008), Oksuzyan, Brønnum-Hansen, and Jeune (2010) "Gender gap in health expectancy" (Oksuzyan, Brønnum-Hansen, and Jeune 2010) and more detailed facts were described in Thomas and Ruth article "Why women live longer than men" (Thomas and Ruth 1999).

For instance, Austad's paper discussed that the historically, women have lived longer than men in almost every country in the world. He is also analyzed sex differences in longevity in many other species; however, it is not clear if there are more species in which females live longer or vice versa. For virtually all the primary causes of death and at virtually all ages, mortality rates are higher for men. Women do not live longer than men because they age more slowly, but because they are more robust at every age. Paradoxically, although women have lower mortality rates they have higher overall rates of physical illness than do men. Despite their lower mortality rates at virtually every age, women have higher overall rates of physical illness, more disability dais, more doctor visits, and more hospital stays than do men. The difference in longevity between women and men in short- and long-life countries is simply the starting point, regardless of culture; apparently, there is a fundamental slope that defines human aging (Austad 2006).

The next authors who are focused on sex differences are Oksuzyan, Brønnum-Hansen, and Jeune (2010). According to their paper, men have higher death rates than women, but women do worse with regard to physical strength, disability, and other health outcomes, the so called male–female health-survival paradox. The paradox is likely to be due to multiple causes that include biological, behavioral, and social differences between the sexes. Despite decades of research on the male–female health-survival paradox, we still do not fully recognize whether behavioral factors explain most of the gender gap or whether biological and social differences contribute more substantially to the explanation of the sex differences in health and mortality (Oksuzyan, Brønnum-Hansen, and Jeune 2010).

Unfortunately, the amount of literature concerning mortality patterns and trends in the post Soviet Central Asia region are limited, which is largely due to a lack of research in this region. However, some research dedicated to the mortality patterns and trends was found in McKee, Healy and Falkingham's "Health care in Central Asia" and they endeavored to describe the situation in the Central Asian republics after facing enormous challenges in embarking on health sector reform. This was due to their changing economic circumstances combined with the process of constructing new systems of government. Also, little is known outside the region about health care systems of these countries, or their experience over the last decade in seeking to restructure and improve their health services. On the one hand this literature disputes precisely this kind of cross-national health policy analysis. Drawing on an extensive network of experts and policy-makers working in a variety of academic and administrative capacities, these

studied seek to synthesize the available evidence on key health sector topics using a systematic methodology. With this focus, the series seeks to contribute to the evolution of a more evidence-based approach to policy formulation in the health sector. By examining closely both the advantages and disadvantages of different policy approaches, and to stimulate the development of strategic responses suited to the real political world in which health sector reform must be implemented. On the other hand, this literature has less discussion of the cause-specific mortality conditions. However, analysis of the general mortality level among Central Asian region can be found (McKee, Healy, and Falkingham 2002).

There is a growing body of evidence suggesting that negative health lifestyles are the principal social determinants of the mortality crisis in the former socialist states. Little is known, however, about health lifestyles in Central Asia, where the downturn in life expectancy was also experienced. Cockerham et al. in their paper "Health lifestyles in central Asia: the case of Kazakhstan and Kyrgyzstan" examined health lifestyles in Kazakhstan and Kyrgyzstan in order to fill an important gap in the literature firstly. Secondly, this paper analyzed the improvements in longevity of the Kyrgyz population, and that such lifestyles are far more positive in Kyrgyzstan despite the somewhat better economic situation in Kazakhstan, where the mortality crisis continues (Cockerham et al. 2004). The paper by Mesle and others "Causes of death in Russia: assessing trends since the 50s" looks at circumstances of premature deaths of working-age men in Russia. The findings reveal significant independent and combined mortality impacts of education, marital status, unemployment, smoking, and alcohol consumption on mortality from cardiovascular and external causes. The study provides evidence of premature cardiovascular death associated with heavy drinking (Mesle et al. 1992).

Moreover, researchers such as Guillot et al. (2011) presented their paper "Mortality in Central Asia before and after the break-up of the Soviet Union: Evidence from Kyrgyzstan". In this paper, they take advantage of unpublished official mortality data from one Central Asian republic, Kyrgyzstan, to examine the reasons for this divergence. Also, authors examine the causes of death that explain the divergence between Kyrgyzstan and Russia. This divergence is overwhelmingly attributable to external and cardiovascular causes, and more generally, to causes that have been demonstrated to be strongly related to alcohol consumption. This result is interpreted in view of the respective social, economic and cultural contexts of Russia vs. Kyrgyzstan (Guillot et al. 2011).

Another source of the mortality conditions in the post-communist countries was disused by Nolte, McKee and Gilmore (2004) in their paper "Morbidity and mortality in transition countries in the European context". In this paper examined the mortality in the countries of the former Soviet Union, they analyzed mortality patterns from the break up of the Soviet Union till the recent time. Also, they are discussed the importance of specific risk factors to health in determining the patterns of morbidity and mortality in the transitional countries in central and eastern Europe and the countries of the former Soviet Union. The next paper which focuses on mortality in the socialist area is Carlson and Hoffman "The state socialist mortality syndrome" where the death rates in European state socialist countries deviated from general improvements in survival observed. The magnitude of structural labor force changes across countries correlates with lagged increases in death rates for men in the working ages. Occupational contrasts within

countries similarly show concentration of rising male death rates among blue collar workers. Collapse of state socialist systems produced rapid corrections in labor force structure after 1990, again correlated with a fading of the state socialist mortality syndrome in following decades (Nolte, McKee, and Gilmore 2004).

Unfortunately, regarding to the publications about mortality, especially cause-specific details in USSR there are few mortality studies in Soviet time. These studies analyze mortality trends in Eastern Europe and the former Soviet Union and identify the driving forces behind observed temporal changes. The paper by France Mesle "Mortality in Eastern Europe and the former Soviet Union: long-term trends and recent upturns" presents mortality trends in many countries of this region during the last thirty years. From the mid-1960s to the late 1980s all countries experienced similar and unfavorable mortality trends due to rising mortality at adult age. However, in the 1990s these trends began to diverge in different parts of the region due to significant life expectancy increases in Central and Eastern Europe and continuous life expectancy decreases in the former Soviet Union. The two contrasting trends were decomposed by causes of death, suggesting some causal mechanisms for the health crisis (Mesle 2002).

Also Mesle, Shkolnikov and Vallin (1992) presented article "Mortality by cause in the USSR in 1970–1987: the reconstruction of time series", which is dedicated an exploration of Soviet causes of death statistics which become accessible after 1986. There discussed the reconstruction of consistent annual series for the period 1970–1987 in spite of changes in cause of death classification caused by the 1980 revision of the Soviet nosological system. Moreover, in this paper the series thus reconstructed are analyzed to describe the main features of the evolution of mortality during the selected period. Trends in causes of death are shown for the crucial period where life expectancy has grown again after two decades of regression.

Andreev, Biryukov and Shaburov (1994) in their paper of "Life expectancy in the former USSR and mortality dynynamics by cause of death: regional aspect" presented mortality trends in the former USSR in terms of demographic transition theory. Moreover, historical background of mortality trends in the USSR from the mid-1960s was discussed. The worsening mortality level in the Soviet Union continued up to 1980. Then expectation of life increased somewhat due to declines in exogenous diseases. All of this and other reasons of changes in mortality trends among the Soviet Union can be found (Andreev, Biryukov, and Shaburov 1994).

After remarkable demographic transformation in the past twenty years the formerly socialist countries of Eastern Europe and the former Soviet Union had experienced. The other facet of this demographic transformation is nearly unprecedented changes in adult mortality rates. Brainerd presented paper "The demographic transformation of post-socialist countries. Causes, consequences and questions". This paper discusses the dimensions and most likely causes of these demographic changes and assesses the possible consequences of the changing mortality patterns. Much remains unknown about the underlying reasons for the demographic transformation of the region; directions for future research in this area are discussed (Brainerd 2009).

Concerning the mortality patterns in post-socialist Central European countries a considerable amount of work has been conducted. The findings of Rychtarikova "The case of the Czech Republic. Determinants of the recent favourable turnover in mortality" started to

analyze from the period of the collapse of the socialist system at the beginning of the 1990s. It discussed how the health situation in the Czech Republic has improved more rapidly than in other Central and Eastern European countries. Also, the recent decline in mortality is likely to be attributable to technical progress in medical treatment and less affected by the change in lifestyle. While the use of cardiovascular drugs and the number of operations of invasive heart-surgery considerably improved (Rychtarikova 2004).

The three Baltic States, Estonia, Latvia, and Lithuania, constitute an interesting population laboratory for testing hypotheses concerning the determinants of mortality changes. These countries have experienced a gradual decline in mortality observed in all the European nations during the past century but, as part of the now defunct USSR, have also been subjected to the abrupt changes accompanying the move in and out of socialism, and the policies of the latter. Gaume and Wunsch in their work "Health and death in the Baltic States" proffer comprehensive research on mortality levels and trends and also, somewhat at a loss of relevant results when explaining spatial and temporal differences in mortality. Several determinants of mortality changes in the USSR have been proposed and many of these factors can be applied to the Baltic situation too (Gaume and Wunsch 2003). The purpose of Krumins's paper "The mortality consequences of the onset of transition: case of Latvia" was to examine the recent mortality changes and differentiation in Latvia and factors behind them during the transition from a centrally planned soviet type economy to a market oriented economy and democratic society. The analysis is mainly based on published and partly on unpublished statistical data of the post-war period. The year 1989 is used as a general baseline to evaluate the impact of socio-economic changes on mortality and health status (Krumins 2001).

In the analysis of the cause-specific mortality in European countries, also the papers for whole region were used. They are works researchers such as Sans, Kesteloot and Kromhout "The burden of cardiovascular diseases mortality in Europe", Ilkka Henrik Makinen's paper "Eastern European transition and suicide mortality", moreover, the paper of Dobrossy "Cancer mortality in central-eastern Europe" and so on. In these papers are concentrated mainly for the one disease for all European regions, which is obviously advantage. However, disadvantage of such kind of the contributions is territorial size of the observed regions.

The issue of mortality within demography still remains an important factor in a population's development. The literature presented in this research is available from different sources. However, the articles and research on this theme are not wide spread, especially on the former Soviet Central Asian republics. Significantly, the presented above overview of literature and statistics clearly indicated that there is a lack of research in the field of mortality in Central Asia despite the principal importance of the mortality process for population development within countries. Another problem which was described in a lot of the articles regarding Central Asian regions included differences in statistical data. Thus further research needs to be conducted, not only to improve the collection of official statistics on births and deaths in many countries across the region, but also to improve the effectiveness of surveys as a measurement tool.

## 2.2 Theoretical background of research

Basic principles of epidemiological transition and its relation to the demographic transition was well described in the 20th century by demographers such as Omran (1971, 1977); Philips (1994). Currently, the concept of epidemiological transition in the expansion of its interpretation can be considered as the basic theoretical model that explains the demographic change in morbidity and mortality.

Conceptually, the theory of epidemiologic transition focuses on the complex change in patterns of health and disease and on the interactions between these patterns and their demographic, economic and sociologic determinants and consequences. An epidemiologic transition has paralleled the demographic and technological transitions in the now developed countries of the world and is still underway in less-developed societies. Ample evidence may be cited to document this transition in which degenerative and man-made diseases displace pandemics of infection as the primary causes of morbidity and mortality (Weisz and Olszynko-Gryn 2009).

According to the theory of epidemiological transition, the demographic situation has radically changed. In particular, that the structure of mortality by causes, detailed changes in the prevalence of exogenous causes of death become the primacy of endogenous and quasi-endogenous.

The beginning of this historic shift exceeds a century, when specialists were assigned to the middle of the 19th century. Although the first signs of it appeared in the 18th century, it was in the mid-nineteenth century, According to some scientists due to the action of general socio-economic factors generated by the development of a bourgeoisie society. The added effect is that some specific factors affect the health and life of people directly, regardless of their level of welfare. This is particularly true when considering new sanitary and hygienic conditions. Moreover, a new role for medicine resulting from industrial development and related scientific, technological and cultural progress, as well as some of the changes eco-biological conditions.

All of these factors will dramatically reduce deaths from epidemic and other infectious diseases which have taken millions of lives in the recent past. Simultaneously, this led to an increase in the proportion of people dying from diseases of the circulatory system and neoplasm. It is this radical change to the structure of mortality is called epidemiological transition.

In accordance with the role of reasons, the exogenous and endogenous causes are divided into the following stages of epidemiological transition by Omran:

1. The Age of Pestilence and Famine
2. The Age of Receding Pandemics
3. The Age of Degenerative and Man-Made Diseases

During the first or pre-transition stage, the age of pestilence and famine is characterized by fluctuating mortality in response to an epidemic, famines and war. The Crude Death Rate (CDR) is high and ranges from 30 to over 50 death per 1,000 population. Life expectancy at birth is low, between 20 and 40 years, and the leading causes of death are infectious and parasitic diseases, such as influenza, diarrhea and tuberculosis.

In the second stage of epidemiological transition, the age of receding pandemics, is a transitional phase. During this stage, mortality starts to decline. CDR reaches a level of less than 30 deaths per 1,000 population, and life expectancy at birth increases to about 55 years. Improved sanitation, hygiene and nutrition, and later also advances in medicine and public health programmes, help control epidemics and pandemics of infectious and parasitic diseases (Omran 1971; Olshansky and Ault 1986; Olshansky et al. 1998). As a result, an increasing number of people no longer die from infections at young ages but from chronic degenerative diseases at middle and older ages. However, in the second stage rises in morbidity and mortality quasi-endogenous causes, such as diseases of the circulatory system, neoplasm start. They then move onto an increasingly young age. Increased levels of pollution, psychological and physical stress may have contributed to this, however it is not certain. More research is required to give this theory more credence. At the same time increasing mortality from accidents, especially in manufacturing was observed.

During the third stage of the age degenerative and man-made diseases, mortality continues to decline until it stabilizes to a level of less than 20 deaths per 1,000 populations. In addition, life expectancy at birth increases and exceeds 70 years by the end of the third stage (Omran 1982). The major causes of death are so-called chronic degenerative and man-made diseases, cancer and diabetes. The term "man-made disease", hereby, includes diseases related to radiation, accident, food additives, occupational hazards, and environmental pollution. Then, the struggle for environmental protection and improvements to the living conditions of people begins. Their work and life conditions are one of the main criteria for the development of new technology, which can minimize threats to the health and lives of people. More and more people have begun to live a healthy lifestyle, get rid of bad habits, exercise, eat correctly and generally follow reasonable hygiene guidelines. Further medical progress in the prevention not only reduces the incidents, but also mortality from many causes. As a result, life expectancy increases, as the average expected age of death from most diseases increases (Omran 1971).

A large number of epidemiological transition factors affecting mortality and life expectancy. As a consequence, many of them are classified in different ways and highlight the key points and different aspects of health and life expectancy.

In particular, A. Omran (1971) distinguishes the following groups of factors of epidemiological transition:

- Eco-biological (state of the environment, the presence of pathogens, especially the human immune system)
- Socio-cultural (economics, politics, the level and lifestyle, nutrition, hygiene and so on)
- Health (sanitation, treatment and preventive measures)

The "cardiovascular revolution" of the 1970s launched a new period of progress. However, the work of Jay Olshansky and Brian Ault (1986) was followed by Richard Rogers and Robert Hackenberg (1987), without criticizing the basic premises of the theory of epidemiologic transition. However, they introduced the idea of a "fourth stage" during which the maximum point of convergence of life expectancies would seem to increase thanks to achievements in the treatment of cardiovascular diseases (Caselli, Mesle, and Vallin 2002).

Olshansky and Ault (1986) have called this the "*Age of Delayed Degenerative Diseases"* which they see as a stage that will propel life expectancy into, and perhaps beyond, the eighth decade. The major degenerative causes of death that prevailed during stage 3 of the transition remain as major killers, but with relatively rapid improvements in survival concentrated among the older population (Smallman-Raynor and Phillips 1999).

The fourth stage of the epidemiologic transition in the age of delayed degenerative diseases, when mortality rates for males had stabilized during 1950s and 1960s is a result of "epidemics" of cardiovascular disease. As such, male mortality again began to decline from around 1970 onwards (Mackenbach 1994). Olshansky and Ault (1986) considered this decline as a new stage in the epidemiologic transition. The age of delayed degenerative diseases is characterized by "rapid mortality decline in advanced ages that are caused by a postponement of the age at which degenerative diseases tend to kill" (Olshansky and Ault 1986). The postponement of death from degenerative diseases is a result of additional public health measures and advances in medical technology. Life expectancy at birth is expected to reach over 80 years by the end of this stage.

Rogers and Hackenberg (1987) also put forward a fourth stage of the epidemiological transition. They agree with Olshansky and Ault (1986) that the major causes of death are still due to degenerative and man-made diseases. Each is becoming increasingly influenced by individual behaviour and new lifestyles, influences not concretely addressed in the present theory. The point they stress the most is the fact that Omran did not include violent deaths in his theory, or deaths due to social pathologies (such as accidents, suicides and homicides).

In recent years, the growing importance of infectious and parasitic diseases has been reported in developed countries (Olshansky et al. 1998; Smallman-Raynor and Phillips 1999). Diseases that were thought to be under control seem to have reappeared (e.g. tuberculosis) while, at the same time, "new" diseases and viruses have emerged, such as HIV/AIDS and hepatitis C and E. Olshansky et al. (1998) suggest that the re-emergence of infectious and parasitic diseases may indicate a fifth stage in the epidemiologic transition (Omran 1971).

The fifth stage of epidemiological transition was developed by Olshansky and others in 1997. This stage, which is tentatively referred to as the *"Age of Emergent and Re-emergent Infection"*, is associated with the resurgence of infectious and parasitic diseases (both old and "new") as a serious public health concern in developed countries. In particular, the emergence of AIDS as a leading cause of death among young adults in cities of North America and Europe, coupled with the re-emergence of some classical infectious diseases (most notably, tuberculosis). These factors have prompted Olshansky and others (Olshansky et al. 1998) to suggest that "the unique attributes of this "new" trend in infectious disease of mortality qualify it as a distinct stage in our epidemiologic history". The notion of "progress" through the stages of epidemiological transition is the subject of a substantial and ongoing debate (see, for example, Phillips and Verhasselt 1994). The first outline of the major progression variants as described by Abdel Omran are outlined next. Then a review of some of the major issues that have emerged from the broader debate on progress through the transition period will be carried out.

V.A. Borisov's classification differs somewhat from the classification of Omran (1971):

- Living standards

- Efficiency of health services
- Sanitary culture of the society
- Ecological environment.

In all the possible classifications there is a common thread such as living standards, sanitarian and so on. All of them are somehow isolated factors, which would be external to the person and inaccessible to his immediate control, and factors related to his lifestyle and behavior that he can somehow control. At the same time, as a set of factors and the importance they attached to one or the other authors, is sometimes determined not only by its pure research interests, but also some external ones like the science of motivation, even to political engagement.

However, the epidemiologic transition, even revised by Olshansky and other authors, seems to be challenged by dramatic exceptions observed since the 1960s in the general trend of increasing life expectancy. Not only have many countries lacked the means to experience the cardiovascular revolution, but a number of others, especially in Africa, have not yet completed the second phase of epidemiologic transition, and are now hard hit by the emergence of new epidemics like AIDS, or the resurgence of older diseases.

In the Soviet Central Asian countries one of the major theories that compete today in the stress-related explanation of the upsurge in mortality is the increase in alcoholism (Leon et al. 1997). The major alternative explanation attributes the rise in mortality to the increased consumption of alcohol that really occurred in the early 1990s according to above mentioned authors in the late 1980s, during the anti-alcoholic campaign, according to unofficial estimates.

The exception in the post-communist countries was a subsequent increase in mortality from causes other than infectious diseases and brought about overall rises in mortality from all causes combined. Another distinctive characteristic of the former Soviet case is the presence of unusually high levels of mortality from accidents and other external causes, which are typically associated with alcoholism (McKee et al. 1998).The variations among the republics conform broadly to expectations that mortality from infectious, digestive, and respiratory system disease is the highest in the less-developed Central Asian republics and the lowest in the Baltic countries. Theoretical frameworks, which could explain mortality differences between regions usually, incorporate other factors such as medical care based on differences in access and quality of medical care. Environmental pollution: also causes certain diseases in various areas. However it is mainly the socio-economic situation and education which enforces healthy behavior, while wealth gives a higher quality of life. Economic affluence permits that the implementation of these factors are influenced by psychosocial stress which may cause excess mortality (Bobak and Marmot 1996).

Special attention needs to be given to lifestyle and diet: smoking, being overweight, physical inactivity and an unhealthy diet because they are risk factors for many chronic diseases. The change in lifestyle of western populations considered as a major determinant of mortality decrease during the fourth stage of the epidemiological transition (Rychtarikova 2004).

In more developed countries, the transition to a new stage of epidemiological transition has been paired with a significant increase in health costs. For example, in the USA, their share in

GDP rose from 5 % in 1960 to 14 % in 1994, 7 % (with significant growth of the GDP). 8–10 % of GDP spent on health care (for the most part from public funds) a level typical of the rich European countries.

According to Mackenbach (1994), the epidemiologic transition theory provides a potentially powerful framework for the study of disease and mortality in populations, especially for the study of historical and international variations. Although its primary purpose was to describe and explain the spectacular fall in mortality which has occurred in all currently industrialized countries, it can also be used to speculate on the likely consequences of future changes in mortality in countries which are lagging behind those which have already completed the epidemiologic transition. Will a fall in infectious disease mortality in currently developing countries lead to a rise in chronic diseases and accidents? In addition, this notion of a more or less fixed pattern of changes over time in cause specific mortality may lead us to interpret cross sectional differences between countries in cause specific mortality as being due to a different timing of the epidemiologic transition, which in turn would suggest differences in stage of economic and social development as likely causes (Mackenbach 1994).

The "health transition" concept moves beyond demography and epidemiology to include the social and behavioural changes that parallel and drive the changing patterns of fertility, illness, disability, and death (Kahn 2006).

Today, the term health transition is preferred by some as it is felt to be a broader concept, involve the cultural, social and behavioural determinants of health and implies a concern with health and survival rather than death. It also implies continuing, socially influenced, change (see, for example, Caldwell et al. 1990, Caldwell and Santow 1991). The health transition, in its focus on the cultural, social and behavioural determinants of health, attempts to highlight factors other than medical interventions and income. It is generally accepted that the provision of modern medical services reduces ill health and lowers mortality, although its precise influence is difficult to quantify and disentangle from other sources of change. These include improving material living standards, education, housing and wider public health interventions. However, what Caldwell and Santow (1991) refer to as "the health transition factor" is also very influential. Societies with similar levels of income and provision of health services can exhibit very different levels of health and mortality. This is also seen in different cultures and families, or even between apparently similar households within the same societies. There is clearly a behavioural, attitudinal effect at work and also, a high probability of genetic or inheritance effect (Smallman-Raynor and Phillips 1999).

In the next two decades there will be dramatic changes and transitions in the world's health needs, as a result of epidemiological transition. At present, lifestyle and behaviour are linked to 20-25% of the global burden of disease (Omran 1971). This proportion is rapidly increasing in poorer countries. By the year 2020, non-communicable diseases are expected to account for seven out of every ten deaths in the developing regions, compared with less than half today. Injuries, both unintentional and intentional, are also growing in importance and by 2020 could rival infectious diseases as a source of ill-health (Weisz and Olszynko-Gryn 2009).

It was previously thought that, as countries develop; non-communicable disease replaced communicable disease as the main source of ill-health. However, there is now evidence that the

poorest in developing countries face a triple burden of communicable disease, non-communicable disease and socio-behavioural illness. The global burden of disease methodology shows that the epidemiological transition is already well advanced, suggesting that public health policy in poor countries, with its traditional emphasis on infectious disease, will need to adapt.

Three examples of health transition, according to the World Health Organization (WHO) are:

- The burden of mental illnesses, such as depression, alcohol dependence and schizophrenia, has been seriously underestimated by traditional approaches that take account of deaths only and not of disability
- Adults under 70 years of age in sub-Saharan Africa today face a higher probability of death from a non-communicable disease than adults of the same age in established market economies
- By 2020 tobacco is expected to kill more people than any single disease, even HIV/AIDS (WHO)

The take up of cigarettes, alcohol and drugs increases with exposure to modern lifestyles and western influences, and the greater personal autonomy and freedom of choice resulting from it. Unfortunately, faced with persistent poverty and destructive social changes, people in these transitional populations are often driven to abuse these substances as a way of escaping from chronic stress and sense of alienation. The inevitable cascade of adverse consequences follows. With increasing cigarette smoking, cardiac disease, respiratory illness and malignant conditions are bound to escalate. Tobacco production and consumption are increasing rapidly in developing countries, without as yet much of the prevention, control and cessation legislation and behavioural interventions evident in industrialized nations Alcohol contributes directly to alcoholic liver disease, malnutrition and dementia, and indirectly to violence, suicide and road traffic incidents. Illicit drug-use by parents results in abandoned children and child employment, while drug-use by children results in poor school performance (Kahn 2006).

Arguably, each major improvement concerning health is likely to first lead to a divergence in mortality since the most favoured segments of the population benefit most from the improvement. When the rest of the population accesses the benefit of the improvement (through improved social conditions, behavioural changes, health policies and so on), a phase of convergence begins and can lead to homogenization until a new major advance occurs. The entire health transition process thus breaks down into successive stages, each including a specific divergence-convergence sub-process (Vallin and Mesle 2004).

Girls generally tend to live longer than boys. However, the extent of this gender gap varies across countries and across time. Since 1960, the gender gap in life expectancy at birth in the world has slightly widened. Whereas in 1960 girls could expect to live 5.0 years more than men, in 2007 this difference was 5.6 years. However, patterns have changed over time. While the gender gap increased substantially during the 1960s and 1970s (reaching a peak of 6.8 years in the mid 80s), it has narrowed during the last 25 years. This “narrowing” pattern reflects in part a reduction in the gender differences in risk behaviours such as smoking and alcohol use. The reasons for the difference between male and female life expectancy are not fully understood. While some scholars argue that women are biologically superior to men and thus live longer,

others argue that men are employed in more hazardous occupations such as in factories, military service and so on.

It is well known that males and females differ in terms of their life expectancy and overall health. Males have a higher mortality level than females in terms of both total mortality and for most causes of death. Men's higher mortality is due in part to gender differences in risk-taking and health-related behaviour (e.g., males have higher rates of cigarette smoking and heavy drinking) and gender differences in employment. Several biological hypothesis have also been proposed including more active female immune functioning, the protective effect of estrogen, compensatory effects of the second X chromosome, reduction in the activity of growth hormone and the insulin-like growth factor signaling cascade, and the influence of oxidative stress on aging and disease (Austad 2006). There is a remarkable discrepancy between the health and the mortality of men and women. Despite the lower mortality at all ages compared to men, women's longer lives are not necessarily healthy lives and men tend to report a better self-assessed health and fewer disabilities. This phenomenon is called the male-female health-survival paradox (Oksuzyan et al. 2008). Proposed explanations for this paradox are rooted in biological, social and psychological interpretations. In addition to the above mentioned factors, there may be a reluctance or delay for men to seek and comply with medical treatment. It cannot be excluded that part of the differences in morbidity may be due to methodological challenges such as differential participation or underreporting of health problems by gender.

In some countries the gender gap in years with activity limitations increased with increasing poverty risk for the 65 years and older and with increasing employment rates among men and women. The gender difference in years with activity limitations was negatively associated with the expenditure on elderly care, indicating that the gender gap was larger in countries with a lower expenditure on elderly care.

According to the death rates for women are lower than those for men at all ages even before birth. Although boys start life with some numerical leverage-about 115 males are conceived for every 100 females – their numbers are preferentially whittled down thereafter. Just 106 boys are born for every 100 girls because of the disproportionate rate of spontaneous abortions, stillbirths and miscarriages of male fetuses (Thomas and Ruth 1999).

One of the main causes of death on the gender gap is heart disease. Men experience an exponential rise in the risk of heart disease beginning in their 40s; in contrast, women's risk of dying from heart disease does not begin to increase until after menopause, and it approaches the male risk only in extreme old age. Although the gender gap in these age groups is smaller than the one described for young adults, the number of people affected by it is far greater. Whereas accidents claim the lives of 45 of every 100,000 young adult males annually, heart disease-the leading cause of death in men and women alike-kills 500 of every 100,000 men between the ages of 55 and 64 every year.

But some sociologists have discounted this reasoning, pointing instead to women's changing roles in society. As more women have taken on behaviors and stresses that were formerly confined to men-smoking, drinking and working outside the home – they have become more likely to suffer from diseases that were traditionally considered "masculine". Mortality from

lung cancer, for example, has almost tripled in women in the past two decades in the world. Smoking seems to be the "great equalizer" for men and women (Thomas and Ruth 1999).

During the Epidemiologic Transition changes in the cause of death pattern from mainly infectious diseases and external causes of death to chronic diseases were accompanied by a shift in the age pattern of mortality from younger towards older ages. During the third stage mortality began to concentrate at the older ages and was mainly caused by chronic diseases. The objective of this theory's analysis is to study the trend of the last stage of the epidemiologic transition in developed countries, and to find out the extend to which this fourth stage, during which deaths by degenerative diseases are postponed to older ages, has been experienced, and if we are heading to, or already in, new stages.

In an article published by Vallin and Mesle, Omran recognizes the existence of one and possibly two additional stages to his initial epidemiological transition theory. According to him, the fourth stage that he called the "*Age of declining cardiovascular mortality, ageing, lifestyles modification, emerging and resurgent diseases*", is characterized by an ongoing rise in life expectancy until it reaches 80 to 85 years or longer. This is especially true for females; with a stabilization followed by a decrease in cardiovascular diseases as a cause of death; as well as by the emergence of new diseases (HIV, Hepatitis B and C, Ebola, Lyme disease, Hantaan virus, New forms of E.Coli and so on) as well as the revival of former diseases (Cholera, Malaria, Dengue, Diphtheria, Tuberculosis, Plague and Chagas disease). The Fifth stage, the *"Age of aspired quality of life with paradoxical longevity and persistent inequities"* for the mid-21$^{st}$ century and beyond, is expected to be one of great human achievements in disease control, health promotion, and further prolongation of healthy life. Inevitably this stage will include, paradoxically, longevity and the emergence of new morbidity and persistent inadequacies. There will be disparities between people because of the polarization of socio-economic status within and between countries (Vallin and Mesle 2004).

Another related finding is that the overall health costs increased with increase in GDP rather than with the shape of old people. This means that the high quality of health care, characterized by high-tech diagnoses, treatment and the use of medicine, is a driving force for the increase in health expenditure. Another reason for rising health cost, and probably the most important, is the inefficiency of the health system. Monopolies in the medicine sector and bureaucracy have successfully prevented structural reforms towards a more patient-oriented heath care system (Hoffmann 2008).

Most of the decline in mortality and gains in life expectancy during this recent mortality transition have been achieved in the elderly population – a phenomenon so unexpected and unexplained that it has been referred to as a new stage in the epidemiologic history of developed nations. Consequently, this emergence of ninety-year old and centenarian populations throws a new doubt on the now traditional theory of epidemiological transition and its explanations. A theory that explains how we reached the current stage still remains to be found, with age-specific mortality trends, the emergence of the oldest-old, factors determining their states of health, in particular their functional state, and the causes of their death. Thus, a theory that can be used to improve forecasts for the future still remains to be found.

## 2.3 Research questions and hypothesis

Research questions will be replied in this research follow the aim which specified above in section 1.3. Consequently, for a full and comprehensive study of this work should be consider to answer the following questions:

- Did the development in the general mortality patterns in the selected countries between the periods of 1985 and 2005?
- Did the improvements in patterns of the cause-specific mortality levels among the selected countries observed in the same period of time?
- Were the developments in the relative frequencies by main causes of death noted in the selected countries in the same time periods?
- What are the levels of the excess male mortality by main causes of death among the selected countries?
- How are the levels of mortality at the adult (15–64) and old age (65 and over) in the selected countries?

Regarding to the cause-specific mortality analysis in the selected countries is aimed at; the following hypotheses will be tested during the study. There are two main groups of hypotheses on the reasons of mortality levels in Central Asia countries.

1. Hypotheses regarding to the general mortality levels:
   1.1. The low expectation of life at birth in the recent time among the post-communist countries is mainly due to the consequences of the collapse of the Soviet Union, such as the political, economic and social transformation, and socio-economic conditions in these countries impact on their mortality levels.
   1.2. The leading three causes of death (cardiovascular diseases malignant neoplasm and external causes) in this region consist of the largest components and they are mainly affected in life expectancy.
2. Hypotheses with regard to cause-specific mortality levels and structure:
   2.1. Mortality changes by the main causes of death recently observed in the societies of developed western countries are compared to post-socialist countries including socio-economic conditions and health care system, the convergence in mortality trends is assumed.
   2.2. The leading cause of mortality is the death due to the diseases of cardiovascular system, and its half of the all causes in the former Soviet Central Asian region.
   2.3. Increase of external causes, especially, death due to suicide in the Central Asian countries after the collapse of Soviet Union due to the psychosocial stress caused by economical crisis and unemployment and it is relatively high in the recent time.
   2.4. Despite of break up of the Soviet Union, the Central Asian countries experience a "Russian pattern" of high excess male mortality which will likely be maintained in the future. While the other post-socialist countries are remained in the position of the "intermediate group".

During the analysis these hypothesis which listed above will be tested.

# Chapter 3

# Methodology and data

## 3.1 Data sources and availability

In preparing this PhD thesis, demographic data was taken from different sources. Data on mortality for the selected countries was sourced from the World Health Organization Mortality Database (MDB). The International Classification of Diseases (ICD) is the international standard diagnostic classification for all general epidemiological, many health management purposes and clinical use. These include the analysis of the general health situation of population groups and monitoring of the incidence and prevalence of diseases and other health problems in relation to other variables. These include the characteristics and circumstances of the individuals affected, reimbursement, resource allocation, quality and guidelines. The data are included is limited to those countries reporting accurate data properly coded according to the ICD. The research analyzed mortality data classified according to the 9$^{th}$ (ICD9) and 10$^{th}$ (ICD10) revisions of the ICD, for the years of 1985 and 2005. The data is available for all post-communist countries and low mortality populations in the years 1985 and 2005. During the data collection problems were found with the data from countries of the former Soviet Central Asian (Turkmenistan and Tajikistan) and post-socialist Central European area (the Czech Republic and Slovakia). Similarly, in Turkmenistan the last available mortality data was until 1998. In the MDB population data for Tajikistan was until 2004. That is why Tajikistan's population data for the end of studying period (2005) was taken from the United Nations Population Division. As is well known from 1918 the Czech Republic and Slovakia were one state – Czechoslovakia, which was a sovereign state in Central Europe and in 1993 Czechoslovakia peacefully split into the Czech Republic and Slovakia. In MDB mortality data for the Czech Republic starts from 1986 and for Slovakia it begins only from 1994. For the analysis, data for the Czech Republic and Slovakia in 1985 was taken from vital statistics.

Moreover, demographic data on age-specific standardized death rates by main causes of death of mortality levels among the selected countries was collected according to the following

characteristics: periods: 1985 and 2005; population aged 0–85+; for males, females and both sexes separately.

## 3.2 Quality of data

The MDB presents the number of deaths classified by age, sex and cause of death for all selected countries. Whereas the given indicators published in the MDB do not occur in the problem comparability of results.

In this study ICD9 and ICD10 was used. The 9th revision of ICD was convened by WHO for 1975. ICD10 came into effect in 1993 (Pechholdova 2010). Since 1990, several different classifications of causes of death introduced in different years have been used in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Kyrgyzstan adopted the ICD10 much earlier, in 2000, while Kazakhstan and Uzbekistan adopted it in 2004. The other countries of Central Asia still use ICD9 classification. Ideally, to fill in the breaks in the statistical series due to changes in the cause of death classification, a precise reconstruction method should be applied (Mesle et al.1992; Mesle and Vallin 1996). However, such a time-consuming method can be replaced by a rough grouping of classification items that make it possible to capture major changes in cause-specific mortality by dealing with very broad groups of causes.

The most widely recognized feature of the former Soviet demographic statistics is the different set of definitions applied to the components of the infant mortality rate. The Soviet definition only counts breathing as a sign of life, and presumes infants who are born before the end of 28 weeks of gestation, or who weigh less than 1,000 grams at birth (there is considerable overlap between these two groups) to be non-viable – they are not counted as live births until they have survived a full seven days (or 168 hours). If they survive for less than this time, they are considered as miscarriages, and not counted at all. Table 1 presents detailed differences in Soviet and WHO definitions of live births and stillbirths. In contrast, the standard international definitions of the United Nations and the World Health Organization consider as live births infants who exhibit some sign of life upon delivery. This differences lead to sizeable understatement of the infant mortality rates in official Soviet statistical sources relative to the rates obtained for countries that follow the international standards. A live birth as it is currently defined may reduce the infant mortality count. Misreporting, for example the reclassification of infant deaths as stillbirths, also appears to have increased throughout the 1990s. In some countries, deaths of older infants may be recorded as deaths of children aged over one year. And it is clear that in a few countries, the registration of births and infant deaths is less than complete because unregistered births and deaths are not included in official statistics. It must be added that most of this hard evidence pertains to the Commonwealth of Independent States (CIS) (Aleshina and Redmond 2003). In the life expectancy calculations using incomplete mortality data in the results could be higher than it is actually valued. Particularly high levels of mortality under-registration are observed in countries, which were affected by armed conflicts during 1990's, in the case of this study it is Tajikistan, which experienced a civil war.

***Tab. 1 - Soviet and WHO definitions of live birth and stillbirth (1937–2008)***

| | Infant born after the end of the 28th week of pregnancy | | | |
|---|---|---|---|---|
| | No signs of life | No breath but other signs of life | Died during the first 7 days | Survived the first 7 days |
| USSR | Stillbirth | | Live birth | |
| WHO | Stillbirth | Live birth | | |
| | Infant born before the end of the 28th week of pregnancy; or with weight under 1,000 gr. Or length under 35 cm. | | | |
| | No signs of life | No breath but other signs of life | Died during the first 7 days | Survived the first 7 days |
| USSR | Miscarriage | | | Live birth |
| WHO | Stillbirth | Live birth | | |

Source: Anderson and Silver (1986)

Data quality is a much more complex issue for causes of death than for mortality levels in the Central Asian region. Researchers conclude that the problem that plagues the causes of death analysis in the New Independent States (NIS) is that the cause of death classifications in the Soviet Union changed over time, and the latest classification is different from the standard ICD9 (Aleshina and Redmond 2003). According to Bobadilla et al. (1997) this problem becomes more significant for some specific causes of death, such as cardiovascular disease. Shkolnikov, Mesle and Vallin (1995) address this incompatibility and adjust the classifications to provide a comprehensive review of trends. They also describe quality of data by causes of death in the former Soviet Union. They find that in many cases, sources of error compensate each other (Bobadilla et al. 1997). One of the most interesting findings is that the results do not support the widespread opinion about an over registration of cardiovascular mortality. Indeed, large errors observed for different cardiovascular diseases compensate each other; consequently, the percentage of error for the total number of cardiovascular diseases is rather small (Mesle, Shkolnikov and Vallin 1992). Unfortunately, some countries are not able to ensure complete registration of all death cases and births.

## 3.3 Overview of selected causes of death and their corresponding codes in ICD9 and ICD10

Health statistics do not include only mortality statistics, and cover the statistics of morbidity, but also cover all aspects of public health, and are usually taken to include statistics on cause-specific mortality. In this research the main causes of death were selected. As well known, the chapter of cardiovascular diseases is one of the large diseases and it comprises around half of the total causes, especially in the case of the Central Asian region. It was a main reason to split it into smaller parts. Firstly, this disease was divided into three parts: cerebrovascular diseases, ischemic heart diseases and other diseases of the circulatory system. During the analysis, the death due to ischemic heart diseases was in a small proportion, also, country grouping according their similarities by cluster analysis showed very heterogeneous result. After that, analyzing this chapter of disease into two parts (cerebrovascular diseases and rest) was decided. According to the analysis of splitting into two groups was observed clearer picture. Conclusively, in comparison of the analysis of two different way of divide (into two or three parts)

cardiovascular diseases split into two parts, such as cerebrovascular diseases and other diseases of the circulatory diseases were selected.

The selected main causes of death are: all causes, cerebrovascular diseases, and other diseases of the circulatory system, malignant neoplasm, external causes, diseases of the respiratory system, diseases of the digestive system and the remaining other causes of death.

In the first period of modern statistics (i.e. right after the establishment of systematic vital event registration) the classifications of causes of death were in the competence of respective administrative authorities and usually comprised simple short lists of the most frequent epidemic diseases and accidents. This has changed with the new advances of nosology and statistics in the 19th century. In 1853, the first international statistical body was founded and at this point starts the history of the classification of diseases as we know it nowadays under the initials ICD used for International Classification of Diseases (Pechholdova 2010). For analyzing cause-specific mortality levels among the selected countries in periods of 1985 and 2005 9th and 10th revisions of the ICD were used.

According to the selected countries four different causes of death code description tables were used. Table 2 illustrates codes of selected causes of death for all selected countries in 1985. The mortality data in the cases of Tajikistan (for 1985 and 2005) and Turkmenistan (for 1985 and 1998) were also calculated based on this table. These list of codes for the selected causes of death were taken form the basic tabulation list and the special coding for some newly independent states of former Soviet Union in the 9th revision. The differences between these two tables were small. Specifically, the main codes are same only they have an additional coding which is presented in the parentheses.

***Tab. 2 - List of WHO MD codes for the selected causes of death according to the 9th revisions of the ICD***

| Causes of death | ICD9 codes |
|---|---|
| All causes | B00 |
| Diseases of the circulatory system | B25-B30 (CH07) |
| Cerebrovascular diseases | B29 |
| Malignant neoplasm | B08-B14 (S08) |
| External causes of death | B47-B56 (CH17) |
| Diseases of the respiratory system | B31, B32 (CH08) |
| Diseases of the digestive system | B33, B34 (CH09) |
| Signs, symptoms and ill-defined conditions | B46 (CH16) |

Source: WHO Mortality Database documentation
(http://www.who.int/whosis/mort/download/en/index.html)

For analysis of mortality rates by main causes of death in the end of study period (2005) according to the 10th revision of the ICD coding were calculated. In 2005, the mortality data for Kazakhstan is separated from the selected countries. According to the code descriptions of causes of death, which was presented by WHO, codes for the other selected countries used ICD10 detailed 3rd and 4th character. In the case of Kazakhstan, codes for calculation of mortality intensities from Mortality Tabulation List 1 of the ICD10 were used. List of codes for Kazakhstan presented in Table 3.

***Tab. 3 - List of WHO MD codes for the selected causes of death according to the 10th revisions of the ICD (only for Kazakhstan)***

| Causes of death | ICD10 codes |
|---|---|
| All causes | 1000 |
| Diseases of the circulatory system | 1064 |
| Cerebrovascular diseases | 1069 |
| Malignant neoplasm | 1027-1046 |
| External causes of death | 1095 |
| Diseases of the respiratory system | 1072 |
| Diseases of the digestive system | 1078 |
| Signs, symptoms and ill-defined conditions | 1094 |

Source: WHO Mortality Database documentation
(http://www.who.int/whosis/mort/download/en/index.html)

In 2005, for computation of mortality rates by the selected causes of death in Kyrgyzstan, Uzbekistan and the post-socialist European countries together with low mortality populations 10th revision of the ICD detailed 3rd and 4th character coding was used (see Table 4).

***Tab. 4 - List of WHO MD codes for the selected causes of death according to the 10th revisions of the ICD***

| Causes of death | ICD10 codes |
|---|---|
| All causes | AAA |
| Diseases of the circulatory system | I00-I99 |
| Cerebrovascular diseases | I60-I69 |
| Malignant neoplasm | C00-C97 |
| External causes of death | V01-Y98 |
| Diseases of the respiratory system | J00-J99 |
| Diseases of the digestive system | KOO-K93 |
| Signs, symptoms and ill-defined conditions | R00-R99 |

Source: WHO Mortality Database ICD10 online version
(http://apps.who.int/classifications/apps/icd/icd10online/)

According to these lists of codes mortality data by main causes of death among the selected countries were collected. Taking into account that fact, the mortality data for end of the study period (2005) is relatively new (in the case of some selected countries). For instance, the selected European countries switched to the 10th revision of the ICD in late 90s. In 2000, the selected countries of EU area were already finished their transition to ICD10. The situation among the former Soviet Central Asian region was quite different. The countries of this region started their transition to 10th revision of the ICD later than selected European countries. From the Central Asian republics Kyrgyzstan was a first state which switched to ICD10 in 2000. Kazakhstan and Uzbekistan switched only in 2004, and these countries were the last countries which transfer to ICD10 from this area. Tajikistan and Turkmenistan are still used ICD9, and regarding to that fact during to the analysis was faced some problems (for instance, the last available year) with mortality data for these countries (see Table 5).

***Tab. 5 - Years of the changes of ICD10 in the selected countries***

| Countries | ICD10 |
|---|---|
| Czech Republic | 1994 |
| Slovakia | 1994 |
| Hungary | 1996 |
| Latvia | 1996 |
| Estonia | 1997 |
| Lithuania | 1998 |
| Poland | 1999 |
| Spain | 1999 |
| USA | 1999 |
| Kyrgyzstan | 2000 |
| France | 2000 |
| Uzbekistan | 2004 |
| Kazakhstan | 2004 |

Source: WHO Mortality Database

As highlighted in Table 5, one of the last countries which switched to 10th revision of the ICD is Kazakhstan. To clarify that the cause-specific mortality levels for Kazakhstan in the next year after switching to ICD10 transformed without any large fluctuation in the cause-specific death rates was calculated. The cause-specific death rates are showed the number of deaths from selected cause per 1,000 populations in a given year, which can be separated for males and females. Figure 1 illustrates the cause-specific death rates by the main causes of death in Kazakhstan for males and females between the periods of 2000–2008 (the last available data). According to these figures can be clearly observed that Kazakhstan was successfully transformed to ICD10 in 2004. Mortality data for 2000–2003 was taken from ICD9.

***Fig. 1 - Cause-specific death rates by main causes of death in Kazakhstan, 2000–2008***

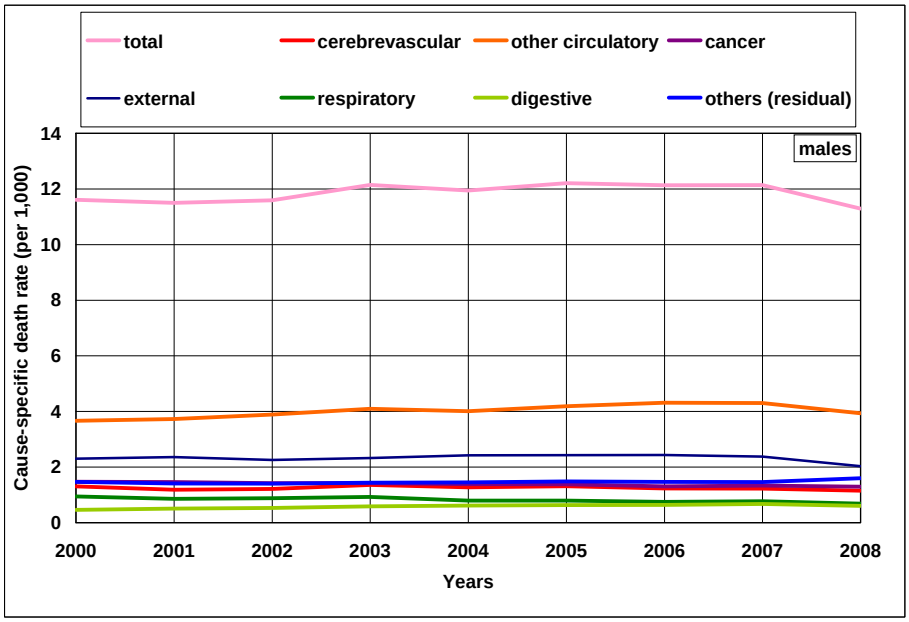
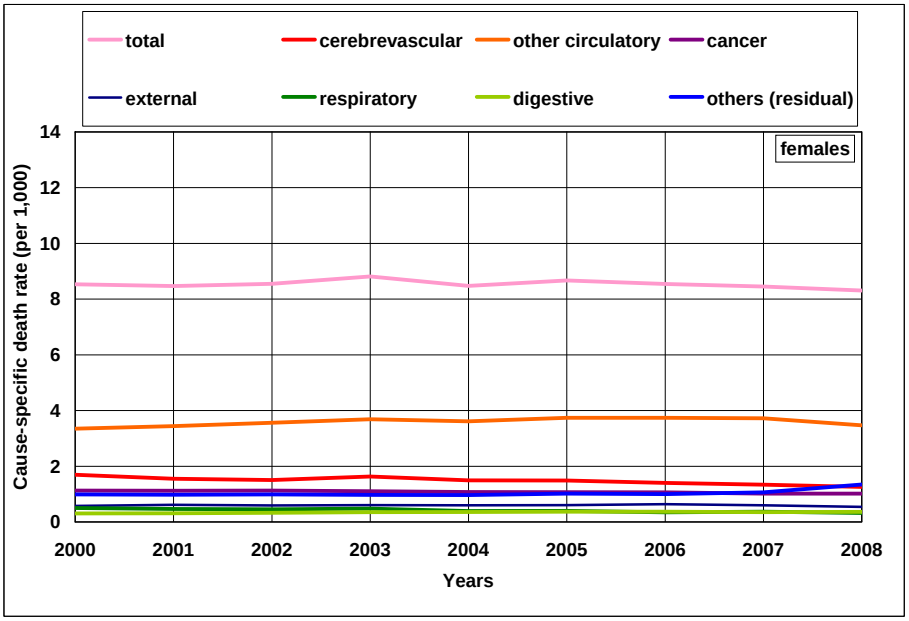


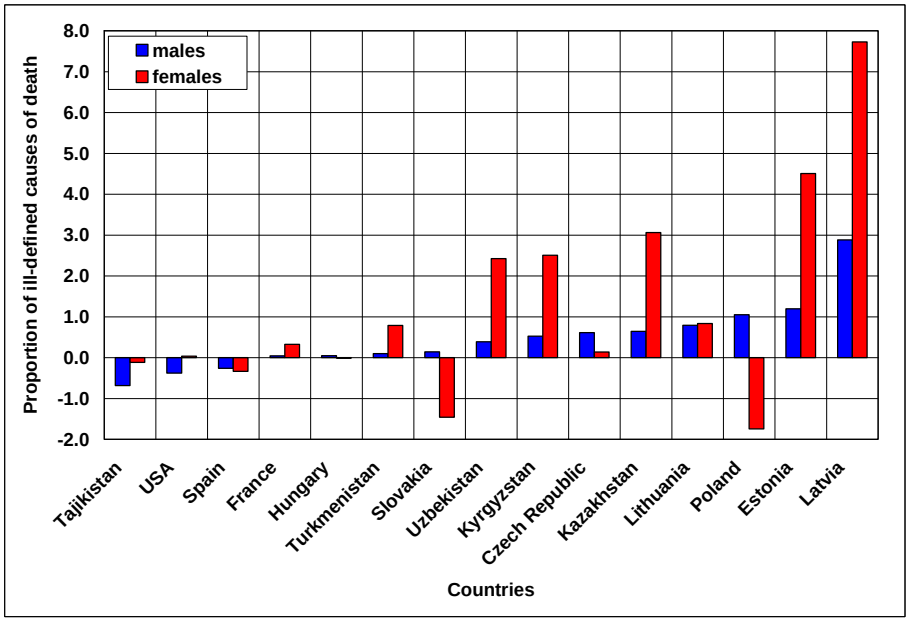
***Fig. 1 - continued***




Source: Author's calculations based on data from www.who.int

The next important issue which also should be highlighted is ill-defined causes of death. The proportion of the ill-defined causes among the selected countries was calculated for the periods of 1985 and 2005. For better illustration the changes of this cause over time among the selected countries the differences between the proportions of the ill-defined causes was calculated (see Figure 2).

***Fig. 2 - Proportion of ill-defined causes of death in selected countries (2005 – 1985)***




Note: sorted according to males, data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int

Figure 2 showed the changes in ill-defined causes among the selected countries. The large difference was observed in female population. The proportion of this cause in low mortality

populations was similar between the periods of 1985 and 2005, also in these countries a high concentration of diagnoses into the "well-known" causes.

## 3.4 Methods

For this study mortality patterns among the selected countries and mortality data published by WHO were used. Based on mortality data, the life expectancy at birth ($e_0$) and standardized death rates by main causes (SDR) was calculated.

A life table (also called a mortality table) is a table which shows, for each age, what the probability is that a person of that age will die before his next birthday (WHO). From this starting point, a number of statistics (biometric functions) can be derived and thus are also included in the table:

- The probability of dying between the exact ages of *x* and *x*+*n*, by sex
- Life expectancy at birth, by sex

Life tables are usually constructed separately for men and women because of their substantially different in mortality rates.

**Life expectancy at birth** is the average number of years a newborn could expect to hypothetically: live, notably if he or she were to pass through life subject to the age-specific death rates of a given period (Demographic dictionary). It is calculated as a weighted average of the age of a cohort of 100,000 newborn subjected to different age-specific mortality rates. Data on population sizes for different age groups and the number of deaths in those groups at the middle of the year is required. In general, several steps are needed to derive life expectancy from age specific death rates using the mortality (life) table.

$$e_0 = \frac{T_0}{l_0}$$

where $e_0$ is the life expectancy at age x. $l_0$ is the radix of the table. $T_0$ is an auxiliary indicator which expresses the number of years of life to be lived by the table generation (not of an individual) at a given age (It is the accumulation of Lx from the highest age of the table (ω-1) to the age of x).

**The age-standardized death rate** is a weighted average of the age-specific mortality rates per 100,000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population. It can be calculated for specific age groups in order to compare mortality at different ages or at the same age over time. Comparisons also can be between countries or areas. The cause mortality rate or **cause-specific mortality rate** is generally expressed per 1,000 populations. The ratio of the number of deaths from a specific cause to the number of deaths from all causes is sometimes referred to as the death ratio, or proportionate mortality.

For computation of the standardized death rates direct and indirect methods can be calculated. For this analysis the direct standardized method was used. During the calculation world standard population (old) was selected.

$$SDR = \frac{\sum (M_x * P_x^s)}{P^s}$$

where $M_x$ is the age-specific mortality rate at age x. $P_x^s$ is the number of people in the age (age group) in the standard population. $P^s$ is the total standard population.

For measuring the gender gap in cause-specific mortality patterns, the cause-specific excess male mortality **ratio** was calculated. The method of cluster analysis which will be discussed further, was applied in order to find countries with similar gender gaps, irrespective of mortality level (instead of probabilities, ratios were taken). And for the calculation this formula was used:

$$Ratio = \frac{SDR^m}{SDR^f}$$

where $SDR^m$ is the standardized mortality rates by main causes of death for males. $SDR^f$ is the standardized mortality rates by main causes of death for females.

The decomposition in life expectancy at birth by age and main causes of death was calculated. The method for decomposing of differences between two life expectancies by age was developed independently in the 1980s by three researchers from Russia, the USA, and France (Andreev 1982, Arriaga 1984, Pressat 1985).

$$ {}_n\varepsilon_x = \frac{1}{2l_x^2}[(l_x^2 * (e_x^2 - e_x^1) - l_{x+n}^2 * (e_{x+n}^2 - e_{x+n}^1)] -$$

$$\frac{1}{2l_x^1}[l_x^1 * (e_x^1 - e_x^2) - l_{x+n}^1 * (e_{x+n}^1 - e_{x+n}^2)]$$

where 1 and 2 are population groups to compared. $x, x+n$ is the exact ages and $n$ is the length of elementary age interval. ${}_n\varepsilon_x$ is the contribution to the overall difference between the life expectancies produced by the difference in mortality in the age group $x, x+n$. $l_x$ and $l_{x+n}$ are the radix of the table or the hypothetical number of life births ages $x, x+n$. $e_x$ and $e_{x+n}$ are life expectancy ages $x, x+n$.

For the cause-specific data in further decomposition according to causes of death (j) the following formula can be used (Andreev 1982):

$$ {}_n\varepsilon_x = \sum_j {}_n\varepsilon_{x,j},$$

$$ {}_n\varepsilon_{x,j} = \frac{{}_nM_{x,j}^2 - {}_nM_{x,j}^1}{{}_nM_x^2 - {}_nM_x^2} * {}_n\varepsilon_x$$

where ${}_nM_{x,j}^1, {}_nM_{x,j}^2$ are central death rates in population 1 and 2 for age group $x, x+n$ and causes of death $j$. ${}_nM_x^1, {}_nM_x^2$ are central death rates for the same age in population groups 1 and 2 for all causes of death combined. ${}_n\varepsilon_x$ is the contribution to the overall difference between the life expectancies produced by the difference in mortality in the age group (Shkolnikov et al 2001).

For the next step regarding mortality analysis, multivariate statistical approaches were used.

A cluster analysis is a collection of statistical methods, which identifies groups of samples that behave similarly or show similar characteristics (SAS/STAT 9.2 User's Guide 2008). In common parlance it is also called a "look-a-like group". The simplest mechanism is to partition the samples using measurements that capture similarities or distances between the samples. The objective of a cluster analysis is to group "look-a-like" observations together with the underlying structure is unknown. This is carried out through a variety of methods, all of which use some measure of distance between data points as a basis for creating groups (clusters). The clustering algorithms are broadly classified into two, namely:

- Hierarchical algorithms. In the hierarchical procedures, a hierarchy or tree-like structure can be constructed to see the relationship among the entities (observations or individuals)
- Non-hierarchical algorithms. In the non-hierarchical method a position in the measurement is taken as central place and the distance is measured from a central point (seed)

Values from different distributions, such as the ones in this example, can be standardized in order to provide a way of comparing them that include consideration of their respective distributions. This is done by transforming the values into Z-scores. It is done and by adding "`/ std=Std`" at the end of the variables list in SAS 9.2 software, which are expressed as standardized deviations from their means. These Z-scores have a mean of 0 and a standard deviation equal to 1. Z-scores calculated from different samples with different units which can then be directly compared because these numbers do not express the original unit of measurement.

In order to calculate a Z-score, it is necessary to start with an original variable (called $x$ ) obtained from a sample (or a population) with a mean of $\mu$ and a standard deviation of $\sigma$. The mean is eliminated by subtracting it from the value; this transforms the original value into a deviation from its mean. The original unit of measurement is also eliminated by dividing the value deviation by the standard deviation. Specifically, the formula for calculating a Z-score is:

$$Z = \frac{x - \mu}{\sigma}$$

where $x$ is an original variable , $\mu$ is the mean and $\sigma$ is the standard deviation.

It means that subtracting the mean centers the distribution and dividing it by the standard deviation normalizes the distribution. The interesting properties of the Z-scores are that they have a zero mean (effect of "centering") and a variance and standard deviation of 1 (effect of "normalizing"). This is because all distributions expressed in Z-scores have the same mean (0) and the same variance (1).

In most methods of hierarchical clustering, this is achieved by the use of an appropriate metric (a measure of distance between pairs of observations), and linkage criteria which specifies the dissimilarity of sets as a function of the pair wise distances of observations in the sets. Typically, this distance is the standard Euclidean distance, i.e. a straight line in two dimensions, but the exact definition of distance is determined by the user. Essentially, data points with the smallest distances between them are grouped together. Then the data with the next smallest distances is added to each group and so on until all observations end up together in

one large group. The cluster is interpreted by observing the grouping history or pattern produced as the procedure was carried out. Euclidean distance between points *x* and *y* is the length of the line segment $\overline{xy}$. The formula for this distance between a point $x(x_1, x_2, etc.)$ and a point $y(y_1, y_2, etc.)$ is:

$$d = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2}$$

Deriving the Euclidean distance between two data points involves computing the square root of the sum of the squares of the differences between corresponding values.

The Ward method is an alternative approach for performing the cluster analysis. This method is distinct from all other methods because it uses an analysis of variance (ANOVA) approach to evaluate the distances between clusters. In short, this method attempts to minimize the Sum of Squares of any two (hypothetical) clusters that can be formed at each step. In general, this method is regarded as very efficient. However, it tends to create clusters of small size (SAS/STAT 9.2 User's Guide 2008).

Ward's method joins clusters to maximize the likelihood at each level of the hierarchy under the following assumptions:

- multivariate normal mixture
- equal spherical covariance matrices
- equal sampling probabilities

An agglomerative clustering method was proposed by Ward in 1963. The clustering criterion is based on the error sum of squares, namely ESS, which is defined as the sum of squared distances of individuals from the centre of gravity of the cluster to which they have been assigned. Initially, ESS is 0, since every individual is in a cluster of its own. Ward's method seeks to choose the successive clustering steps so as to minimize the increase in ESS at each step. For a set $x$ the ESS is described by the following expression:

$$ESS(x) = \sum_{i=1}^{Nx_x} \left| x_i - \frac{1}{N_x} \sum_{j=1}^{Nx} x_j \right|^2$$

where the ESS of set $x$ of $N_x$ values is the sum of squares of the deviations from the mean value or the mean vector (centroid).

For the cluster analysis, SAS 9.2 software was used. In SAS 9.2 software SAS/STAT was applied, which provides comprehensive statistical tools for a wide range of statistical analysis, including cluster analysis, analysis of variance and so on. From the SAS/STAT three procedures were used, namely, DISTANCE, CLUSTER and TREE. More detailed information about procedures can be found in the Methodological annex.

The next approach which was used in this thesis is the factor analysis. Factor analysis is a generic term for a family of statistical techniques concerned with the reduction of a set of observable variables in terms of a small number of latent factors. It has been developed primarily for analyzing relationships among a number of measurable entities (such as survey items or test scores). The underlying assumption of factor analysis is that there exists a number of unobserved latent variables (or "factors") that account for the correlations among observed

variables, such that if the latent variables are partialled out or held constant, the partial correlations among observed variables all become zero. In other words, the latent factors determine the values of the observed variables. Each observed variable ( $y$ ) can be expressed as a weighted composite of a set of latent variables ( $f$ 's) such that

$$y_i = a_{i1} f_1 + a_{i2} f_2 + ... + a_{ik} f_k + e_i$$

where $y_i$ is the $i^{th}$ observed variable on the factors, $e_i$ is the residual of $y_i$ on the factors. Given the assumption that the residuals are uncorrelated across the observed variables, the correlations among the observed variables are accounted for by the factors.

In the output of factor analysis illustrates in an eigenvalues. They are values that consolidate the data variance in a matrix (the eigenvalue) while providing the linear combination of variables (the eigenvector) to do it. The Factor procedure was initially run by allowing all of the variables entered into the procedure to be possible factors. For exploratory data analysis purposes, this is a preferred way to run factor analysis, so that all of the eigenvalues can be analyzed. Based on this analysis, it is determined how many factors will be included in the final factoring program.

In this analysis the rotation method was specified. A number of orthogonal and oblique rotation procedures have been proposed. Each procedure has a slightly different simplicity function to be maximized. The ROTATE= option in the Factor procedure statement supports five orthogonal rotation methods: EQUAMAX, ORTHOMAX, QUARTIMAX, PARSIMAX, and VARIMAX; and two oblique rotation methods: PROCRUSTES and PROMAX. The VARIMAX method has been the most commonly used orthogonal rotation procedure. In this case was specified the VARIMAX orthogonal rotation method. VARIMAX rotation is an orthogonal rotation of the factor axes to maximize the variance of the squared loadings of a factor (column) on all the variables (rows) in a factor matrix, which has the effect of differentiating the original variables by the extracted factor. Each factor will tend to have either large or small loadings of any particular variable. A VARIMAX solution yields results which make it as easy as possible to identify each variable with a single factor. This is the most common rotation option.

$$R_{\mathrm{vari\,max}} = \arg\max_{R}\left( \sum_{j=1}^{k}\sum_{i=1}^{p} \tilde{R}_{ij}^{4} - \frac{\gamma}{p}\sum_{j=1}^{k}\left( \sum_{i=1}^{p} \tilde{R}_{ij}^{2} \right)^{2} \right)$$

where and $\gamma = 1$ for VARIMAX. $R$ is the rotation and $i$ th variable on the $j$ th factor after rotation.

The analysis of the age-specific mortality pattern by main causes of death for selected post-communist and low mortality population countries separated for males, females and both sexes in the years of 1985 and 2005. The first part of the research sought to analyze the cause-specific mortality pattern for all ages. In order to define age grouping for the mortality analysis by main causes of death factor analysis in SAS 9.2 software was used. The initial data for factor analysis were age-specific death rates by main causes of death, which were listed in the beginning of the chapter, for all ages among the selected countries in years of the 1985 and 2005. For the properly delimit age groups several attempts was analyzed. Firstly, for each disease separately

factor analysis was used. In the result, they showed different age groups. For instance, cardiovascular diseases were divided into 3 factors (age groups), such as 25–69, 70 and over and 0–24. According to the result of malignant neoplasm was completely different separated, and it shows three age groups, such as 30–44, 45 and over, and last one 0–29. In the case of all causes also were divided into three factors, like 15–64, 65 and over, and last group 0–14. Significantly, all of these results were completely different from each other. It makes difficulties to analysis age-specific mortality patterns by main causes of death among the selected countries. Remarkable, that only one similarity was that they were separated into three factors or age groups, and everywhere "child mortality" (third factor in all cases) were weak factor. Summarize all of these results select the same age-groups for whole analysis was decided. Factor analysis based on the mortality data by all causes was choose among the other diseases. Finally, initial data for the factor analysis was the standardized death rates (SDR) by all causes of death for all ages in the periods of 1985 and 2005, respectively.

According to the results of the factor analysis, initial mortality data by causes of death were divided into 3 factors (or 3 age groups).The Eigenvalues are illustrated in Table 6. Each row of the table pertains to a single eigenvalue. Following the column of eigenvalues there are three measures of each eigenvalue's relative size and importance. The first of these displays the difference between the eigenvalue and its successor. The last two columns display the individual and cumulative proportions that the corresponding factor contributes to the total variation. Eigenvalues correspond to each of the principal components and represent a partitioning of the total variation in the sample. Because correlations are used, the sum of all the eigenvalues is equal to the number of variables.

***Tab. 6 - Eigenvalues table from procedure Factor (all ages)***

| Eigenvalues of the Correlation Matrix: Total = 18 Average = 1 | | | | |
|---|---|---|---|---|
| | Eigenvalue | Difference | Proportion | Cumulative |
| 1 | 14.4403 | 13.0922 | 0.8022 | 0.8022 |
| 2 | 1.3481 | 0.3187 | 0.0749 | 0.8771 |
| 3 | 1.0294 | 0.4713 | 0.0572 | 0.9343 |
| 4 | 0.5582 | 0.3386 | 0.0310 | 0.9653 |
| 5 | 0.2196 | 0.0729 | 0.0122 | 0.9775 |
| 6 | 0.1467 | 0.0126 | 0.0082 | 0.9857 |
| 7 | 0.1341 | 0.0786 | 0.0075 | 0.9931 |
| 8 | 0.0556 | 0.0318 | 0.0031 | 0.9962 |
| 9 | 0.0238 | 0.0102 | 0.0013 | 0.9975 |
| 10 | 0.0136 | 0.0038 | 0.0008 | 0.9983 |
| 11 | 0.0099 | 0.0020 | 0.0005 | 0.9989 |
| 12 | 0.0080 | 0.0027 | 0.0004 | 0.9993 |
| 13 | 0.0053 | 0.0022 | 0.0003 | 0.9996 |
| 14 | 0.0031 | 0.0010 | 0.0002 | 0.9989 |
| 15 | 0.0021 | 0.0010 | 0.0001 | 0.9999 |
| 16 | 0.0011 | 0.0004 | 0.0001 | 0.9999 |
| 17 | 0.0007 | 0.0003 | 0.0000 | 1.0000 |
| 18 | 0.0003 | | 0.0000 | 1.0000 |

Note: Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The first row of the table corresponds to the first principal component, the second row to the second principal component, and so on (see Table 6). In this case, the information clearly

illustrates that the first principal component accounts for 80 % of the variation, the second approximately 7 % and the last one is less than 6 %. It means the first two factors (or age group) are important for this analysis (SAS/STAT 9.2 User's Guide 2008).

According to the output table from the procedure Factor, the results have been divided into 3 factors (see Table 7). Factor 1 includes that adult mortality is measured by the age-specific death rates between the exact ages of 15 and 64. Factor 2 contains senior, which is measured by the age-specific death rates between the exact ages of 65 and over. Finally, in Factor 3 are child mortality is measured by the age-specific death rates between exact ages of 0 and 14. As was mentioned in the previous paragraph further age-specific mortality analysis by main causes of death are concentrated in first two factors. They are between the exact ages of 15 and 64 and in the next group the exact ages of 65 and over.

***Tab. 7 – Output table from procedure Factor (all ages)***

| Rotated Factor Pattern | | | |
|---|---|---|---|
| | Factor 1 | Factor 2 | Factor 3 |
| 20-24 | 0.8625 | 0.3000 | 0.3467 |
| 25-29 | 0.8618 | 0.3304 | 0.3424 |
| 40-44 | 0.8501 | 0.4452 | 0.2422 |
| 35-39 | 0.8403 | 0.4174 | 0.2978 |
| 30-34 | 0.8280 | 0.3549 | 0.3644 |
| 15-19 | 0.8184 | 0.2633 | 0.4005 |
| 45-49 | 0.8150 | 0.5105 | 0.1753 |
| 50-54 | 0.7914 | 0.5517 | 0.1878 |
| 55-59 | 0.7293 | 0.6160 | 0.2496 |
| 60-64 | 0.6924 | 0.6215 | 0.3166 |
| 80-84 | 0.3000 | 0.8762 | 0.3357 |
| 75-79 | 0.4139 | 0.7865 | 0.4206 |
| 85+ | 0.3389 | 0.7441 | -0.0015 |
| 70-74 | 0.4624 | 0.7295 | 0.4539 |
| 65-69 | 0.6079 | 0.6621 | 0.3923 |
| 0-4 | 0.1426 | 0.1520 | 0.9264 |
| 10-14 | 0.4653 | 0.2528 | 0.8072 |
| 5-9 | 0.4627 | 0.3140 | 0.7586 |

Note: Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

# Chapter 4

# Analysis of general mortality changes in the selected countries between the period of 1985 and 2005

## 4.1 Changes in life expectancy at birth among the selected countries

Significantly, life expectancy at birth represents the average life span of a newborn and is an indicator of the overall health of a country. Life expectancy is one of the most important demographic indicators used to compare different population groups. Life expectancy rose rapidly in the twentieth century due to improvements in public health, nutrition and medicine. Improvements in health and welfare increase life expectancy. It's likely that life expectancy of the more developed countries will slowly advance and then reach a peak in the range of the mid-80s in age. In less developed countries, life expectancy at birth has been increasing steadily since the middle of the 20$^{th}$ century, mainly due to the near-eradication of infectious disease and high standards of living (which includes diet, sanitation and health care). Moreover, public health campaigns and cultural change may also have a measurable influence on life expectancy. In 1985, life expectancy at birth in the world was 63.8 years and it reached 68.2 years in 2005 (World Bank 2005).

To understand the low life expectancy at birth in Central Asia among the selected countries, the impact of the economic crisis that occurred after the collapse of the Soviet Union must be explored. Equally, issues such as increasing poverty and deteriorating health also deserve to be discussed. The mortality condition in the former Soviet Central Asian region in both periods (1985 and 2005) are alone worrisome, the increase in mortality level over the past decade gives particular cause for concern, both because this increase represents a setback to health efforts of the past twenty years and because it presages serious long-term health consequences in the general population that will result from the arresting of economic development and lowered living standards that followed independence. There may also be an increase in deaths from alcohol. This assumption would be consistent with the fact that the country recorded a sharp decline. In contrast, life expectancy at birth rose sharply in the late 1980's because of the anti-

alcohol campaign. Also should be taking into account the differences in the definition of infant mortality rate. It includes two different practices of registration of live births and stillbirths. The first is namely "Soviet" and the second is the "WHO" registration practices of live births and stillbirths. The "Soviet" definitions of live birth and stillbirth differ from WHO definitions. The detail of these definitions was discussed in the chapter of data collection and quality.

According to Figure 3 in 1985 life expectancy at birth among Turkmen males was 61.1 years and 67.9 years for females. Due to the lack of data latest available year for this analysis were 1998. The life expectancy at birth in Turkmenistan increased to 62.6 years for males and 66.9 years for females in 1998. In this time periods differences between values of two years equal to 1.5 years for males and – 8.5 years for females. After more than ten years the life expectancy curve for females of Turkmenistan was decreased. The decline in female life expectancy was much more consistent, with Turkmenistan experiencing a steep fall similar to that seen in its neighbors, such as Tajikistan (differences between 1985 and 2005 equal to – 0.7) and Uzbekistan (differences between 1985 and 2005 is – 0.2). In the case of males, Uzbekistan and Turkmenistan life expectancy at birth increased by 2.6–3.5 years comparing the years 1985 and 2005.

Kazakhstan's expectation of life at birth decreased between 1985 and 2005 by 2.2 years for males. The value for female in the same period a small rose by 0.8 years. Between these periods, mortality rates more than doubled for men aged 30–44 and rose to about 75 % for men aged 45–54 (Kulzhanov and Rechel 2007). Moreover, there are also substantial regional variations in life expectancy at birth. The most prosperous areas (Almaty city and the capital Astana) have a substantial advantage in terms of life expectancy over the more depressed areas of the country (Becker and Urzhumova 2005).

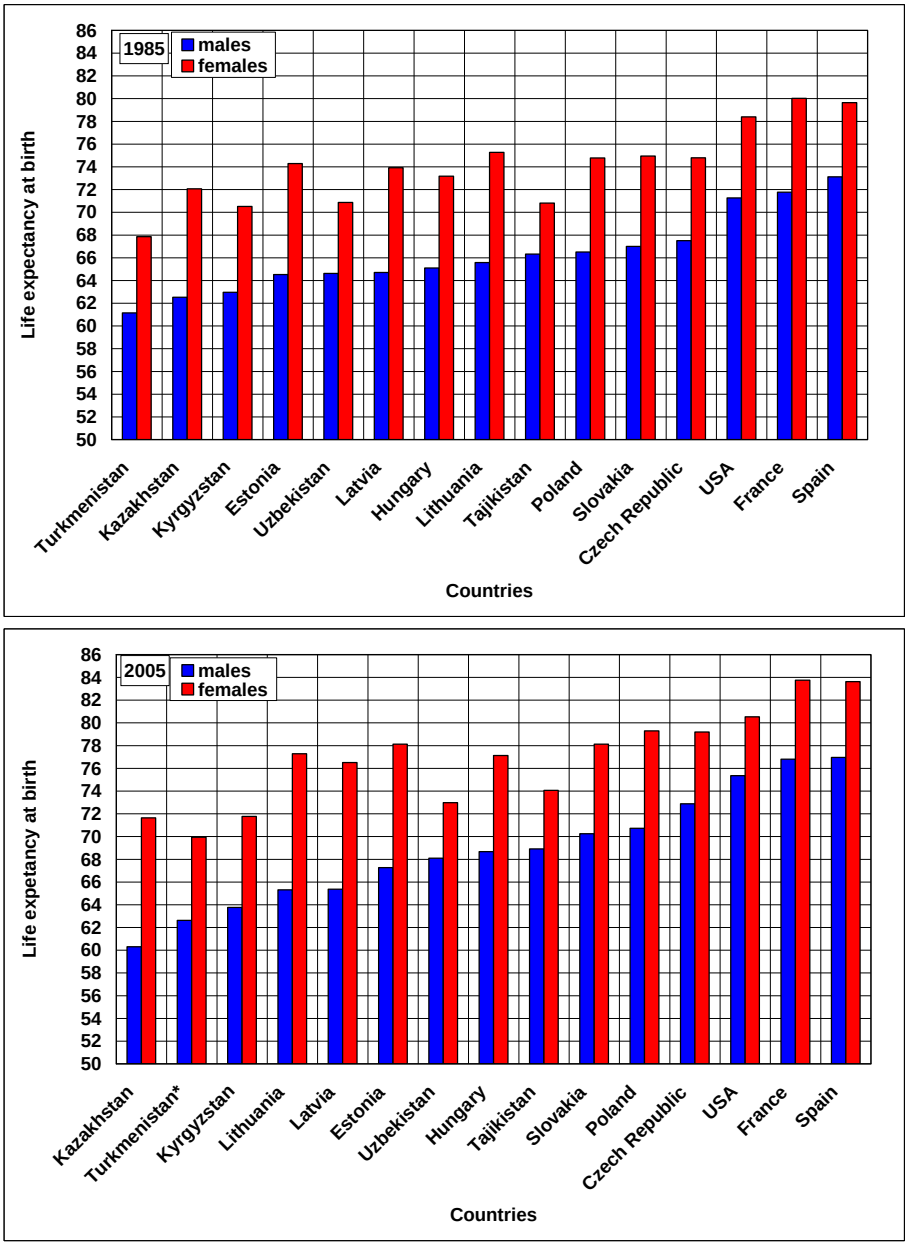
In 1985, the lowest value of life expectancy at birth among the Central European countries was observed in Hungary (65.1 years – males, 73.2 – females) (see Figure 4). Nowadays, the situation in Central European countries has positively changed as one country after another has resumed its health progress. In 2005, life expectancy at birth increased by 3.6–5.4 years for males and 3.3–4.4 years for females in this region.

The lowest male expectation of life at birth among the Baltic countries group in 1985 was 64.5 years in Estonia and in 2005 it was 65.3 years in Lithuania. In 2005, the lowest female life expectancy at birth was observed in Latvia at 76.5 years among the three Baltic states. When comparing the beginning (1985) and the end (2005) of the periods of study, male life expectancy at birth increased only by 0.7–1.7 years in this region and significantly increased by 2.6–3.0 years for females. In the years 1985 and 2005 diseases of the circulatory system, malignant neoplasm and external causes of death were the three major causes of deaths contributing to this spectacular degradation of survival among the Baltic states. During these years, excess male mortality reached its highest value.

The relatively high standard of health care, sanitary culture and economic development on the territory of France, Spain and the United States determined a higher level of life expectancy at birth in comparison with the other selected countries. Between 1985 and 2005 the life expectancy at birth in Spain which was the highest among observed countries, rose from 73.1 to

76.9 years for males, whereas life expectancy at birth among French females increased from 80.0 to 83.8 years in the same period of time (see Figure 3).

***Fig. 3 - Life expectancy at birth in the selected countries, 1985 and 2005***




Note: sorted according to male's life expectancy at birth, Turkmenistan* means that data for Turkmenistan was calculated for 1998

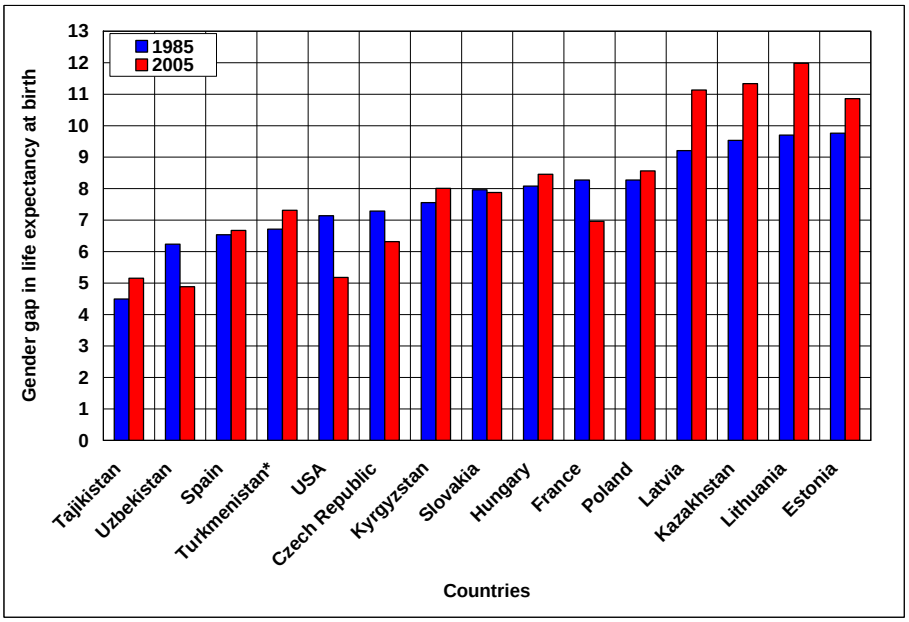
Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Public health situation is best characterized by life expectancy and mortality indicators, which are largely affected by one of the health determinants - the gender (Gigele, Rozentale, and Skrule 2007). The gender gap in longevity has changed over time and varies across countries. Stages have been described that relate gender differences in longevity to societal development. In developing societies (stage 1), life expectancy in women is limited by high maternal mortality, so that the gender gap between men and women tends to be smaller. Stage 2

societies have had improvements in maternal and infant mortality, resulting in an increase in the gender gap that substantially favors women. Currently, a lot of countries are entering a third stage, in which the life expectancy for women is so high that it may be near its maximum, and now the continued improvements in life expectancy are relatively greater for men than for women (Newman and Brach 2001).

The gender gap between male and female life expectancy at birth among the selected countries in the periods of 1985 and 2005 clearly illustrates in Figure 4. In the beginning of analysis the lowest gender gap belong to Tajikistan and it equal to 4.5 years. In Estonia the highest gender gap (9.8 years) was observed. In 2005, the largest difference between the genders was found in Lithuania (12 years) and the smallest in Uzbekistan (4.9 years). Contrastingly, in the Baltic states has one of the world's largest gender gap in life expectancy at birth. Male life expectancy at birth also experienced a much steeper fall than female life expectancy at birth in the first half of the 90s.

***Fig. 4 - Gender gap in life expectancy at birth in the selected countries, 1985 and 2005***




Note: sorted according to male's life expectancy at birth, Turkmenistan* means that data for Turkmenistan was calculated for 1998

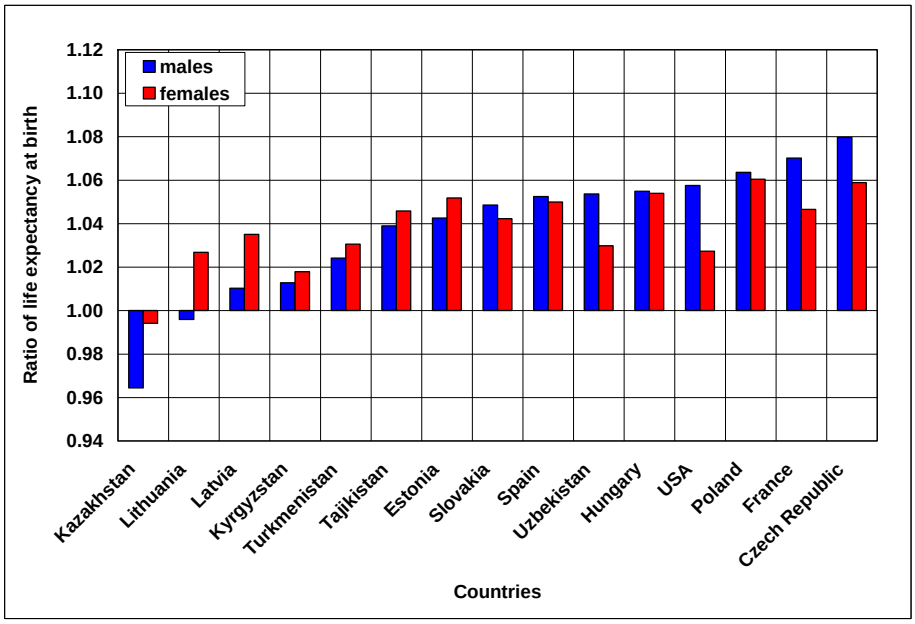
Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Another reason for the difference between male and female life expectancy at birth are not fully understood. While some scholars argue that women are biologically better to men and thus live longer, others argue that men are employed in more hazardous occupations such as in factories, military service and so on (Oksuzyan, Brønnum-Hansen, and Jeune 2010). Moreover, there are very likely to be genetic factors that relate to the difference in longevity. The genetic differences are expressed in the hormonal, immunologic, and other physiologic differences in men and women. One of the most interesting facts about genetics and gender is that, at conception, the ratio between males and females is about 160 males per 100 females. Owing to a higher rate of early fetal loss in males, at the time of birth, the ratio is almost even, although

there is still a slight excess in male births (105 male births per 100 female births). Therefore, women have a more favorable survival rate, even throughout the prenatal period (Newman and Brach 2001).

Figure 5 illustrates that men life expectancy at birth increased faster than for women. An exceptional situation was observed in Kazakhstan for both sexes and Lithuania only for males showing a negative trend. In addition, Kazakhstan's males experienced negative changes in life expectancy at birth. With the collapse of inter-republic trade and the simultaneous transition to a market economy, the era of economic collapse was mirrored by a deteriorating life expectancy at birth. Consequently, the economic recovery has not been accompanied by a comparably symmetric rise in life expectancy at birth.

***Fig. 5 - Ratio of life expectancy at birth in 2005 to life expectancy at birth in 1985 in the selected countries***




Note: sorted according to male's life expectancy at birth, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Finally, the changes in life expectancy over time among the selected countries between years of 1985 and 2005 were analyzed. The lowest life expectancy at birth was found in the former Soviet Central Asian republics. The highest values belong to the low mortality populations. The intermediate level of average life span was noted in the post-socialist European area among the other selected countries. A large gender gap in life expectancy was observed in the three Baltic states and the shortest one was in the Central Asian countries.

## 4.2 Decomposition of life expectancy at birth

In order to obtain summary measures which take account of compositional effect (age, marital status, nationality or other characteristics), demographers have devised a number of techniques. In general, to decompose means to separate something into its constituent parts or elements or

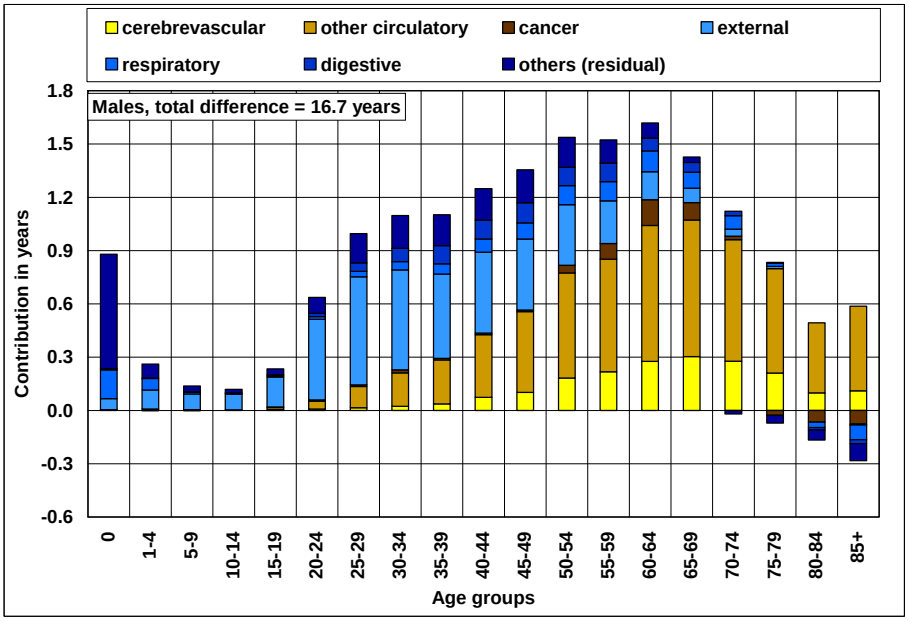
into simpler compounds. The decomposition methods used in demography also follow this separation principle by dividing demographic variables into specific components. Decomposition methods are used when comparing demographic variables that belong to different populations, or when comparing variables of the same population over time (Canudas Romo 2003). The question then would be whether the change over time in life expectancy is because of a decline (or increase) in life expectancy in each country or because of change over time in the population composition of the respective countries.

To have a measure of the weighting of each cause of death in life expectancy, several researchers have developed methods enabling differences of life expectancy between two populations to be allocated according to age or cause (Pressat 1985, Arriaga 1984, Andreev 1982, Pollard 1982, 1988, 1990). They possess the enormous advantage of providing an additive decomposition of the life expectancy differences. The basic elements of the decomposition can be regrouped over a certain interval of ages or according to different causes of death (Mesle 2006).

In the case of this analysis decomposition of the gap in life expectancy by age and the selected main causes of death in 2005 was used. The selected main causes of death are: all causes, cerebrovascular diseases, other diseases of the circulatory system, malignant neoplasm, external causes of morbidity and mortality, diseases of respiratory system, diseases of the digestive system and the remaining other causes of death. This method will examine the contributions of deaths at different ages and from different causes to the total life expectancy gap between the two countries. Regarding to the aim of this thesis, it is to contrast cause-specific mortality settings in the selected post-communist countries those of low mortality populations. The countries for the decomposition method were chosen as representatives from each macro-region. They are Kazakhstan from former Soviet Central Asian region, the Czech Republic from Central Europe. Lithuania like a classic Baltic state and Spain (the highest life expectancy among males) with France (the highest life expectancy among females) represented low mortality populations. The represent country from low mortality regions (Spain and France) was selected as a standard. Decomposition method among the three countries which mentioned before with low mortality population separated for men and women in 2005.

Figure 6 shows that the gap in life expectancy at birth for men in Kazakhstan and Spain is almost 17 years, with the greatest contribution being made by differences between infant mortality and mortality rates at ages from 25 to 70 years of age. Excess male mortality in Kazakhstan from other diseases of the circulatory system plays a crucial role at ages between 40 and older ages. At younger ages external causes of morbidity and mortality play a major part. The contribution made by the digestive system diseases and other remaining causes are considerable, but much less significant than those of circulatory system diseases and external causes. Malignant neoplasm and respiratory diseases contribute even less. All other causes of death at old ages actually make a negative contribution.

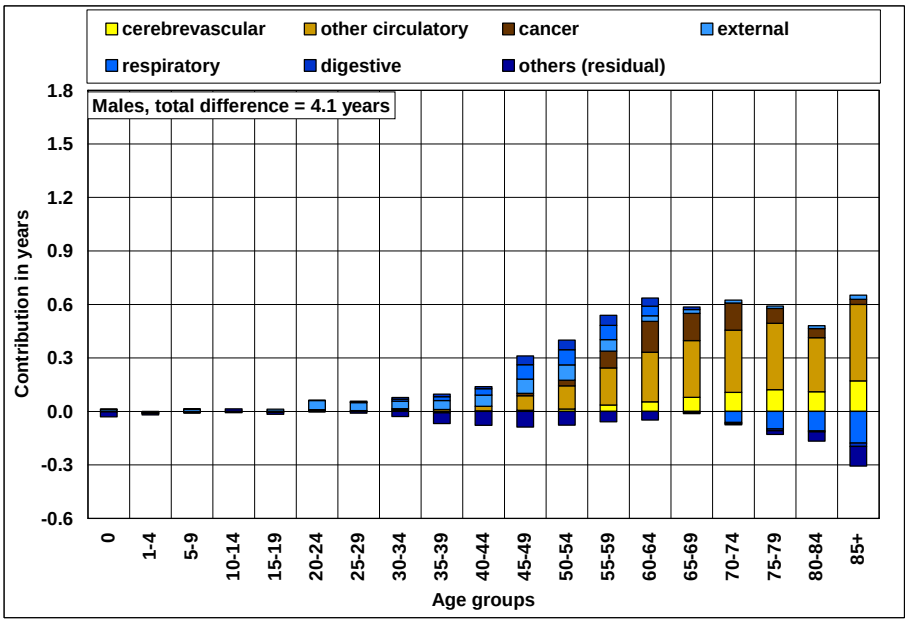
***Fig. 6 - Decomposition of Kazakhstan–Spain gap in life expectancy by age and main causes of death for males, 2005***




Source: Author's calculations based on data from www.who.int

According to Figure 5 the overall gap for Czech and Spanish males is 4.1 years. The largest contribution being made by differences between mortality rates at ages of 55 and over. Higher mortality rates in the Czech Republic at ages between 55 and 80 and which play significantly role is the other diseases of the circulatory system. Cancer at ages between 60 and 75 plays less role compared with the circulatory system. The contribution made by other selected causes of death less. The respiratory system diseases at old ages and other remaining causes at younger ages showed a negative contribution, being lower in the Czech Republic than in Spain in 2005.

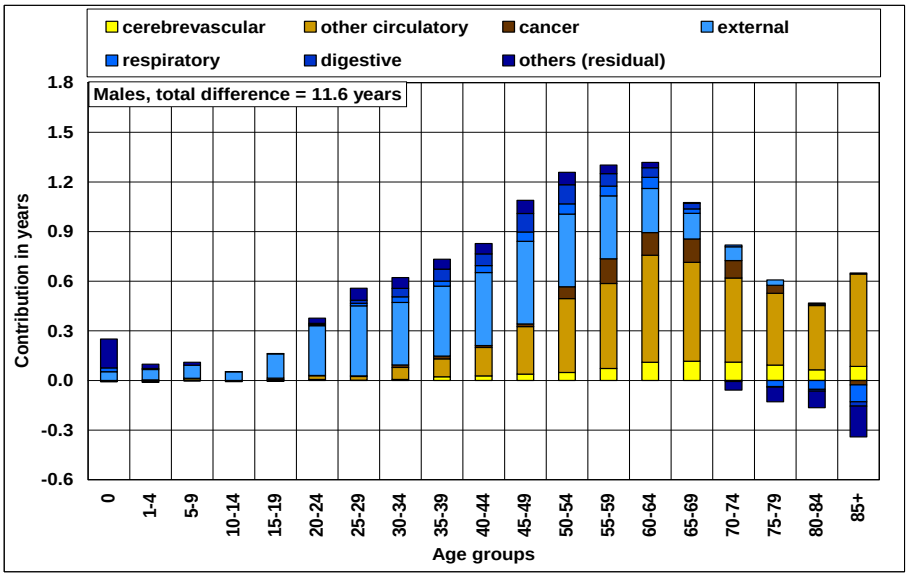
***Fig. 7 - Decomposition of the Czech Republic–Spain gap in life expectancy by age and main causes of death for males, 2005***




Source: Author's calculations based on data from www.who.int

The gap between expectation of life at birth among males of Lithuania and Spain is equal to 11.6 years (see Figure 8). Higher rates of the other diseases of the circulatory system in Lithuania play a role at senior ages, while in the younger ages are external causes. The contribution made by diseases of the digestive system, respiratory system and remaining other causes is insignificant. A negative contribution at older ages mainly from all other causes of death is lower in Lithuanian males than among the Spanish males.

***Fig. 8 - Decomposition of Lithuania–Spain gap in life expectancy by age and main causes of death for males, 2005***

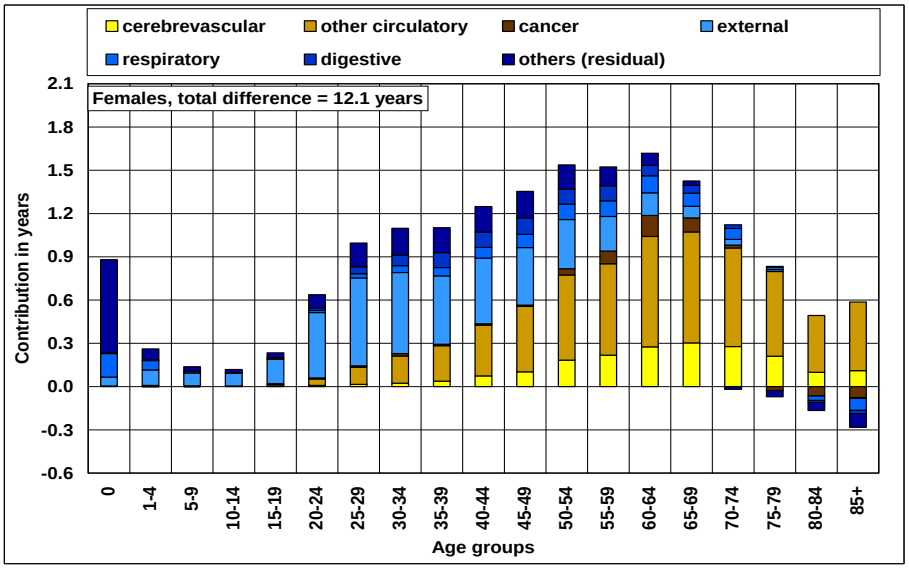



Source: Author's calculations based on data from www.who.int

The contribution of years of life of the main selected causes of death in life expectancy at birth for female population in 2005 was analyzed. The selected main causes of death are same like in the case of males and they are listed above. Decomposition by age and causes of death among Kazakhstan, the Czech Republic and Lithuania was observed. The highest expectation of life at birth among women was found in France. That why representative countries from each macro-region will be decompose with France.

According to Figure 9 the gap in life expectancy at birth among women is 12.1 years and its structure by age and causes of death is quite different from that for men. Firstly, the greatest contribution to the overall expectation of life gap is from excess mortality in Kazakhstan at ages 30 and 70. Second, cardiovascular diseases and external causes play a much greater role, with smaller contributions from digestive system and respiratory system diseases. Also a large contribution from all other causes at infant ages was noted.

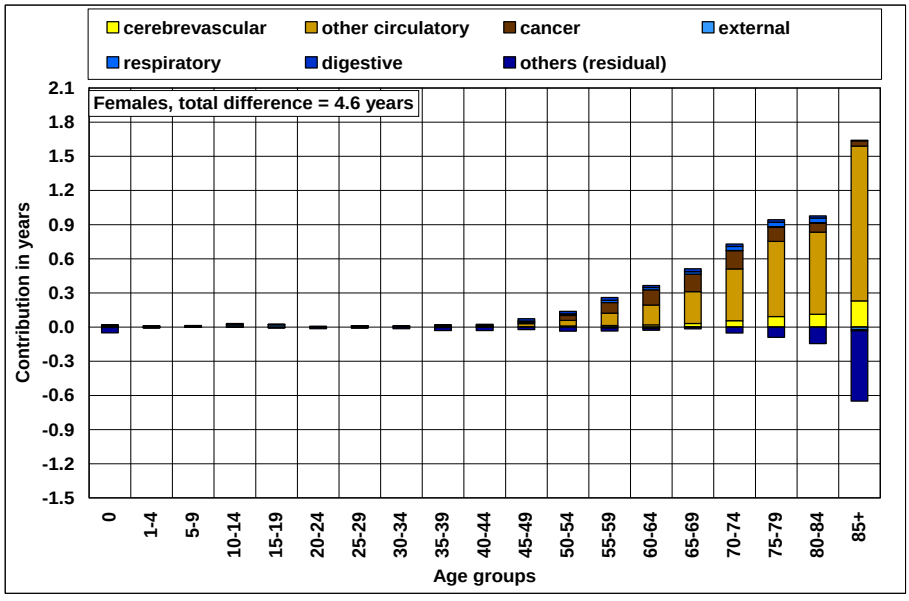
***Fig. 9 - Decomposition of Kazakhstan–France gap in life expectancy by age and main causes of death for females, 2005***




Source: Author's calculations based on data from www.who.int

Figure 10 illustrates the result of the decomposition of life expectancy by age and selected causes of death between females of the Czech Republic and France in 2005. The gap in expectation of life at birth between these two countries is equal to 4.6 years. Its structure by age and cause of death is quite similar among young adult ages, especially between ages of 45 and below. Excess mortality in the Czech Republic from other diseases of the circulatory system plays a major role at older ages. The contribution made by cerebrovascular diseases and cancers are important, but much less significant than first two diseases. All other causes of death at old ages make a negative contribution, and it means they are lower than in France.

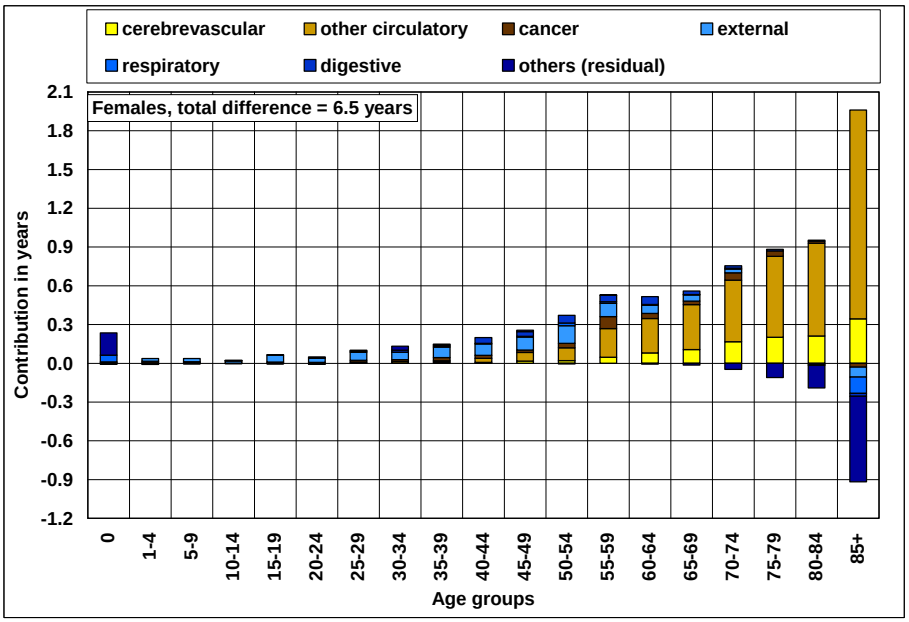
***Fig. 10 - Decomposition of the Czech Republic–France gap in life expectancy by age and main causes of death for females, 2005***




Source: Author's calculations based on data from www.who.int

For women the gap in life expectancy at birth between Lithuania and France is 6.5 years (see Figure 11). The largest contribution to the overall life expectancy gap is from excess mortality in Lithuania at ages over 55. Moreover, other diseases of the circulatory system diseases play a much significant role between ages of 55 and over. External causes of morbidity and mortality at ages between 20 and 50 are considerable, but much less significant than the other causes of circulatory system diseases. All other cause of death make a negative contribution at oldest ages, which means that values of other remaining causes of death is lower in Lithuania rather than in France in the same period of time. The result of Lithuanian females is quite similar with Czech females.

***Fig. 11 - Decomposition of Lithuania–France gap in life expectancy by age and main causes of death for females, 2005***




Source: Author's calculations based on data from www.who.int

In summary, decomposition by age and causes of death for males among the selected countries in 2005 showed a different picture. Kazakhstan vs. Spain contribution to the life expectancy for men is significant between younger ages. In Kazakhstan vs. Spain and Lithuania vs. Spain a similar pattern was observed, in both cases the greatest contribution was at adult ages. Also the gap between life expectancies at birth was more than 10 years. Moreover, in the both cases important role plays the other diseases of the circulatory system and external causes of morbidity and mortality. The next decomposition in the Czech Republic vs. Spain is much less significant than in the first two. The major contribution between old adults was analyzed. In the decomposition for women reference country was France. Female pattern was quite different from males and the causes of death and period was a same. Kazakhstan vs. France showed dissimilar result from the Czech Republic vs. France and Lithuania vs. France. The similarities in structure by age and causes of death were observed among the last two. In Kazakhstan vs. France decomposition the greatest contribution was at adult ages and other diseases of the circulatory system and external causes played a major part. The decomposition in life expectancy by age and causes of death for females in the Czech Republic vs. France and

Lithuania vs. France was mainly at older ages. Also in both cases a negative contribution at oldest ages was noted.

# Chapter 5

# Analysis of the development of cause-specific mortality in selected countries between the period of 1985 and 2005

## 5.1 Comparative analysis of the cause-specific mortality levels

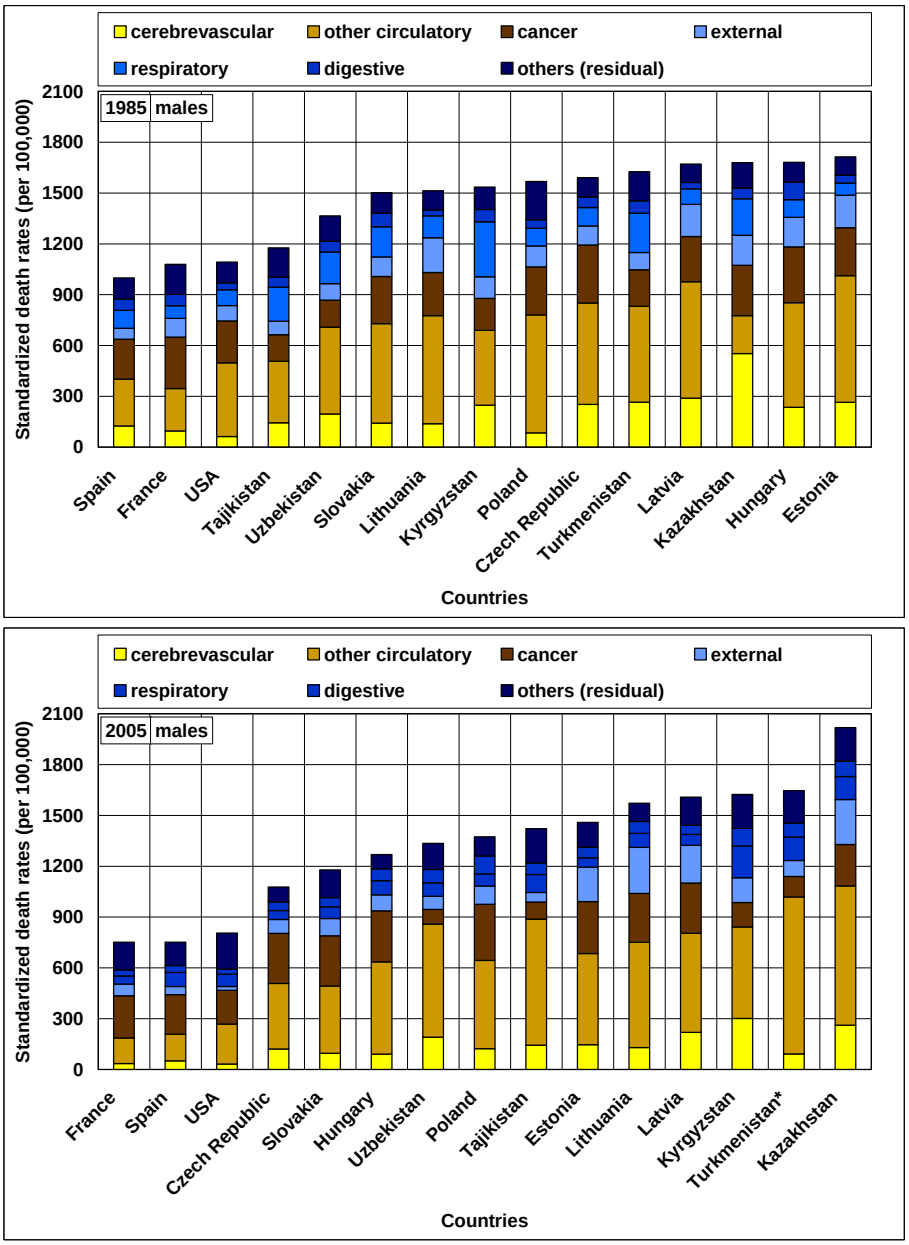
In this introductory part, the standardized death rates by main causes of death will be discussed in order to investigate the cause-specific mortality levels among the selected countries. The analysis was separated for males, females and both sexes in 1985 and 2005, respectively. A comparative analysis of the SDR by main causes of death will be presented for each sex (males, females and both sexes). The selected causes of death will be the same during the whole analysis. The cause-specific mortality levels in the selected countries will be discussed by the macro-regions. The lowest mortality levels by main causes of death belonged to all low mortality populations in the selected periods. The highest mortality levels among males were observed in Hungary and Estonia in 1985. In 2005, it was found in Turkmenistan's and Kazakhstan's males in the same period (see Figure 12).

Figure 12 illustrates the cause-specific mortality levels in the selected countries for the male population. In comparison, it can be seen that the mortality levels between the selected periods were increased and some decreased. The decline of malignant neoplasm and the respiratory system diseases was highlighted. Its values decreased by 44–93 and 79–136 deaths respectively, per 100,000 populations. In the beginning of the period, the countries of the Central Asian region had significantly high all diseases of the cardiovascular system. In 2005, the level of this disease mainly increased in Kazakhstan (290 deaths per 100,000) and Turkmenistan (174 deaths per 100,000). In Kyrgyzstan an inverse situation occurred, and their value decreased by 54 deaths per 100,000 in 2005. With particular reference to the case of other diseases of the cardiovascular system a big increase was analyzed. The largest increase in mortality levels were in Kazakhstan, Tajikistan and Turkmenistan where more than 350 deaths per 100,000 among males occurred between the two periods of time. The rates for the digestive system diseases (by 10–30 deaths per 100,000) and other remaining causes (19–68 deaths per 100,000) rose in the

male populations of the Central Asian countries. In the case of Uzbekistan, in the end of study period, the SDR by other causes of death increased only by 3 deaths per 100,000.

In the countries of the Central European area the SDR by all cardiovascular diseases declined (see Figure 12). Only in Poland did the value for the cerebrovascular diseases increase by 38 deaths per 100,000 in 2005. Less improvements by the same disease took place in Slovakia (47 deaths per 100,000) compared with the rest of the Central European countries (more than 100 deaths per 100,000).

***Fig. 12 - Standardized death rates (per 100,000) by main causes of death of mortality levels in the selected countries for males, 1985 and 2005 (all ages)***




Note: sorted according to SDR by all causes, Turkmenistan* means that instead of 2005 data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The mortality levels by cancer were increased in the Czech Republic and Hungary, while the opposite situation was observed in Slovakia and Poland (see Figure 12). In the last two countries an improvement in the rate of malignant neoplasm was noted. SDR by external causes, the respiratory and digestive system diseases, also remaining other causes declined. However, in Poland by the end of analyzed period (2005) the SDR by diseases of the digestive system rose and even doubled (from 50 to 105 deaths per 100,000). In 2005, the SDR by other causes for Slovakia increased by 42 deaths per 100,000.

In the three Baltic states, the cause-specific mortality levels were quite similar to the Central European countries (see Figure 12). The death rates for all cardiovascular diseases among males from the Baltic states were decreased. The largest decline in the Estonian level of cerebrovascular diseases by 118 deaths per 100,000 was observed. The lowest decline in SDR was in Lithuania, by only 9 deaths per 100,000. In relation to the other diseases of the circulatory system, the largest decline occurred in Estonia (209 deaths per 100,000). The next declining diseases in these three countries are SDR by diseases of the respiratory system. The rest of the selected diseases increased during the analysis. For instance, SDR by cancer (by 23–34 deaths per 100,000), external causes (by 12-67 deaths per 100,000) and diseases of the digestive system (by 16-36 deaths per 100,000) increased.

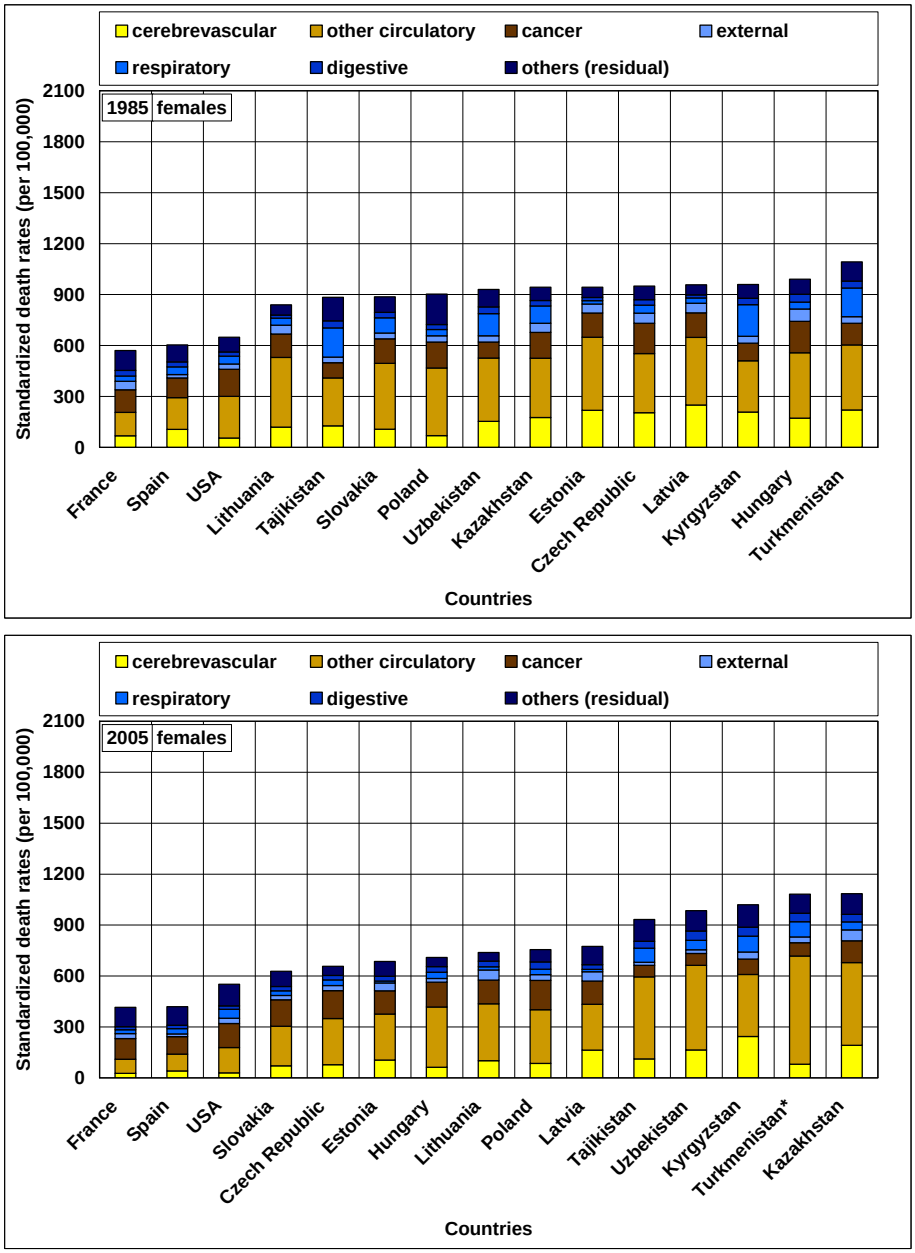
During the analysis, the cause-specific mortality levels for males form the low mortality populations all other selected causes of death after the twenty year time period declined mostly (see Figure 12). The exceptions were in Spain and the USA, where their SDR by other remaining causes of death increased by 13 and 89 deaths per 100,000, respectively, in the same time period. The largest decline was in the male mortality levels of other diseases of the circulatory system. The SDR by this disease halved approximately.

Women cause-specific mortality levels are different among the selected countries. As was mentioned before, the structure of analysis will be same with males. The lowest values of SDR by all causes for females were highlighted in the low mortality countries. The highest mortality levels among females were observed in Hungary and Turkmenistan in 1985. In 2005, the big SDR by all causes were Turkmenistan's and Kazakhstan's females in the same period (see Figure 13).

Firstly, the female mortality levels by main causes of death in the Central Asian region will be discussed (see Figure 13). In 2005, the SDR by all cardiovascular diseases increased, excluding Tajikistan's and Turkmenistan's case. In Tajikistan, the death rate by the cerebrovascular diseases decreased from 126 to 111 deaths per 100,000 between the years of 1985 and 2005. In Turkmenistan, the SDR by the same disease declined from 220 to 80 deaths per 100,000 between the years of 1985 and 1998. Remarkably, the death rates by other diseases of the circulatory system in this region increased. Due to these diseases the rate in the Central Asian republics divided. In the first part, the death rate increased by more than 200 deaths per 100,000 persons, and in the second rose to around 100 deaths per 100,000. The SDR by some diseases slightly declined, for instance, the rate for diseases of the digestive system and part external causes, together with the remaining other causes of death. In comparison, the cause-specific mortality levels for females in the former Soviet Central Asian countries are better than

in males. In general, their mortality levels confronted with other selected countries are obviously higher.

***Fig. 13 - Standardized death rates (per 100,000) by main causes of death of mortality levels in the selected countries for females, 1985 and 2005 (all ages)***




Note: sorted according to SDR by all causes, Turkmenistan* means that instead of 2005 data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the second country group which comprises the Central European republics large improvements have taken place concerning in their cause-specific mortality levels for females after the collapse of the socialist regime (see Figure 13). Mainly, their SDRs by the selected causes of death declined, except in small cases. In Poland, the death rate due to cerebrovascular diseases increased from 69 to 85 deaths per 100,000 between the selected periods. Also SDR by

cancer in Slovakia and Poland improvements arose. Their values dropped by 11 and 20 deaths per 100,000, respectively. In the patterns of Polish females by digestive system diseases, the figure increased by 14 deaths per 100,000 compared with the beginning of periods (Dobrossy 2002)

The next macro-region is the three Baltic states. The death rates by main causes of death are clearly illustrated in Figure 13. In the case of the Baltic states, the female cause-specific mortality levels are better compared with a male's from the same region. These patterns of mortality levels are closer to the Central European countries from the same sex. Most of the death rates improved in 2005. For instance, the death rates by all cardiovascular diseases declined to around half of their values in 1985. However, only in Lithuanian females did cancer and external causes decrease by 2 and 8 deaths per 100,000 populations. The rate from digestive system diseases increased to more than 10 deaths per 100,000 for all three countries. In the case of other causes, in Lithuania SDR increased by 9 deaths per 100,000, while the values for Estonia and Latvia declined by 25 and 48 deaths per 100,000, respectively.

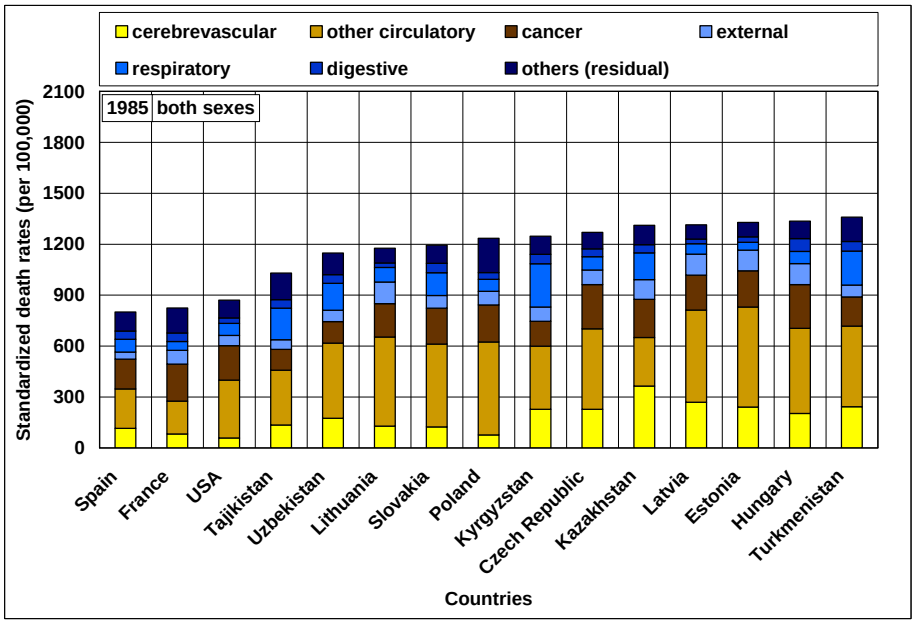
The last macro-region in the analysis of female mortality levels by main causes of death is the low mortality populations. Their results will now be presented (see Figure 13). In these countries, a clear "low mortality" pattern was observed. More than half of the death rates by selected causes of death in this region developed in a positive way. However, in the values of these country groups, a number of decreases occurred. They included SDR by the respiratory system diseases which increased by 7 deaths per 100,000 residents. In the remaining other causes for females in Spain and the USA, an increase of SDR was also noted. In general, the cause-specific mortality levels for females from this region notably decreased compared with the other selected countries.

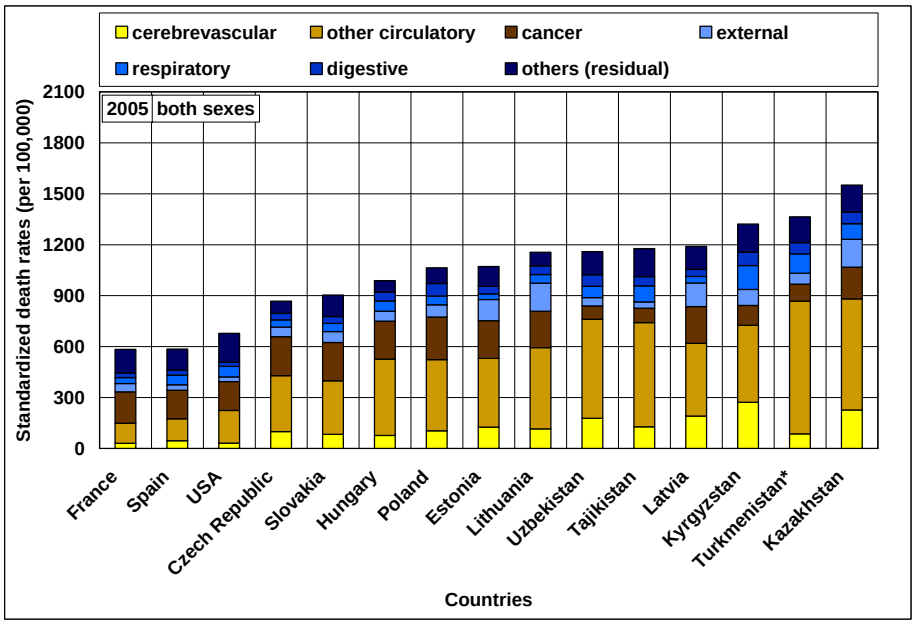
Figure 14 illustrates the changes of the cause-specific mortality levels overtime for both sexes among the selected countries. In the former Soviet Central Asian countries the cause-specific mortality profiles for both sexes can be found in Figure 3. According to the death rates by cerebrovascular diseases the picture is heterogeneous. In 2005, Kazakhstan and Turkmenistan the death rates by this cause decreased by 137–157 deaths per 100,000 citizens. An opposite situation was found in Kyrgyzstan, and the rate increased from 227 to 272 deaths per 100,000 populations. A small variation by this disease in Tajikistan and Uzbekistan was observed. In the case of other diseases of the circulatory system, a large increase took place in Kazakhstan, Tajikistan and Turkmenistan's rates rose to around 300 and more deaths per 100,000 populations. The SDR by diseases of the digestive system and remaining other causes for all countries of this region increased. In comparison with other selected diseases standardized death rates by malignant neoplasm and respiratory system diseases showed a positive picture.

In the Central European countries, regarding death rates for both sexes, a reduction of mortality levels was observed (see Figure 14). Significantly, the death rates for all cardiovascular diseases declined. Only the SDR by this disease for Poland was increased by 27 deaths per 100,000. For instance, in 2005, the SDR by cerebrovascular diseases for the rest of the Central European countries halved. In the case of SDR by cancer for Slovakia and Poland,

the figure slightly increased by 15 and 34 deaths per 100,000 populations, respectively. The death rates by other selected causes decreased.

***Fig. 14 –Standardized death rates (per 100,000) by main causes of death of mortality structure in the selected countries for both sexes, 1985 and 2005 (all ages)***




Note: sorted according to SDR by all causes, Turkmenistan* means that instead of 2005 data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Among the three Baltic states a comparison of the mortality levels by the main causes of death for both sexes showed an interesting result between 1985 and 2005 (see Figure 14). The all cardiovascular diseases and the respiratory system diseases rates increased over time, an inverse situation occurred with the rest of the selected causes. The SDR by cerebrovascular diseases by the end of analyzed periods halved, and death rate by other diseases of the

circulatory system significantly declined. According to the SDR by cancer and external causes, increases were noted in Latvia and Lithuania.

The SDR by main causes of death for both sexes in the low mortality populations reduced (see Figure 14). In 2005, only the death rates by other remaining causes for Spain and the USA were higher than in the beginning. This SDR by other causes increased by 11 deaths per 100,000 populations for Spain, and 65 deaths per 100,000 for the USA. Notably, the decrease of SDR by other diseases of the circulatory system was more than 100 deaths per 100,000 in Spain and the USA. In comparison, the lowest values of SDR by main causes of death among the selected countries belong to this macro-region.

## 5.2 Standardized death rates by main causes of death of mortality levels

The standardized death rates by main causes of death, which were listed before, for selected post-communist and low mortality population countries, have been separated for males, females and both sexes in the period of 1985 and 2005 respectively. These variables were used for the hierarchical cluster analysis based on Euclidean distance and Ward method.

In 1985 the selected post-communist countries was a member of the Soviet Union. As well known, that The Soviet Union's collapse into independent nations began early in 1985. The post-socialist European area becomes independent since 90s. Over than 70 years Czechoslovakia shared the same history. In 1992 Czechoslovakia was peacefully dissolved by parliament and in 1993 it formally separated into two completely independent countries: the Czech Republic and the Slovak Republic. The former Soviet Central Asian republics gained independence in 1991. The cause-specific analysis for 1985 will show the mortality conditions in the period of pre-dissolution among the selected post-communist countries, and their comparison with low mortality populations.

The entry data for the hierarchical cluster analysis is standardized death rates by main causes of death for males in 1985 (see Table 8) were used.

***Tab. 8 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for males, 1985 (standardized for all ages)***

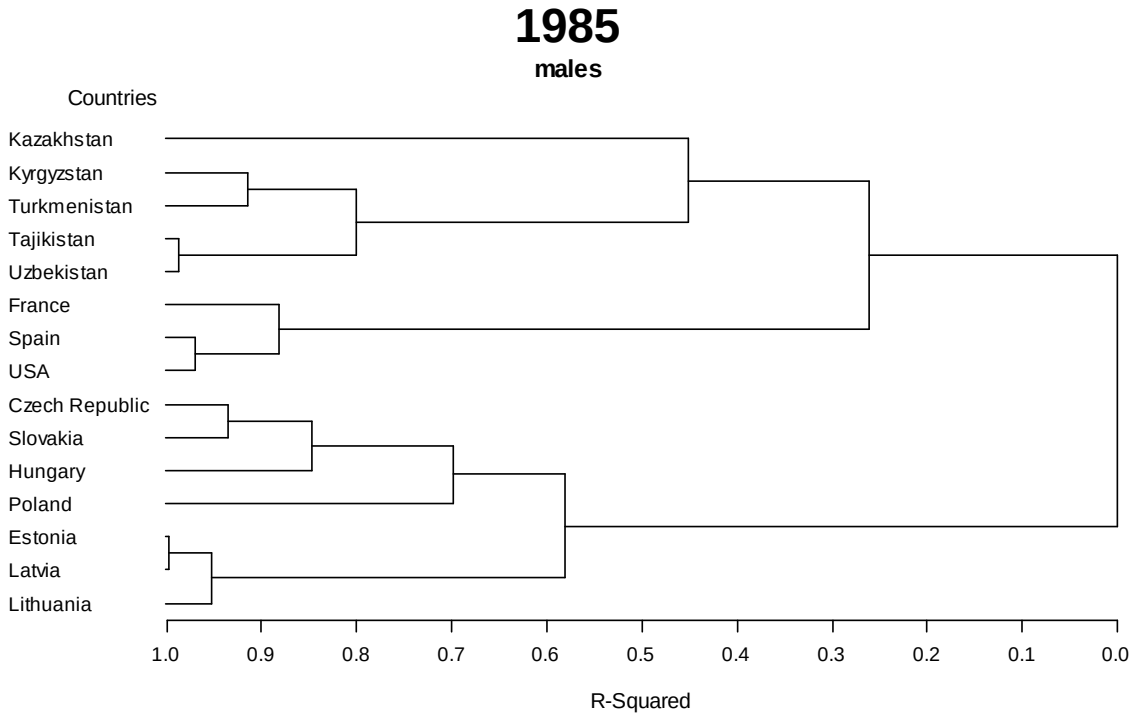
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 1,679 | 552 | 224 | 297 | 177 | 215 | 63 | 150 |
| Kyrgyzstan | 1,535 | 247 | 442 | 188 | 128 | 324 | 73 | 132 |
| Tajikistan | 1,176 | 144 | 363 | 157 | 79 | 201 | 58 | 174 |
| Turkmenistan | 1,626 | 265 | 567 | 214 | 103 | 232 | 72 | 173 |
| Uzbekistan | 1,365 | 195 | 513 | 159 | 97 | 187 | 63 | 150 |
| Czech Republic | 1,590 | 252 | 598 | 343 | 112 | 109 | 62 | 114 |
| Hungary | 1,502 | 142 | 587 | 278 | 115 | 178 | 80 | 121 |
| Poland | 1,681 | 235 | 617 | 330 | 174 | 104 | 104 | 117 |
| Slovakia | 1,567 | 84 | 696 | 283 | 124 | 105 | 50 | 225 |
| Estonia | 1,713 | 264 | 748 | 283 | 192 | 72 | 46 | 109 |
| Latvia | 1,671 | 288 | 688 | 267 | 190 | 91 | 38 | 109 |
| Lithuania | 1,513 | 138 | 638 | 255 | 205 | 129 | 35 | 114 |
| France | 1,079 | 96 | 250 | 304 | 110 | 74 | 67 | 178 |
| Spain | 998 | 125 | 277 | 236 | 64 | 106 | 66 | 126 |
| USA | 1,092 | 62 | 436 | 247 | 90 | 94 | 40 | 122 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The result of country grouping in a cluster analysis can be clearly seen in Figure 15. Specifically, the selected countries are divided into three major groups. The former Soviet Central Asian republics are in the first group. Low mortality populations in the second and post-socialist countries are in the last. These major groups can be further divided into four subgroups and one country like a unique apart. Kazakhstan is the unique outsider in this analysis. The first subgroup is represented by Kyrgyzstan, Turkmenistan, Tajikistan and Uzbekistan. Low mortality countries belong to the second. The third subgroup includes all Central European countries and the Baltic states are depicted in the fourth subgroup.

***Fig. 15 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for males, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Table 9 highlights groups of countries with lowest and highest values. In Kazakhstan high value of the all causes and cerebrovascular diseases was observed. Other diseases of the circulatory diseases showed lowest value among the selected countries. The highest value of all causes of death is in Kazakhstan and more than half of them took cardiovascular diseases. Cardiovascular disease is the largest contributor to the gap in mortality between the Central Asian region and western European countries. Especially, in Kazakhstan the standardized death rates have dramatically increased steeply among men. There is now increasing evidence that alcohol consumption has played some part in these fluctuations. The overall higher level of cardiovascular mortality compared to the EU average is likely to be due to differences in traditional cardiovascular risk factors that are more frequent in the Central Asian region such as smoking, a diet high in saturated animal fat, and, in some areas, a diet that is extremely low in antioxidants. In addition, differences in the quality of medical care as regards treatment of cardiovascular disease and in particular poor detection and treatment of high blood pressure, a

major risk factor for cerebrovascular disease may play some part (Nolte, McKee, and Gilmore 2004). The lowest value of other diseases of the circulatory system can be due to the most part of circulatory diseases contained cerebrovascular diseases.

Highest value of the respiratory system diseases and remaining other causes of death in 1985 occurred in the Central Asian republics, excluding Kazakhstan (see Table 9). Also the lowest value of cancer mortality belongs to this subgroup. The values of the diseases of the respiratory system in the first subgroup are about two times higher than average for all country groups. In the Central Asian countries a big differences between urban and rural places. Also socio-economic condition in these countries was a low and middle income, those who spent a large part of their lives in an urban setting tended to have unhealthier lifestyles and therefore a higher risk of chronic diseases of the respiratory system compared with their less urbanized counterparts. An exception to this rule may arise from exposure to indoor air pollution in rural areas where solid fuels are used for cooking and heating (Cockerham et al. 2004).

The next leading cause in this subgroup is other remaining causes of death (see Table 9). In this subgroup of countries a higher level of this causes perhaps it is a result of the low concentration of diagnoses into the "well-known" causes and a quite higher percentage of ill-defined causes of death. Moreover, this country group's value is closer to the value for Kazakhstan from the same diseases.

***Tab. 9 - Average standardized values (Z-scores) of each country group for males, 1985 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 0.917 | 2.860 | -1.682 | 0.723 | 1.036 | 0.930 | 0.093 | 0.278 |
| Kyrgyzstan, Turkmenistan, Tajikistan, Uzbekistan | -0.110 | 0.056 | -0.225 | -1.347 | -0.642 | 1.220 | 0.313 | 0.482 |
| France, Spain, USA | -1.604 | -0.924 | -1.113 | 0.111 | -0.945 | -0.787 | -0.192 | 0.029 |
| Czech Republic, Slovakia, Hungary, Poland | 0.536 | -0.228 | 0.678 | 0.923 | 0.017 | -0.334 | 0.706 | 0.101 |
| Estonia, Latvia, Lithuania | 0.729 | 0.200 | 1.070 | 0.214 | 1.432 | -0.705 | -1.197 | -0.898 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the second subgroup which comprises of the low mortality populations the lowest values of all causes, cerebrovascular diseases, external causes and respiratory system diseases were highlighted (see Table 9). The standardized mortality rate due to all causes of death is significantly lower compared with other subgroups. The relatively high level of quality of health care and increasingly health expenditures can be influence to reduction of mortality rates. In comparison with the selected post-communist countries in the same time period low mortality populations were in better socio-economic conditions. Perhaps, this kind of factor can influence to avoid high mortality level.

In the third subgroup high malignant neoplasm and digestive system diseases among the other country groups was obtained (see Table 9). Cancer mortality in this subgroup is higher than the total average for all country groups. Also the next country with a high value of this disease is Kazakhstan. Although these regional differences might be explained by variations in

lifestyles, environmental exposures and medical practices such as screening are also likely to be important determinants of cancer risk, especially, among males. Another lifestyle variable, which correlated to an increased incidence of cancer, is obesity. These diseases are closely associated with the lifestyle in industrial countries (Klugman, Schieber, and Heleniak 1996).

The highest value of the diseases of the digestive system in post-socialist Central European countries is closer to the value which was observed the Central Asian region (see Table 9). Digestive symptoms include a wide variety of symptoms that affect the digestive or gastrointestinal system. Digestive symptoms can be due to a wide variety of mild to serious diseases, disorders and conditions; moreover, it can be result from gastrointestinal or digestive conditions or from conditions of other body systems, such as the endocrine system, the nervous system (Guo 1993).

In the last subgroup a high other diseases of the circulatory system and external causes occurred (see Table 9). Other diseases of the circulatory system under the Soviet era in the three Baltic states were worse situation compared with other subgroups. Regarding to external causes in the three Baltic states researchers such as Stankuniene, Jasilionis, and Krumins (1999) analyzed this causes especially suicide in this region. According to their results during the transition in Lithuania, contrary to Estonia and Latvia, mortality trends due to suicide have proceeded in the same direction as in the pre-transitional period. Higher suicide mortality rates in rural areas have remained not only much higher than in the cities but have been increasing further and at a more rapid speed in Lithuania during the transitional period. Also they explained the presence of higher suicide mortality rates in rural areas is connected with the higher level of alcohol consumption among the rural male (Krumins 2001).

Higher other diseases of the circulatory system, for instance, coronary heart disease were a high in this region. Furthermore, the increasing mortality from coronary heart disease among males was increasing. However, the slowdown of the rise in male mortality from coronary heart disease, which had started immediately before the transition, i.e. during the time of the anti-alcohol campaign (1985), continued into the initial stage of the transitional period (1991- 1993). In spite of this, differences in mortality from these diseases among males were continuing to grow, albeit at a slower rate in Lithuania during the transitional period (Stankuniene, Jasilionis, and Krumins 1999).

The lowest values of the digestive system diseases and all other causes in this subgroup were highlighted (see Table 9). The digestive system diseases among the three Baltic states males even lower compared with the low mortality populations which was selected as a reference countries. An opposite situation was observed in the Central European countries. Also in this country group the lowest value of the external causes of death was noted. In this time started Gorvochev's anti-alcohol campaign which results perhaps influenced into declining of this disease as one of the reason.

After 90s the formerly socialist countries of Europe and the former Soviet Union became independent and they have experienced a remarkable political, socio-economical and demographic transformation in the past twenty years. The collapse of the old system was accompanied by an overall fall in production and a sharp decline in living standards: employment decreased, the GDP per capita is fall. Only by mid-90s the socio-economic and

political situation had started to stabilize. For highlight improvements or deteriorations in the cause-specific mortality levels among males in the selected countries the same procedures was used for analysis in 2005. These variables which listed in Table 10 were used for the hierarchical cluster analysis based on Euclidean distance and Ward method.

***Tab. 10 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for males, 2005 (standardized for all ages)***

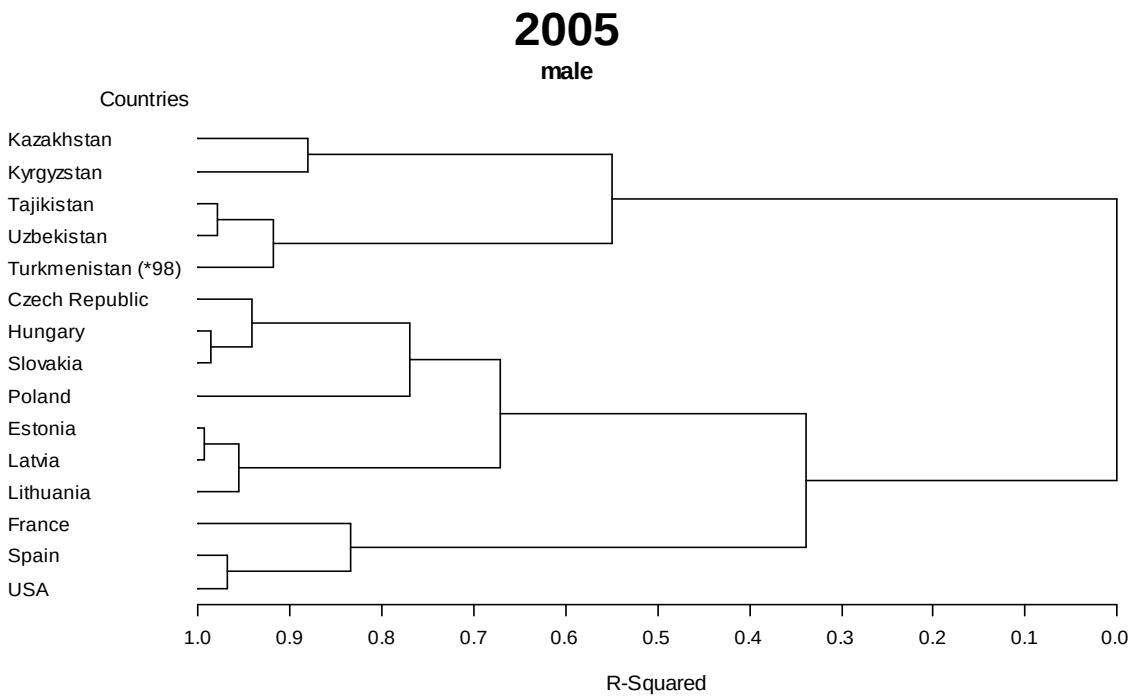
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 2,018 | 262 | 821 | 245 | 265 | 136 | 91 | 198 |
| Kyrgyzstan | 1,624 | 301 | 540 | 144 | 147 | 188 | 104 | 200 |
| Tajikistan | 1,422 | 143 | 744 | 101 | 57 | 106 | 69 | 202 |
| Turkmenistan (*98) | 1,646 | 91 | 927 | 121 | 95 | 139 | 82 | 191 |
| Uzbekistan | 1,334 | 190 | 668 | 87 | 77 | 80 | 79 | 153 |
| Czech Republic | 1,077 | 121 | 387 | 295 | 83 | 52 | 51 | 88 |
| Hungary | 1,269 | 91 | 544 | 301 | 94 | 84 | 70 | 84 |
| Poland | 1,373 | 123 | 521 | 331 | 108 | 72 | 105 | 113 |
| Slovakia | 1,178 | 95 | 398 | 296 | 103 | 69 | 55 | 163 |
| Estonia | 1,458 | 146 | 538 | 306 | 203 | 55 | 63 | 146 |
| Latvia | 1,607 | 219 | 585 | 297 | 223 | 63 | 54 | 166 |
| Lithuania | 1,572 | 129 | 621 | 289 | 271 | 83 | 70 | 108 |
| France | 751 | 35 | 151 | 249 | 69 | 48 | 36 | 164 |
| Spain | 751 | 51 | 158 | 233 | 49 | 83 | 40 | 138 |
| USA | 805 | 32 | 236 | 199 | 23 | 73 | 30 | 212 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The result of grouping countries in a cluster analysis can be clearly seen in Figure 16. Specifically, the selected countries are divided into two major groups and four subgroups.

***Fig. 16 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for males, 2005 ((adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998
Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

All post-socialist countries are in the first group and the more developed countries in the second (see Figure 16). The first subgroup is represented by Kazakhstan, Kyrgyzstan. The second subgroup is represented by Tajikistan, Uzbekistan, and Turkmenistan (*98). Thereafter, the third subgroup includes all Central European countries together with the Baltic states and low mortality populations are depicted in the fourth subgroup.

Table 11 highlights the groups of countries with the lowest and highest values. Among the selected countries, the highest values of all causes of death except other diseases of the circulatory system and respiratory system diseases are observed in Kazakhstan and Kyrgyzstan. The collapse of the Soviet Union and, alongside the Soviet production system had severe consequences for the economy in central Asia, with each country experiencing economic depression and rapid inflation, with negative economic growths until the mid–1990s, with consequences for health care spending. Some countries experienced slightly economic growth since, most notably Kazakhstan and Turkmenistan. There was, however, little change in Tajikistan, where the combined public expenditure on health care and education is now less than expenditure on debt service (Nolte, McKee, and Gilmore 2004).

Cardiovascular disease is the largest contributor to the gap in mortality between the Central Asia region and industrialized countries, with rates about three times higher than in Western Europe (McKee, Healy, and Falkingham 2002). Cerebrovascular diseases in these countries showed the highest value. In most former Soviet republics, the rising mortality in Kazakhstan can overwhelmingly be attributed to circulatory system disease and failure, and to a large rise in accidents, injuries, and traumas. For instance, when comparing the 1990 and 2000 data, 103% of the increase (that is, the entire increase and more) in mortality can be attributed to increases in these two factors; mortality from other diseases of the circulatory system and diseases of the digestive system actually declined slightly. This pattern is not in fact surprising, given the concentration of the mortality increase in middle-aged groups. Mortality among males in the working aged groups is far more likely to be from heart and circulatory system disease or accidents and violent deaths than from degenerative diseases more heavily associated with old age (Becker and Urzhumova 2005).

The next leading cause of death was noted in Kazakhstan and Kyrgyzstan in term of the external causes (see Table 11). As well as cardiovascular disease, alcohol is often an important proximate cause. In this case males are heavy drinkers rather than females. As well known that females in the Central Asian country, according their tradition and customs, they are mainly careful mothers, good wives. Taking into account that we are live in the modern society frequently in the rural areas females are not modernized. Regarding this facts females are less use alcohol than males. These countries have experienced a very rapid growth in road traffic. In recent years, adolescent suicide is growing in Kazakhstan, and now it is first place in the suicide rate among the students of Central Asian countries. According to the researchers in sphere of psychology have whole lists of causes and events that result in tragedy: school problems, family conflicts, unrequited love, unreasonable expectations, and even a failed exam ... But, alas, things are not so simple. In many families, conflicts often arise because of the lack of money and of course the main reason is financial problems of the family. As a result, among the CIS countries Kazakhstan was the leader in the number of suicides among young people. Annual statistics of

voluntary death at the age of 20 to 24 years is 35 cases per 100,000 populations. Regarding to the level of suicidal activity Kazakhstan only lags behind of Russia (Post-soviet 2011).

Cancer mortality also showed the highest value in this subgroup (see Table 11). These Central Asian countries have seen a decrease in diseases of the respiratory system since independence. Mortality from some of the most common cancers (including rectal and lung) remains low in Central Asia in comparison with other selected countries, and the downward trend has been observed in recent decades for some cancers (including Stomach, Lung and other tobacco-related cancers) in all countries. In general, neoplasm in Central Asia represented a diverse group of causes of death, which is dominated by tobacco-related cancers linked to the intensity of smoking. Nevertheless, the incidence of cancer varies between countries, while others are more common in people who live in Central Asia (for instance, cancer of the stomach). While these regional differences can be explained by differences in lifestyle, environmental exposures and medical practices, such as screening, may also be important risk factors for cancer (Klugman, Schieber, and Heleniak 1996).

Diseases of the digestive system also showed the highest value in Kazakhstan and Kyrgyzstan are compared with other selected countries (see Table 11). This value is twice higher than average value. Also confronted with values for 1985 can be seen that the digestive diseases in these countries increased. If in the beginning of analysis SDR was less than 70 for both cases, in the end it's about 100 per 100,000 populations. Moreover, should taking account that Kyrgyzstan and Kazakhstan switched to ICD10 in 2000 and 2004, respectively.

All other causes of death in this subgroup showed the highest value among the selected countries (see Table 11). Regarding to the highest value of all other causes of death in this subgroup might be related to ill-defined causes of death. Moreover, other factors such as higher infectious and parasitic diseases in these countries were observed. The mortality from infectious and parasitic diseases in Kyrgyzstan is significantly higher than in other countries of NIS or European level (Guillot 2007). Also Kazakhstan's level of the infectious and parasitic diseases mortality is closer to the Kyrgyzstan's value, but within the Central Asian region it is comparatively higher.

In the second half of the Central Asian countries, Tajikistan, Uzbekistan and Turkmenistan, which belong to the second subgroup showed lowest values of the respiratory system diseaseas (see Table 11). Interestingly, some studies have discussed the problem of registration and coding of deaths, which is a common problem in Central Asian republics (Ilkhamov and Jakubowski 2001). The one of the main reasons for this were increasing rates of smoking. These patterns are likely to reflect initial income and public health deterioration, followed by income and public health system recovery. Thus, there are some causes of death that appear to be coming under control. However, as is noted below, these levels remain high by world standards (Brainer 2010).

Also the highest other diseases of the circulatory system belong to this subgroup. according to the results can be seen that the highest cardiovascular diseases were found among the Central Asian countries. Perhaps, traditional factors, such as smoking, a diet high in fat and, probably, poor detection and treatment of hypertension, as well as (at least in some areas in this region)

diets that are extremely low in antioxidants can influence cardiovascular diseases (McKee, Healy, and Falkingham 2002).

***Tab. 11 - Average standardized values (Z-scores) of each country group for males, 2005 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakstan, Kyrgyzstan | 1.390 | 1.945 | 0.639 | 1.344 | 1.104 | -0.466 | 1.917 | 1.137 |
| Tajikistan, Uzbekistan, Turkmenistan* | 0.379 | 0.042 | 1.155 | 0.436 | -0.599 | -1.575 | 0.501 | 0.735 |
| Czech Republic, Hungary, Slovakia, Poland, Estonia, Latvia, Lithuania | 0.088 | -0.071 | -0.031 | 0.010 | 0.356 | 0.839 | -0.529 | -0.608 |
| France, Spain, USA | -1.511 | -1.172 | -1.509 | -1.354 | -0.968 | -0.071 | -0.543 | -0.073 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Table 11 clearly illustrates that in the third subgroup of countries the highest value of the respiratory system diseases and the lowest values of other causes of death are reported. The highest value of diseases of the respiratory system was observed in this region. The development of respiratory disease is dependent on several factors, including the chemical nature and physical state of the inhaled substance, the size and concentration of the dust particles, the duration of exposure, and individual susceptibility (Brhel 2002). In the Czech Republic respiratory system disease was the fourth most common cause of death in recent time. After a decade of strong annual fluctuation in the 1970s, the standardized rate of mortality due to this cause continued to decrease from 1980 until the late 1990s (Bryndovava et al. 2009). Since then, a slight upward trend has been observed. Nevertheless, at 42.0 deaths per 100,000 population, this indicator was lower in the Czech Republic in 2006 than in both the EU27 average for that year (43.7) (WHO Regional Office for Europe 2009).

All other causes of death in this region also showed the lowest value among the selected countries (see Table 11). In the three Baltic states more recent changes have been prompted by the lessons learned from the first round of reform implementation, and they are motivated by a desire to improve the regulation of new phenomena such as the rising cost of pharmaceuticals; implement strategies to manage decentralized hospital networks; optimize the planning and pricing of health services; and transform the patient-doctor relationship into a client-service relationship (Koppel et al. 2008).

In essence, the low mortality populations showed the lowest values of the all causes of death, cerebrovascular diseases, other diseases of the circulatory system and diseases of the digestive system (see Table 11). The cardiovascular diseases mortality in France, Spain and the USA are also one of the leading causes of death. In comparison with other post-communist countries it is lower. In the USA in 2006, the age-adjusted death rate for heart disease – the leading cause of death – was 66 % lower than the rate in 1950. The age-adjusted death rate for a stroke (cerebrovascular disease), the third leading cause of death, had declined 76 % since 1950 (U.S. Department of Health and Human services 2009).

The last subgroup of countries showed the lowest value of the all selected causes, excluding the respiratory system diseases and other causes among the selected countries (see Table 11). Also socio-economic factor have influence on overall health condition in the country. For instance, The United States spends more on health per capita than any other country, a trend that continues to increase (see Table 11). Major sponsors of health care include private health insurers and public programs such as Medicaid and Medicare. Furthermore, low mortality countries spend a larger share of their GDP on health than any other major industrialized country in the world. In 2006, the United States, France and Spain devoted 9–15 % of their GDP to health, compared with 11 % in Switzerland, the country with the next highest share (World Bank 2006).

Summary of the male cause-specific mortality levels in the selected countries illustrates in Figure 17. The highest mortality levels in former Soviet Central Asian region were observed. In the beginning of studying period (1985) Kazakhstan separated from other Central Asian countries and the cerebrovascular diseases was extremely high among the selected countries. In the end of analyzing period (2005) Kazakhstan and Kyrgyzstan showed a similarity in their mortality pattern. Vulnerable difference between the same time periods in male population was low malignant neoplasm, but by the end of period this value was higher than in 1985. The influence of changes in the politic, socio-economic and other sphere which is experienced post-communist countries after the collapse of the socialist regime and since their independence. In the countries of the former socialist Europe chose a fast and radical reorganization of their economy, the increase in mortality rates was higher than in the states where the transition was more gradual.

***Fig. 17 - Standardized values of cause-specific mortality levels in the selected countries for males, 1985 and 2005 (all ages)***

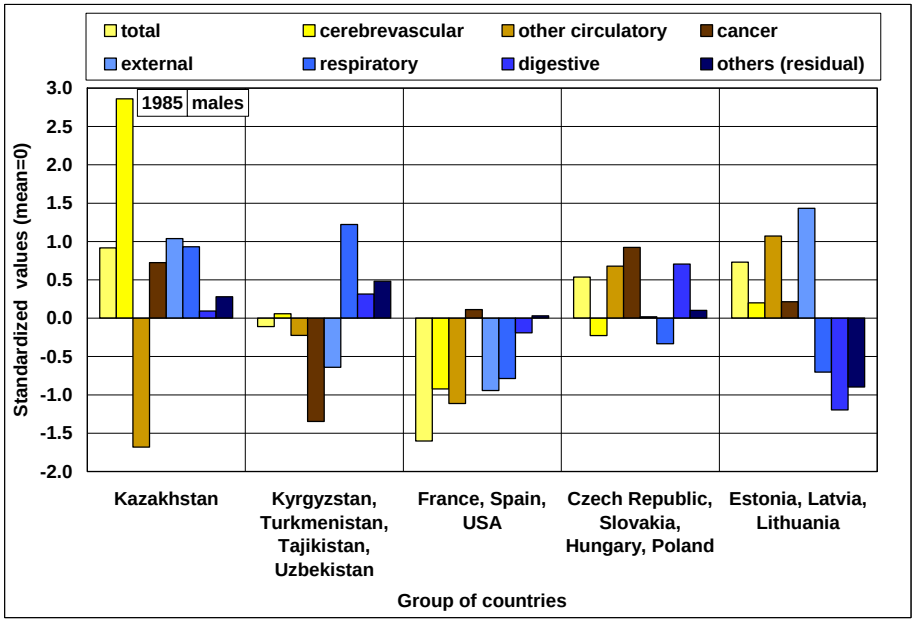
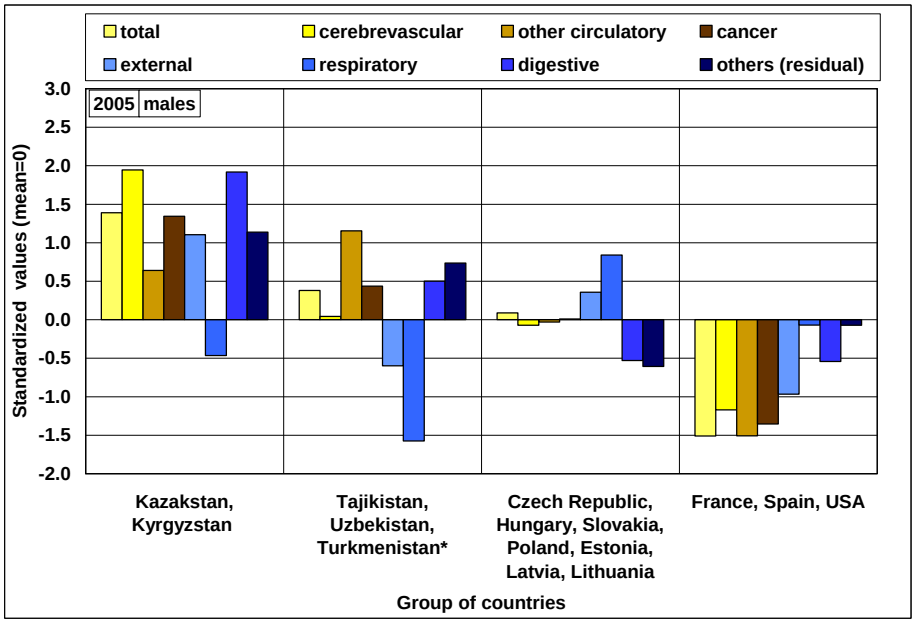


***Fig. 17 – continued***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Between the selected time periods in post-socialist European area improvements was observed, especially in the three Baltic states. In 1985, their cause-specific mortality levels in other diseases of the circulatory system, cancer and external causes of death slightly were improved. The cause-specific mortality condition among males in Central European countries also changed in a positive way (see Figure 17).

Women live longer than men. Indeed, in the more developed countries today women live around 6 years longer than men on average (World Bank 1985). This difference varies from country to country. Initial data for cluster analysis among females in the selected countries by the main causes of death represents in Table 12.

***Tab. 12 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for females, 1985 (standardized for all ages)***

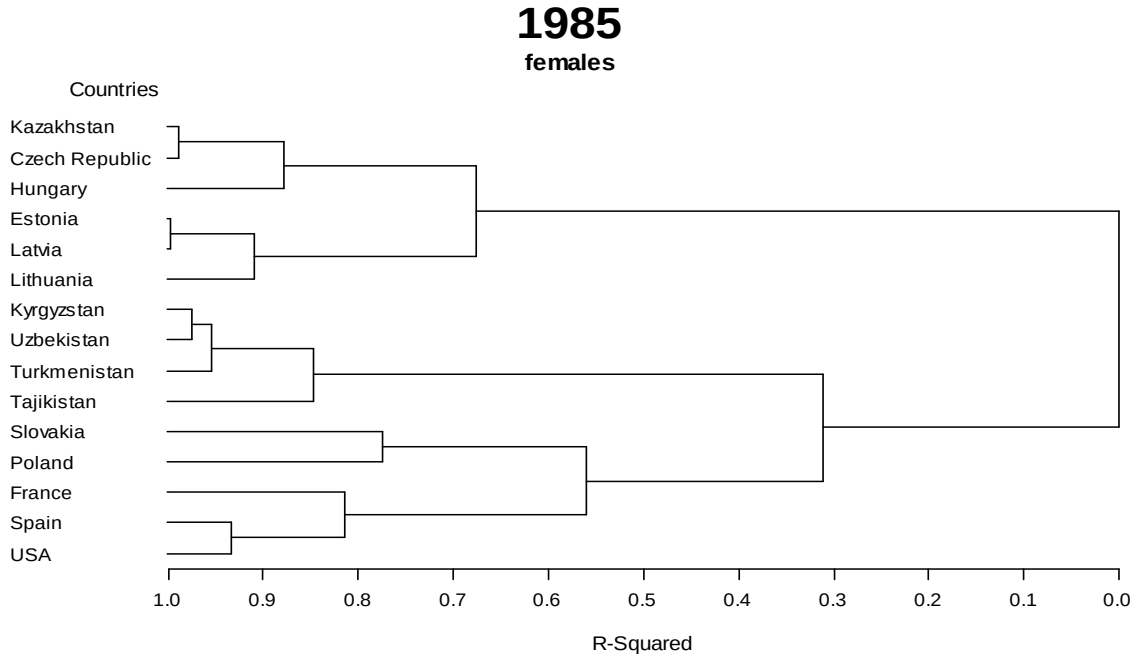
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 943 | 176 | 349 | 153 | 53 | 101 | 33 | 78 |
| Kyrgyzstan | 959 | 208 | 302 | 104 | 41 | 185 | 38 | 81 |
| Tajikistan | 884 | 126 | 283 | 89 | 34 | 171 | 42 | 139 |
| Turkmenistan | 1,092 | 220 | 383 | 128 | 38 | 169 | 41 | 114 |
| Uzbekistan | 930 | 153 | 373 | 95 | 36 | 131 | 39 | 104 |
| Czech Republic | 950 | 203 | 348 | 179 | 59 | 47 | 32 | 80 |
| Hungary | 887 | 106 | 389 | 144 | 34 | 90 | 32 | 92 |
| Poland | 990 | 171 | 385 | 185 | 72 | 40 | 47 | 88 |
| Slovakia | 902 | 69 | 425 | 152 | 37 | 37 | 29 | 153 |
| Estonia | 943 | 218 | 430 | 143 | 53 | 20 | 18 | 61 |
| Latvia | 957 | 250 | 398 | 145 | 57 | 31 | 17 | 60 |
| Lithuania | 839 | 119 | 411 | 137 | 52 | 42 | 18 | 61 |
| France | 570 | 68 | 137 | 133 | 50 | 31 | 33 | 116 |
| Spain | 603 | 106 | 187 | 116 | 19 | 46 | 29 | 100 |
| USA | 649 | 55 | 245 | 160 | 31 | 46 | 24 | 87 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Country grouping according their similarities on mortality levels illustrates in Figure 18. The major differences between three groups were observed. They are the three Baltic states, the Czech Republic, Hungary together with Kazakhstan in the first. In the second group Soviet Central Asian republic excluding Kazakhstan are in the second. In the last group is Slovakia, Poland and low mortality populations. These major groups are divided into four subgroups. The countries which belong to the first subgroup are same with first major group (the three Baltic states, the Czech Republic, Hungary and Kazakhstan). The second subgroup comprises Kyrgyzstan, Uzbekistan, Turkmenistan and Tajikistan. Slovakia and Poland belong to the third subgroup. Low mortality populations are in the last.

***Fig. 18 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for females, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the first subgroup the highest cerebrovascular diseases, malignant neoplasm and external causes was observed (see Table 13). A vice verse situation with the digestive system diseases and other causes of death, they showed the lowest values among the other subgroups. Regarding to the cerebrovascular diseases in Kazakhstan, the highest value of this disease among the males were noted, and now the similar situation was observed among females according to that fact a high cerebrovascular diseases occurred Kazakhstan for both sexes. Thus, while the standardized death rates has halved since the fall of communism in some countries from this region (such as the Czech Republic and Poland) due to improvements in nutrition and health services (particularly medication, which has contributed to narrowing the "east-west gap") the rate in other countries (such as Hungary and Slovakia) remains more than double that of the EU average (Monostrori et al. 2010). In the countries of the former Soviet Union, such as the Baltic states, the burden of cerebrovascular diseases accounted around one third of the overall burden

of diseases (Nolte, McKee, and Gilmore 2004). The inverse situation with the digestive diseases and other causes of death in this subgroup was obtained.

In the second subgroup which comprises of the Central Asian republics, except Kazakhstan showed the highest all causes, the respiratory system and digestive system diseases. Only the malignant neoplasm value was the lowest among the other subgroups (see Table 13). A high mortality levels in this subgroup might be related with inequalities emerged during the 80s. Some of them were associated with the budget crisis in Central Asia. As the government health budget shrank, people increasingly had to pay for services and drugs. Rural areas have suffered most from the findings, they have experienced cuts and hospital closures, and there are variations in the health status and resources across the region. Efficiency gains are not yet evident and pressure on expenditures will raise as health workers demand salaries commensurate with their skills and responsibilities.

The highest levels of other diseases of the circulatory system and remaining other causes in the third subgroup were obtained (see Table 13). Regarding to the level of other diseases of the circulatory system in this country group has declined since the 1970s, but the decline has started much later or the trend has even been increasing in the reference countries. The death rates due to other diseases of the circulatory disease are heavily correlated with socio-economic conditions, lifestyle, public health policy and accessible and effective healthcare. Moreover, the level of diagnosis, availability of appropriate material and technical basis, the qualifications of physicians, especially the diagnosis affected to the development of leading cause of death. In 1985, high levels of this disease in this subgroup were closer to the previous country group. Also the highest mortality level by other remaining causes of death observed among the Polish and Slovak females in 1985, and this value was extremely high compared with the other subgroups. In the time of pre-dissolution of the Soviet Union these countries experienced economic problems through the 1980s which perhaps had influence on the overall health of their population.

***Tab. 13 - Average standardized values (Z-scores) of each country group for females, 1985 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Czech Republic, Hungary, Estonia, Latvia, Lithuania | 0.427 | 0.635 | 0.604 | 0.695 | 0.975 | -0.556 | -0.445 | -0.769 |
| Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan | 0.623 | 0.432 | 0.007 | -1.200 | -0.537 | 1.464 | 0.931 | 0.415 |
| Slovakia, Poland | 0.141 | -0.999 | 0.680 | 0.385 | -0.664 | -0.271 | -0.122 | 1.237 |
| France, Spain USA | -1.780 | -1.179 | -1.670 | -0.048 | -0.792 | -0.660 | -0.269 | 0.161 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the low mortality populations the lowest all causes, all cardiovascular diseases, external causes and the respiratory system diseases was analyzed (see Table 13). Women from France, Spain and the USA had mostly low mortality levels among the selected countries. The selected low mortality populations, such as France, Spain and the USA kept the position of having low cause-specific mortality levels by main causes of death. They showed quite a large

improvement in the health of the population, especially in the cardiovascular diseases, in contrast to the other countries.

After the collapse of the Soviet Union in ex-communist countries were started the complicated socio-economic period. The strict State anti-alcohol policy calmed down and the change to a market economy caused unemployment. Table 14 illustrates initial data for the hierarchical cluster analysis.

***Tab. 14 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for females, 2005 (standardized for all ages)***

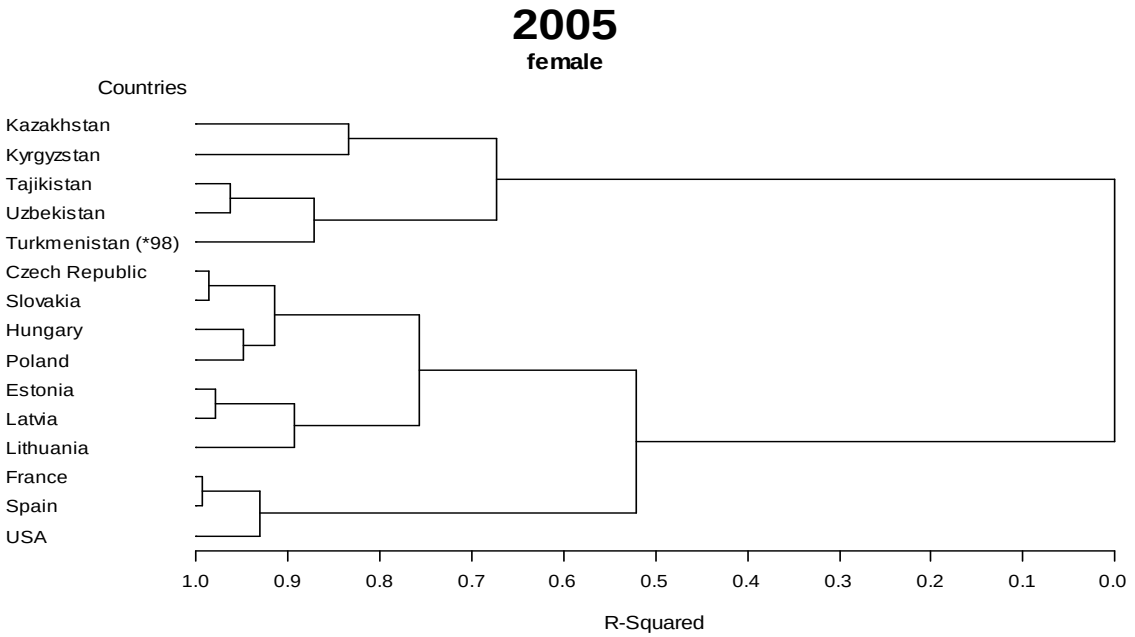
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 1,085 | 191 | 487 | 129 | 64 | 47 | 44 | 122 |
| Kyrgyzstan | 1,020 | 243 | 365 | 91 | 41 | 94 | 53 | 132 |
| Tajikistan | 933 | 111 | 483 | 68 | 17 | 83 | 41 | 129 |
| Turkmenistan (*98) | 1,082 | 80 | 637 | 79 | 33 | 91 | 50 | 112 |
| Uzbekistan | 984 | 164 | 498 | 70 | 22 | 55 | 55 | 119 |
| Czech Republic | 657 | 77 | 272 | 165 | 29 | 33 | 27 | 54 |
| Hungary | 708 | 62 | 355 | 146 | 22 | 37 | 33 | 53 |
| Poland | 755 | 85 | 316 | 173 | 34 | 31 | 42 | 73 |
| Slovakia | 627 | 71 | 233 | 155 | 26 | 27 | 26 | 89 |
| Estonia | 685 | 104 | 272 | 137 | 46 | 12 | 28 | 87 |
| Latvia | 774 | 163 | 271 | 137 | 54 | 14 | 27 | 108 |
| Lithuania | 738 | 101 | 335 | 139 | 60 | 19 | 33 | 51 |
| France | 415 | 26 | 84 | 121 | 29 | 22 | 19 | 114 |
| Spain | 420 | 40 | 99 | 103 | 15 | 31 | 21 | 110 |
| USA | 551 | 30 | 149 | 141 | 31 | 53 | 20 | 127 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The result of grouping countries among females in a cluster analysis is clearly illustrated in Figure 19. The selected countries are divided into two major groups and four subgroups.

***Fig. 19 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for females, 2005 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores. Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The first group comprises former Soviet Central Asian countries group and opposes the post-socialist European area are joined to Baltic countries and this cluster is connected in the next step to low mortality populations and they are categorized in the second major group (see Figure 19). These major groups further can be divided into four subgroups. Kazakhstan and Kyrgyzstan belong to the first subgroup of the second former Soviet Central Asian republics, which is represented by Tajikistan, Uzbekistan, and Turkmenistan (*98). All European countries of ex-socialist regime are in the third. Low mortality populations are in the last subgroup.

The average values of each subgroup for the female population in 2005 observed the highest and lowest values of standardized death rates by causes of death (see Table 15). According to Table 15 in the first subgroup observed the highest values of the all causes, cerebrovascular diseases, malignant neoplasm, external causes and other causes of death. The mortality trends in Kazakhstan and Kyrgyzstan showed quiet similar behavior of male and female population. Moreover, table 4 clearly illustrates that cerebrovascular diseases of death among Kazakh and Kyrgyz females are higher compared to the other selected countries. Twenty-five to thirty percent of people worldwide are estimated to be affected by hypertension, the "silent killer", which is often asymptomatic until a heart attack or stroke occurs. In Kazakhstan, cardiovascular disease is the leading cause of death in adults. To reverse this disturbing trend, several international organizations are ready to help in solving this problem, such as USAID works with health departments, public institutions and other organizations in Kazakhstan (USAID 2006). From the report Minister of Health of Kyrgyzstan has been informed that according to the World Health Organization, cardiovascular diseases around the world cause death to 17.5 million people, representing 30 % of all deaths. 80 % of all victims are residents of developing countries. Directly in Kyrgyzstan cardiovascular diseases cause 49 % of deaths of people. In comparison with 1991, the cases of cardiovascular disease increased by 34 % (European Observatory on Health Care Systems 2008).

A high value of malignant neoplasm has been identified in the first subgroup (see Table 15). 54 % of all cancer cases in Kazakhstan occur in females. One of the leading types of cancer is breast cancer, which is the most common cancer among females. Breast cancer incidence of breast cancer which has been increasing at an annual rate of 7 %, and the average age of diagnosis has decreased from 50–60 years old to 35–50 years old. Since 2005, the government has improved the coverage screening programmes for cervical and breast cancer. In the last few years, mammography screening has been performed in a female population of a specific age and within a specific time frame (within a defined number of years). Breast cancer rates are highest in the capital of Bishkek and in the Chui Region of Kyrgyzstan. Significantly, the average age of women diagnosed with breast cancer has dropped dramatically over the last few years, exacting an increasing toll on society. More than half of those suffering from the disease only seek medical care in the last stages of tumour growth, partly due to poor understanding of the risks, as well as neglect of personal health (Baizhumanova and Sakamoto 2010).

The next leading cause of death in the first subgroup among the female population is external causes of death (see Table 15). It might be due to the several factors, such as car accidents, which are another important cause of external cause mortality and the use of seat

belts, although mandatory, is not strictly enforced. According to the WHO database, if in a year around one billion people committed suicide around eight hundred thousand of them would be from Kazakhstan. If there was one suicide every 40 seconds in the world, almost every hour in Kazakhstan someone would be voluntarily parted with life. Another fact of suicide according to research by psychologists, if someone decided to commit suicide, it's basically ends dramatically. Women in most cases are not going to kill themselves using only the suicide attempts to blackmail or to gain attention. Therefore, according to statistics, one case of male suicide equal to five women attempted suicide.

All other causes of death are also high in this subgroup (see Table 15). For instance, the incidence of other communicable diseases such as syphilis has also increased dramatically (McKee, Healy, and Falkingham, 2002). The incidents of syphilis increased from 1.45 per 100,000 populations in 1990 to 269.5 per 100,000 in 1997, decreasing again to 60.9 per 100,000 in 2005 (WHO Regional Office for Europe 2007). This trend was similar to developments throughout the former Soviet Union, although incidence rates in Kazakhstan were above the CIS average. In 2000, syphilis was diagnosed in 1 % of blood donors, 1 % of pregnant women, and 2 % of hospital patients. Many patients in the early stages of syphilis were unnecessarily hospitalized, while others obtained anonymous health care from the private sector (Godinho et al. 2004). The incidence rate of hepatitis A decreased in Kazakhstan from 444 per 100,000 in 1990 to 70 per 100,000 in 2003 (WHO Regional Office for Europe 2007).

In the second subgroup of countries the highest values of other diseases of circulatory system, diseases of the digestive system and respiratory system diseases were highlighted (see Figure 15). Also the lowest values of the external causes of death and diseases of the respiratory system belong to this subgroup which consists of countries such as Tajikistan, Uzbekistan and Turkmenistan. Mortality from other diseases of the circulatory system in the Central Asian republics is higher than the European average level. This is due to the prevalence of circulatory system diseases and risk factors of the development of the population. According to the results of population studies carried out using standardized methods and standardized criteria for evaluation (WHO), more than 26 % of the population of the age of 40 years suffers from arterial hypertension. Lipid metabolism have approximately 22 % male and 34 % of the female population, over 54 % of the adult population smoke, about 4 % suffer from diabetes.

The next leading cause of death in this region among females is digestive system disease (see Table 15). Digestive disorders, or gastrointestinal diseases, include a number of conditions that affect the digestive system, including heartburn; constipation; hemorrhoids; irritable bowel syndrome; ulcers; gallstones; celiac disease (a genetic disorder in which consumption of gluten damages the intestines); and inflammatory bowel diseases, including Crohn’s disease (which causes ulcers to form in the gastrointestinal tract) (U.S. Department of Health and Human Services 2009). Digestive disorders are common diseases that often occur in foods. Taking into account the fact of low GDP per capita and low living conditions in the region among the selected countries could suggest that such factors are one of the essential facts which affect the high level of this disease.

Table 15 shows a low value of external causes in the second subgroup. External causes of death within the male population of Tajikistan, Uzbekistan and Turkmenistan were the lowest

value among the selected countries in the same time period. However conversely, females observed the opposite result. Now in our modern world there are a lot of women behind the wheel. In more traditional societies such as the countries of Central Asia, historically, women were the only the housekeepers. They created a comfortable and warm home. But now women do not lag behind men. The main responsibilities of women have been enough time to do all the household chores. They can also work and earn money for his family. Nowadays, it is not surprising to meet women who smoke, drink and drive cars as well as men. Many disputes arise around the question "how good is a woman driver". Many of them claim that women on roads create a lot of situations of the accident; they are not quick to use solutions than men. As well as women sitting behind the wheel, they can be making up, talking on a cell phone and lose vigilance.

Table 15 illustrates the second subgroup of countries as having high values of respiratory system and digestive system diseases. The trajectory of these disease within the second subgroup was broadly similar to that of many other countries of the former Soviet Union, which have experienced steeply rising rates in the 90s, associated with the overall socio-economic transition with its resulting increases in poverty levels (Rowe and Rechel 2006).

***Tab. 15 - Average standardized values (Z-scores) of each country group for females, 2005 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakstan, Kyrgyzstan | 1.325 | 1.828 | 0.650 | 1.148 | 1.184 | -0.411 | 1.010 | 0.972 |
| Tajikistan, Uzbekistan, Turkmenistan* | 1.082 | 0.263 | 1.379 | 1.142 | -0.716 | -1.515 | 1.222 | 0.740 |
| Czech Republic, Slovakia, Hungary, Poland, Estonia, Latvia, Lithuania | -0.255 | -0.160 | -0.182 | -0.296 | 0.242 | 0.788 | -0.687 | -0.863 |
| France, Spain, USA | -1.370 | -1.107 | -1.387 | -1.216 | -0.639 | -0.051 | -0.292 | 0.626 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values, Turkmenistan* means that data for Turmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the third subgroup, which consists of Central European countries and Baltic states, showed a low relative values of respiratory system, digestive system diseases and other causes of death among the selected countries (see Table 15). This subgroup is one of the largest subgroups which include seveen countries In the case of respiratory diseases only the highest value of the 3 countries within the third subgroup will be discussed. According to initial data (see Table 14) Slovakia (37 standardized deaths per 100,000 populations), the Czech Republic (33 standardized deaths per 100,000) and Hungary (31 standardized deaths per 100,000) will be analyzed. Diseases of the respiratory system in Slovakia have been one of the highest among the post-socialist countries. This rate has, however, fallen significantly since the mid–1980s. In 1985, the Slovak rate was double the EU rate, but the rate is now below the EU average (Hlavacka, Wagner, and Riesberg 2004). Nowadays, respiratory system disease was the fourth most common cause of death in the Czech Republic. After a decade of strong annual fluctuations in the 1970s, the standardized rate of mortality due to this cause decreased from

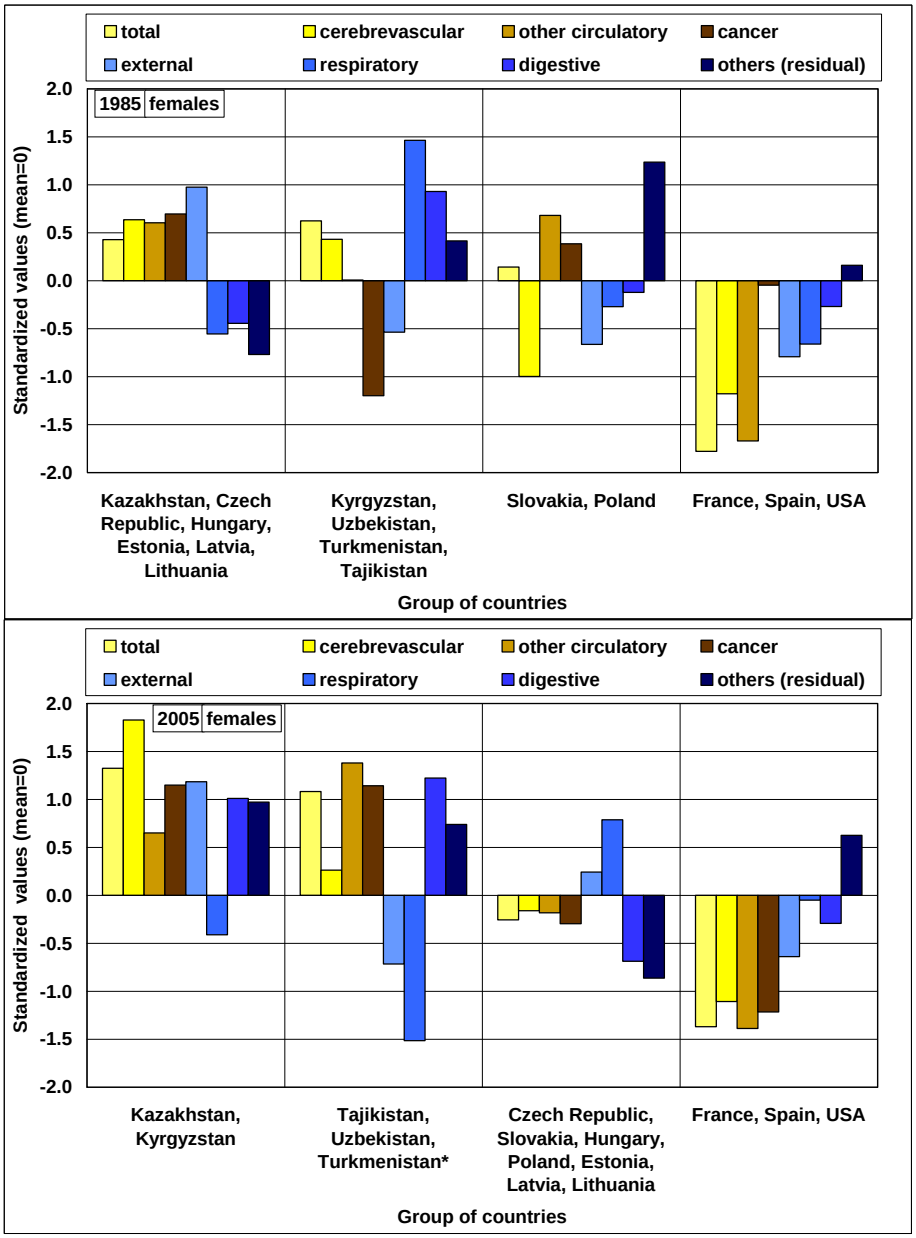
1980 until the late 1990s. Since then, a slight upward trend has been observed (Bryndova et al. 2009). Mortality connected with smoking grew in the early 90s and from the second half of the 1990s a decrease can be observed in Hungary. In recent times, the case of females, mortality due to smoking heavily increases, which calls attention to the growing popularity of smoking among Hungarian women (Monostori et al. 2009).

Low mortality populations showed the lowest values of all causes, cardiovascular diseases and malignant neoplasm (see Table 15). Mortality due to cerebrovascular diseases has decreased about twofold since 1970 in a developed society. Cardiovascular diseases, mainly coronary heart disease and stroke, are the main cause of illness and premature death in the world (where they account for 30 % of all global deaths in 2005) and in Europe. The causes are well established and well known. The most important include unhealthy diet, physical inactivity and tobacco use, which are responsible for about 80 % of coronary heart disease and cerebrovascular disease. Other determinants of this disease are poverty and stress. Outdoor and indoor air pollution is among the environmental determinants. These risk factors allow a great potential for prevention (WHO ENHIS). Taking into account the high quality of life in the fourth subgroup can be supposed that their inhabitance is enough secured to prevent these risk factors.

The last subgroup observed low cancer mortality (see Table 15). New research on deaths from cancer in Europe concludes that the key priority for continuing to reduce mortality is cutting tobacco smoking. Despite the impact of smoking, the deaths from all cancers in Europe between the early nineties and early 2000s fell by eight per cent in women, with a large drop among the middle aged. This is the key favourable message from the research team led by Professor Carlo La Vecchia (MD) at the Mario Negri Institute, University of Milan, and Professor Fabio Levi (MD) at the Institute of Social and Preventive Medicine, Centre Hospitalier Universitaire Vaudois and University of Lausanne. Further falls in cancer deaths in the EU will be influenced by more than just reduced smoking. The research team highlights the need for interventions in, for example, alcohol drinking and aspects of nutrition – including overweight and obesity. More widespread adoption of screening, and early diagnosis and therapeutic advancements for treatable cancers would also contribute (AlphaGalileo 2010). According to Table 15 all other causes of death also showed low values among the selected countries. One of the main reasons of the low values of this disease in the low mortality countries can be related with higher "well-known" diseases in this country group.

Finally, the female cause-specific mortality pattern among the selected countries illustrated a positive result rather than in males between the period of 1985 and 2005, respectively (see Figure 20). Analysis of the mortality levels by main causes of death according to the macro-regions showed the results that mainly highest values was observed in the former Soviet Central Asia.

***Fig. 20 - Standardized values of cause-specific mortality levels in the selected countries for females, 1985 and 2005 (all ages)***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the countries of this region low values of cancer and external causes over time was observed (see Figure 20). Significantly, the other diseases of the circulatory system were rose by the end of analysis. In 1985, Kazakhstan was out of the Central Asian country group, but till the end of selected period it showed similarities with Kyrgyzstan females. Moreover, the mortality due to the cerebrovascular diseases among Kazakhstan females was decreased. In the countries of Central Europe together with the three Baltic states the cause-specific mortality levels were reduced. Outsiders of this country group were Slovakia and Poland in 1985. However, in 2005, in the mortality conditions among these two states slightly was improved. In

low mortality countries which are a reference country group in this study mainly the lowest level of cause-specific mortality values was noted during the whole analysis.

The cause-specific mortality level by the main causes of death for both sexes among the selected countries in 1985 will be discussed. The initial data for delimit countries with similarities is SDR by main causes of death for both sexes in the selected countries presented in Table 16.

***Tab. 16 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for both sexes, 1985 (standardized for all ages)***

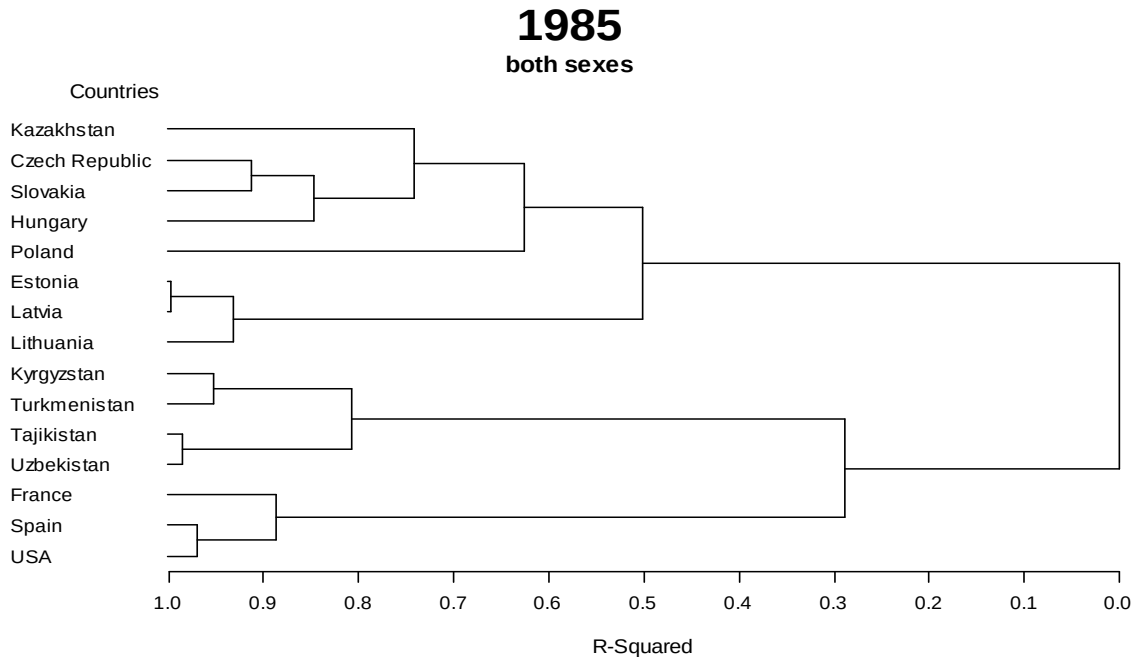
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 1,311 | 364 | 286 | 225 | 115 | 158 | 48 | 114 |
| Kyrgyzstan | 1,247 | 227 | 372 | 146 | 84 | 255 | 56 | 106 |
| Tajikistan | 1,030 | 135 | 323 | 123 | 56 | 186 | 50 | 156 |
| Turkmenistan | 1,359 | 242 | 475 | 171 | 70 | 200 | 57 | 143 |
| Uzbekistan | 1,147 | 174 | 443 | 127 | 67 | 159 | 51 | 127 |
| Czech Republic | 1,270 | 228 | 473 | 261 | 86 | 78 | 47 | 97 |
| Hungary | 1,194 | 124 | 488 | 211 | 75 | 134 | 56 | 106 |
| Poland | 1,335 | 203 | 501 | 258 | 123 | 72 | 75 | 103 |
| Slovakia | 1,235 | 77 | 561 | 218 | 80 | 71 | 39 | 189 |
| Estonia | 1,328 | 241 | 589 | 213 | 122 | 46 | 32 | 85 |
| Latvia | 1,314 | 269 | 543 | 206 | 123 | 61 | 27 | 85 |
| Lithuania | 1,176 | 128 | 524 | 196 | 128 | 85 | 26 | 87 |
| France | 824 | 82 | 193 | 219 | 80 | 53 | 50 | 147 |
| Spain | 801 | 115 | 232 | 176 | 41 | 76 | 48 | 113 |
| USA | 870 | 59 | 340 | 204 | 60 | 70 | 32 | 105 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the results of country groups for both sexes in 1985 the selected countries can be divided into the three major groups (see Figure 21).

***Fig. 21 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for both sexes, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

They are: Kazakhstan together with post-socialist European area, other countries of the Central Asian region and low mortality populations (see Figure 21). These major groups further will be divided into four subgroups. The Central European countries and Kazakhstan includes in the first subgroup. The three Baltic states belong to the second. The rest of the Soviet Central Asian republics are in the third country group. The last subgroup comprises of the low mortality populations.

According to the average values table in the first subgroup the highest malignant neoplasm was found (see Table 17). The values of the other diseases in this subgroup are higher than the total average for all country groups. Up to the late 60s, there was no evidence of health deterioration in the populations of the Central Europe countries. Mortality from non-communicable including cancer mortality has risen. The striking variations in the cancer load Central and Eastern Europe can be attributed to the variations in cancer risk — both lifestyle-related and environmental — and can be largely explained by the social and economic inequalities rooted in the political realities that have undeniably existed among the various geopolitical regions of Europe (Boyle and Ferlay 2005).

In general, the cause-specific mortality levels in the second subgroup were higher compared with the other subgroups (see Table 17). A big amount of the highest rates of the selected diseases for both sexes belong to this country group in 1985. They are: all causes, both cardiovascular diseases and external causes of death. Moreover, the lowest levels of the respiratory system and digestive system diseases with other remaining causes of death also were noted in this subgroup. Regarding to the cardiovascular diseases, it was one of the frequent disease and for reduction of death rates by cardiovascular diseases taken a long time. As was mentioned before the mortality due to the transport accident and suicide were high in this region.

In the Central Asian countries, excluding Kazakhstan the cause-specific mortality level for both sexes were higher (see Table 17). The highest values of the respiratory system and digestive system diseases with remaining other causes were observed in this subgroup. High values of these diseases are noticeable in Tajikistan, Turkmenistan and Uzbekistan. The negative position of the Central Asia is particularly striking. One of the sources of problem might be an ecological reason. A big climate buffer, and as it shrank, the summers got hotter and the winters colder. Left behind was a salt flat close to 300 kilometer wide, infused with pesticides from decades of agricultural run-off. Every few weeks, violent dust storms kicked hundreds of tons of salt, sand, and chemicals into the air, and into people's lungs. Throat respiratory disease became common, and with no reliable protein source and so on (Walters 2010). The highest mortality level for both sexes among the selected countries mainly shared between the three Baltic states and the Soviet Central Asian republics (except Kazakhstan) in 1985.

The lowest mortality countries is shown the lowest levels of cause-specific mortality by all causes, cardiovascular diseases and external causes of death in 1985 (see Table 17). Health indicators in low mortality populations have been improving constantly since the 70s. Their average expectation of life is one of the best in the world for both sexes. Due to the mortality due to diseases of the circulatory system has been reduced twofold since 1970 for the all

members of this subgroup. Mortality level due to the external causes was shown a slight decrease during the same period. A relatively higher socio-economic condition in this country group, in addition, their proportion of the well-known diseases was higher among the others. Summary all of such fact the general mortality rates by main causes of death were lower compared with the selected countries.

***Tab. 17 - standardized values (Z-scores) of each country group for both sexes, 1985 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Czech Republic, Slovakia, Hungary, Poland | 0.554 | 0.249 | 0.303 | 0.908 | 0.296 | -0.171 | 0.516 | 0.189 |
| Estonia, Latvia, Lithuania | 0.574 | 0.409 | 1.059 | 0.195 | 1.319 | -0.775 | -1.355 | -1.022 |
| Kyrgyzstan, Turkmenistan, Tajikistan, Uzbekistan | 0.172 | 0.198 | -0.153 | -1.326 | -0.646 | 1.353 | 0.541 | 0.459 |
| France, Spain, USA | -1.727 | -1.089 | -1.359 | 0.060 | -0.952 | -0.743 | -0.226 | 0.095 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

At the same time, countries of the former Soviet Union experienced very marked fluctuations in mortality, related to the social and economic transformation which these countries have undergone since the fall of the communism. Up to the mid–90s, the trends were completely parallel in all the European republics of the former Soviet Union. However, more recently, the have begun to diverge. While the Baltic states show signs of improvement in mortality from heart disease, and mortality trends could soon begin to mirror those of Central European countries (Mesle 2002). In table 18 illustrates initial data on the standardized death rates by causes of death for hierarchical cluster analysis for both sexes in selected countries in 2005.

***Tab. 18 - Standardized death rates by main causes of death (per 100,000) of mortality levels in the selected countries for both sexes, 2005 (standardized for all ages)***

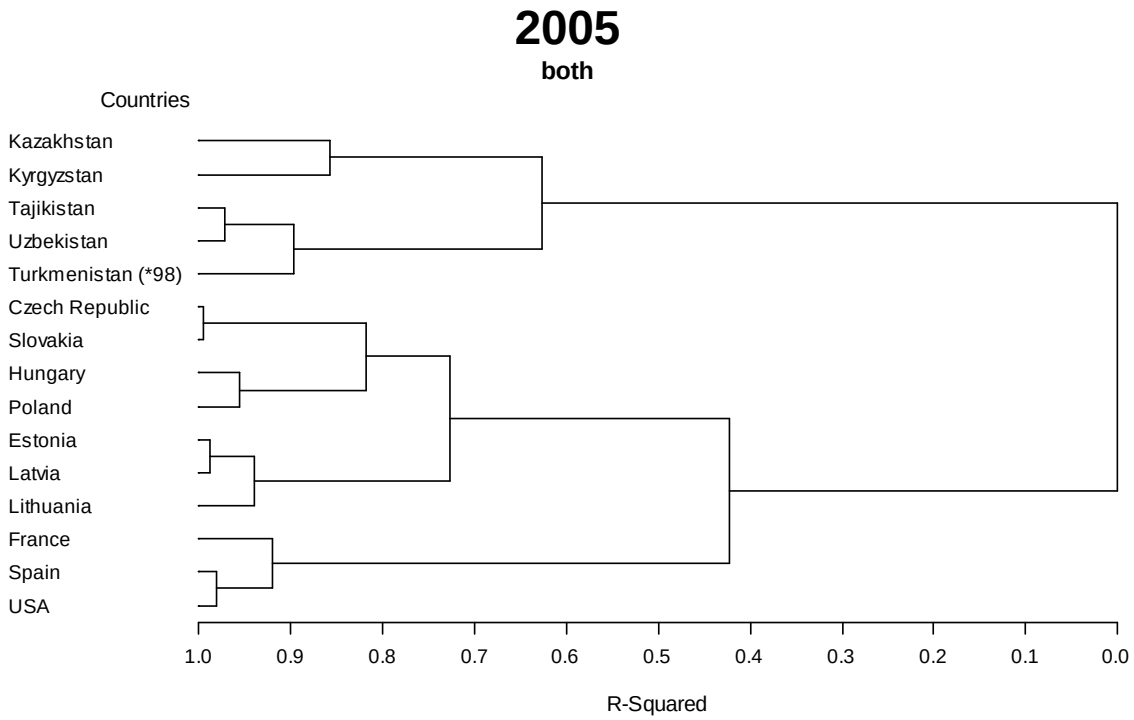
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 1,551 | 227 | 654 | 187 | 164 | 92 | 67 | 160 |
| Kyrgyzstan | 1,322 | 272 | 453 | 117 | 94 | 141 | 78 | 166 |
| Tajikistan | 1,177 | 127 | 613 | 85 | 37 | 94 | 55 | 166 |
| Turkmenistan (*98) | 1,364 | 86 | 782 | 100 | 64 | 115 | 66 | 152 |
| Uzbekistan | 1,159 | 177 | 583 | 78 | 50 | 67 | 67 | 136 |
| Czech Republic | 867 | 99 | 330 | 230 | 56 | 43 | 39 | 71 |
| Hungary | 989 | 77 | 450 | 224 | 58 | 61 | 52 | 69 |
| Poland | 1,064 | 104 | 419 | 252 | 71 | 52 | 74 | 93 |
| Slovakia | 903 | 83 | 315 | 226 | 64 | 48 | 40 | 126 |
| Estonia | 1,072 | 125 | 405 | 222 | 125 | 33 | 45 | 116 |
| Latvia | 1,191 | 191 | 428 | 217 | 138 | 39 | 41 | 137 |
| Lithuania | 1,155 | 115 | 478 | 214 | 166 | 51 | 52 | 79 |
| France | 583 | 31 | 117 | 185 | 49 | 35 | 27 | 139 |
| Spain | 585 | 46 | 129 | 168 | 32 | 57 | 30 | 124 |
| USA | 678 | 31 | 193 | 170 | 27 | 63 | 25 | 169 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

The result of grouping countries among both sexes in a cluster analysis can be clearly seen in Figure 22. The selected countries are divided into two major groups and four subgroups.

***Fig. 22 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels in the selected countries for both sexes, 2005 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

All former Soviet Central Asian countries are in the first group and the post-socialist Baltic and European area together with the selected low mortality populations in the second (see Figure 20). Kazakhstan and Kyrgyzstan belong to the first Central Asia subgroup. The second subgroup is represented by Tajikistan, Uzbekistan, and Turkmenistan (*98). The second major group includes all Central European countries with the Baltic states, and low mortality populations are depicted in the fourth subgroup. The grouping of countries with similar mortality rates by cause of death for males, females and both sexes showed the result that country groups for each sex were alike.

In Kazakhstan and Kyrgyzstan a high all causes of death, cerebrovascular diseases, malignant neoplasm, external causes of death, diseases of the digestive system and all other causes of death was observed (see Table 19). The overall higher level of cardiovascular mortality compared to the EU average is likely to be due to differences in traditional cardiovascular risk factors that are more frequent in the central Asian region such as smoking, a diet high in saturated animal fat, and, in some areas, a diet that is extremely low in antioxidants. In addition, differences in the quality of medical care as regards treatment of cardiovascular disease and in particular poor detection and treatment of high blood pressure, a major risk factor

for both ischaemic heart disease and cerebrovascular disease may play some part (Guillot et al. 2011).

The next leading causes of death in this subgroup are malignant neoplasm (see Table 19). In 2006, 17,608 Kazakhs died from cancer, representing 12 % of all deaths occurring in Kazakhstan during that year. The largest proportion of cancer deaths for both men and women were from lung cancer (18 %). Breast cancer accounted for 16 % of all cancer deaths among women, while lung cancer accounted for 28 % of all cancer deaths among men. Stomach cancer accounted for 14 % of both all male and all female cancer deaths. The top four cancers combined (lung, stomach, breast and esophagus) accounted for more than 46 % of all cancer deaths in 2006 for both men and women (Baizhumanova and Sakamoto 2010). Cancer mortality is quite low and has continued to fall in recent years. However, the rate of premature mortality due to breast cancer in Kyrgyzstan is one of the highest in the Central Asia region. The foremost cancer among women in Kyrgyzstan is breast cancer. Every year, about 500 women are diagnosed with breast cancer, i.e. one or two women a day. The disease is detected at a late stage in 40 % of diagnosed cases, which complicates the disease and its treatment. Lack of awareness among women about the risks factors of breast cancer and the ignorance of early disease symptoms are responsible for the current situation. Also breast cancer is a taboo disease because of the low level of knowledge about its origin, causes and treatment options (Kabar 2010).

External causes are also high in the first subgroup among the selected countries (see Table 19). In 2000, the international community adopted the Millennium Development Goals (MDG) as the basis for international development policies. Covering a range of sectors, they have the advantage of providing common, objectively veritable measures of progress in world development. Yet the application of this common framework to diverse settings can create challenges. A particular example is the application of health goals to the countries of the Central Asia region. One of the goals is the importance of reducing morbidity and premature mortality from cardiovascular disease and external causes across the entire region to European Union levels (Millennium Development Goals for Health in Europe and Central Asia 2004). Hopefully, through this programme mortality rates will decrease in the future.

High digestive system diseases mainly increase in mortality from cirrhosis and chronic liver diseases in Kazakhstan and Kyrgyzstan (see Table 19). In recent years, this indicator has been the highest rates among countries in the Central Asian region. It could be due to the fact that quality control system of food is underdeveloped and poorly coordinated and low-quality food is domestically produced and distributed, as well as imported from other countries (Ministry of Health 2004). Also the problems of poor sanitation and contaminated water (salinity, toxins and bacteria) have increased in urban and rural areas of the Central Asian region.

Table 19 clearly illustrates that all other causes of death are high in this subgroup. These causes are includes a lot of remaining disease. Perhaps, one of the highest rates due to HIV/AIDS in this subgroup also influence into the higher rate due to this disease. For instance, Kazakhstan is still at an early stage of a HIV/AIDS epidemic, but there are a number of factors in place that create the potential for a dramatic increase, which includes widespread injecting drug use, migration, an extensive commercial sex industry, high-risk behaviour, marginalization

of vulnerable groups, low public awareness of HIV/AIDS and limited capacity of the Government and civil society to implement effective responses. According to UNAIDS estimates, in 2005 only 11 % of those in need received antiretroviral treatment (UNAIDS 2006). Despite the fact that the Kyrgyz Republic still has a low prevalence of HIV-infection, the situation is rapidly changing every year. By the beginning of 2005 a cumulative number of officially registered populations were 655 people, including 31 AIDS patients. The HIV incidence rate in Kyrgyz Republic is 13.5 per 100,000 people in 2005, but it is estimated that today around 7,000 people are living with HIV/AIDS in the country (European Observatory on Health Care Systems 2008).

The second subgroup of countries includes Tajikistan, Uzbekistan and Turkmenistan. In this subgroup, the high value of other diseases of circulatory system and the lowest respiratory system diseases was observed (see Table 19). For instance, ischaemic heart diseases constitute almost two thirds of all circulatory system mortality cases in Uzbekistan. Although there are no significant gender gaps in the aggregate data on circulatory system mortality, some significant differences exist. Males, for example, are more likely to die of ischaemic heart disease. In 2005, age-standardized mortality rates from diseases of the circulatory system in Uzbekistan were more than three times higher than the average in the EU in 2004 (Ahmedov et al. 2007). The main reasons for still having high mortality rates from cardiovascular diseases among the countries of Central Asia include lifestyle factors such as smoking and a diet high in fat and extremely low in antioxidants, as well as the poor detection and treatment of hypertension. Furthermore, household food supply is limited by restricted access to land and markets, but poor quality diet also results from traditional preferences for fatty foods and animal products, rather than fruit and vegetables. Thus, in the period of transition, problems of a healthy lifestyle have exacerbated. The high rates of infectious and non-infectious diseases in many respects reflect unhealthy lifestyles, such as drug abuse or unsafe sexual practices. Although alcohol consumption and smoking play a smaller role than before independence, they have become more common among adolescents and young people, and there has also been a rise in the use of illicit drugs (Khodjamurodov and Rechel 2010).

***Tab. 19 - Average standardized values (Z-scores) of each country group for both sexes, 2005 (all ages)***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakstan, Kyrgyzstan | 1.412 | 1.906 | 0.645 | 1.314 | 1.127 | -0.457 | 1.552 | 1.174 |
| Tajikistan, Uzbekistan, Turkmenistan* | 0.662 | 0.157 | 1.256 | 0.701 | -0.623 | -1.583 | 0.745 | 0.799 |
| Czech Republic, Slovakia, Hungary, Poland, Estonia, Latvia, Lithuania | -0.041 | -0.133 | -0.085 | -0.101 | 0.342 | 0.837 | -0.753 | -0.753 |
| France, Spain, USA | -1.508 | -1.117 | -1.487 | -1.341 | -0.926 | -0.066 | -0.022 | 0.175 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.
Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Low respiratory system diseases in second subgroup were reported (see Table 19). Mortality from respiratory disease in Turkmenistan, after rising somewhat during the period 1992–1994,

recently began to decrease. As under the Soviet system, health care continues to be universally available to all citizens without charge. The health care system that Turkmenistan inherited from the Soviet regime is fraught with deficiencies, however. On the whole, physicians are poorly trained, modern medical technologies are almost unheard of, and many basic medicines are in short supply. Although health care is available to most urban residents, the system is financially bankrupt, and treatment is often primitive. Only recently have some medical professionals been allowed to offer private medical care, and the state maintains a near monopoly of health care (Rechel, Sikorskaya, and McKee 2009).

The third subgroup showed high diseases of the respiratory system, low diseases of the digestive system and all other causes of death (see Table 19). High respiratory system diseases were observed in Hungary (253 standardized deaths per 100,000 population), the Czech Republic (230 standardized deaths per 100,000) and Poland (226 standardized deaths per 100,000) among the other post-socialist republics. In essence, one of the main reasons of this disease is smoking. The fall of the communism and the transition to a market economy has contributed to a change in the smoking habits of Hungarians. The appearance of transnational tobacco companies and formerly unavailable international cigarette brands in the Hungarian market resulted in increased competition and intensified promotion of tobacco products. Nowadays, there are around 2.6 million smokers (1.6 million men and 1 million women, respectively – out of a population of 10 million) in Hungary. According to the 2002 report of the Central Statistics office, out of 100 Hungarians who die as a result of a smoking related disease, 25 die of coronary heart disease, 24 of lung cancer, 16 of hypertension and consequent stroke, 10 of cancer of the upper digestive and respiratory tracks (lip, oral, esophageal and laryngeal cancers), 10 of chronic obstructive pulmonary diseases (chronic bronchitis, asthma and emphysema) and 15 of other smoking-related ill health statuses (Remak, Robert, and Nemeth 2006).

Respiratory system disease was one of the leading causes of death in the Czech Republic in 2005 (see Table 19). Nevertheless, this indicator was lower in the Czech Republic in 2006 than the EU average for that year (Bryndova et al. 2009). In the case of Poland, tobacco-smoking is one of the leading risk factors for cardiovascular diseases, diseases of the respiratory system and tumours. Chronic non-communicable diseases, including those caused by tobacco-smoking or second-hand smoke, have for many years constituted the most significant health, social and economic problems in Poland. In response to the growing epidemic of chronic non-communicable diseases, the last few years have seen the implementation of preventive programmes and early detection. In spite of the major successes achieved in recent years in this field, tobacco-smoking remains a massive health, social and economic problem (Golinowka and Sowa 2006). Although people are more aware of the harmful effects of the addiction, huge numbers of women and men persist in smoking cigarettes. Poland is not exceptional in this respect. The WHO report published in February 2008 demonstrates that the tobacco-smoking epidemic is the cause of lung cancer and cardiovascular and other diseases, and that every year it kills 5.4 million people worldwide. By 2030 this number could increase to 8 million per annum (Kuszewski and Gericke 2005).

Lower digestive system diseases were in Estonia (33 standardized deaths per 100,000 populations), the Czech Republic (43 standardized death per 100,000) and Poland (48 standardized deaths per 100,000) among the third subgroup (see Table 19). Estonian standardized death rate by diseases of the digestive system can be related to vigorously, and quite successful reforms to its health system over recent decades. Whereas incremental changes can be observed during the period 2003–2008, larger scale legislative reforms had been implemented since the early 1990s and at the beginning of this century. The current system is built on solidarity-based health financing; a modern provider network based on family medicine-centred PHC; modern hospital services; and more concentration on public health (Koppel et al. 2008). The Czech Republic also has a similar reform. Many of the recent reforms to the Czech health system have attempted to address the chronic financial instability that has marked the system since its inception in early 1990s. Other recent reforms have focused on the issue of hospital ownership and management structures, or on improving purchaser-provider relationship, compliance with European Union law and coordination between the systems of health and social care. The key challenge to health reform in the coming decades will be how to keep high-quality care accessible to all inhabitants of the Czech Republic, while taking into account economic development and demographic ageing (Bryndova et al. 2009). The health care system in Poland has been systematically reformed since 1989. Essentially, these reforms developed in parallel with the orientation of the overall economy towards a market-based economy. These reforms are aimed at improvement of primary health care through a new focus on family medicine; the financing of health care by independent sickness funds and subsequently by the National Health Fund; the development of the private sector in ambulatory and primary health care (currently 58 % of ambulatory health services are delivered by the private sector);and so on. Through these reforms mortality levels in this country are decreasing (Kuszewski and Gericke 2005).

All other diseases in this subgroup are the lowest among the selected countries (see Table 19). These countries have modern health care techniques such as a diagnostic, therapeutic and etc, also their population has access to highly effective drugs, which helps to anticipate and cure their diseases at an early stage. Also they reflect the best hygienic conditions, the greatest advances in medicine, bacteriology, chemistry, public education, and intellectual progression in relation to how to have a healthy life style. Heart disease and stroke mortality are associated with risk factors such as diabetes, high cholesterol, high blood pressure, smoking, and dietary factors. Moreover, other important factors include socio-economic status, obesity, and physical inactivity. Factors contributing to the decline in heart disease and stroke mortality include better control of risk factors, improved access to screening, increased early detection, and better treatment and care, including new drugs and expanded uses for existing drugs (U.S. Department of Health and Human services 2009).

In the fourth subgroup low values of all of the selected causes of death, except were reported (see Table 19). Nowadays, in low mortality populations newer therapeutic measures in cardiovascular medicine have been introduced that have substantially influenced our current management approach. For example, thrombolytic therapy and (more recently) advances in percutaneous coronary angioplasty have revolutionised the way acute myocardial infarctions are

managed. Many studies have also shown the importance of risk factor control, such as better and tighter blood pressure control, diabetes control and recently the use of statins and angiotensin-converting enzyme inhibitors (Nadar and GYH Lip 2002).

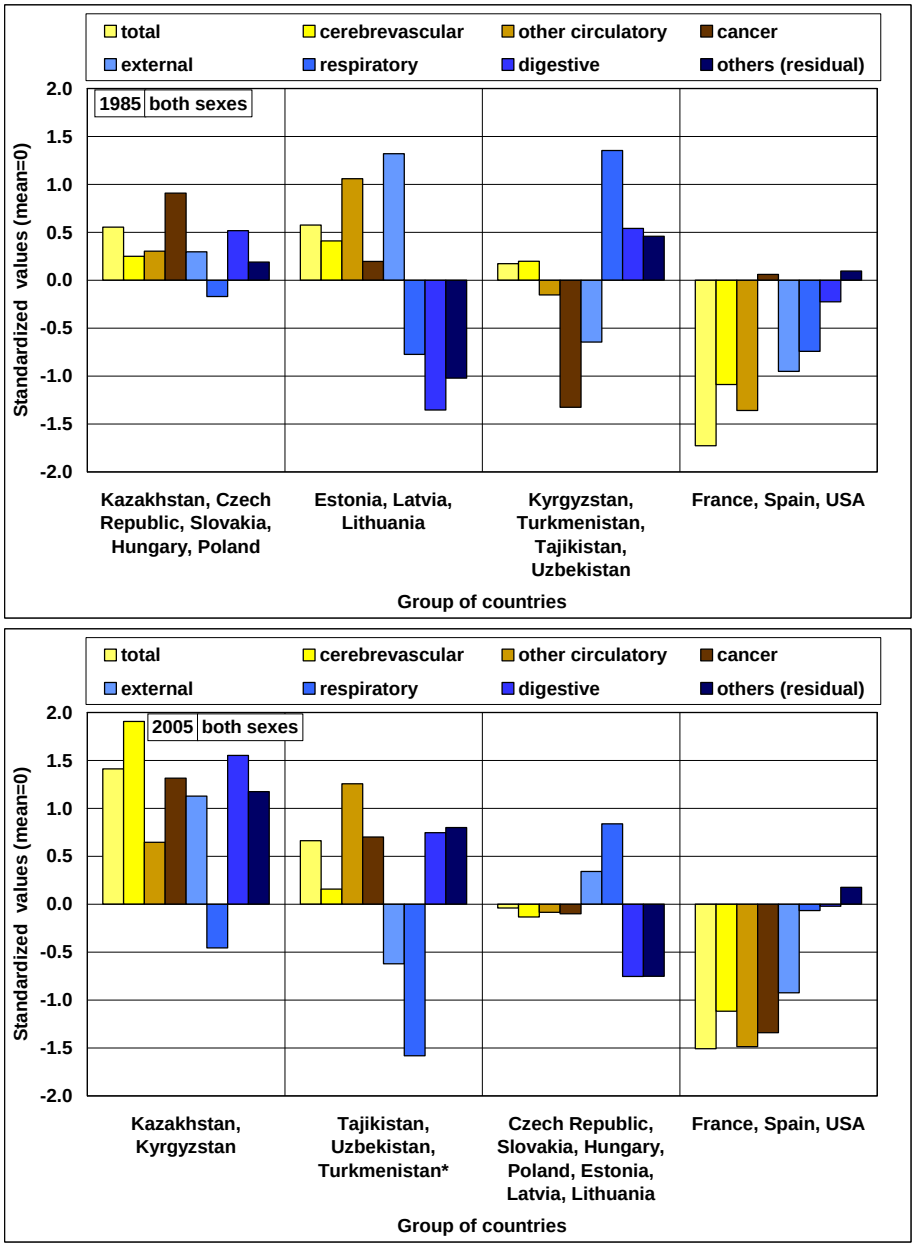
Low malignant neoplasm in the last subgroup can be due to the recently revised European Code Against Cancer, which provides a public health roadmap for cancer risk reduction in Europe, some results of the recommendations were discussed. In real terms, they are that the introduction of organized mammographic screening programmes throughout Europe will lead to a reduction in breast cancer mortality. The maximum effect will be derived from programmes with effective quality control procedures in place. Similarly, screening for colorectal cancer has been shown to be effective and there is a need for organized colorectal cancer screening programmes throughout Europe. Also, the overwhelming majority of lung cancer is caused by tobacco smoking and tobacco control is clearly a number one priority in Europe, aimed not only at men, but increasingly targeted towards women (Boyle and Ferlay 2005).

External causes of death in the fourth subgroup are lower among the selected countries (see Table 19). This category includes deaths resulting from intentional self-harm (suicide) and transport accidents. Although suicide is not a major cause of death and the data for some European Union countries may suffer from underreporting, it is often considered as an important indicator to be addressed by society. Although transport accidents occur on a daily basis, the number of deaths caused by transport accidents are fewer than, for example, the number of suicides.

Finally, the cause-specific mortality pattern for both sexes among the selected countries illustrated a heterogeneous result between the period of 1985 and 2005, respectively (see Figure 23). A short summary of the mortality levels by main causes of death by the macro-regions showed the results that mainly highest values was observed in the former Soviet Central Asia among the other selected countries. In the Central Asian region low values of cancer and external causes (excluding Kazakhstan and Kyrgyzstan) over time was highlighted. Significantly, the all circulatory system diseases and remaining other causes were rose by the end of analysis. In 1985, Kazakhstan was out of the Central Asian country group, but till the end of selected period it showed similarities with Kyrgyzstan, which is a similar pattern what was observed among females. In the beginning of studied period Kazakhstan was with Central European countries, and lower level of cause-specific mortality levels was noted.

After the collapse of the Soviet Union, and since independence the mortality levels in this country was changed into negative way (see Figure 23). All values of the main causes of death were increased. In the countries of Central Europe together with the three Baltic states the cause-specific mortality levels were decreased. In 1985, the three Baltic states showed intermediate level of mortality among the other countries. By the end of analysis significantly decrease in other diseases of the circulatory system was observed. Unfortunately, in the malignant neoplasm level opposite situation was obtained. In the selected low mortality populations of this study mainly the lowest level of cause-specific mortality values was noted.

***Fig. 23 - Standardized values of cause-specific mortality levels in the selected countries for both sexes, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Finally, analysis of the mortality levels among the selected countries showed a similar pattern between males, females and both sexes in 2005. The highest values of the main causes of death belong to the Soviet Central Asian republics. Post-socialist European area is an intermediate position. The low mortality population showed the lowest values of the main causes of death among the selected countries. Notably, the top three causes of death among the selected countries for males and females were all cardiovascular diseases, malignant neoplasm and external causes.

## 5.3 Comparative analysis of the cause-specific mortality structure

Before commencing with an analysis of relative structure of the standardized death rates by main causes of death the mortality rates by main causes of death will be introduced. The selected causes of death are the same which was listed before. In this part of the analysis the percentage of the SDRs by main causes of death will be presented in graphical form. All the comparative analysis was separated for males, females and both sexes in the selected periods of time (1985 and 2005, respectively).

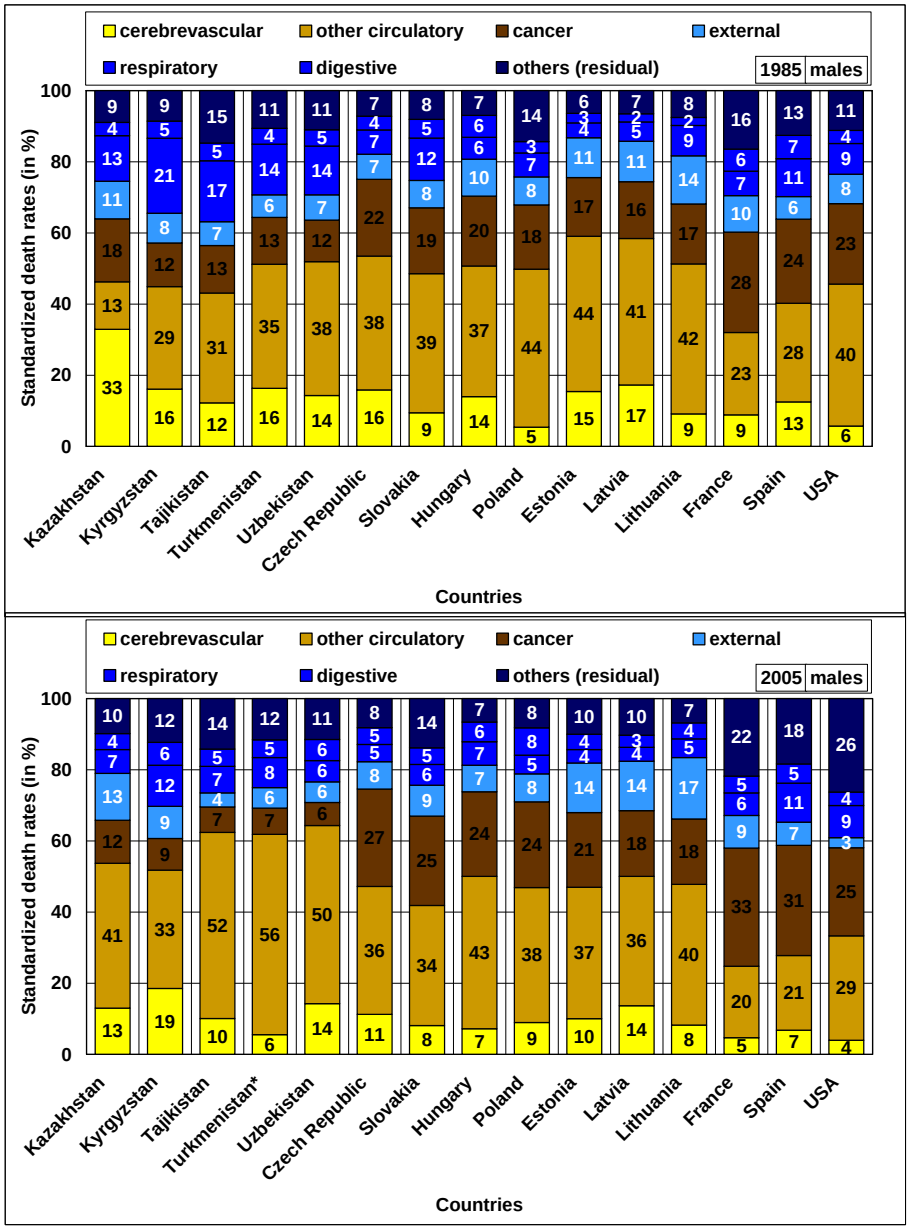
Figure 24 illustrates the cause-specific mortality structure in the selected countries for males. According to this, several significant changes can be observed in both positive and negative ways. In the beginning of study period (1985) in the countries of the Central Asian region, a significantly high proportion of other diseases of the circulatory system and the respiratory system disease were noted. Especially in the case of Kazakhstani males, where a high proportion of the cerebrovascular diseases were analyzed.

However, by the end of the studied period the percentage of this disease in Kazakhstan declined form 33 % to 13 % (see Figure 24). In 2005, the percentage of other diseases of the circulatory system was rose. In essence, in Kazakhstan, Turkmenistan and Tajikistan this value increased by more than 20 %. The most minimal increase was found in Kyrgyzstan (for 4 %). In 1985, a high proportion of the respiratory system diseases in the Central Asia dropped, and in 2005, it was less than 10 % of the total death rate. Cancer mortality in this region compared with 1985, increased by more than for 5 %. Other selected main causes of death's percentages are similar.

In the countries of the Central European area, excluding Slovakia the proportion of cerebrovascular diseases changed in a positive way, it decreased by 2–5 % between the studied periods (see Figure 24). Only Poland's percentage increased by 4 %. In the case of the other diseases of the circulatory system, improvements in the Czech Republic and Slovakia were observed (by an interval of 2–5 %). In Poland the value of this disease declined by 6 %, and in Hungary this proportion showed a growth of 6 % in 2005. During the analysis of the cause-specific mortality structure among the Central European countries quite betterments was highlighted.

In the three Baltic states the proportion of the all cardiovascular diseases showed a slightly similar pattern between the selected periods (see Figure 24). The cerebrovascular diseases decreased by 2–6 % in 2005. Moreover, the other diseases of the circulatory system also dropped and consist of 3–7 % of the total causes. In the cancer and external causes an opposite situation occurred, their values were increased by around 4 %. Other selected causes proportion among the three Baltic states between the periods of pre-transition and recent time revealed slightly similar cause-specific mortality patterns.

***Fig. 24 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for males, 1985 and 2005 (all ages)***




Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

During the analysis in the low mortality populations all other selected causes of death after the twenty year time period mostly declined (see Figure 24). Only two causes like exceptions, malignant neoplasm and other remaining causes of death increased in the same periods of time. SDR by cancer mortality proportion increased by 3–7 %. If the percentage of the other causes of death in France and Spain rose by 5 %, in the United States the proportion increased by 15 % in 2005.

The cause-specific mortality structure for females in the selected countries is illustrated in Figure 25. Clearly, there are changes in the mortality structure, which will be discussed further.

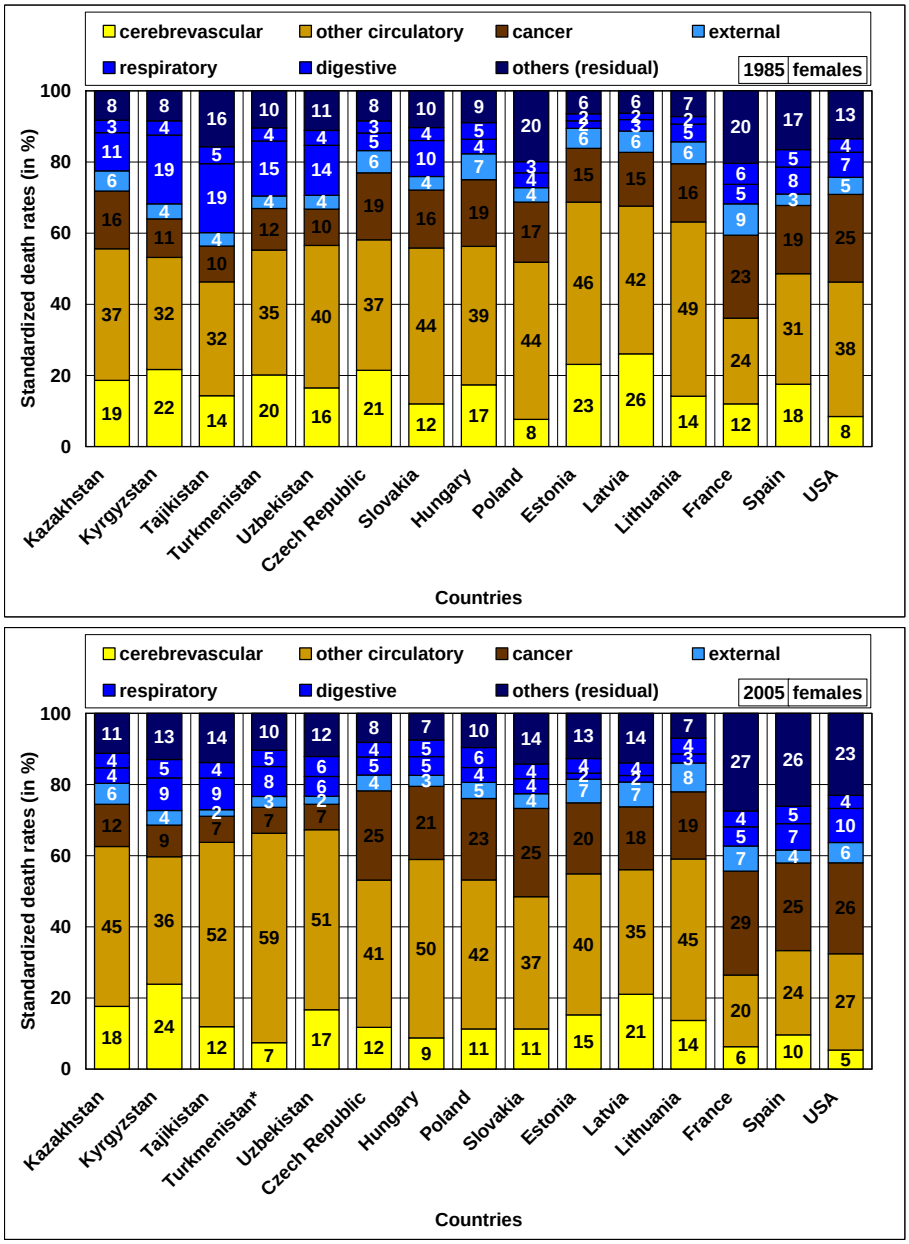
In the beginning of this period, in the countries of the Central Asian region, a significantly high proportion of other diseases of the circulatory system and the respiratory system diseases, like among males were noted. Especially in 2005, in Turkmenistan the proportion of other diseases of the circulatory system increased (from 32 to 52 % from total causes) and the inverse situation with the percentage of the cerebrovascular diseases which was decreased by 13 % from total causes. Moreover, a similar pattern of the cause-specific mortality structure was observed among Tajikistan's women, their value rose by 20 %. The proportion of malignant neoplasm in this region increased by 2–4 %. By the end of analysis, in Kyrgyzstan and Tajikistan the values of the respiratory system diseases halved from 19 to 9 % of the total causes. A minimal increase among the Central Asian females was found among the percentage of the digestive system diseases and external causes of death between the selected periods of time.

Among the females of the Central European countries, especially in the Czech Republic and Hungary, the proportion of the cerebrovascular diseases decreased by 9–10 % of the total causes between the studied periods (see Figure 25). Only in Poland the percentage of these diseases increased by 4 % for women. Significantly, the proportion of other diseases of the circulatory system in this country group declined, excluding Hungary. In the case of Hungarian females the percentage of this disease increased by 11 % in 2005. In the end of the study period, the cancer mortality proportion was much higher than in the beginning. A minimal increase was observed in Hungary (2 % of total causes). In the rest of the Central European countries the percentage of the malignant neoplasm rose by 6–9 %. In the other selected causes of death, the proportions similarly declined. However, in Poland other remaining causes halved in 2005.

In the cause-specific mortality structure of the three Baltic states a small changes was analyzed (see Figure 25). The proportion of the all cardiovascular diseases for females revealed a positive situation between the selected periods. In 2005, the percentage of the cerebrovascular diseases decreased by 5–8 %. However, the value for Lithuanian females remain unchanged, both values are the same (14 % of the total causes). The other diseases of the circulatory system also dropped, consisting of 4–7 % of the total causes among the three Baltic states. In the cancer and external causes was an inverse situation, and first one was increased more than the second disease. The proportion of the cancer was increased by 2–5 %. The external causes of death showed a quiet similar proportion in all three states. The proportion of digestive system diseases increased exactly by 2 % in 2005.

In the comparison between the two periods of time in the low mortality populations all other selected causes of death after the twenty year time periods mostly declined (see Figure 25). Only two causes like exceptions, such as malignant neoplasm and other remaining causes of death increased in the same periods of time, which is similar to the male's case. The proportion of SDR by cancer mortality increased to around 6 % of the total causes, but in the USA this proportion change was small (only for 1 %). While the percentage of the other causes of death in Spain and the USA rose by 10 %, in France the proportion also increased by 7 % in 2005. The decrease of the percentages of all cardiovascular diseases in the low mortality countries were less than 10 % between the two periods of time, excluding the USA. In the case of the USA, the proportion of other diseases of the circulatory system declined by 11 % from the total causes.

***Fig. 25 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for females, 1985 and 2005 (all ages)***



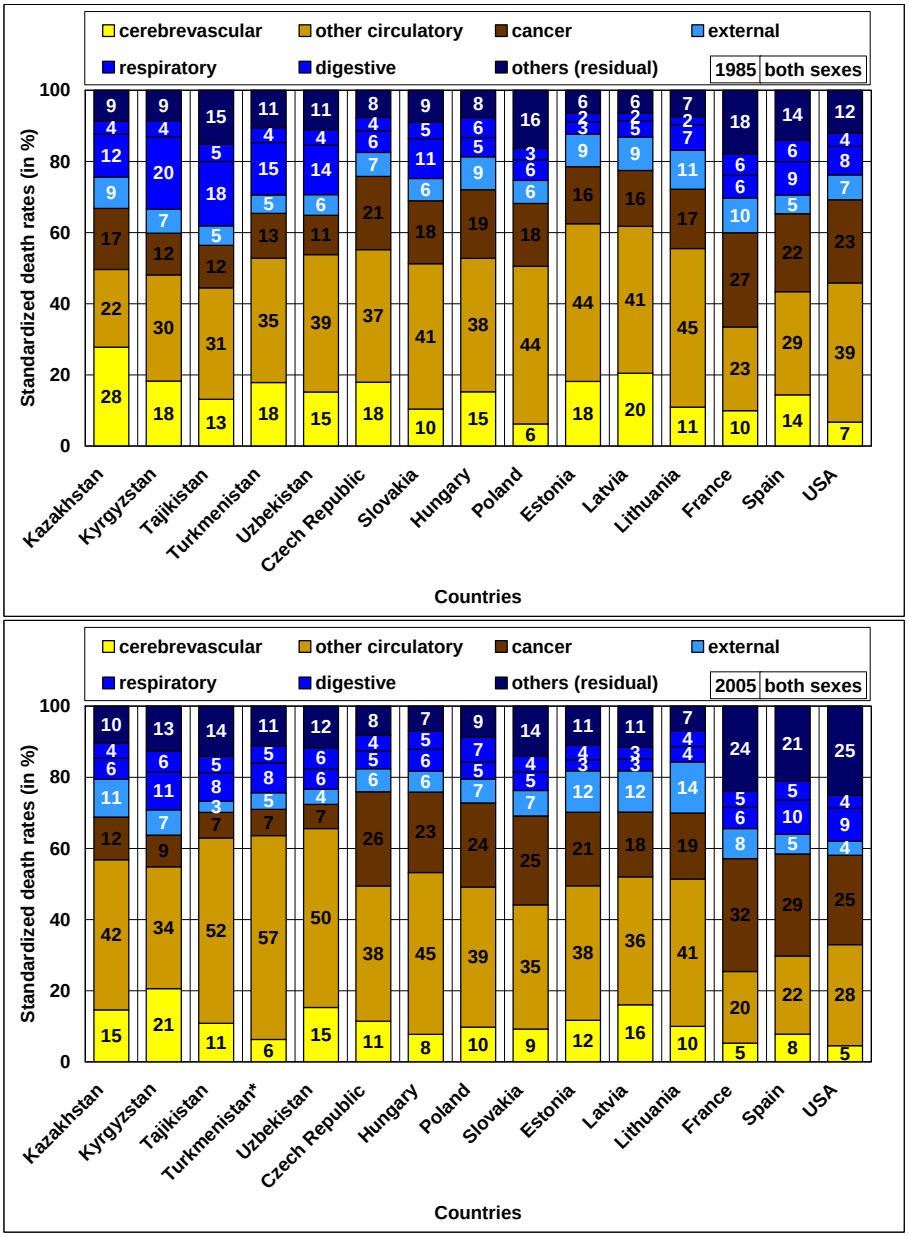

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Between the periods of pre-dissolution and their independence, within the post-communist countries, the percentage of SDR changed. Therefore, the cause-specific mortality structure for both sexes will be discussed (see Figure 26). The analysis will commence according to the macro-regions of the selected countries. Firstly, in the former Soviet Central Asian republics the mortality structure profile for the countries of Central Asia showed that mainly decline in the proportions of the cerebrovascular diseases, cancer and the respiratory system diseases was noted. A significant decline in the percentage of cerebrovascular diseases in Kazakhstan and Turkmenistan was observed. Their values were dropped by more than 10 % in 2005.

Uzbekistan's value is the same for the both periods of time. The proportion of mortality due to cancer also decreased by 3–5 % of the total causes.

***Fig. 26 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for both sexes, 1985 and 2005 (all ages)***




Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

A valuable decline in the case of respiratory system diseases in Kyrgyzstan and Tajikistan was found (see Figure 26). It halved. For the other countries the respiratory system diseases was declined by 6-8 %. A large increased in cause-specific mortality structure in other diseases of the circulatory system occurred. The minimal value belongs to Kyrgyzstan (only 4 %). In Kazakhstan, Tajikistan and Turkmenistan the proportion of this disease rose by 20, 21 and 22

%, respectively. In 2005, the percentage of other diseases of the circulatory system in Uzbekistan increased by 12 % of the total causes.

The second macro-region comprises the Central European countries. In this country group the declining cerebrovascular diseases percentage and the increasing proportion of other diseases of the circulatory system was observed (see Figure 26). As regards the proportion of the cerebrovascular diseases, the value for the Czech Republic and Hungary decreased by 7 %. Conversely, the value of this disease rose by only 1 % in Slovakia. During the analyzed period cerebrovascular disease in Poland for both sexes increased from 6 to 10 %. In 2005, the percentage of other diseases of the circulatory system was higher than its value in 1985 for this country group, excluding Slovakia and Poland. In the beginning time period the share of other diseases of the circulatory system was 44 for Poland and 41 for Slovakia, whereas at the end of the analysis its value dropped to 5 and 6 %, respectively. The proportion of cancer (3–7 %) and the digestive system diseases (1–4 %) also declined. In the case of the other causes the cause-specific mortality structure were separated in the countries of the Central Europe. In the Czech Republic and Hungary, a decrease was observed, whereas in Slovakia and Poland an opposite situation was noted. Significantly, in comparison with the other countries in this macro-region, the proportion of respiratory system diseases in Slovakia increased by 5 %. An inverse situation was highlighted in Slovakia; where the share of this disease was half.

The three Baltic states the cause-specific mortality structure is similar in both periods of time (see Figure 26). Remarkably, the proportion of the all cardiovascular system diseases was dropped. When the cerebrovascular diseases decreased by 1–6 %, the other diseases of the circulatory system declined by 3–7 % in this region. In 2005, the share of malignant neoplasm increased by 2–5 %. Also, a slight increase of around 3 and 2 % in external causes of death and the digestive system diseases were observed. In Estonia and Latvia the percentage of the remaining other causes rose to around 5 % of the total causes, while the Lithuanian value was just the same compared with 1985.

In the low mortality populations the cause-specific mortality structure was in a good situation among the selected countries (see Figure 26). The share of all diseases of the cardiovascular system declined. Significantly, a decrease in the proportion of cerebrovascular diseases by 11 % was observed among the USA population. The changes in the percentage of the selected causes of death in this country group declined, excluding cancer and other causes. These two diseases proportion increased between 1985 and 2005. In 2005, the share of cancer mortality increased by 2–7 % in the end of the study period. In the case of the other causes of death in this macro-region, the result was higher, at around 7 % in France and Spain compared to the values in 1985. In the USA, the proportion of this group of diseases increased by 13 %.

## 5.4 Relative structure of the standardized death rates by main causes of death

For comparison of the relative structure of main causes of death among the selected countries, the percentage of the standardized mortality rates by main causes of death was calculated. The

main causes of death, which was listed before for the selected post-communist and low mortality populations, has been separated for males, females and both sexes between the periods of 1985 and 2005, respectively. The initial data for the hierarchical cluster analysis the percentage of the standardized death rates by main causes of death were used. Firstly, in the analysis will be started with the mortality patterns of males in the selected countries. The initial data for this analysis presented in Table 20.

***Tab. 20 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for males, 1985 (all ages)***

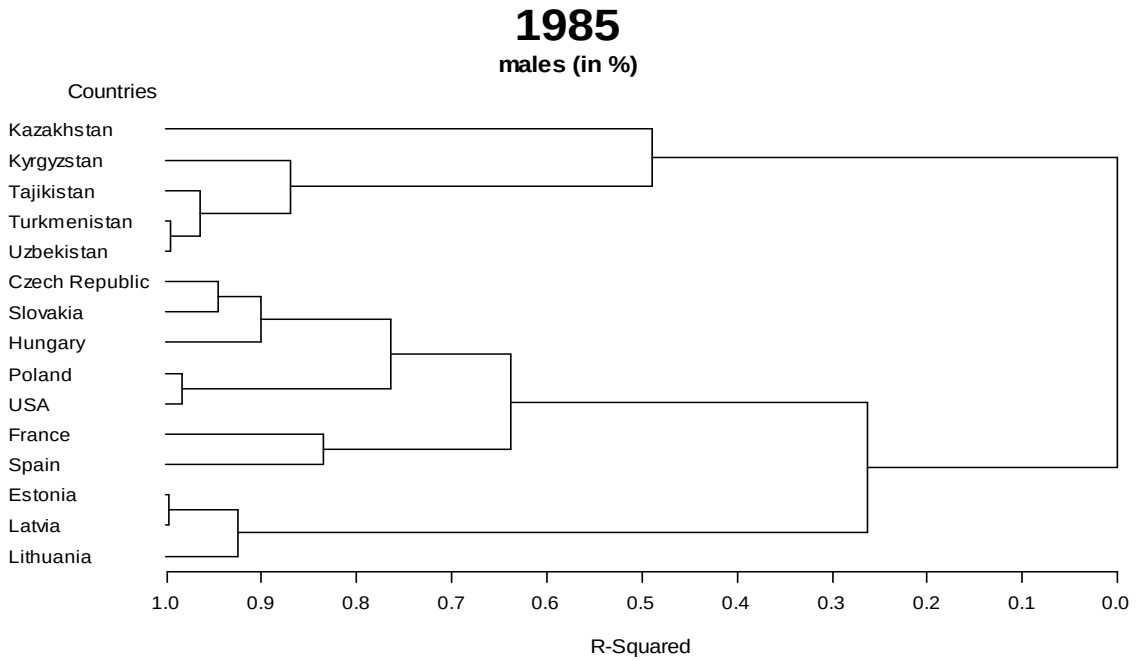
| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 33 | 13 | 18 | 11 | 13 | 4 | 9 |
| Kyrgyzstan | 16 | 29 | 12 | 8 | 21 | 5 | 9 |
| Tajikistan | 12 | 31 | 13 | 7 | 17 | 5 | 15 |
| Turkmenistan (*98) | 16 | 35 | 13 | 6 | 14 | 4 | 11 |
| Uzbekistan | 14 | 38 | 12 | 7 | 14 | 5 | 11 |
| Czech Republic | 16 | 38 | 22 | 7 | 7 | 4 | 7 |
| Hungary | 9 | 39 | 19 | 8 | 12 | 5 | 8 |
| Poland | 14 | 37 | 20 | 10 | 6 | 6 | 7 |
| Slovakia | 5 | 44 | 18 | 8 | 7 | 3 | 14 |
| Estonia | 15 | 44 | 17 | 11 | 4 | 3 | 6 |
| Latvia | 17 | 41 | 16 | 11 | 5 | 2 | 7 |
| Lithuania | 9 | 42 | 17 | 14 | 9 | 2 | 8 |
| France | 9 | 23 | 28 | 10 | 7 | 6 | 16 |
| Spain | 13 | 28 | 24 | 6 | 11 | 7 | 13 |
| USA | 6 | 40 | 23 | 8 | 9 | 4 | 11 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the hierarchical tree for males in 1985 can be clearly seen major differences between two country groups (see Figure 27).

***Fig. 27 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for males, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

On the one hand all of the communist Central Asian republics and socialist European area together with low mortality population in the second. Further, these major two groups can be divided into four subgroups and one country like an outsider of this analysis (see Figure 27). Where Kazakhstan is country apart which showed a unique pattern. The rest of Central Asian countries belong to the first subgroup. The second country group includes all Central European countries and United States. Low mortality populations such as France and Spain are together in the third subgroup. The last country group comprises the three Baltic states.

According to the average (z-scores) table the highest frequency of the cerebrovascular diseases among males was found in Kazakhstan (see Table 21). The inverse situation was observed in the case of other diseases of the circulatory system among the selected countries. In comparison of the two parts of cardiovascular diseases such as cerebrovascular and the rest among Kazakhstani males based on the results of analysis first one is share more part rather than second one, respectively. Regarding to the initial data in 1985 the cause-specific mortality structure for Kazakhstani males showed that the death rate for the cerebrovascular diseases equal to 33 percent, while the other diseases of the circulatory system only 13 percent.

The Soviet Central Asian countries, excluding Kazakhstan which belongs to the first subgroup a low malignant neoplasm and external causes of death were highlighted. Moreover, in this country group a high respiratory system disease was observed (see Table 21). From the main analysis of cause-specific mortality patterns in the Central Asian males, which was discussed in the previous chapter were resulted that the malignant neoplasm level were low compared with other country groups. Consequently, the share of the cancer in this subgroup showed the lowest value. The similar situation was covered the case of external causes in 1985 among the Central Asian republics. The highest respiratory system disease within this subgroup belongs to Kyrgyzstan and Tajikistan. Their proportion a twice higher confronted with the ex-socialist European area.

In the second subgroup the lowest cerebrovascular diseases was noted (see Table 21). Partly, the values of other selected causes are lower than total average for all subgroups. Notably, in this country group together with post-socialist European area the USA was observed in 1985. Analyzing the initial data for the hierarchical clustering one of the reasons to join the USA into this subgroup is a low proportion of the cerebrovascular diseases, especially, lower than in France and Spain. On the other hand, the value for other diseases of the circulatory system for the USA males is higher than in the rest of low mortality populations. Summarizing this reasons in the second country group highlight the lowest cerebrovascular diseases value among the other subgroups.

In the third country group the highest malignant neoplasm, the digestive system diseases and other causes of death was illustrated (see Table 21). The share of malignant neoplasm for males from total causes more than 24 percent in 1985, which is the high compared with other countries. In the cases of the digestive system diseases proportion, again the highest percentage of this disease is belonging to this subgroup. Other causes of death also showed their highest values in this country group. The next subgroup with a high values for other causes is the first, which comprises with Central Asian countries except Kazakhstan.

***Tab. 21 - Average values (Z-scores) for the relative structure by main causes of death of each country group for males, 1985 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 2.931 | -2.498 | -0.062 | 0.780 | 0.520 | -0.419 | -0.347 |
| Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan | 0.159 | -0.199 | -1.161 | -0.797 | 1.301 | 0.272 | 0.358 |
| Czech Republic, Slovakia, Hungary, Poland, USA | -0.552 | 0.562 | 0.454 | -0.281 | -0.477 | 0.090 | -0.162 |
| France, Spain | -0.459 | -1.087 | 1.720 | -0.258 | -0.331 | 1.496 | 1.366 |
| Estonia, Latvia, Lithuania | 0.036 | 0.885 | -0.334 | 1.442 | -0.893 | -1.371 | -1.004 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the last subgroup the highest other diseases of the circulatory system and external causes of death was observed (see Table 21). The contrary situation among males was with the respiratory system and digestive system diseases, also other causes of death. The share of the values of other diseases of the circulatory system is the highest compared with other country groups and its value more than 40 percent of the total causes in 1985. Regarding to the cause-specific mortality levels for the three Baltic states males showed extremely, high value among the countries. In this time period the level of the external causes of death within Baltic states reached their pick. More positive death rate by respiratory system diseases for males was obtained. The percentage of this diseases in the three Baltic states are very low among the selected countries, even less than low mortality population's value. The other causes showed quite similar pattern like previous disease. Their proportions of the total causes are very low.

The changes by the end of studied period in the relative structure by main causes of death among males of the selected countries will be discussed further. These variables were used for the hierarchical cluster analysis based on the Euclidean distance and Ward method. Table 22 shows the initial data for males in selected countries in 2005.

***Tab. 22 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for males, 2005 (all ages)***

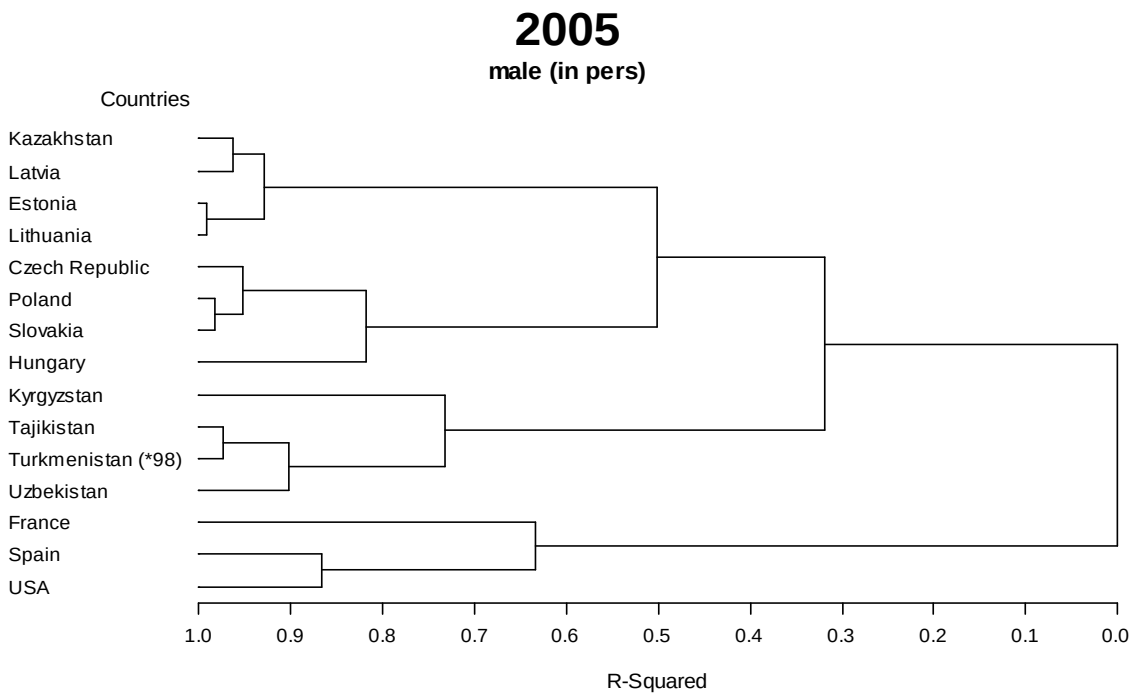
| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of morbidity and mortality | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 13 | 41 | 12 | 13 | 7 | 4 | 10 |
| Kyrgyzstan | 19 | 33 | 9 | 9 | 12 | 6 | 12 |
| Tajikistan | 10 | 52 | 7 | 4 | 7 | 5 | 14 |
| Turkmenistan (*98) | 6 | 56 | 7 | 6 | 8 | 5 | 12 |
| Uzbekistan | 14 | 50 | 6 | 6 | 6 | 6 | 11 |
| Czech Republic | 11 | 36 | 27 | 8 | 5 | 5 | 8 |
| Hungary | 7 | 43 | 24 | 7 | 7 | 6 | 7 |
| Poland | 9 | 38 | 24 | 8 | 5 | 8 | 8 |
| Slovakia | 8 | 34 | 25 | 9 | 6 | 5 | 14 |
| Estonia | 10 | 37 | 21 | 14 | 4 | 4 | 10 |
| Latvia | 14 | 36 | 18 | 14 | 4 | 3 | 10 |
| Lithuania | 8 | 40 | 18 | 17 | 5 | 4 | 7 |
| France | 5 | 20 | 33 | 9 | 6 | 5 | 22 |
| Spain | 7 | 21 | 31 | 7 | 11 | 5 | 18 |
| USA | 4 | 29 | 25 | 3 | 9 | 4 | 26 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In 2005 the cause-specific mortality structures (irrespective of the total level) for males was differentiated between the two major country groups. Central Asian countries together with post-socialist Europe are in the first country group, and low mortality populations in the second (see Figure 28).

***Fig. 28 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for males, 2005 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The selected countries were divided into four subgroups according to the hierarchical tree (see Figure 28). A similarity in the mortality pattern was observed in Kazakhstan and Baltic states. The Central European countries are in the second subgroup. Central Asian republics, except Kazakhstan are in the third subgroup. Finally, France, Spain and the United Sates are in the last.

Table 23 clearly illustrates that the highest structural values of cerebrovascular diseases and external causes of death. The value of cerebrovascular diseases in this subgroup showed the highest one, compared with other subgroups. As was mentioned before, this disease is still high among males of this region. Also, the respective the lowest values of the respiratory system, the digestive system diseases and other causes can be found in the first subgroup. In Kazakhstan and the Baltic states, an extremely that high proportion of external causes of death among the selected countries were observed. For instance, the other selected countries have values of less than 10 percent of the total causes of death. According to initial data, the countries of the first subgroup have a value more than 10 percent. Lithuania has the highest value, it is equal to 17 percent, while the others have similar result 14 percent (see Table 22). The countries within the first subgroup a low percentage of the respiratory system disease were registered. The diseases of the digestive system also showed the lowest result in this subgroup among the others. It

equals to 3-4 percent of all causes of death and it's lower than 2 times (see Table 23). Other causes of death in this subgroup are high. Moreover, the highest proportion of these diseases to total cause was observed.

The second subgroup illustrates a high percentage of other diseases of the circulatory system among male population in 2005 (see Table 23). In Central European countries disease of the digestive system amounted to more than 5 percent of the total cause-specific mortality was observed among the selected countries. All other causes of death demonstrated a low percentage of the total cause-specific mortality among the other subgroups. Concerning cardiovascular diseases, ischaemic heart disease and cerebrovascular disease are the leading causes of death in Poland, in that order. As cardiovascular mortality accounts for the major share of all deaths, the trend of cardiovascular mortality is similar to the general trend. Mortality through circulatory disease grew rapidly between 1970 and 1980. After reaching a peak in 1990, the number of deaths owing to this health issue has been decreasing. Mortality rates from ischaemic heart disease rose until 1991 and started to decline only after then. After several years of decline, mortality rates from strokes have leveled off in recent years (Golinowska and Sowa 2006). Other diseases of the circulatory system in Latvia showed low value among the other selected countries. As everyone knows that the leading cause of death is diseases of the circulatory system in each country.

A high proportion of all respiratory system diseases belongs to the third subgroup (see Table 23). In Central Asian countries, except Kazakhstan, values of malignant neoplasm and external causes of death showed lower level compared with other subgroups. Cancer is the leading cause of deaths in most countries of the WHO European Region, although the share varies between the countries. The most significant causes of death is malignant neoplasm (cancer) was the one of the leading cause of death in the countries of this region. It can be explained by the fact that there has long been concern about lifestyle, especially smoking, alcohol consumption, and the traditional unhealthy diet. The cancer mortality and external causes in this subgroup showed a lower percentage among the selected countries. Notably, the differences in cancer among the subgroups are significant. In essence, the values are less than 9 percent, while the values for the other selected countries are higher. The value of external causes in this subgroup is the lowest and this value closer to the low mortality population's result.

***Tab. 23 - Average values (Z-scores) for the relative structure by main causes of death of each country group for males, 2005 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan, Latvia, Estonia, Lithuania | 0.760 | 0.039 | -0.266 | 1.277 | -0.540 | -1.133 | -0.840 |
| Czech Republic, Poland, Slovakia, Hungary | -0.385 | 0.552 | 0.315 | -0.279 | -0.507 | 0.228 | -0.289 |
| Kyrgyzstan, Tajikistan, Turkmenistan*, Uzbekistan | 0.159 | -0.199 | -1.161 | -0.797 | 1.301 | 0.272 | 0.358 |
| France, Spain, USA | -0.713 | -0.523 | 1.482 | -0.267 | -0.339 | 0.844 | 1.027 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Low mortality populations, which belong to the fourth subgroup, and showed a result that a low percentage of cerebrovascular diseases and other diseases of the circulatory system among the selected countries (see Table 23). The percentage of cerebrovascular diseases from total cause-specific mortality in these countries was really low compared with the other selected countries. While these values in other subgroups are more than 10 percent of all causes of death, the last subgroup average is lower than 7 percent. A similar situation with other diseases of the circulatory system was mentioned in this analysis. A high proportion of cancer mortality, the digestive system diseases and all other causes of death were observed in this subgroup. Cancer in this subgroup accounts for around 25 and percent and over of the all causes of death. The proportion of respiratory system disease is higher than the total average. Other causes of death also showed a higher proportion among the other subgroups.

Conclusively, the relative structure of the standardized death rates by man causes of death for males among the selected countries between the periods of 1985 and 2005 illustrates in Figure 29, respectively. Between the pre-dissolution and since their independent time in the former Soviet Central Asian republic the positive changes in mortality structure over time should be highlighted (see Figure 29). Especially, among Kazakhstani males the proportion of the all cardiovascular diseases significantly was decreased. If in the beginning of the analysis Kazakhstan was an outsider country, in the end it join into the three Baltic states, and showed improvements in their mortality structure. In the pre-transition period among Kazakhstani males external causes and respiratory system disease were a high, after the collapse of the Soviet Union the proportion of the respiratory system diseases were decreased and the more increase in the values of the external causes was observed.

Notably, in the other countries from the former Soviet Central Asian region the percentage of the all cardiovascular diseases was increased, in details, for other diseases of the circulatory system more than for the cerebrovascular diseases (see Figure 29). Moreover, a small increase in the percentage of the digestive system disease was noted.

***Fig. 29 - Standardized values of the relative structure by main causes of death in the selected countries for males, 1985 and 2005***

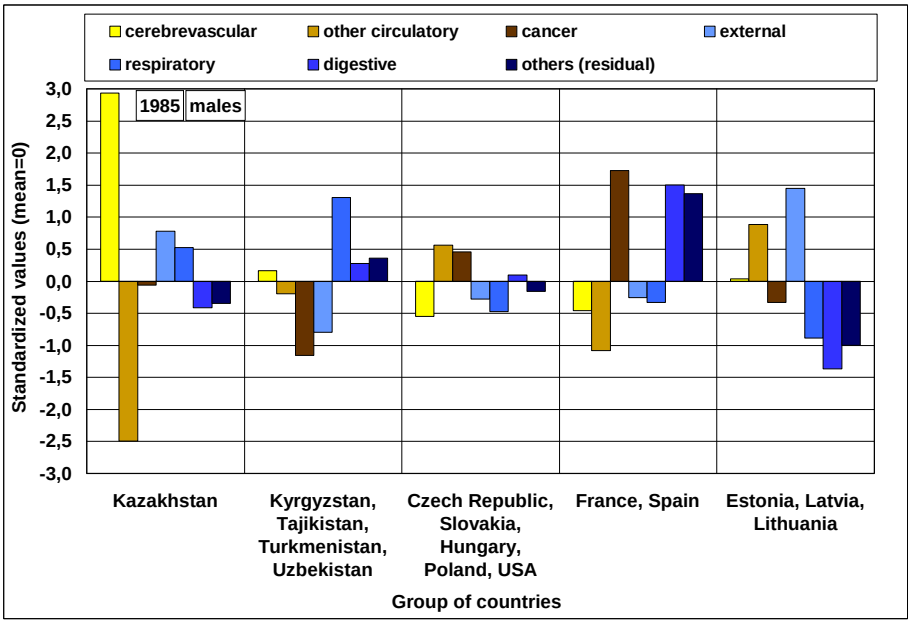
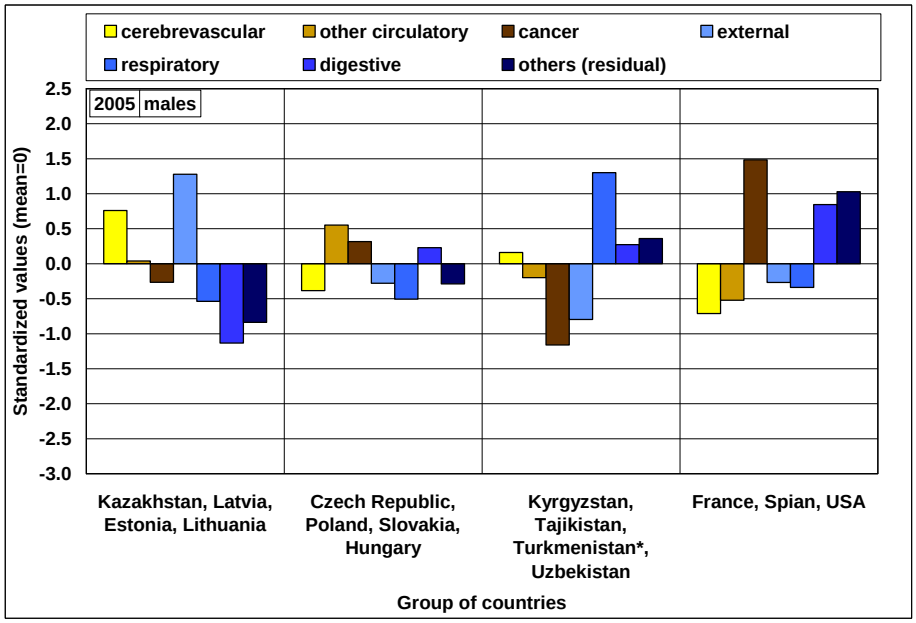


***Fig. 29 – continued***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the countries of the Central Europe better mortality conditions were analyzed (see Figure 29). In the Central European countries have shifted over time towards low mortality populations. Only except the proportion of the malignant neoplasm and the digestive system diseases. The first disease percentage of the total causes was less than in the case of diseases of the digestive system. In the patterns of the rest of the selected causes in this region were insignificant. The three Baltic states males between the selected periods of time showed quite similar pattern. The main amount proportion was the external causes of death in this region and its value increased over time. In 2005, the cerebrovascular diseases value a valuable decline was observed. In the case of the other selected causes of death for males were partly decreased by the end of studied period.

In low mortality countries the relative structure of SDR by main causes of death were improved (see Figure 29). Significantly, the reduction of the proportion of the cerebrovascular diseases, cancer, external causes and the digestive system diseases was observed. However, in this macro-region also the increase of the mortality structure was noted. For instance, in 2005 the percentage of the respiratory system diseases and remaining other causes was rose.

The relative structure of SDR by main causes of death for females among the selected countries in 1985 will be discussed further. The cause-specific mortality structure of the women is differentiated from men. Especially, in the case of the Soviet Central Asian countries females had a lower percentage of the cancer, external causes and respiratory system diseases in 1985 compared with males in the same period of time. For instance, the proportion of the external causes in the Soviet era can be due to the simple fact, that in that time the number of women drivers was less rather then in recent time. The initial data for the hierarchical clustering are illustrates in Table 24.

***Tab. 24 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for females, 1985 (all ages)***

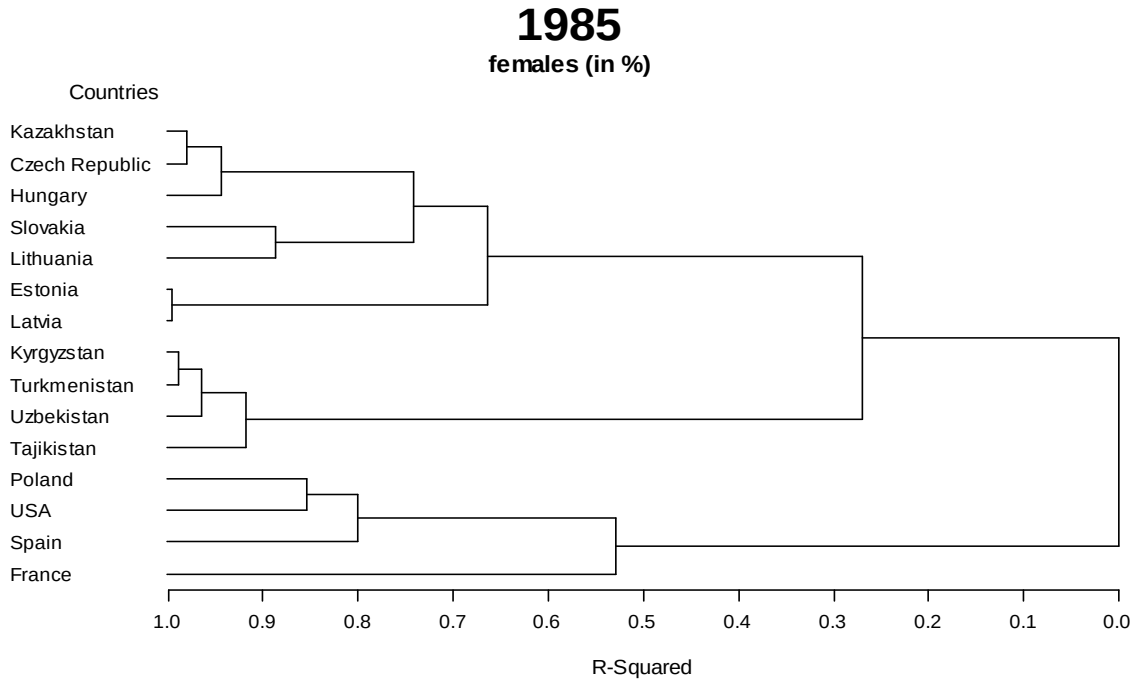
| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 19 | 37 | 16 | 6 | 11 | 3 | 8 |
| Kyrgyzstan | 22 | 32 | 11 | 4 | 19 | 4 | 8 |
| Tajikistan | 14 | 32 | 10 | 4 | 19 | 5 | 16 |
| Turkmenistan (*98) | 20 | 35 | 12 | 4 | 15 | 4 | 10 |
| Uzbekistan | 16 | 40 | 10 | 4 | 14 | 4 | 11 |
| Czech Republic | 21 | 37 | 19 | 6 | 5 | 3 | 8 |
| Hungary | 12 | 44 | 16 | 4 | 10 | 4 | 10 |
| Poland | 17 | 39 | 19 | 7 | 4 | 5 | 9 |
| Slovakia | 8 | 44 | 17 | 4 | 4 | 3 | 20 |
| Estonia | 23 | 46 | 15 | 6 | 2 | 2 | 6 |
| Latvia | 26 | 42 | 15 | 6 | 3 | 2 | 6 |
| Lithuania | 14 | 49 | 16 | 6 | 5 | 2 | 7 |
| France | 12 | 24 | 23 | 9 | 5 | 6 | 20 |
| Spain | 18 | 31 | 19 | 3 | 8 | 5 | 17 |
| USA | 8 | 38 | 25 | 5 | 7 | 4 | 13 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the country grouping by similarities in the relative structure of SDR by main causes of death for females among the selected countries in 1985 the countries separated into three major groups (see Figure 30).

***Fig. 30 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for males, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The post-socialist European area (except Poland) together with Kazakhstan was found in the first group (see Figure 30). The rest of Central Asian republics are in the second. Low mortality population with Poland situated in the last. These major country groups can be divided into four

subgroups in 1985. Kazakhstan, Hungary, the Czech Republic, Slovakia and Lithuania are in the first subgroup. The second subgroup includes the two Baltic states (Estonia and Latvia). The Soviet Central Asian region, excluding Kazakhstan showed similarities in female mortality pattern and was observed in the third subgroups. The last country group comprises Poland together with Spain and the USA. French female's mortality structure was as outsider of the analysis.

In the first subgroup the female mortality structure in 1985 were without any extreme values (see Table 25). The proportion of the SDR by the cardiovascular diseases, external causes and remaining other causes of death in this subgroup showed a high values than the total average or all country groups. The values for the rest selected causes were lower compared with the total average.

In the countries from the second country group the highest percentage of the all cardiovascular diseases was observed (see Table 25). Moreover, the lowest values of the other causes, respiratory system and digestive system diseases were highlighted in 1985. The proportion of the cardiovascular disease in this subgroup was one of the highest values compared with other country groups. For instance, the percentage of other diseases of the circulatory system was more than 40 present in 1985. Regarding to the share of the respiratory and digestive system diseases from total causes among Estonian and Latvian females in 1985 was equal to only 2 percent for both cases. Also the proportion of the remaining other causes was less around half values for other selected countries.

In the third subgroup the highest proportion of the respiratory system diseases was observed in 1985 (see Table 25). The opposite situation was with malignant neoplasm and external causes among the females of this country group. The relative frequency of diseases of the respiratory system was significantly high compared with other subgroups. If the share of the this disease in this country group consists more than 10 percent of the total causes, in the other subgroups its share were less than 6 percent in 1985. The inverse situation was found in cancer and external causes among females from this subgroup. Its values were around 10 and 4 percents, respectively.

***Tab. 25 - Average values (Z-scores) for the relative structure by main causes of death of each country group for females, 1985 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan, Hungary, Czech Republic, Slovakia Lithuania | -0.005 | 0.488 | 0.240 | 0.441 | -0.325 | -0.201 | -0.604 |
| Estonia, Latvia | 1.473 | 0.870 | -0.255 | 0.406 | -1.070 | -1.604 | -1.088 |
| Kyrgyzstan, Turkmenistan, Uzbekistan, Tajikistan | 0.265 | -0.493 | -1.261 | -0.811 | 1.425 | 0.411 | -0.009 |
| Poland, Spain, USA | -1.032 | -0.035 | 0.914 | -0.701 | -0.449 | 0.220 | 1.106 |
| France | -0.886 | -2.106 | 1.609 | 2.332 | -0.586 | 1.908 | 1.913 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Poland, Spain and United States which belong to the last country group showed the lowest proportion of the cerebrovascular diseases among the other countries (see Table 25). The share of this disease consists for Polish and the US females 18 percent and for Spanish females 18 percent of the total causes, which significantly lower than in the other selected countries. The values of the rest of the selected causes in this subgroup were relatively lower than the total average for all countries.

The reason of separation of the French females from others perhaps due to the higher proportion of the cancer, external causes, the digestive system and other remaining causes (see Table 25). Moreover, a low percentage of other diseases of the circulatory system belong to this country. The relative structure of the SDR by external causes and the digestive system diseases for females in 1985 was closer to other low mortality populations. However, in the case of cancer and other causes proportions significantly higher than values which was observed in the other countries of this macro-region. Remarkable, the percentage of other diseases of the circulatory system were very low among French women in 1985.

For highlight the relative structure of SDR by main causes of death for females among the selected countries the values in 2005 was recorded. After this analysis we have opportunity compare female patterns in the selected countries between the selected periods of time. These variables which were listed in Table 26 were used for the hierarchical cluster analysis based on Euclidean distance and Ward method.

***Tab. 26 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for females, 2005 (all ages)***

| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 18 | 45 | 12 | 6 | 4 | 4 | 11 |
| Kyrgyzstan | 24 | 36 | 9 | 4 | 9 | 5 | 13 |
| Tajikistan | 12 | 52 | 7 | 2 | 9 | 4 | 14 |
| Turkmenistan (*98) | 7 | 59 | 7 | 3 | 8 | 5 | 10 |
| Uzbekistan | 17 | 51 | 7 | 2 | 6 | 6 | 12 |
| Czech Republic | 12 | 41 | 25 | 4 | 5 | 4 | 8 |
| Hungary | 9 | 50 | 21 | 3 | 5 | 5 | 7 |
| Poland | 11 | 42 | 23 | 5 | 4 | 6 | 10 |
| Slovakia | 11 | 37 | 25 | 4 | 4 | 4 | 14 |
| Estonia | 15 | 40 | 20 | 7 | 2 | 4 | 13 |
| Latvia | 21 | 35 | 18 | 7 | 2 | 4 | 14 |
| Lithuania | 14 | 45 | 19 | 8 | 3 | 4 | 7 |
| France | 6 | 20 | 29 | 7 | 5 | 4 | 27 |
| Spain | 10 | 24 | 25 | 4 | 7 | 5 | 26 |
| USA | 5 | 27 | 26 | 6 | 10 | 4 | 23 |

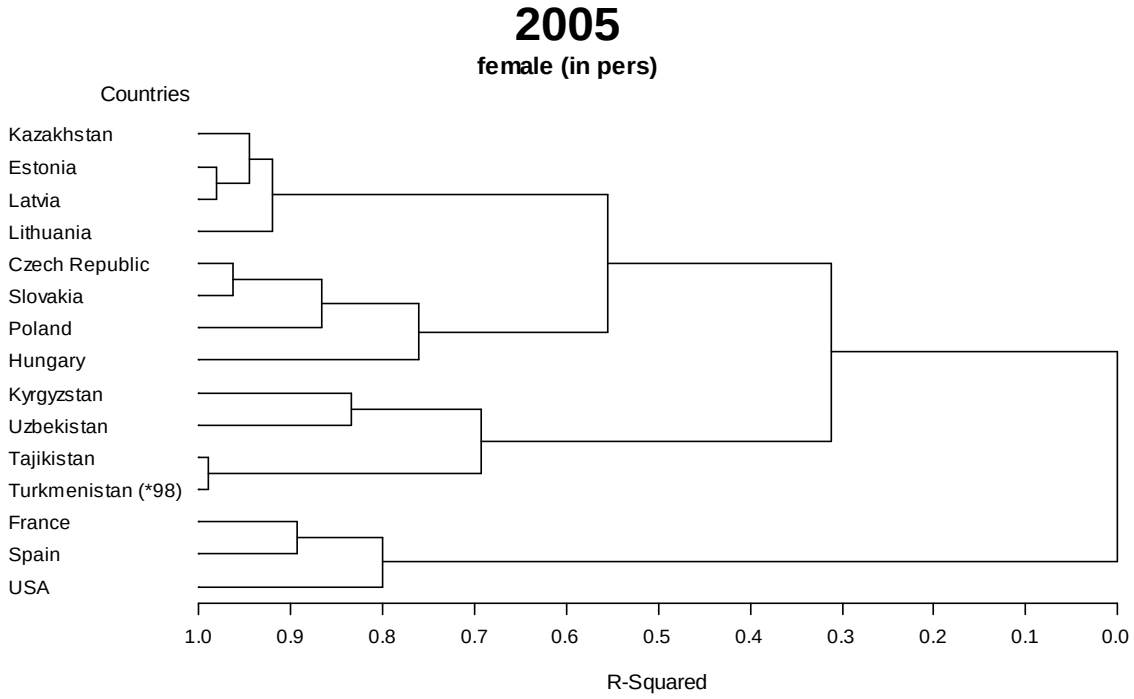
Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Figure 31 clearly illustrates that the cause-specific mortality structure for females were differentiated between the two major country groups in 2005. For instance, the Central Asian countries and post-socialist Europe are in the first country group, and low mortality populations in the second (see Figure 31). The selected countries were divided into four subgroups according to the hierarchical tree. A similarity in the mortality pattern was observed in Kazakhstan and Baltic states and they are in the first subgroup. The Central European countries are in the second subgroup. Central Asian republics, except Kazakhstan are in the third subgroup. France, Spain and the United Sates are in the last subgroup. A more detailed picture

of the mortality structure among the selected countries can be found in Table 27. In this table, the average values of each country group were calculated. Additionally, the highest and lowest values are highlighted.

***Fig. 31 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for females, 2005 (standardized for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Kazakhstan and the Baltic states showed a high proportion of cerebrovascular diseases and external causes of death between females among the selected countries (see Table 27). Also the first subgroup highlighted low values of cancer mortality, digestive system diseases and respiratory system diseases. The value of cerebrovascular diseases is closer to the results of other Central Asian republics and two times higher compared with central Europe and the low mortality populations. Currently, the percentage of external causes of death from all causes of death in these host countries is one of the leading factors. The opposite situation related to the cancer and digestive system diseases occurred in this subgroup. According to Table 10 within all selected countries this disease a similar result was produced. The percentage of respiratory system disease is low, and it is about 3 times lower.

In the second subgroup low proportion of the other causes of death was observed (see Table 27). The percentage of the other causes of death is lower than average for all the selected countries. The values of percentage of the main causes of death in this subgroup are at an intermediate level.

The next subgroup presents a high percentage of the other diseases of the circulatory system, mortality due to cancer and diseases of the digestive system among the other subgroups (see Table 27). Concerning other diseases of the circulatory system in Central Asian countries,

except Kazakhstan, a similar result for males and females was identified. In both cases this disease comprises is about half of the total causes of death. The differences in digestive system diseases are not significant; it is only 1–2 percent.

***Tab. 27 - Average values (Z-scores) for the relative structure by main causes of death of each country group for females, 2005 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan, Estonia, Latvia, Lithuania | 0.797 | 0.065 | -0.734 | 1.140 | -0.133 | -1.138 | -0.418 |
| Czech Republic, Slovakia, Poland, Hungary | -0.480 | 0.293 | 0.214 | -0.380 | 0.679 | -0.342 | -0.667 |
| Kyrgyzstan, Uzbekistan, Tajikistan, Turkmenistan* | 0.442 | 0.801 | 0.704 | -1.040 | -1.362 | 0.936 | -0.247 |
| France, Spian, USA | -1.013 | -1.545 | -0.245 | 0.373 | 1.089 | 0.724 | 1.776 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the third subgroup, the percentage of external causes of death in this subgroup is ostensibly lower among the selected countries (see Table 27). The cancer mortality situation for males and females is similar. According to the initial data percentage of external causes of death from all causes of death, it is less than 4 percent. The same disease in the other subgroups is higher.

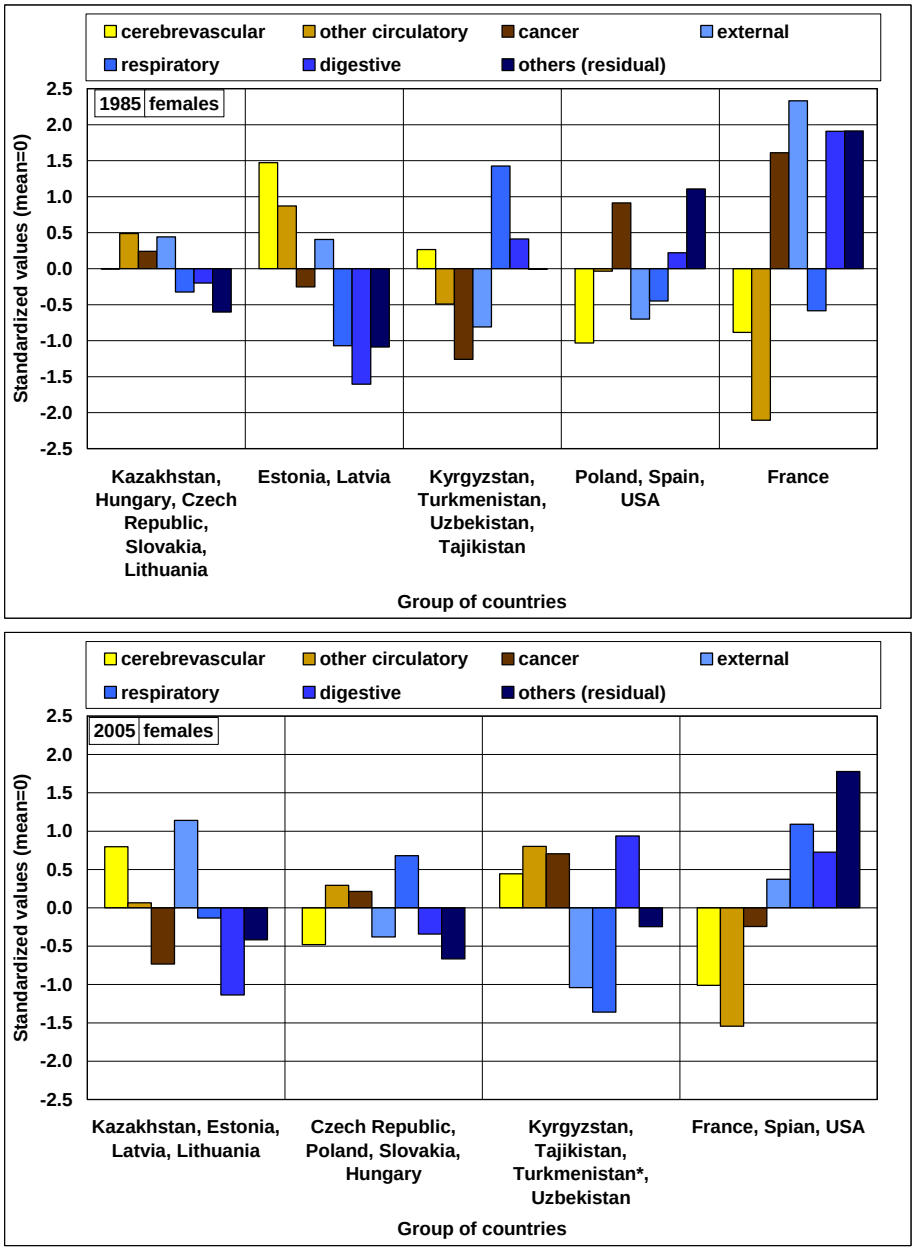
Table 27 illustrates that the fourth subgroup low percentage of the all cardiovascular diseases. The values of the cerebrovascular diseases and other diseases of the circulatory system in this last subgroup are lower than average for all the selected countries. In comparison with the Central Asian republics where all cardiovascular diseases are about half of all causes of death and in low mortality populations these values are about 25 percent. The proportion of respiratory system diseases and other causes of death in last subgroup are high among the selected countries. In essence, respiratory system disease between females in the last subgroup is around 10 percent of total mortality. Other causes of death are also high in this subgroup. In both cases the differences between subgroups are significant.

In contrast, the relative structure of SDR by main causes of death among the selected countries between the periods of 1985 and 2005 are graphically illustrates (see Figure 32). According to that the changes of mortality structure over time for females among the selected countries can clearly observed. Regarding to the separate cases by macro-regions will be discussed further. Firstly, the mortality conditions Central Asian republics excluding Kazakhstan in the both periods of time were a quite similar. The proportion of the cardiovascular diseases was significantly increased. In essence, a large decline of the percentage was found in respiratory system diseases. In comparison, the proportion of the cancer mortality in this macro-region was a similar in the both selected years. Kazakhstani females mortality structure in the Soviet era were closer to the ex-socialist European area, and by the end of analyzed period Kazakhstan was found in the three Baltic states country group. In 1985, the relative mortality structure of SDR by main causes of death for females an intermediate

mortality levels pattern was recorded. In 2005, the proportions of the main causes of death were a higher in cerebrovascular diseases, and significantly lower in respiratory system and digestive system diseases.

The next macro-region which will be summarized according their female mortality structure is Central European area. Slightly increase in the cerebrovascular diseases and cancer mortality structure among the females in 2005 was observed (see Figure 32). The proportion of external causes and respiratory system diseases was declined since their independent time.

***Fig. 32 - Standardized values of the relative structure by main causes of death in the selected countries for females, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the countries of the Baltic region female mortality structure by main causes of death was quite improved (see Figure 32). In 2005, the percentage of the cerebrovascular diseases was increased, and this disease is more common among the Baltic states females in the both periods of time. Less proportion among females of this region comprises diseases such as other diseases of the circulatory system, cancer and external causes.

Contrastingly, the lower proportion between the selected periods among females of low mortality populations were all causes with a few exceptions, such as percentage of other diseases of the circulatory system and respiratory system diseases (see Figure 32). Which values were increased by the end of study period.

After the analyzing relative structure of the SDR by main causes of death for males and females among the selected countries between the studied periods, it is time to discuss both sexes in the same periods. The initial data for the country grouping according their similarities in mortality structure by selected causes of death in 1985 illustrates in Table 28.

***Tab. 28 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for both sexes, 1985 (all ages)***

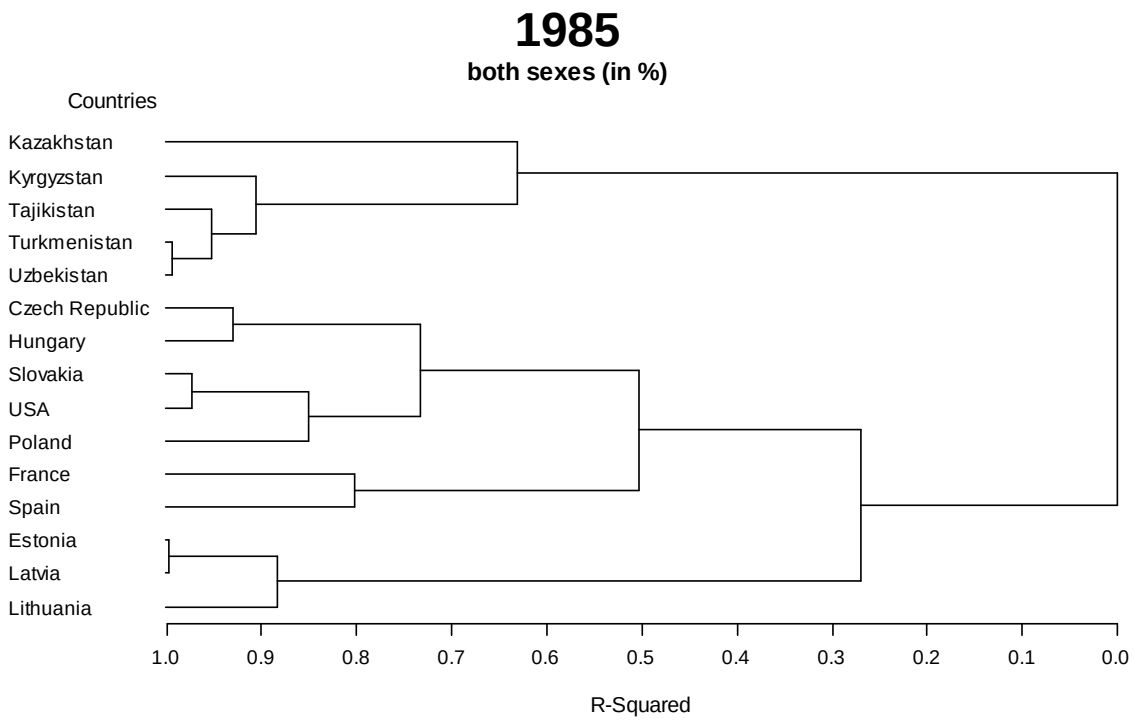
| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 28 | 22 | 17 | 9 | 12 | 4 | 9 |
| Kyrgyzstan | 18 | 30 | 12 | 7 | 20 | 4 | 9 |
| Tajikistan | 13 | 31 | 12 | 5 | 18 | 5 | 15 |
| Turkmenistan (*98) | 18 | 35 | 13 | 5 | 15 | 4 | 11 |
| Uzbekistan | 15 | 39 | 11 | 6 | 14 | 4 | 11 |
| Czech Republic | 18 | 37 | 21 | 7 | 6 | 4 | 8 |
| Hungary | 10 | 41 | 18 | 6 | 11 | 5 | 9 |
| Poland | 15 | 38 | 19 | 9 | 5 | 6 | 8 |
| Slovakia | 6 | 44 | 18 | 6 | 6 | 3 | 16 |
| Estonia | 18 | 44 | 16 | 9 | 3 | 2 | 6 |
| Latvia | 20 | 41 | 16 | 9 | 5 | 2 | 6 |
| Lithuania | 11 | 45 | 17 | 11 | 7 | 2 | 7 |
| France | 10 | 23 | 27 | 10 | 6 | 6 | 18 |
| Spain | 14 | 29 | 22 | 5 | 9 | 6 | 14 |
| USA | 7 | 39 | 23 | 7 | 8 | 4 | 12 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The hierarchical tree shows similarities or homogeneity in the mortality structure among the selected countries and how they will differentiate within groups (see Figure 33). A quite clear difference between the Soviet Central Asian republic are on the one hand, and post-socialist European area with low mortality populations in the second. These two major groups can be further divided into four subgroups. All of the Central Asian countries were situated in the first subgroup. The second country group comprises of the Central European republics and the USA. France and Spain are in the third subgroup. In the last country group consist of the countries of the Baltic region.

***Fig. 33 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for both sexes, 1985 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the first subgroup the highest proportion of cerebrovascular diseases and digestive system diseases was observed (see Table 29). Moreover, the lowest percentage of malignant neoplasm and external causes of death was noted in 1985. The mortality structure of cerebrovascular diseases for both sexes was extremely high in Kazakhstan. The value of the other countries of this region were a lower comparable with Kazakhstani populations, and it is lower for 10 percents. The share of digestive system diseases was a little higher compared with other subgroups, and it amounts around 4 percents of the total cause. During the all analysis, the lowest level of malignant neoplasm belongs to the Soviet Central Asian countries. Also external causes of death comprise lower proportion of the total cause.

The second subgroup had a low percentage of cerebrovascular diseases among the other country groups (see Table 29). The value of this disease a share was less than ten percent of the total cause in 1985 for both sexes of Slovakia, Poland and the USA. The percentage in the Czech Republic and Hungary were for 15 percents of total cause in the same year. Regarding all of these different value in summary it gives lower proportion rather than in other countries. The proportion of the rest causes partly lower than the total average for all subgroups.

In the third subgroup low values of other diseases of the circulatory system was analyzed (see Table 29). However, the highest relative structure by malignant neoplasm, digestive system diseases and remaining other causes in this subgroup was found. The share of other diseases of the circulatory diseases was account around 13 percents of the total causes for both sexes, and showed in the result the lowest value among the other subgroups. A big amount of the

proportion of cancer for both sexes was observed in France than in Spain within this country group. And the percentage of the last two diseases extremely high compared with others.

***Tab. 29 - Average values (Z-scores) for the relative structure by main causes of death of each country group for both sexes, 1985 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan Uzbekistan | 0.639 | -0.624 | -0.983 | -0.570 | 1.180 | 0.183 | 0.056 |
| Czech Republic, Hungary, Slovakia, USA, Poland | -0.629 | 0.536 | 0.530 | -0.179 | -0.485 | 0.075 | -0.015 |
| France, Spain | -0.473 | -1.320 | 1.534 | -0.004 | -0.365 | 1.525 | 1.441 |
| Estonia, Latvia, Lithuania | 0.298 | 1.026 | -0.267 | 1.252 | -0.914 | -1.445 | -1.030 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The last subgroup a high percentage of other diseases of the circulatory system and external causes of death was analyzed for both sexes in 1985 (see Table 29). It amount around 40 and 10 percents of the total cause, respectively, among their populations. It is relatively high in comparison with other countries. The lowest proportion of other causes, respiratory system and digestive system diseases was highlighted in this subgroup. The share of the last tree diseases for both sexes comprises a minimal value of the total causes in 1985.

Table 30 shows the mortality structure of the standardized death rates by main causes of death among the selected countries for both sexes in 2005. It is initial data for the further analysis of mortality patterns by main causes of death in the selected period of time.

***Tab. 30 - Percentage of the SDR (per 100,000) by main causes of death of mortality structure in the selected countries for both sexes, 2005 (all ages)***

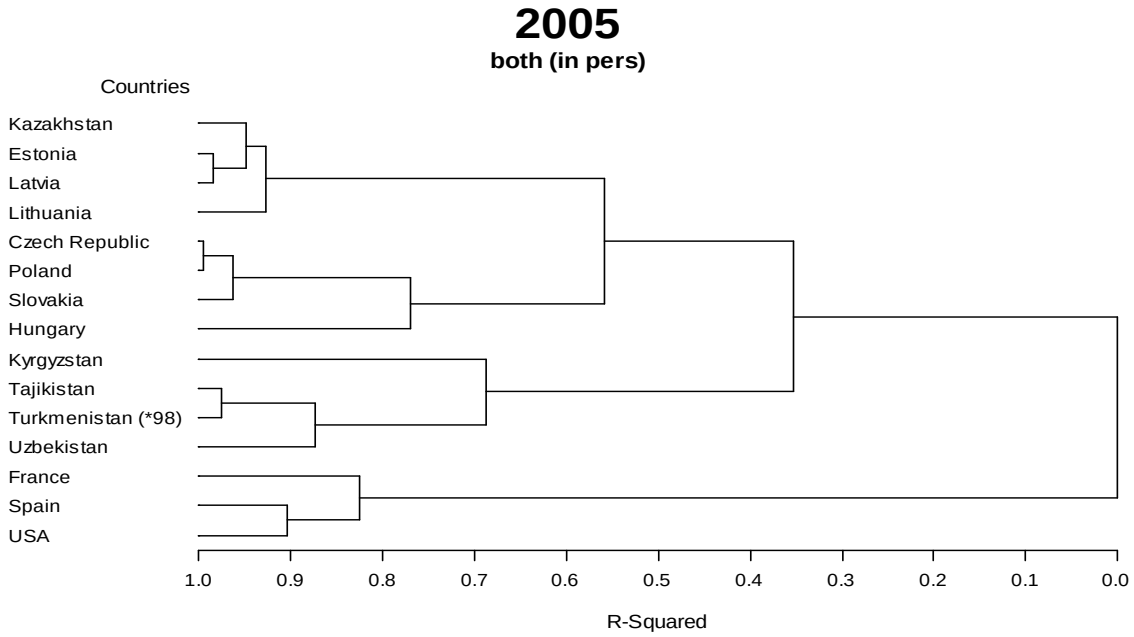
| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 15 | 42 | 12 | 11 | 6 | 4 | 10 |
| Kyrgyzstan | 21 | 34 | 9 | 7 | 11 | 6 | 13 |
| Tajikistan | 11 | 52 | 7 | 3 | 8 | 5 | 14 |
| Turkmenistan (*98) | 6 | 57 | 7 | 5 | 8 | 5 | 11 |
| Uzbekistan | 15 | 50 | 7 | 4 | 6 | 6 | 12 |
| Czech Republic | 11 | 38 | 26 | 6 | 5 | 4 | 8 |
| Hungary | 8 | 45 | 23 | 6 | 6 | 5 | 7 |
| Poland | 10 | 39 | 24 | 7 | 5 | 7 | 9 |
| Slovakia | 9 | 35 | 25 | 7 | 5 | 4 | 14 |
| Estonia | 12 | 38 | 21 | 12 | 3 | 4 | 11 |
| Latvia | 16 | 36 | 18 | 12 | 3 | 3 | 11 |
| Lithuania | 10 | 41 | 19 | 14 | 4 | 4 | 7 |
| France | 5 | 20 | 32 | 8 | 6 | 5 | 24 |
| Spain | 8 | 22 | 29 | 5 | 10 | 5 | 21 |
| USA | 5 | 28 | 25 | 4 | 9 | 4 | 25 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Figure 34 clearly illustrates the mortality structure for both sexes, which were differentiated between the two major country groups.

***Fig. 34 - Dendogram resulting from the hierarchical analysis of the relative structure by main causes of death in the selected countries for both sexes, 2005 (adjusted for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores. Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Central Asian countries together with the post-socialist European area are in the first country group, and low mortality countries in the second (see Figure 34). These two major country groups were divided into four subgroups according to the hierarchical tree. Kazakhstan and the Baltic states are in the first subgroup. The Central European countries showed similarities in the mortality patterns and they are in the second subgroup. Kyrgyzstan, Tajikistan, Turkmenistan (*98) and Uzbekistan are in the third subgroup. France, Spain and the United Sates are in the last subgroup.

According to Table 31, in the first subgroup countries, there were high proportion of cerebrovascular diseases and external causes of death. Cerebrovascular diseases in this subgroup were higher for both sexes. A large amount of this disease equal more than 15 percent. External causes of death account for less than 10 percent of the total causes of death. This disease extremely high in this subgroup compared with others. Contrastingly, the relative structure of mortality due to cancer in this region showed significantly, lower value compared with other subgroups. Digestive system diseases were lower level among the selected countries. Also in this subgroup, a low percentage of respiratory system diseases were observed. These two diseases account for approximately 4 percent of the total causes of death.

Contrastingly, the second subgroup has a low other causes of death rate (see Table 31). The percentage of the other causes of death in this subgroup is less than 10 percent of total cause-specific mortality among the selected countries. This is in stark contrast to the other subgroups, where the main causes of death in Central European area is intermediate.

***Tab. 31 - Average values (Z-scores) for the relative structure by main causes of death of each country group for both sexes, 2005 (all ages)***

| Group of countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan, Estonia, Latvia, Lithuania | 0.619 | 0.013 | -0.788 | 1.423 | -0.180 | -0.882 | -0.413 |
| Czech Republic, Poland, Slovakia, Hungary | -0.437 | 0.162 | 0.502 | -0.283 | 0.660 | -0.524 | -0.856 |
| Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan* | 0.589 | 0.933 | 0.534 | -0.797 | -1.337 | 0.390 | 0.069 |
| France, Spain, USA | -1.028 | -1.478 | -0.330 | -0.457 | 1.142 | 1.354 | 1.599 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

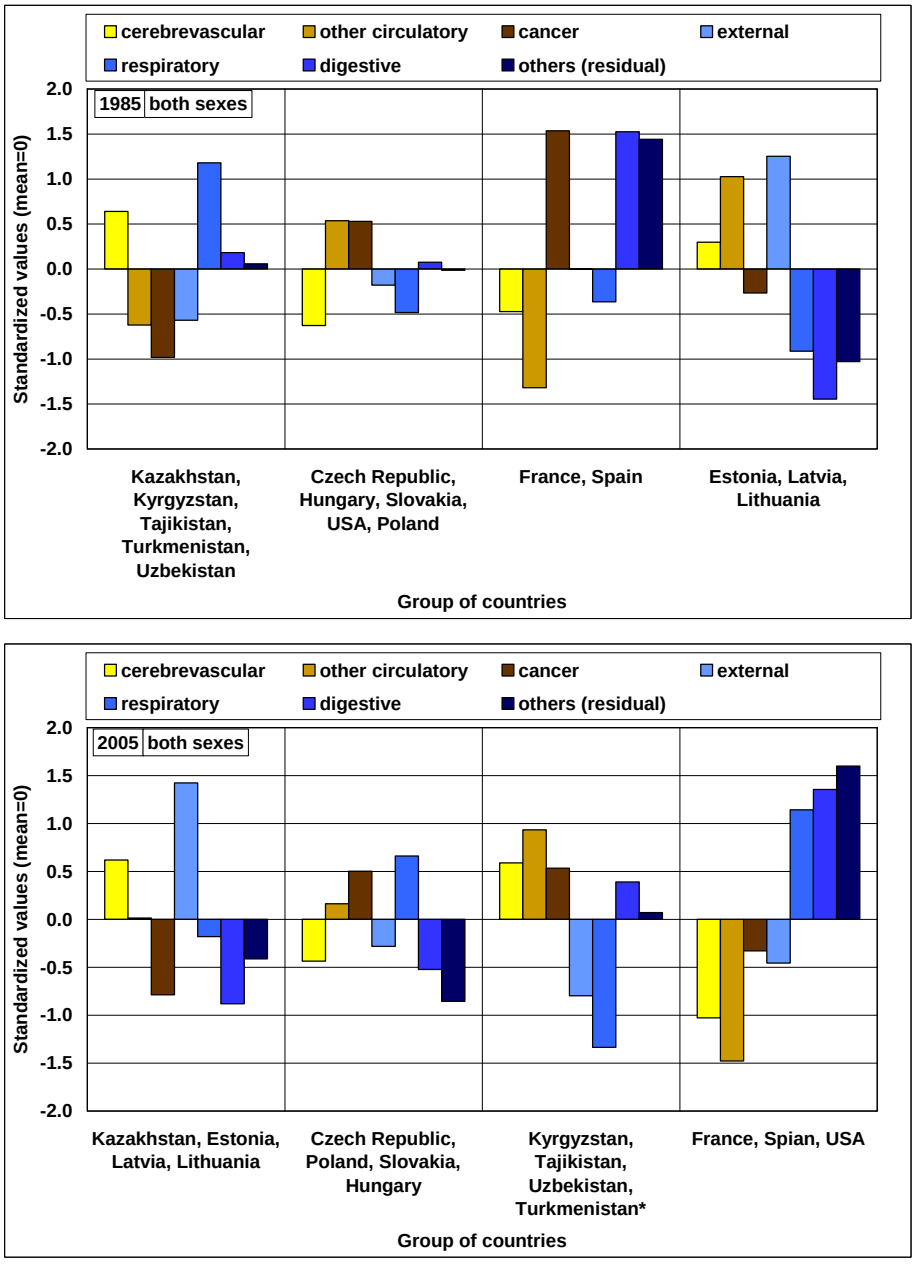
The third subgroup showed a high proportion of other diseases of circulatory system and cancer (see Table 31). As previously mentioned all cardiovascular mortality in the countries of Soviet Central Asia, except Kazakhstan, is the main cause of death. About half of their population died from these kinds of diseases. According to the initial data, cancer mortality is less than 10 percent, and the differences between the other subgroups are about 10 percent. Regarding respiratory system diseases, which is in a lower proportion, and its percentage more than 5 percent of the total causes of death, and the differences among the other selected countries is equal to 1–2 percent. External causes of death are also lower compared with the other subgroups.

Table 31 clearly illustrates that respiratory system, digestive diseases and other causes of death in the fourth subgroup are high among the selected courtiers for both sexes in 2005. In real terms, more than 30 percent of all causes of death related to the proportion of malignant neoplasm in the fourth subgroup. Diseases of the respiratory system are account for about 10 percent of the all causes of death. From the initial data the share of the other causes of death in this subgroup is more than 15 percent, while for the other subgroups this value is less than 12 percent. All cardiovascular diseases are low in this subgroup. Significantly, the cerebrovascular diseases in the last subgroup are lower, and difference with the highest value which belongs to the first subgroup, and equals to 1.5. Other diseases of the circulatory system are about two times lower among the other subgroups.

Finally, summarizing the mortality structure by main causes of death for both sexes among the selected countries between the periods of 1985 and 2005 illustrates in Figure 35. In the countries of the former Soviet Central Asia valuable changes over time was observed (see Figure 35). The proportion of the cancer, external causes (except Kazakhstan) and other remaining causes was remarkable declined in this macro-region. A vice versa situation was noted in other diseases of the circulatory system and digestive system diseases in 2005. Among the population of Kazakhstan the share of the percentage of external causes of death was increased. The rest of the selected causes slightly changes by the end of studied period. The relative structure of mortality by main causes of death for both sexes of Central European countries the proportion of other diseases of the circulatory system, cancer and digestive system

diseases were increased compared with 1985. Also in this region some betterment were noted in 2005. They are the share of the cerebrovascular diseases, respiratory system diseases and other remaining causes of death. After the collapse of the socialist regime a quite positive changes was observed for both sexes in 2005.

***Fig. 35 - Standardized values of the relative structure by main causes of death in the selected countries for both sexes, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The three Baltic states the mortality structure by main causes of death for both sexes was observed in the both periods (see Figure 35). In 2005, the share of cerebrovascular diseases was dropped. Notably, their level of external causes for both sexes in 2005 extremely increased.

Significantly increased were other diseases of the circulatory system rather than in cerebrovasculaar diseases was analyzed. In the cases of the last diseases can be seen more declined in 2005. In the low mortality populations the main or top two causes of death was clearly highlighted. They are cancer and other remaining causes of death. Moreover, in 2005, the percentage of digestive system diseases was suddenly increased for both sexes. The cerebrovasular diseases were higher in 2005 rather than in 1985.

## 5.5 Excess male mortality by main causes of death in selected countries

In essence, excess male mortality is measured as the male to female ratio of the standardized death rates by main causes of death (which was listed before) at a given year. Researchers have long known that women outlive men on average, and have more recently discovered that men have higher mortality risks across their entire lifespan. More specifically, it depends on several factors, for example, bio-genetic factors such as greater female survival over males, especially among young children. In addition, labor force participation could be a factor, as it is sometimes suggested that male jobs are on average more physically hazardous to health than female jobs (Hemstrom 1999).

The initial data for excess male mortality analysis, ratio of SDR by main causes of death in the selected countries in 1985 was used (see Table 32).

***Tab. 32 –Ratio of male to female standardized death rates (per 100,000) by main causes of death of mortality levels in the selected countries, 1985 (all ages)***

| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 1.8 | 3.1 | 0.6 | 1.9 | 3.3 | 2.1 | 1.9 | 1.9 |
| Kyrgyzstan | 1.6 | 1.2 | 1.5 | 1.8 | 3.1 | 1.7 | 1.9 | 1.6 |
| Tajikistan | 1.3 | 1.1 | 1.3 | 1.8 | 2.4 | 1.2 | 1.4 | 1.2 |
| Turkmenistan | 1.5 | 1.2 | 1.5 | 1.7 | 2.7 | 1.4 | 1.8 | 1.5 |
| Uzbekistan | 1.5 | 1.3 | 1.4 | 1.7 | 2.7 | 1.4 | 1.6 | 1.5 |
| Czech Republic | 1.7 | 1.2 | 1.7 | 1.9 | 1.9 | 2.3 | 1.9 | 1.4 |
| Hungary | 1.7 | 1.3 | 1.5 | 1.9 | 3.4 | 2.0 | 2.5 | 1.3 |
| Poland | 1.7 | 1.4 | 1.6 | 1.8 | 2.4 | 2.6 | 2.2 | 1.3 |
| Slovakia | 1.7 | 1.2 | 1.7 | 1.9 | 3.4 | 2.8 | 1.7 | 1.3 |
| Estonia | 1.8 | 1.2 | 1.7 | 2.0 | 3.6 | 3.6 | 2.5 | 1.8 |
| Latvia | 1.7 | 1.2 | 1.7 | 1.8 | 3.3 | 2.9 | 2.2 | 1.8 |
| Lithuania | 1.8 | 1.2 | 1.6 | 1.9 | 4.0 | 3.1 | 1.9 | 1.9 |
| France | 1.9 | 1.4 | 1.8 | 2.3 | 2.2 | 2.4 | 2.0 | 1.5 |
| Spain | 1.7 | 1.2 | 1.5 | 2.0 | 3.3 | 2.3 | 2.2 | 1.3 |
| USA | 1.7 | 1.1 | 1.8 | 1.5 | 2.9 | 2.1 | 1.6 | 1.4 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Excess male mortality among the selected countries in 1985 illustrates in Figure 36. The gender gap is not that correlated with the mortality level. From the hierarchical tree long distances between the selected countries were observed (see Figure 36). The selected countries can be divided into two major country groups. The Soviet Central Asian republics are in the first and the post-socialist Europe with low mortality populations in the second. These major groups

further can be divided into tree subgroups and one country like an outsider of the analysis. Kazakhstan is unique country apart. In the first subgroup includes other Central Asian republics, except Kazakhstan. The Central European countries with low mortality populations showed similarities in excess male mortality in 1985 and they belong to the second subgroup. The tree Baltic states are in the last subgroup.

***Fig. 36 - Dendogram resulting from the hierarchical analysis of excess male cause-specific mortality in the selected countries, 1985 (standardized for all ages)***


Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the average z-scored table in Kazakhstan revealed a low excess male mortality by other diseases of the circulatory system and digestive system diseases (see Table 33). The lowest excess male mortality by other diseases of the circulatory system can be due to low levels of this disease among Kazakhstani females in 1985. In the case of digestive system diseases also can be explain the fact that males value of this disease were a two times higher than for females in 1985. Moreover, the highest excess male mortality by cerebrovascular diseases, cancer and other causes was observed. During the whole analysis the mortality levels by cerebrovascular diseases and malignant neoplasm were high for both sexes were noted.

In the first country group a low excess male mortality almost by half of the selected causes of death was noted (see Table 33). They are all causes, malignant neoplasm, external causes and respiratory system diseases. Especially, the gender gap in the death rate by external causes of death for females was significantly lower than males in 1985. The less male-female differences were noted by the other listed causes of death in this subgroup. This fact of the one of the main reason which will be explained of the lowest excess male mortality pattern by half of the main causes of death in this country group. In the second country group only the lowest excess male mortality by other remaining causes of death occurred in 1985 (see Table 33). It might be due to

the lower female death rate by this cause of death in 1985. Other values of the main causes of death were relatively lower than the total average.

***Tab. 33 - Average standardized values (Z-scores) of male to female ratios in each country group, 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 0.737 | 3.565 | -3.027 | 0.471 | 0.615 | -0.208 | -0.179 | 1.724 |
| Kyrgyzstan, Turkmenistan, Uzbekistan, Tajikistan | -1.346 | -0.311 | -0.434 | -0.719 | -0.430 | -1.226 | -0.920 | -0.233 |
| Czech Republic, Hungary, Poland, USA, Slovakia, Spain | 0.176 | -0.194 | 0.490 | -0.324 | -0.306 | 0.131 | 0.115 | -0.734 |
| Estonia, Latvia, Lthuania | 0.792 | -0.361 | 0.498 | 0.187 | 1.156 | 1.399 | 0.775 | 1.309 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the last subgroup a high excess male mortality by all causes, other diseases if the circulatory system, external causes, respiratory system and digestive system diseases was analyzed in 1985 (see Table 33). The gender gap among within this country group was relatively lower. The male-females differences of mortality levels by main causes of death a lower compared with other subgroups. For instance, the value of all causes among males was around two times higher than females. Moreover, this country group experienced the recent trend of a faster decrease in male mortality. The period of this mortality decline was also a period of major shifts in the most causes of death.

The excess male mortality in 2005 among the selected countries will be analyzed. The initial data for the hierarchical clustering into country groups presents in Table 34.

***Tab. 34 - Ratio of male to female standardized death rates (per 100,000) by main causes of death of mortality levels in the selected countries, 2005 (all ages)***

| Countries | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 1.9 | 1.4 | 1.7 | 1.9 | 4.1 | 2.9 | 2.1 |
| Kyrgyzstan | 1.6 | 1.2 | 1.5 | 1.6 | 3.6 | 2.0 | 2.0 |
| Tajikistan | 1.5 | 1.3 | 1.5 | 1.5 | 3.3 | 1.3 | 1.7 |
| Turkmenistan (*98) | 1.5 | 1.1 | 1.5 | 1.5 | 2.9 | 1.5 | 1.6 |
| Uzbekistan | 1.4 | 1.2 | 1.3 | 1.2 | 3.5 | 1.4 | 1.4 |
| Czech Republic | 1.6 | 1.6 | 1.4 | 1.8 | 2.8 | 1.6 | 1.9 |
| Hungary | 1.8 | 1.5 | 1.5 | 2.1 | 4.3 | 2.3 | 2.1 |
| Poland | 1.8 | 1.4 | 1.6 | 1.9 | 3.2 | 2.3 | 2.5 |
| Slovakia | 1.9 | 1.3 | 1.7 | 1.9 | 3.9 | 2.6 | 2.1 |
| Estonia | 2.1 | 1.4 | 2.0 | 2.2 | 4.4 | 4.7 | 2.2 |
| Latvia | 2.1 | 1.3 | 2.2 | 2.2 | 4.1 | 4.4 | 2.0 |
| Lithuania | 2.1 | 1.3 | 1.9 | 2.1 | 4.5 | 4.4 | 2.1 |
| France | 1.8 | 1.3 | 1.8 | 2.1 | 2.4 | 2.1 | 1.9 |
| Spain | 1.8 | 1.3 | 1.6 | 2.3 | 3.2 | 2.7 | 2.0 |
| USA | 1.5 | 1.1 | 1.6 | 1.4 | 0.7 | 1.4 | 1.5 |

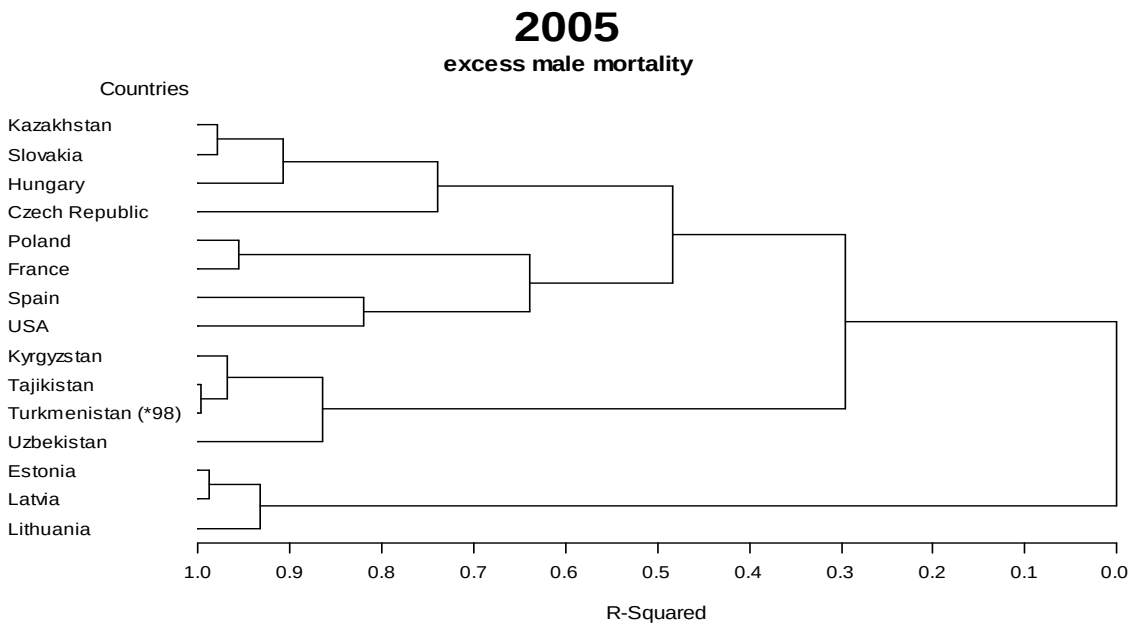
Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The grouping of countries using a hierarchical cluster analysis based on the Euclidean distance and Ward method in the selected countries clearly illustrates how the countries are

currently divided (see Figure 37). According to the result of hierarchical tree, which shows a very heterogeneous result for the selected countries. From the hierarchical tree, long distances between the selected countries were observed. The selected countries can be divided into two major country groups. The first one includes the post-socialist Central European area, together the low mortality populations and Kazakhstan. Other Central Asian countries, such as Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and the Baltic states are in the second group. These two major groups are further divided into the four country subgroups. Kazakhstan, Slovakia, Hungary and the Czech Republic are in the first subgroup and countries such as Poland with low mortality countries are in the second subgroup. The next subgroup contains other Central Asian states (Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan). Similarities in excess male mortality were observed between the Baltic states as the last subgroup of this analysis.

***Fig. 37 - Dendogram resulting from the hierarchical analysis of excess male cause-specific mortality in the selected countries, 2005 (standardized for all ages)***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The average values of each country group are illustrated in Table 35. The data for Kazakhstan, Slovakia, Hungary and the Czech Republic revealed rather high levels of excess male mortality by cerebrovascular diseases due to faster developments in male mortality than expected. Kazakhstan is in this group because of higher female mortality. The values of other selected main causes of death are lower than the total average for all subgroups.

The second subgroup showed low excess male mortality by malignant neoplasm, external causes of death and other causes among the selected countries (see Table 35). According to the initial data standardized death rates by cancer mortality, external causes and other causes of death for females are lower than for males in Poland and France. Due to this fact, the ratio for the second subgroup is low when compared with the other subgroups.

In the third subgroup low excess male mortality by all causes, all cardiovascular diseases and diseases of the respiratory system were observed (see Table 35). According this result can be observed that the high excess male mortality in this country group continued the pattern which was noted in 1985. The values of these diseases are high for both sexes in 2005 among the selected countries. Excess male mortality by malignant neoplasm in this subgroup showed a high value. According to the initial data high cancer mortality for both sexes among the other selected countries was registered in this subgroup.

In the last subgroup which consisted of the three Baltic states a low excess male mortality by digestive system diseases was observed (see Table 35). The standardized death rates by diseases of the digestive system for the Baltic states for males and females are not highly differentiated. Also in this subgroup the highest excess male mortality by all causes, other causes of circulatory system, external causes of death, respiratory system diseases and other causes of death were highlighted. This may be due to fact what suggested by Waldron (1976), for the expanding gap prior to the 1970s was the increase over the same period in male mortality due to ischemic heart disease and lung cancer, both of which were related to cigarette smoking among men. However, in the late 1970s mortality due to lung cancer rose among women. At the same time, there was a decrease in mortality due to heart disease among men. Hence, the drop in the life expectancy gap suggests behavioral changes between the two sexes (Leung, Zhang, and Zhang 2004).

***Tab. 35 - Standardized values of male to female ratio by main causes of death in the selected countries, 1985 and 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Slovakia, Hungary, Czech Republic | 0.102 | 1.155 | -0.502 | -0.233 | 0.258 | -0.108 | -0.416 | 0.482 |
| Poland, France, Spain, USA | -0.112 | -0.436 | 0.137 | -0.896 | -0.869 | -0.076 | 0.822 | -1.104 |
| Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan | -1.077 | -0.643 | -0.792 | 1.475 | -0.100 | -1.021 | -0.030 | 0.134 |
| Estonia, Latvia, Lithuania | 1.449 | -0.101 | 1.542 | -0.461 | 0.948 | 1.606 | -0.502 | 0.651 |

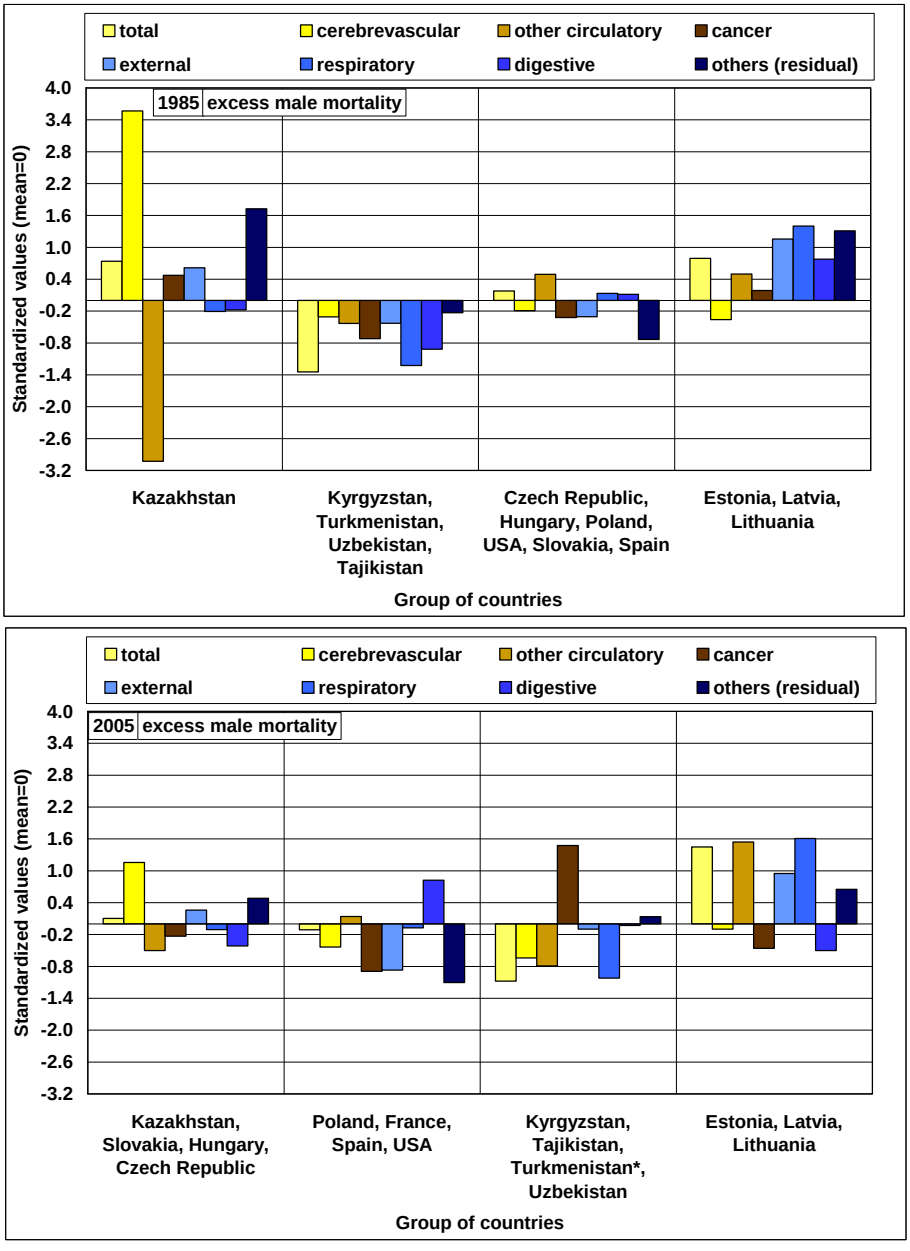
Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Summarizing excess male mortality pattern in the selected countries between the two periods of time clearly illustrates in Figure 38. The short summary for each macro-region will be discussed. In the first macro-region of this analysis was represented by the former Soviet Central Asian republics in the both periods (see Figure 38). In 1985, Kazakhstan showed a different pattern of excess male mortality and was as outsider of the analysis. In the end of studied period in Kazakhstan was observed quite improvements in excess male mortality by main causes of death. The highest cerebrovascular diseases which were observed in 1985 were significantly decreased. The similar situation was in the case high excess male mortality by other causes of death. In the other countries of this region excess male mortality showed better picture compared with Kazakhstan. By the end of the studied period (2005) the excess male

mortality by digestive system diseases was increased. The excess male mortality levels by the rest of selected causes of death were more stable.

***Fig. 38 - Standardized values of male to female ratio by main causes of death in the selected countries, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the ex-socialist Central Europe the excess male mortality levels were quite similar between two periods (see Figure 38). In 2005, a higher excess male mortality by digestive system diseases and other remaining causes was observed. In comparison with the period of 1985, after the collapse of the socialist regime excess male mortality in the three Baltic states slightly changed. In 2005, a high excess male mortality by all causes, other diseases of the circulatory system and diseases of the respiratory system was noted

Finally, excess male mortality in all of the selected countries tends to experience more adverse conditions in terms of the environment. Low income, for instance, is often associated with exposure to environmental hazards at work such as noxious substances and the risk of accidents. Equally, poor housing conditions such as crowding, air pollution and noise may also be a contributory factor. These situations may affect the health and wellbeing of people, either directly by causing discomfort and stress, or indirectly by giving rise to unhealthy coping behaviour such as the use of drugs or heavy drinking. Unfortunately, when faced with chronic poverty and disruptive social change, people in these transitional populations are often forced to abuse these substances as a way of avoiding chronic stress and feelings of alienation.

# Chapter 6

# Analysis of the age-standardized death rates by main causes of death in selected countries between the period of 1985 and 2005

## 6.1 Age-standardized death rates by main causes of death of mortality levels at ages 15–64

Table 36 illustrates the initial data for males between the exact ages of 15 and 64 among the selected countries in 1985. These variables were used for the hierarchical cluster analysis based on the Euclidean distance and Ward method.

***Tab. 36 – SDR (per 100,000) by main causes of death of mortality levels at ages 15–64 (adjusted) in the selected countries for males, 1985***

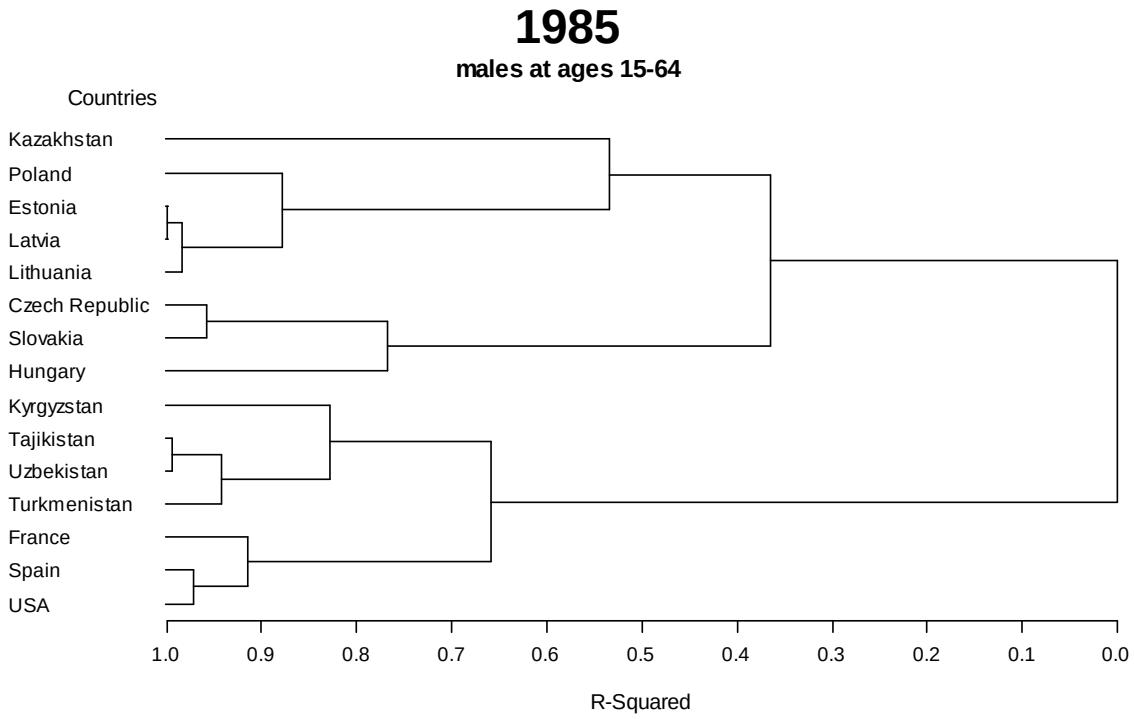
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 481 | 107 | 35 | 93 | 126 | 35 | 22 | 62 |
| Kyrgyzstan | 386 | 42 | 74 | 64 | 85 | 41 | 28 | 53 |
| Tajikistan | 252 | 19 | 54 | 43 | 50 | 22 | 16 | 47 |
| Turkmenistan | 359 | 43 | 86 | 59 | 68 | 21 | 25 | 56 |
| Uzbekistan | 300 | 31 | 70 | 46 | 61 | 21 | 23 | 47 |
| Czech Republic | 465 | 39 | 153 | 131 | 64 | 22 | 26 | 30 |
| Hungary | 458 | 33 | 135 | 111 | 77 | 30 | 39 | 32 |
| Poland | 597 | 58 | 173 | 132 | 113 | 26 | 60 | 35 |
| Slovakia | 459 | 21 | 147 | 108 | 89 | 20 | 19 | 56 |
| Estonia | 572 | 47 | 163 | 115 | 148 | 27 | 23 | 49 |
| Latvia | 570 | 47 | 170 | 112 | 146 | 26 | 19 | 51 |
| Lithuania | 521 | 30 | 131 | 99 | 159 | 29 | 19 | 53 |
| France | 332 | 14 | 54 | 111 | 69 | 11 | 28 | 46 |
| Spain | 270 | 17 | 59 | 80 | 45 | 16 | 26 | 26 |
| USA | 309 | 9 | 96 | 73 | 69 | 14 | 16 | 32 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the country grouping by similarities in age-specific mortality among the selected countries in 1985, the figures showed a long distance result (see Figure 39). They are divided into two major groups. All of the selected post-communist countries are clustered into one group, whereas the low population countries are categorized in the second. These two major groups can be further divided into four subgroups and one outlier. Kazakhstan is the outsider of the analysis. The Baltic states together with Poland are in the first subgroup. The Czech Republic, Slovakia and Hungary showed similarities in their mortality patterns and they belong to the second subgroup. Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan are in the third subgroup. Finally,the last subgroup comprises low mortality populations. More detailed information can be found in Table 37.

***Fig. 39 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for males, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Table 37 illustrates the mortality rate for the age group of 15–64 for males in Kazakhstan. According to the results the highest cerebrovascular diseases, respiratory system diseases and other causes of death was observed. The problems of the highest cerebrovascular mortality among the working age male population in Kazakhstan continue hitherto. The adult male population in Kazakhstan is in a risk group. However, in stark contrast, the value of the other circulatory system diseases in Kazakhstan's males showed opposite result. It is the lowest among the selected countries.

In the second subgroup the highest value of all causes, external causes of morbidity and mortality occurred (see Table 37). Also, adult males in this country group have the lowest

diseases of the digestive system among the other subgroups. The values of other selected causes of death are low among the Polish and the three Baltic states male population at ages 15–64.

According to the results, which are clearly represented in Table 4, the highest values of the other circulatory system diseases, malignant neoplasm and diseases of the digestive system were noted in the Czech Republic, Slovakia and Hungary, which belong to the third subgroup (see Table 37). The lowest other causes of death is in this subgroup are among the selected countries. The mortality levels in this subgroup are closer to the result of the second subgroups. This means the post-socialist European countries had a similar level of the age- and cause-specific mortality.

***Tab. 37 - Average standardized values (Z-scores) of each country group for males at aged 15–64 (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 0.514 | 2.937 | -1.485 | 0.048 | 0.920 | 1.404 | -0.316 | 1.537 |
| Poland, Estonia, Latvia, Lithuania | 0.942 | -0.031 | 0.955 | 0.568 | 1.177 | 0.184 | -0.549 | 0.641 |
| Czech Republic, Slovakia, Hungary | 0.733 | 0.245 | 0.972 | 1.124 | -0.167 | 0.245 | 1.426 | -1.135 |
| Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan | -0.851 | -0.139 | -0.740 | -1.333 | -0.676 | 0.285 | -0.259 | 0.525 |
| France, Spain, USA | -1.026 | -0.997 | -0.763 | -0.121 | -0.807 | -1.339 | -0.244 | -0.932 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The Soviet Central Asian republics, excluding Kazakhstan, showed the lowest value of adult cancer mortality among the other subgroups (see Table 37). The other values are lower than average for all the countries. In the third subgroup adult males were less vulnerable among the selected countries in 1985.

In the last subgroup the lowest values of all causes of death, cerebrovascular diseases, external causes of morbidity and mortality and diseases of the respiratory system were observed (see Table 37). Other causes of death in the last subgroup are low in 1985. The country group showed quite a large improvement in the health of the population in contrast to the other countries

In era of the Soviet Union selected post-communist countries shared a similar history. They were in one political regime, similar socio-economic situation. After the break up of the Soviet Union, the post-communist countries underwent a transformation. Some of them experienced political, socio-economical crises, which has influenced to their demographic development. Table 38 illustrates initial data for females between the exact ages of 15 and 64 among the selected countries in 2005. These variables were used for the hierarchical cluster analysis in order to delimit selected countries by their similarities in cause-specific mortality levels at adult (15–64) ages.

***Tab. 38 – SDR (per100,000) by main causes of death of mortality levels at ages 15–64 (adjusted) in the selected countries for males, 2005***

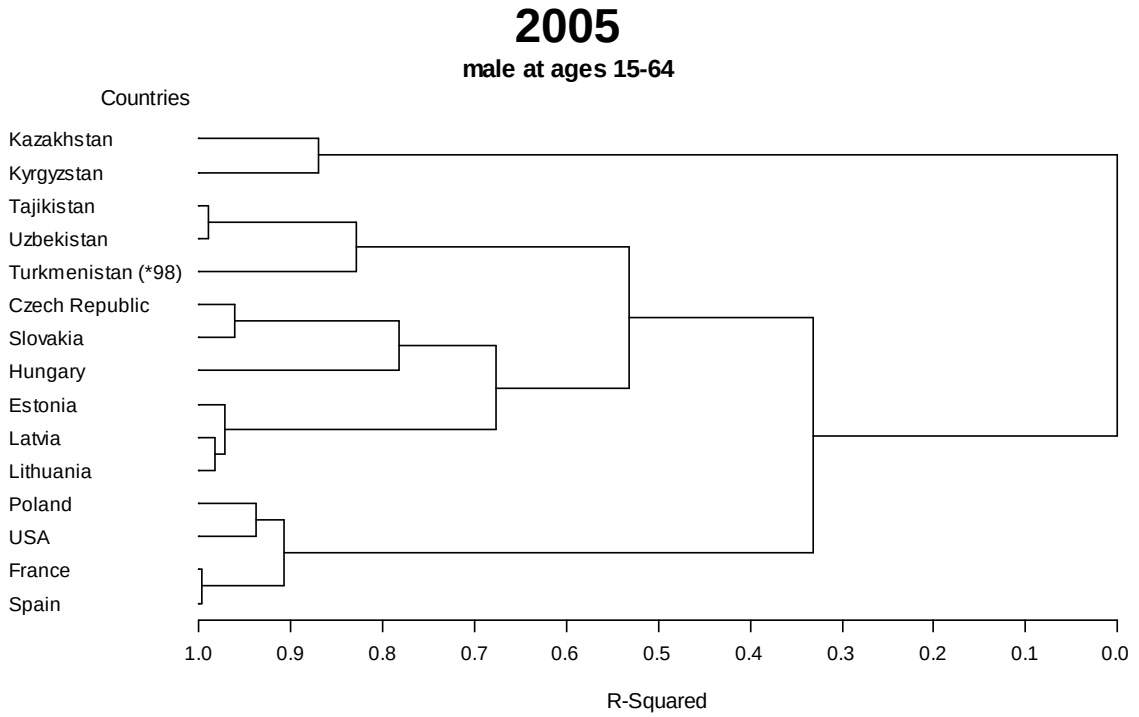
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 690 | 50 | 188 | 66 | 212 | 37 | 47 | 90 |
| Kyrgyzstan | 399 | 45 | 78 | 35 | 100 | 24 | 47 | 70 |
| Tajikistan | 214 | 12 | 62 | 22 | 36 | 11 | 18 | 53 |
| Turkmenistan (*98) | 390 | 13 | 147 | 32 | 68 | 23 | 32 | 75 |
| Uzbekistan | 265 | 22 | 86 | 23 | 50 | 12 | 28 | 46 |
| Czech Republic | 332 | 15 | 84 | 106 | 59 | 30 | 29 | 8 |
| Hungary | 373 | 15 | 103 | 102 | 70 | 17 | 36 | 30 |
| Poland | 530 | 28 | 142 | 154 | 74 | 21 | 69 | 41 |
| Slovakia | 387 | 21 | 89 | 96 | 78 | 11 | 28 | 65 |
| Estonia | 548 | 33 | 139 | 97 | 159 | 20 | 36 | 64 |
| Latvia | 635 | 44 | 196 | 102 | 178 | 29 | 30 | 55 |
| Lithuania | 632 | 27 | 168 | 97 | 212 | 28 | 45 | 55 |
| France | 242 | 6 | 31 | 92 | 43 | 6 | 15 | 48 |
| Spain | 199 | 7 | 32 | 74 | 34 | 8 | 14 | 30 |
| USA | 261 | 7 | 61 | 60 | 19 | 11 | 14 | 89 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

According to the country grouping for males in 2005, the countries can be divided into two major groups (see Figure 40). From the hierarchical tree, long distances between the selected countries were observed.

***Fig. 40 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for males, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Kazakhstan and Kyrgyzstan are clustered into one group, whereas all the other selected countries are categorized in the second (see Figure 37). These two major groups can be further divided into four subgroups. Kazakhstan and Kyrgyzstan are in the first subgroup. Tajikistan, Uzbekistan and Turkmenistan (*98) belong to the second. Central European countries, except Poland, together with the Baltic states are in the third subgroup. Finally, western more developed countries are in the last subgroup.

The average values for the first subgroups are clearly illustrated in Table 39. In this subgroup, which consists of Kazakhstan and Kyrgyzstan the highest values of all the selected main causes of death, except other diseases of circulatory system and malignant neoplasm are illustrated. Adult males in a very vulnerable age group are among the countries of the first subgroup. In these countries the "Russian pattern" of excess male mortality was observed. Men at working ages are the principal group concerned, and the crisis can be mainly explained by an upsurge in cardiovascular diseases, external causes of morbidity and mortality, respiratory system diseases, digestive system diseases and also other causes of death.

***Tab. 39 - Average standardized values (Z-scores) of each country group for males at ages 15–64 (adjusted), 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan | 0.846 | 1.691 | 0.483 | -0.710 | 0.969 | 1.222 | 0.946 | 1.143 |
| Tajikistan, Uzbekistan, Turkmenistan | -0.713 | -0.499 | -0.168 | -1.378 | -0.636 | -0.446 | -0.429 | 0.142 |
| Czech Republic, Slovakia, Hungary, Estonia, Latvia, Lithuania | 0.622 | 0.272 | 0.594 | 0.868 | 0.500 | 0.539 | 0.553 | -0.553 |
| Poland, France, Spain, USA | -0.820 | -0.879 | -1.006 | 0.086 | -0.757 | -1.085 | -0.981 | 0.152 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Adult males in the second subgroup showed some of the lowest values of the cancer mortality compared with the other subgroups (see Table 39). In this subgroup other selected causes of death were observed quite lower compared with first subgroup.

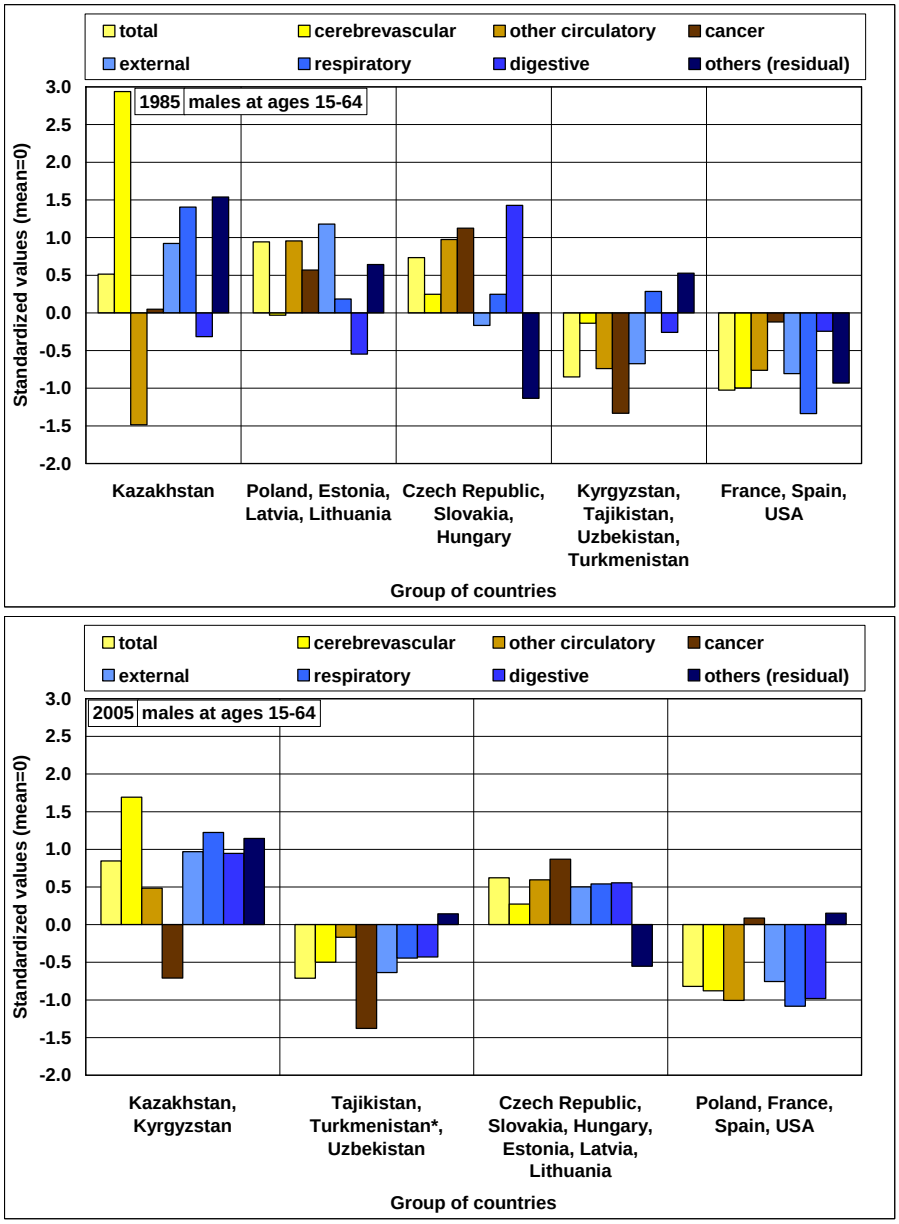
In the Czech Republic, Slovakia, Hungary and the three Baltic states, high other diseases of the circulatory system and malignant neoplasm diseases were highlighted (see Table 39). Other diseases of the circulatory system showed higher values for adult ages. The result of this disease for low mortality populations is quite similar. Malignant neoplasm of the larynx, trachea, bronchus and lung are more common among males aged 15–64 in EU (Niederlaender 2006). A low value of the other causes of death in the third subgroup was registered in 2005. In comparison with others this subgroup showed an intermediate position.

The last subgroup of countries highlights the low mortality pattern between males aged 15–64 among the selected countries (see Table 39). Clearly, all selected main causes of death, except cancer mortality and other causes of death are low. Cancer mortality is equal to the total average value, and other causes of death in this subgroup are lower than average for all

subgroups. This might be due to the fact that adult males in this subgroup are of a less vulnerable age group compared with the first two subgroups.

Finally, the adult male mortality trend by main causes of death among the selected countries showed a heterogeneous picture (see Figure 41). The former Soviet Central Asian republics, excluding Kazakhstan in beginning of the study period (1985) showed an intermediate level of cause-specific mortality and since independence period mortality by causes of death were higher among males at ages 15–64. In the Soviet era in Kazakhstan, the highest mortality by causes of death was noted.

***Fig. 41 - Standardized values of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for males, 1990 and 2006***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The leading causes of death among Kazakhstani adult males were cardiovascular diseases, especially, cerebrovascular diseases (see Figure 41). The mortality level in the post-socialist European countries between the selected time periods significantly was improved. In the low mortality populations, the cause-specific adult male mortality level continuously decreases year by year. Also, France, Spain, and the United States kept the position of having low mortality levels.

Women live longer than men. The magnitude of this sex/gender difference varies considerably from one country to another and from one year to the next (Gjonca, Tomassini, and Vaupel 1999). Initial data for the cause-specific adult female mortality analysis among the selected countries in the beginning of time period (1985) is shown in Table 40.

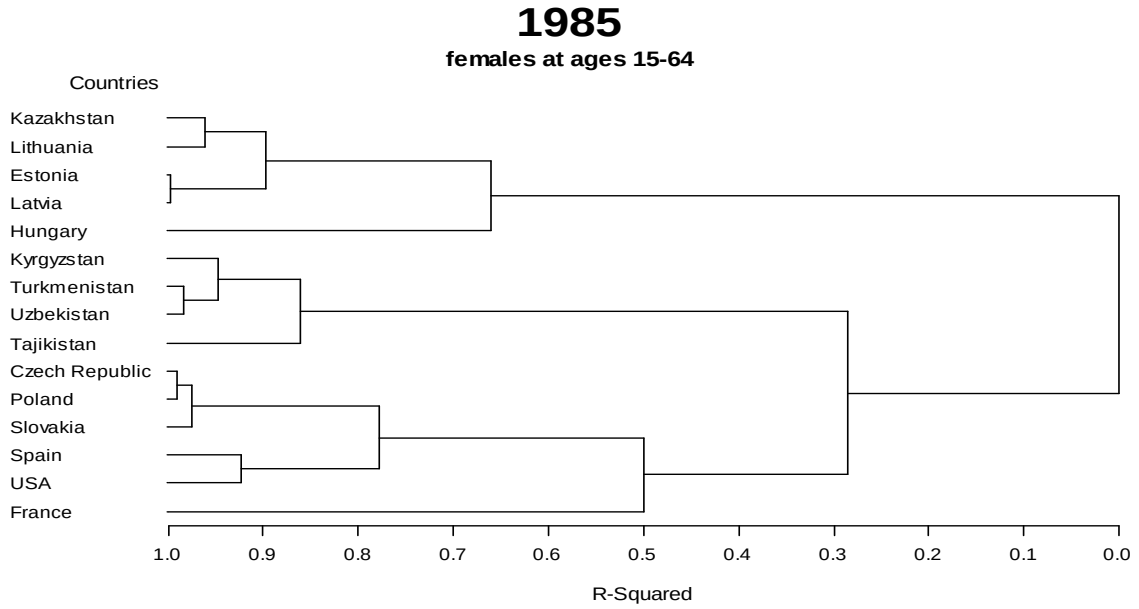
***Tab. 40 – SDR (per 100,000) by main causes of death of mortality levels at ages 15–64 (adjusted) in the selected countries for females, 1985***

| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 228 | 28 | 50 | 61 | 31 | 16 | 12 | 30 |
| Kyrgyzstan | 215 | 39 | 44 | 44 | 21 | 22 | 15 | 30 |
| Tajikistan | 193 | 20 | 40 | 32 | 16 | 26 | 12 | 46 |
| Turkmenistan | 216 | 37 | 52 | 42 | 19 | 14 | 14 | 38 |
| Uzbekistan | 195 | 26 | 48 | 35 | 17 | 16 | 15 | 39 |
| Czech Republic | 214 | 24 | 53 | 79 | 17 | 8 | 11 | 22 |
| Hungary | 201 | 18 | 56 | 65 | 15 | 11 | 13 | 22 |
| Poland | 282 | 34 | 71 | 86 | 30 | 10 | 25 | 26 |
| Slovakia | 202 | 15 | 57 | 69 | 16 | 7 | 9 | 28 |
| Estonia | 248 | 33 | 55 | 78 | 33 | 8 | 9 | 31 |
| Latvia | 259 | 38 | 60 | 81 | 35 | 9 | 7 | 29 |
| Lithuania | 219 | 23 | 46 | 73 | 33 | 9 | 8 | 28 |
| France | 135 | 7 | 15 | 53 | 23 | 4 | 12 | 74 |
| Spain | 118 | 10 | 21 | 46 | 11 | 5 | 9 | 16 |
| USA | 166 | 8 | 38 | 63 | 20 | 9 | 8 | 20 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the adult female population hierarchical tree, in 1985 a long distance result developed (see Figure 42).

***Fig. 42 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for females, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

These major groups can be further divided into four subgroups and one country apart (see Figure 42). The first one comprises Kazakhstan and Hungary together with the Baltic states. In the second subgroup Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan are listed. Central European countries except Hungary represent the third subgroup. The last subgroup is Spain and the USA. France is like the outsider country of this analysis.

According to the result of the adult female cause-specific mortality level, the first subgroup revealed that the highest values of all selected causes of death excluding diseases of the respiratory system, digestive system and other remaining causes of death was registered (see Table 41). Female population at ages 15–64 in these countries was in higher risk group among the selected countries. The leading causes for this country group are mainly cardiovascular diseases, cancer and external causes of death. Also the value for all causes was high in this subgroup compared with others.

In the rest of the Central Asian republics, which belong to the second subgroup only the lowest value of malignant neoplasm was observed (see Table 41). Contrastingly, in this subgroup high value of respiratory system and digestive system diseases was observed among adult females. They are frequent diseases among females between the exact ages of 15 and 64 among the other selected countries. Also, the values of these two diseases are extremely high compared with other subgroups.

***Tab. 41 - Average standardized values (Z-scores) of each country group for females at aged 15–64 (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Estonia, Latvia, Lithuaniia, Hungary | 0.957 | 0.662 | 0.649 | 0.874 | 1.272 | -0.220 | 0.059 | -0.236 |
| Kyrgyzstan, Turkmenistan, Uzbekistan, Tajikistan | -0.031 | 0.598 | -0.073 | -1.268 | -0.547 | 1.300 | 0.461 | 0.444 |
| Czech Republic, Slovakia, Poland | -0.013 | -0.460 | 0.575 | 0.601 | -0.820 | -0.453 | -0.220 | -0.152 |
| Spain, USA | -1.489 | -1.381 | -1.229 | -0.336 | -0.887 | -0.767 | -0.760 | -0.984 |
| France | -1.639 | -1.561 | -2.218 | -0.426 | 0.058 | -1.208 | 0.039 | 3.019 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

In the third subgroup the values of all of the selected causes was without any extreme values. Adult females of this country group are in a intermediate position compared with other subgroups (see Table 41).

In the last subgroup low levels of external causes of death, respiratory system diseases and other (residual) causes of death was noted. In France which is a unique country in this analysis, the lowest values of the all causes, including all circulatory system diseases and respiratory system diseases occurred (see Table 41). Yet again, the same ostensibly "low mortality" pattern in these countries (France, Spain and the USA) was observed. However, these "low mortality" patterns are a result of the countries in comparison. However other causes of death in France showed the highest value among the other subgroups.

After the collapse of the Soviet Union the mortality conditions in the post-communist countries changed. It might be seen further in the analysis for 2005. Mortality pattern by main

causes of death among females aged 15–64 in the selected countries in 2005 will be analyzed further. The selected causes of death are the same for both sexes. The initial data for a hierarchical cluster analysis was presented in Table 42.

***Tab. 42 – SDR (per 100,000) by main causes of death of mortality levels at ages 15–64 in the selected countries for females, 2005***

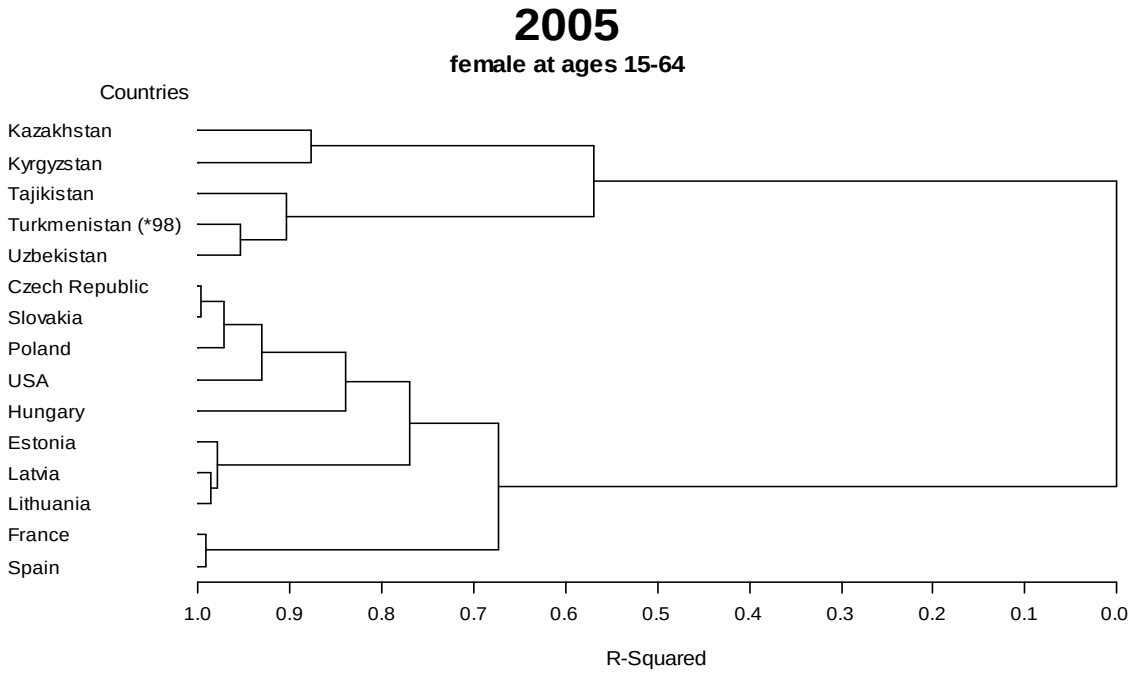
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 266 | 31 | 70 | 49 | 45 | 12 | 21 | 37 |
| Kyrgyzstan | 182 | 31 | 31 | 31 | 24 | 9 | 20 | 36 |
| Tajikistan | 130 | 10 | 36 | 20 | 9 | 11 | 10 | 34 |
| Turkmenistan (*98) | 198 | 9 | 82 | 25 | 19 | 11 | 16 | 35 |
| Uzbekistan | 157 | 14 | 48 | 24 | 12 | 8 | 19 | 33 |
| Czech Republic | 151 | 6 | 29 | 70 | 14 | 6 | 11 | 14 |
| Hungary | 148 | 6 | 33 | 60 | 14 | 6 | 15 | 14 |
| Poland | 224 | 14 | 47 | 89 | 18 | 9 | 25 | 22 |
| Slovakia | 150 | 11 | 25 | 68 | 14 | 4 | 9 | 20 |
| Estonia | 191 | 15 | 36 | 61 | 33 | 4 | 15 | 27 |
| Latvia | 229 | 24 | 57 | 65 | 38 | 8 | 14 | 24 |
| Lithuania | 208 | 12 | 44 | 62 | 44 | 5 | 19 | 22 |
| France | 107 | 3 | 8 | 52 | 14 | 2 | 6 | 21 |
| Spain | 82 | 4 | 9 | 41 | 8 | 3 | 4 | 13 |
| USA | 156 | 6 | 27 | 55 | 21 | 10 | 7 | 31 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The country groupings show that there are obvious differences between the former Soviet Central Asia and the post-socialist European area paired with low mortality countries (see Figure 43).

***Fig. 43 - Dendogram resulting from the hierarchical analysis of mortality levels at ages 15–64 in the selected countries for females, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

These two major country groups can be divided into four subgroups (see Figure 43). The similarities in development among Kazakhstan and Kyrgyzstan were observed in 2005. The second subgroup comprises the second part of Central Asian countries (Tajikistan, Turkmenistan and Uzbekistan): countries which have had a similar development. The third subgroup is post-socialist Europe and the United States. The representatives of low mortality populations such as France and Spain are in the last subgroup.

Table 43 highlights the average values for all subgroups with the highest and lowest values. In Kazakhstan and Kyrgyzstan the highest values of the all the causes of death, cerebrovascular diseases, external causes of death and respiratory system diseases were registered. Moreover, the remaining three diseases in the first subgroup are higher than the total average. Kazakh and Kyrgyz adult females are in the same situation as males, and they are in a risk age group.

The second area of the Central Asian countries (Tajikistan, Uzbekistan and Turkmenistan) showed high results of other causes of circulatory system diseases, digestive system diseases and other causes of death (see Table 43). Also, a low malignant neoplasm was observed. Adult females aged 15–64, among the second part of Central Asian countries is a vulnerable age group.

The results of this analysis clearly illustrates that in the whole former Soviet Central Asian countries showed high female mortality by main causes of death between the exact ages of 15 and 64, among the selected countries (see Table 43). The last two subgroups showed similar results which is mostly lower than average for all subgroups. In the third subgroup high cancer mortality exists. The other main causes of death are in this subgroup are lower or equal to the average.

***Tab. 43 - Average standardized values (Z-scores) of each country group for females at ages 15–64 (adjusted), 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan | 1.066 | 1.995 | 0.572 | -0.584 | 1.028 | 1.064 | 0.113 | 1.001 |
| Tajikistan, Uzbekistan, Turkmenistan | -0.215 | -0.245 | 0.814 | -1.434 | -0.668 | 0.866 | 1.068 | 1.338 |
| Czech Republic, Slovakia, Poland, USA, Hungary, Estonia, Latvia, Lithuania | 0.211 | -0.148 | -0.075 | 0.750 | 0.214 | -0.222 | 0.056 | -0.463 |
| France, Spain | -1.590 | -1.038 | -1.492 | -0.266 | -0.881 | -1.473 | -1.461 | -0.989 |

Note: *Turmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

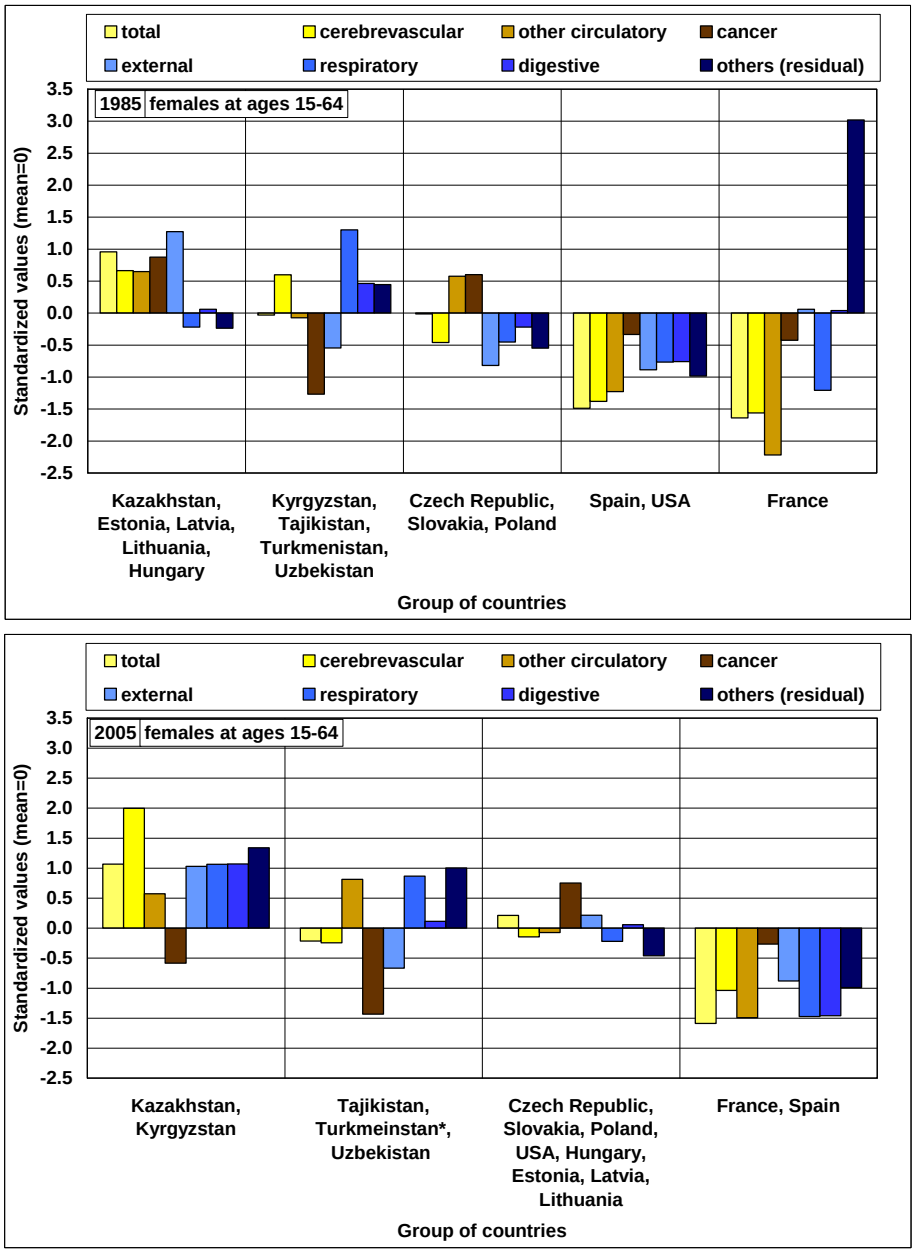
Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

The last subgroup showed low patterns of female mortality aged 15–64 by all causes of death, except cancer mortality compared with the other subgroups (see Table 43). This could be because this country group is more developed socio-economically and demographically than the others.

Finally, the adult female mortality pattern among the selected countries showed a significantly different picture compared with adult males (see Figure 44). The Central Asian countries in the Soviet era showed a lower age- and cause-specific mortality level than in the end of the study period (2005). In the Central European and the Baltic states improvements to

the mortality level. Low levels of cause-specific mortality among adult females in the low mortality populations were observed.

***Fig. 44 - Standardized values of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for females, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

After analyzing males and females cause-specific mortality patterns separately, an analysis will be presented for both sexes between the exact ages of 15 and 64 among the selected countries by main causes of death in the period of 1985 and 2005. Table 44 illustrates the main age- specific standardized death rates by main causes of death of mortality levels at adult ages in the selected countries for both sexes for the hierarchical cluster analysis in 1985.

***Tab. 44 – SDR (per 100,000) by main causes of death of mortality levels at ages 15–64 (adjusted) in the selected countries for both sexes, 1985***

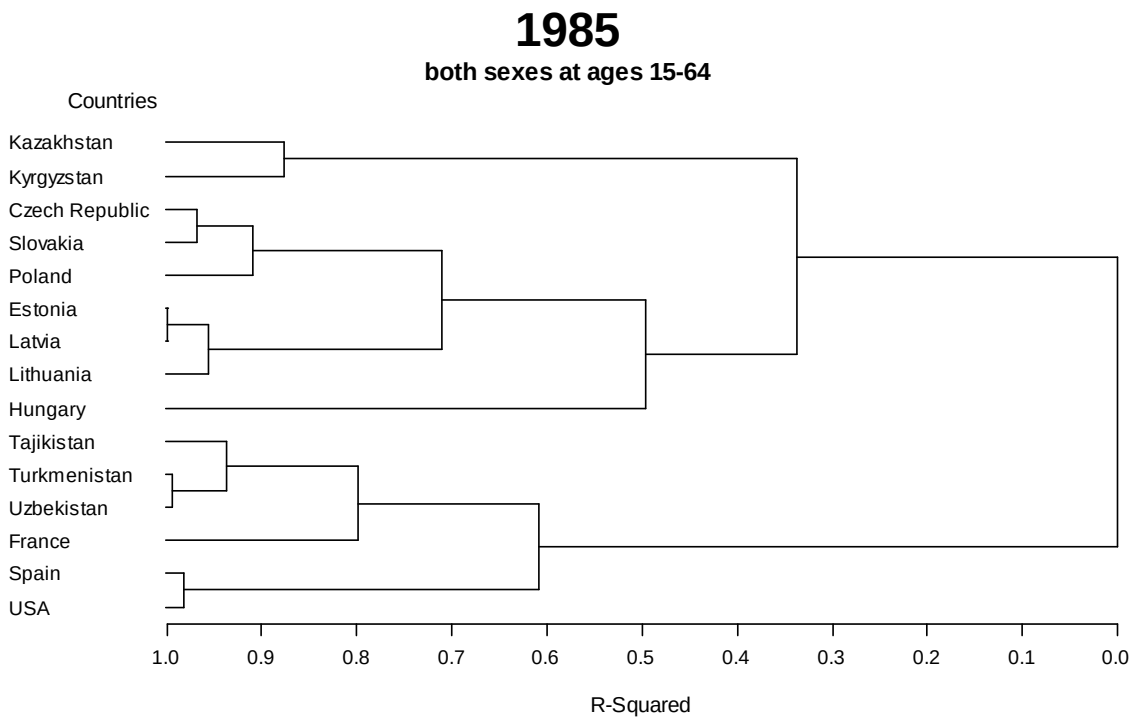
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 228 | 28 | 50 | 61 | 31 | 16 | 12 | 30 |
| Kyrgyzstan | 215 | 39 | 44 | 44 | 21 | 22 | 15 | 30 |
| Tajikistan | 193 | 20 | 40 | 32 | 16 | 26 | 12 | 46 |
| Turkmenistan | 216 | 37 | 52 | 42 | 19 | 14 | 14 | 38 |
| Uzbekistan | 195 | 26 | 48 | 35 | 17 | 16 | 15 | 39 |
| Czech Republic | 214 | 24 | 53 | 79 | 17 | 8 | 11 | 22 |
| Hungary | 201 | 18 | 56 | 65 | 15 | 11 | 13 | 22 |
| Poland | 282 | 34 | 71 | 86 | 30 | 10 | 25 | 26 |
| Slovakia | 202 | 15 | 57 | 69 | 16 | 7 | 9 | 28 |
| Estonia | 248 | 33 | 55 | 78 | 33 | 8 | 9 | 31 |
| Latvia | 259 | 38 | 60 | 81 | 35 | 9 | 7 | 29 |
| Lithuania | 219 | 23 | 46 | 73 | 33 | 9 | 8 | 28 |
| France | 135 | 7 | 15 | 53 | 23 | 4 | 12 | 74 |
| Spain | 118 | 10 | 21 | 46 | 11 | 5 | 9 | 16 |
| USA | 166 | 8 | 38 | 63 | 20 | 9 | 8 | 20 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the dendogram results for both sexes between the exact ages of 15 and 64 among the selected countries a long distance line is shown in Figure 45.

***Fig. 45 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for both sexes, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

There are significant differences between post-socialist Europe together with Kazakhstan and Kyrgyzstan, and the rest of the Central Asian republics (Tajikistan, Turkmenistan and Uzbekistan) and low mortality populations in 1985 (see Figure 45). These major groups can be

separated into four subgroups, and one country apart. Kazakhstan and Kyrgyzstan are in the first subgroup. The three Baltic states together with the Czech Republic, Slovakia and Poland are in the second. Hungary is an outlier of the analysis. Tajikistan, Turkmenistan and France belong to the third subgroup. The last subgroup comprises Spain and the USA.

In the first subgroup the highest values of the cerebrovascular diseases and respiratory system diseases were observed (see Table 45). Also in this country group, the lowest other diseases of the circulatory system diseases was highlighted. Among the populations of Kazakhstan and Kyrgyzstan between the exact ages of 15 and 64 a large amount of the cardiovascular diseases consist of cerebrovascular diseases.

The socialist European countries, excluding Hungary, showed an intermediate value of the main causes of death among the selected countries (see Table 45). These values are higher than average for all subgroups.

***Tab. 45 - Average standardized values (Z-scores) of each country group for both sexes at aged 15– 64 (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan | 0.177 | 1.483 | -0.886 | -0.469 | 0.393 | 1.735 | 0.039 | 0.518 |
| Czech Republic, Slovakia, Poland, Estonia, Latvia, Lithuania | 0.676 | 0.005 | 0.854 | 0.757 | 0.557 | -0.103 | -0.284 | -0.248 |
| Hungary | 1.644 | 0.959 | 1.512 | 1.428 | 0.661 | 0.026 | 3.130 | -0.783 |
| Tajikistan, Turkmenistan, Uzbekistan, France | -0.869 | -0.370 | -0.824 | -1.030 | -0.736 | -0.144 | -0.100 | 1.023 |
| Spain, USA | -1.290 | -1.237 | -0.784 | -0.456 | -0.921 | -1.152 | -0.551 | -1.429 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Hungary is an outsider of this analysis for both sexes at ages 15–64 in 1985. In Hungary, the highest values of all causes, other circulatory system diseases, cancer, external causes of death and diseases of the digestive system were noted (see Table 45). It might due to the fact that Hungarian males of the same age group, which were in the subgroup have the highest values of other circulatory system diseases, cancer and digestive system diseases. Among the Hungarian adult females which were highlighted in the subgroup with the highest values of all the selected causes of death, except the digestive system diseases and remaining other causes of death.

In the third subgroup the highest values of other (residual) and the lowest cancer mortality occurred (see Table 45). Low malignant neoplasm can be related to males and females between the exact ages of 15–64, who had the lowest cancer mortality among the selected countries in 1985. Other causes of death were higher than average for all subgroups among the males and females.

The last subgroup which comprises Spain and the USA population age groups of 15–64 showed the lowest values of all causes of death, excluding the other circulatory system diseases and cancer among the other subgroups (see Table 45). During the analysis for the year of 1985, the lowest values mostly belong to the adult population of these countries.

Initial data for analyzing patterns of the cause-specific mortality levels between the exact ages of 15 and 64 among the selected countries in 2005 is illustrated in Table 46.

***Tab. 46 – SDR (per 100,000) by main causes of death of mortality levels at ages 15–64 in the selected countries for both sexes, 2005***

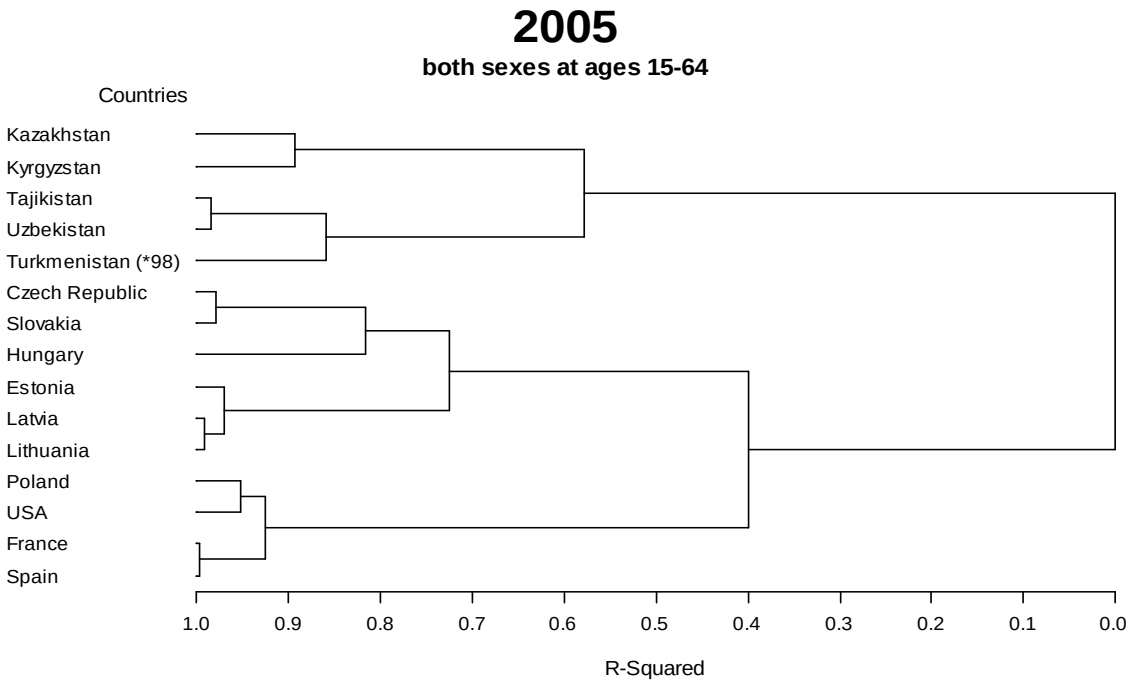
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 478 | 41 | 129 | 58 | 128 | 25 | 34 | 64 |
| Kyrgyzstan | 291 | 38 | 54 | 33 | 62 | 17 | 33 | 53 |
| Tajikistan | 172 | 11 | 49 | 21 | 23 | 11 | 14 | 43 |
| Turkmenistan (*98) | 294 | 11 | 115 | 28 | 44 | 17 | 24 | 55 |
| Uzbekistan | 211 | 18 | 67 | 23 | 31 | 10 | 23 | 39 |
| Czech Republic | 242 | 11 | 57 | 88 | 36 | 18 | 20 | 11 |
| Hungary | 260 | 10 | 68 | 81 | 42 | 12 | 26 | 22 |
| Poland | 377 | 21 | 95 | 121 | 46 | 15 | 47 | 32 |
| Slovakia | 268 | 16 | 57 | 82 | 46 | 8 | 18 | 42 |
| Estonia | 370 | 24 | 88 | 79 | 96 | 12 | 26 | 46 |
| Latvia | 432 | 34 | 127 | 84 | 108 | 19 | 22 | 39 |
| Lithuania | 420 | 20 | 106 | 80 | 128 | 17 | 32 | 38 |
| France | 174 | 5 | 20 | 72 | 29 | 4 | 11 | 34 |
| Spain | 140 | 5 | 21 | 57 | 21 | 6 | 9 | 22 |
| USA | 209 | 6 | 44 | 57 | 20 | 10 | 11 | 60 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Similarities in cause-specific mortality for both sexes between the exact ages of 15 and 64 among the selected countries showed results which differentiated between the two major country groups (see Figure 46).

***Fig. 46 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 15–64 in the selected countries for both sexes, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

They include the Central Asian countries and the post-socialist European area paired with low mortality countries (see Figure 46). These two major country groups are further separated into four subgroups. Kazakhstan and Kyrgyzstan showed similar patterns of the age-specific mortality by main causes of death. Tajikistan, Uzbekistan and Turkmenistan are in the second subgroup. The Czech Republic, Slovakia and Hungary together with all Baltic states are in the third. In the last subgroups countries such as Poland with low mortality populations are included.

Table 47 clearly illustrates the average values in age-specific mortality levels by main causes of death for both sexes in 2005. These average values for all subgroups highlighted with highest and lowest values together with the total average were computed. The result of the similarities among the selected countries showed that the highest values of the main causes of death belonged to the first subgroup. In Kazakhstan and Kyrgyzstan populations aged between 15 and 64, high all causes, cerebrovascular diseases, external causes of death, digestive system diseases, respiratory system diseases and other causes of death were observed in 2005. The adult population from these two countries was experienced very high mortality among the selected countries.

In other Central Asian countries, such as Tajikistan, Uzbekistan and Turkmenistan, which belong to the second subgroup, high other diseases of the circulatory system and low malignant neoplasm mortality were observed (see Table 47). Other main causes of death in this subgroup result are equal and higher than average. In any case, the first and the second subgroups showed similar cause-specific mortality pattern for adults.

The third subgroup had high cancer mortality and low other causes of death (see Table 47). In the post-socialist European area, except Poland, general mortality levels are better. The rest of the main causes of death are lower compared with the total average for all subgroups.

In the last subgroup a low value of the main causes of death, except cancer mortality and other causes of death, was registered (see Table 47). Only malignant neoplasm and other causes of death values are lower than the average values. In Poland, France, Spain and the United States low adult mortality pattern by the main causes of death exist, compared with other selected countries.

***Tab. 47 - Average standardized values (Z-scores) of each country group for both sexes at ages 15–64 (adjusted), 2005***

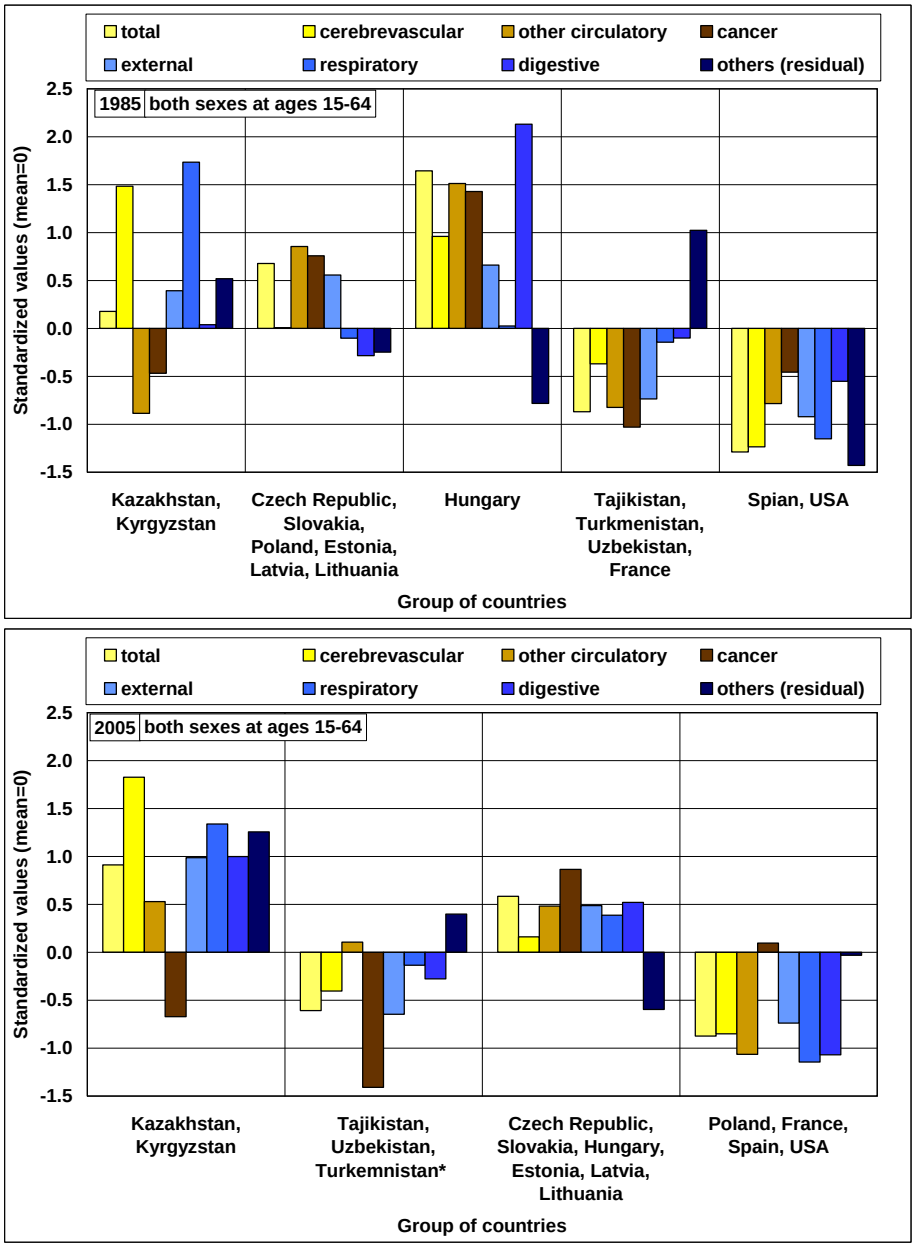
| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan | 0.912 | 1.826 | 0.106 | -0.672 | 0.987 | 1.337 | 0.998 | 1.256 |
| Tajikistan, Uzbekistan, Turkmenistan* | -0.609 | -0.405 | 0.528 | -1.409 | -0.646 | -0.135 | -0.278 | 0.397 |
| Czech Republic, Slovakia, Hungary, Estonia, Latvia, Lithuania | 0.583 | 0.161 | 0.482 | 0.865 | 0.487 | 0.386 | 0.520 | -0.596 |
| Poland, France, Spain, USA | -0.874 | -0.851 | -1.066 | 0.096 | -0.740 | -1.146 | -1.070 | -0.032 |

Note: *Turmenistan was calculated for 1998
Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was took from http://esa.un.org/wup2009/unup/index.asp?panel=1

Finally, mortality by main causes of death among the selected countries for both sexes between the exact ages 15 and 64 among the selected countries is shown in Figure 47. According to the results between the years 1985 and 2005, a high mortality pattern from the main causes of death was experienced in the former Soviet Central Asian region, more specifically among Kazakhstan and Kyrgyzstan.

***Fig. 47 - Standardized values of cause-specific mortality levels at ages 15–64 (adjusted) in the selected countries for both sexes, 1990 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The Hungarian population at ages 15–64 showed one of the highest results in 1985. In the end of studying period (2005) significantly improvements were observed (see Figure 47). In the

countries of the post-socialist European area cause-specific mortality levels between the exact ages of 15 and 64 improvements were highlighted. In Spain and the United States of America low adult mortality for both sexes at adult ages was observed. In the case of France, in the beginning of analysis (1985) the highest other (remaining) causes of death was noted, but in the end (2005) cause-specific mortality level among the French adults was lower.

## 6.2 Age-standardized death rates by main causes of death of mortality levels at ages 65 and over

According to the results of the factor analysis the second age group to be analyzed analysis is between the exact ages of 65 and over. Mortality patterns by main cause of death for seniors among the selected countries have been separated for males, females and both sexes in the period of 1985 and 2005. For analyzing cause-specific mortality levels among the seniors in the selected countries, the same methods are used. The initial data for the hierarchical cluster analysis is presented in Table 48.

***Tab. 48 -SDR (per 100,000) by main causes of death of mortality levels at ages 65+ (adjusted) in the selected countries for males, 1985***

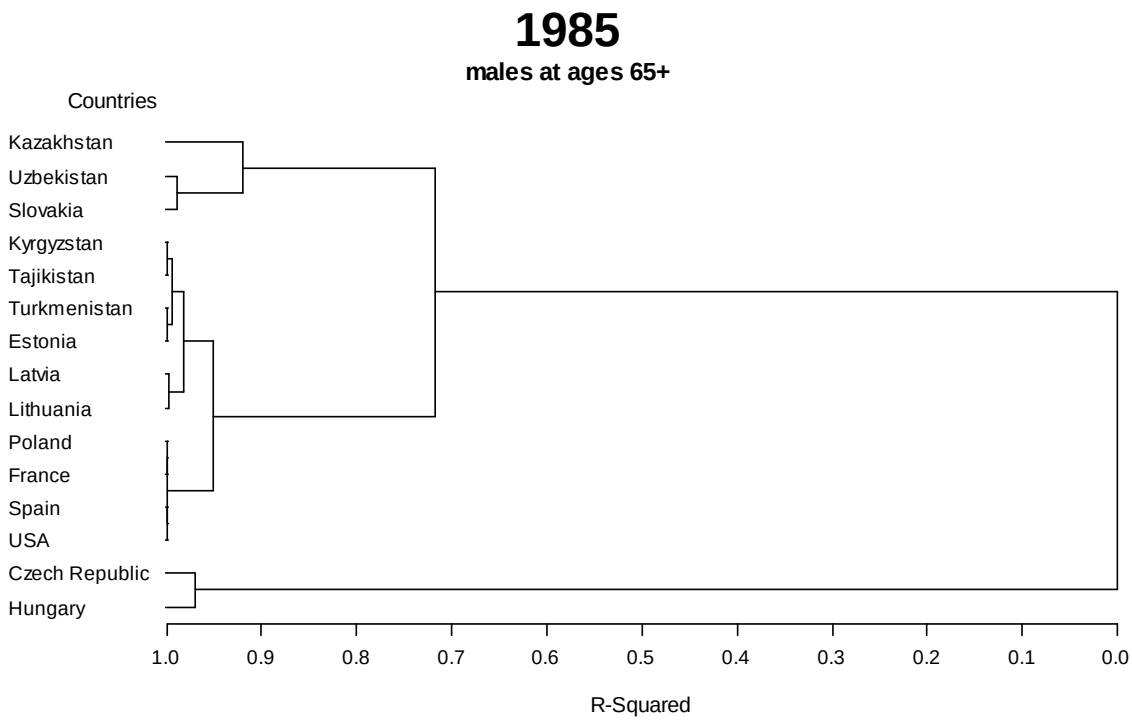
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 900 | 370 | 163 | 149 | 27 | 123 | 29 | 39 |
| Kyrgyzstan | 872 | 184 | 336 | 88 | 19 | 190 | 31 | 25 |
| Tajikistan | 687 | 117 | 293 | 82 | 12 | 113 | 25 | 45 |
| Turkmenistan | 872 | 182 | 399 | 108 | 15 | 95 | 30 | 43 |
| Uzbekistan | 822 | 148 | 429 | 79 | 13 | 96 | 24 | 34 |
| Czech Republic | 996 | 187 | 401 | 203 | 38 | 77 | 32 | 58 |
| Hungary | 891 | 102 | 405 | 150 | 27 | 122 | 33 | 52 |
| Poland | 976 | 169 | 407 | 194 | 53 | 70 | 40 | 45 |
| Slovakia | 926 | 58 | 477 | 155 | 25 | 77 | 27 | 106 |
| Estonia | 978 | 195 | 515 | 153 | 27 | 37 | 21 | 30 |
| Latvia | 980 | 225 | 479 | 140 | 29 | 57 | 17 | 33 |
| Lithuania | 917 | 108 | 500 | 138 | 31 | 94 | 13 | 32 |
| France | 727 | 85 | 200 | 190 | 37 | 64 | 37 | 115 |
| Spain | 653 | 100 | 196 | 147 | 14 | 83 | 35 | 77 |
| USA | 672 | 47 | 299 | 153 | 18 | 72 | 20 | 63 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the country grouping by similarities in age-specific mortality among the selected countries in 1985, the countries showed a short distance result (see Figure 48). They are divided into two major groups. All of the selected countries are clustered into one group, whereas the Czech Republic and Hungary are categorized in the second. These two major groups can be further divided into four subgroups and one outsider. Kazakhstan is the outsider of the analysis. Uzbekistan and Slovakia are in the first subgroup. Kyrgyzstan, Tajikistan and Turkmenistan together with the three Baltic states showed similarities in mortality patterns and they belong to the second subgroup. Poland and other low mortality populations are in the third subgroup. The last subgroup comprises the Czech Republic and Hungary. More detailed information can be found in Table 48.

***Fig. 48 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 65+ (adjusted) in the selected countries for males, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Kazakhstan which is a unique country for the analysis of senior age cause-specific mortality patterns among the selected countries. Table 49 clearly illustrates that Kazakhstani males between the exact ages of 65 and over had high levels of cerebrovascular diseases compared with the other selected countries. The values of the main causes of death are mostly higher than the total average.

***Tab. 49 - Average standardized values (Z-scores) of each country group for males at ages 65+ (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 0.668 | 2.061 | -0.189 | 0.548 | 0.337 | 1.420 | 0.559 | 0.484 |
| Uzbekistan, Slovakia | 0.432 | 0.094 | 0.677 | 0.092 | -0.034 | 0.941 | 0.373 | 0.417 |
| Kyrgyzstan, Tajikistan, Turkmenistan, Estonia, Latvia, Lithuania | -0.432 | -0.438 | -0.359 | -0.438 | -0.403 | -0.454 | -0.484 | -0.495 |
| Poland, France, Spain, USA | -0.807 | -0.767 | -0.812 | -0.674 | -0.610 | -0.934 | -0.698 | -0.694 |
| Czech Republic, Hungary | 2.144 | 1.723 | 2.119 | 2.296 | 2.294 | 1.579 | 2.196 | 2.216 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The first subgroup showed a result without any extreme values among the selected countries (see Table 49). In 1985 about half of the values of the selected causes of death in this subgroup were higher than the total average for all subgroups. A similar pattern was analyzed in the

second subgroup. The first two subgroup's male population between the exact ages of 65 had less risk among the selected countries.

In the third subgroup clearly a low level of the cause-specific mortality levels for senior was observed (see Table 49). The all the values of the main causes of death are their lowest among the other countries. In this country group are Poland and the low mortality populations are classified, and in 1985 their population between the exact ages of 65 and over showed a low mortality pattern by main causes of death. The situation in the last subgroup is in stark contrast. The highest values of all causes, excluding cerebrovascular diseases in this subgroup were highlighted in 1985. Seniors cause-specific mortality levels among male population are vulnerable compared with the other subgroups.

The same method way of the analysis was used for the year 2005. The initial data for the hierarchical cluster analysis among males is presented in Table 50.

***Tab. 50 - SDR (per 100,000) by main causes of death of mortality levels at ages 65+ (adjusted) in the selected countries for males, 2005***

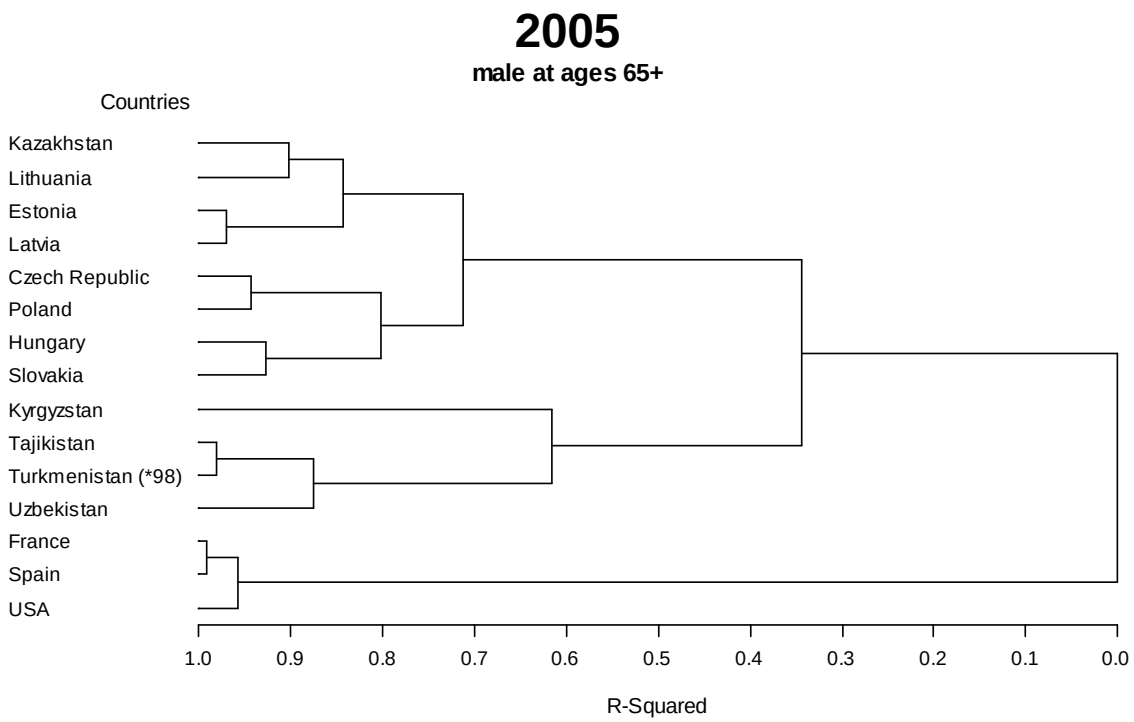
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 889 | 153 | 432 | 132 | 29 | 66 | 29 | 48 |
| Kyrgyzstan | 830 | 192 | 347 | 76 | 20 | 113 | 33 | 49 |
| Tajikistan | 796 | 96 | 467 | 55 | 9 | 61 | 32 | 77 |
| Turkmenistan (*98) | 765 | 56 | 518 | 59 | 9 | 46 | 29 | 48 |
| Uzbekistan | 760 | 125 | 445 | 44 | 13 | 39 | 32 | 62 |
| Czech Republic | 696 | 95 | 279 | 191 | 21 | 22 | 21 | 67 |
| Hungary | 798 | 71 | 397 | 185 | 19 | 59 | 29 | 38 |
| Poland | 804 | 93 | 363 | 176 | 31 | 49 | 34 | 58 |
| Slovakia | 680 | 66 | 264 | 184 | 20 | 51 | 23 | 71 |
| Estonia | 764 | 100 | 336 | 192 | 32 | 29 | 23 | 53 |
| Latvia | 810 | 150 | 328 | 178 | 32 | 29 | 20 | 73 |
| Lithuania | 778 | 88 | 374 | 173 | 42 | 46 | 21 | 34 |
| France | 526 | 31 | 127 | 164 | 26 | 43 | 21 | 114 |
| Spain | 557 | 46 | 129 | 158 | 14 | 81 | 27 | 103 |
| USA | 569 | 28 | 190 | 143 | 3 | 67 | 16 | 120 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

According to the hierarchical tree, the senior female population showed long distance results (see Figure 47). Clearly, this illustrates that the countries are divided into two major groups of mortality patterns. Foremost, all of post-communist countries are positioned in the first group, and low mortality populations in the second. These two major groups can be further divided into four subgroups and one unique separate country (Kyrgyzstan) is an outsider. The first subgroups represent countries such as Kazakhstan together with three Baltic states. All Central European countries belong to the second subgroup. Tajikistan, Turkmenistan (*98) and Uzbekistan consist of the third subgroup. Low mortality populations showed similar senior mortality patterns.

***Fig. 49 - Dendogram resulting from the hierarchical analysis of mortality levels at aged 65+ (adjusted) in the selected countries for males, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Table 51 illustrates the average values of each subgroup for senior males in 2005. According to this table the first subgroup revealed high external causes of morbidity and mortality, and also low values of the respiratory system diseases when compared with other subgroups. Males at a senior age in Kazakhstan and the three Baltic states are in a vulnerable age group. Regarding diseases of the respiratory system, it is the opposite situation; they have an extremely low value among the selected countries.

In the second subgroup, which consists of the entire post-socialist Central Europe a high level of malignant neoplasm and low other causes of death were observed (see Table 51). All cardiovascular mortality among the senior males in this subgroup is lower than the total average. Other selected main causes of death are relatively lower compared with other subgroups among the senior males in this subgroup.

The next subgroup consists of only one country (see Table 51). Kyrgyzstani senior males are outliers in this analysis. According to the average values, the table illustrates high levels of all causes of death, cerebrovascular diseases, respiratory system and digestive system diseases among the males between the exact ages of 65 and over in 2005. Mortality by causes of death such as malignant neoplasm is lower than the total average for all the subgroups. But other diseases of the circulatory system, external causes of death and other causes of death for Kyrgyz males at senior ages are higher than the total average.

In the third subgroup high other diseases of the circulatory system were observed (see Table 51). Also within this subgroup, a low value of malignant neoplasm was registered. While the

countries of Central Asia still experienced high mortality at all ages. The values of the cardiovascular diseases are higher than the total average for all subgroups. Moreover, in this subgroup, digestive system diseases and other causes of death for senior males are higher than average.

***Tab. 51 - Average standardized values (Z-scores) of each country group for males at ages 65+ (adjusted), 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Estonia, Latvia, Lithuania | 0.700 | 0.640 | 0.292 | 0.519 | 1.166 | -0.481 | -0.499 | -0.592 |
| Czech Republic, Poland, Hungary, Slovakia | 0.089 | -0.241 | -0.063 | 0.798 | 0.135 | -0.359 | 0.150 | -0.717 |
| Kyrgyzstan | 0.882 | 2.130 | 0.121 | -1.194 | -0.116 | 2.596 | 1.188 | -0.346 |
| Tajikistan, Turkmenistan*, Uzbekistan | 0.363 | -0.011 | 1.221 | -1.624 | -0.662 | -0.198 | 0.918 | -0.205 |
| France, Spain, USA | -1.710 | -1.230 | -1.567 | 0.266 | -1.035 | 0.454 | -0.848 | 1.694 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

The last subgroup values are mostly low among the other subgroups (see Table 50). The lowest values of all causes, all cardiovascular diseases, and external causes of death and digestive system diseases were highlighted. In low mortality countries, a major part of their population has a high probability of surviving compared with the other selected countries. Even at senior ages they have low mortality by main causes of death among the other subgroups.

In summary, the cause-specific mortality level at senior ages among the selected countries is underpinned in Figure 50.

***Fig. 50 - Standardized values of cause-specific mortality levels at ages 65 + (adjusted) in the selected countries for males, 1985 and 2005***

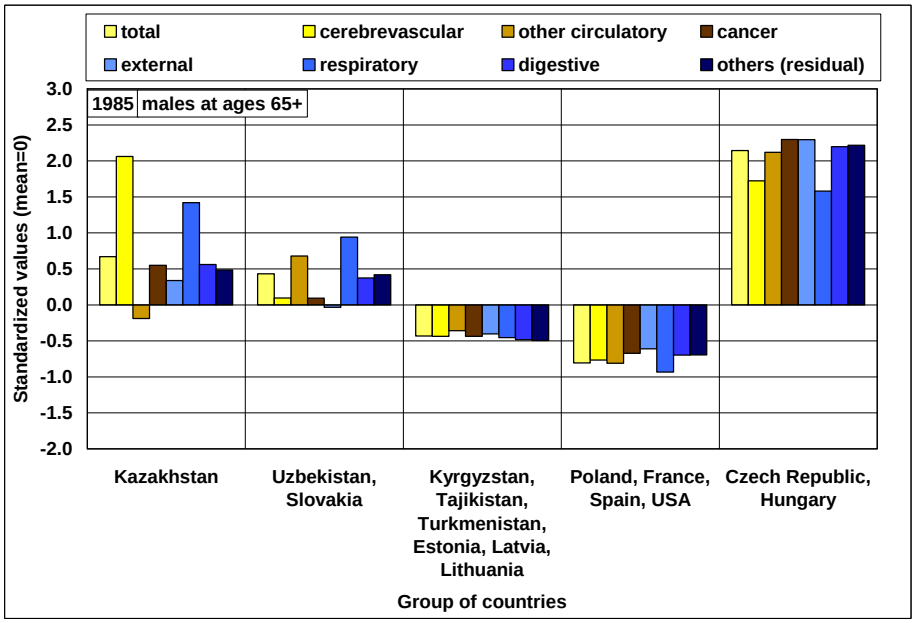
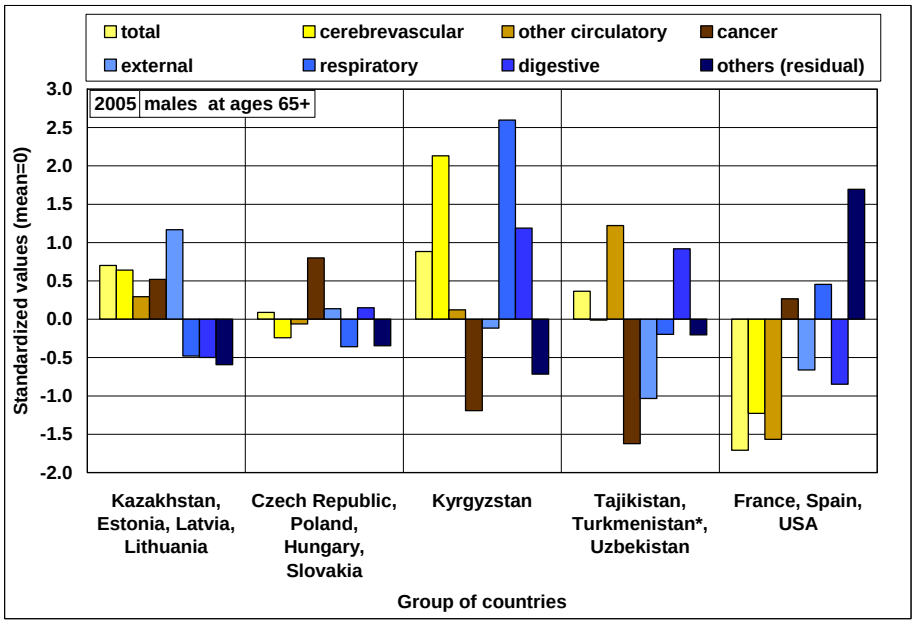


***Fig. 50 - continued***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

Female cause-specific mortality patterns at senior ages among the selected countries will be analyzed further. Table 52 shows the age-specific standardized death rates by main causes of death between the exact ages of 65 and over for females in the selected countries, which is initial data for the cluster analysis.

***Tab. 52 – SDR (per 100,000) by main causes of death of mortality levels at ages 65+ (adjusted) in the selected countries for females, 1985***

| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 604 | 143 | 290 | 75 | 11 | 52 | 18 | 16 |
| Kyrgyzstan | 608 | 166 | 262 | 45 | 8 | 97 | 19 | 12 |
| Tajikistan | 504 | 98 | 233 | 40 | 9 | 79 | 17 | 28 |
| Turkmenistan | 622 | 158 | 293 | 60 | 9 | 61 | 19 | 21 |
| Uzbekistan | 571 | 118 | 317 | 41 | 7 | 56 | 17 | 15 |
| Czech Republic | 769 | 197 | 316 | 107 | 42 | 40 | 23 | 44 |
| Hungary | 687 | 94 | 353 | 77 | 17 | 79 | 19 | 48 |
| Poland | 724 | 150 | 334 | 109 | 42 | 30 | 23 | 37 |
| Slovakia | 683 | 57 | 381 | 80 | 18 | 29 | 20 | 98 |
| Estonia | 750 | 209 | 419 | 71 | 17 | 12 | 10 | 12 |
| Latvia | 760 | 242 | 385 | 70 | 18 | 21 | 11 | 14 |
| Lithuania | 667 | 110 | 421 | 64 | 13 | 33 | 10 | 15 |
| France | 533 | 96 | 165 | 90 | 32 | 36 | 26 | 80 |
| Spain | 474 | 84 | 175 | 70 | 7 | 42 | 21 | 75 |
| USA | 496 | 53 | 231 | 90 | 9 | 40 | 16 | 56 |

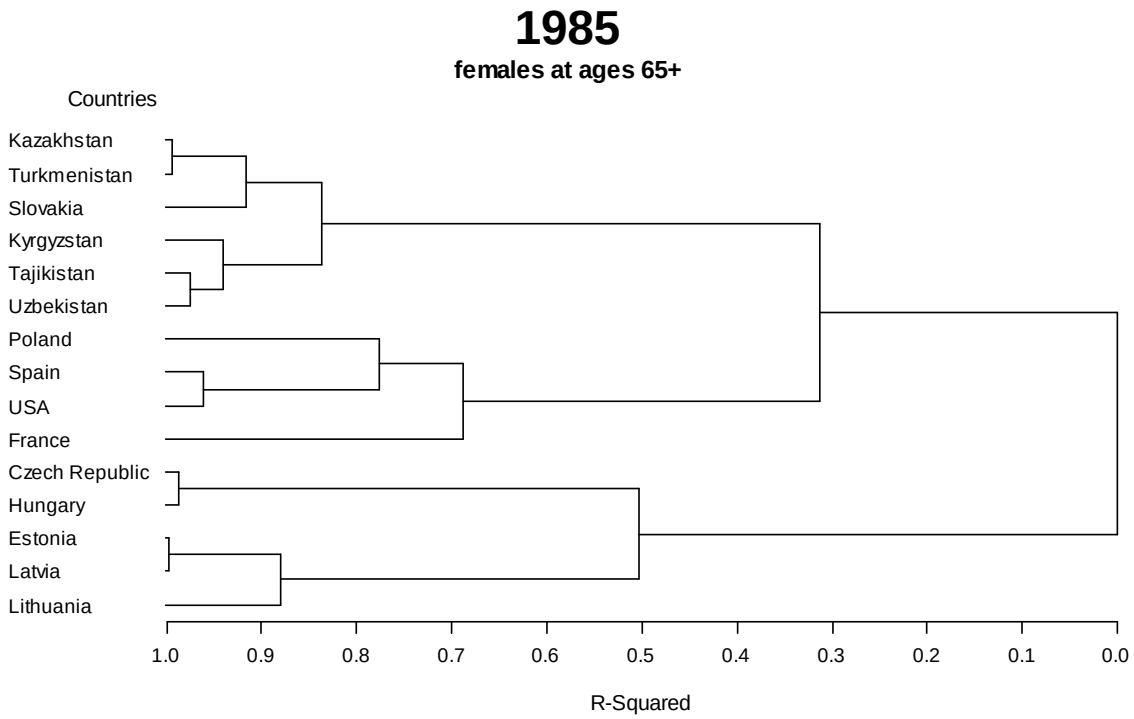
Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The dendogram for females between the exact ages of 65 and over showed a long distanced result (see Figure 51). Clearly differences between Soviet Central Asia and Slovakia, socialist Central Europe and Poland together with low mortality populations were seen. These major

country groups can be further separated into four subgroups. For instance, they include the Central Asian republic and Slovakia in the first subgroup. Concurrently, Poland with low mortality populations belong to the second subgroup. The Czech Republic and Hungary are in the third subgroup. The last subgroup comprises all of three Baltic states.

***Fig. 51 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 65 + (adjusted) in the selected countries for females, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.

Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The cause-specific mortality levels among the females between the exact ages of 65 and over in the first subgroup have the highest values of respiratory system diseases (see Table 53). Also in this country group the lowest level of the cancer and external causes was noted. Due to this the results ostensibly show that senior females have a low mortality level by the main causes of death.

In the second subgroup the lowest values of the all causes, all circulatory system diseases and the highest remaining other causes of death were highlighted (see Table 53). In the low mortality countries and the Polish female population aged 65 and over, which belong to the second subgroup a low level of other selected causes of death occurred.

Table 53 clearly illustrates that the highest values of malignant neoplasm, external causes of morbidity and mortality and diseases of the digestive system were observed in the third subgroup. Other selected main causes of death levels in this country group are lower than the total average. The results of Czech and Hungarian females at a senior age are a quite similar to the other subgroups.

In the last subgroup the highest values of all causes, all circulatory system diseases and malignant neoplasm were analyzed (see Table 53). Also in this subgroup the lowest level of the

respiratory system, digestive system diseases and other (residual) were observed. During socialism, the three Baltic states cause-specific mortality levels were in an intermediate position when compared with the other selected countries.

***Tab. 53 - Average standardized values (Z-scores) of each country group for females at ages 65+ (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Turkmenistan, Slovakia, Kyrgyzstan, Tajikistan, Uzbekistan | -0.339 | -0.049 | -0.170 | -0.770 | -0.587 | 0.997 | -0.011 | -0.458 |
| Poland, Spain, USA, France | -0.806 | -1.045 | -0.829 | 0.464 | -0.062 | -0.440 | 0.640 | 1.236 |
| Czech Republic, Hungary | 0.967 | 0.746 | 0.250 | 1.681 | 2.067 | -0.516 | 1.116 | -0.119 |
| Estonia, Latvia, Lithuania | 1.179 | 0.995 | 1.278 | -0.201 | -0.121 | -1.064 | -1.575 | -0.651 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

Table 54 attempts to present the initial data for a hierarchical cluster analysis in 2005. The female population between the exact ages of 65 and over among the selected countries will analyzed further. For more detailed information of cause-specific mortality levels can be found in Table 55.

***Tab. 54 – SDR (per 100,000) by main causes of death of mortality levels at ages 65+ (adjusted) in the selected countries for females, 2005***

| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 643 | 134 | 345 | 64 | 11 | 25 | 17 | 48 |
| Kyrgyzstan | 664 | 180 | 304 | 41 | 7 | 66 | 21 | 44 |
| Tajikistan | 613 | 84 | 363 | 31 | 3 | 51 | 22 | 58 |
| Turkmenistan (*98) | 635 | 58 | 445 | 35 | 7 | 30 | 22 | 38 |
| Uzbekistan | 677 | 133 | 398 | 29 | 5 | 28 | 24 | 60 |
| Czech Republic | 567 | 58 | 297 | 108 | 15 | 31 | 18 | 40 |
| Hungary | 577 | 61 | 341 | 87 | 7 | 31 | 19 | 32 |
| Poland | 588 | 81 | 302 | 96 | 17 | 24 | 20 | 47 |
| Slovakia | 491 | 65 | 222 | 90 | 11 | 23 | 18 | 61 |
| Estonia | 519 | 98 | 253 | 81 | 10 | 8 | 14 | 54 |
| Latvia | 564 | 151 | 228 | 78 | 12 | 7 | 15 | 74 |
| Lithuania | 533 | 85 | 297 | 80 | 14 | 13 | 15 | 30 |
| France | 416 | 33 | 109 | 83 | 20 | 29 | 16 | 125 |
| Spain | 436 | 50 | 124 | 70 | 9 | 38 | 21 | 124 |
| USA | 510 | 34 | 174 | 96 | 11 | 56 | 16 | 123 |

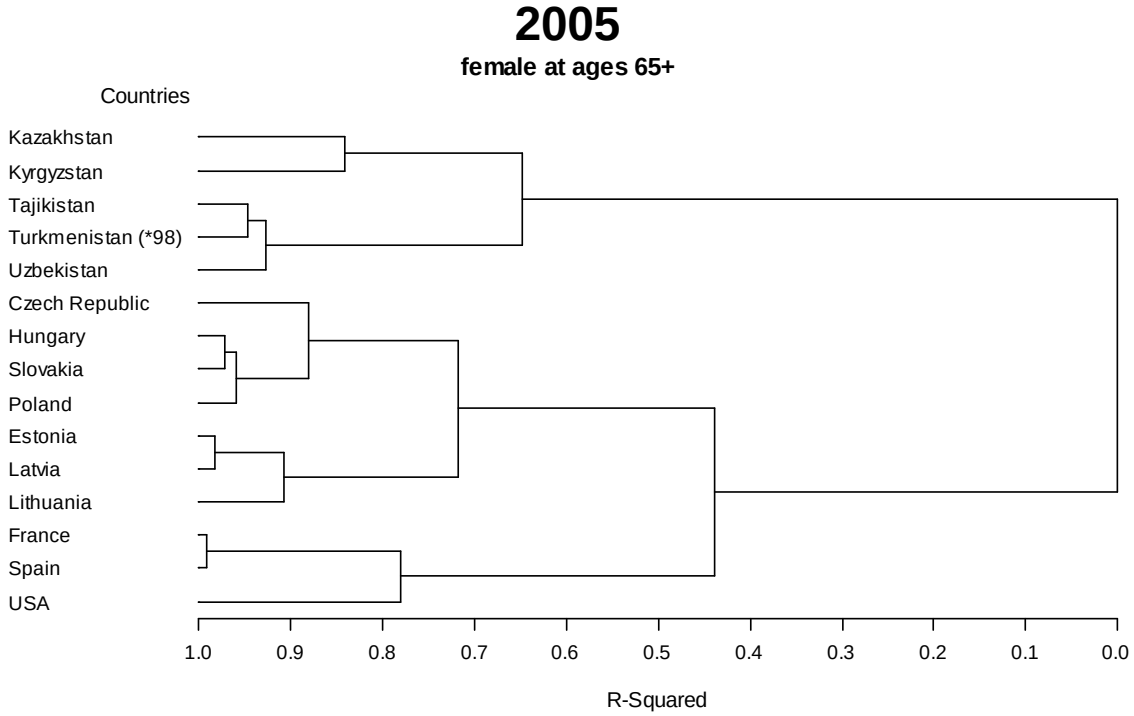
Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, Turkmenistan (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

According to the results of similarity in senior females, the selected countries showed a long distance picture (see Figure 52). Clearly, this illustrates the differences between the two major groups of mortality patterns. These two major groups can be further divided into four subgroups. Furthermore, Kazakhstan and Kyrgyzstan show similarities in mortality development. This is why they are represented in the first subgroup. The other Central Asian republics (Tajikistan, Turkmenistan (*98) and Uzbekistan) are in the second subgroup. The

third subgroup comprises the Central European area and the Baltic states. France, Spain and the United States of America are in the last subgroup.

***Fig. 52 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at aged 65+ (adjusted) in the selected countries for females, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the first subgroup, high all causes, cerebrovascular diseases, external causes of death, respiratory system diseases and other causes of death were observed (see Table 55). Other causes of death in this subgroup showed low value among the other country groups. Females at senior ages showed high mortality patterns by main causes of death among the other subgroups. Other diseases of the circulatory system, malignant neoplasm and digestive system diseases are also higher than average for all the subgroups.

The second subgroup showed high other diseases of the circulatory system and digestive system diseases among the other subgroups in 2005 (see Table 55). Malignant neoplasm is a low when compared with other selected countries. High death rates among females between the exact ages of 65 and over in the cause-specific mortality patterns belong to the first two subgroups, which consist of the post Soviet Central Asian countries.

In the third subgroup high malignant neoplasm and the opposite situation related to respiratory system and digestive system diseases were highlighted (see Table 55). Furthermore, other main causes of death are lower or quite similar with last subgroup value. Lower all causes, all cardiovascular diseases, external causes of death and digestive system diseases were registered in the last subgroup. In the low mortality countries, cause-specific mortality levels among females between the exact ages of 65 and over are the lowest compared with other

subgroups. Notable, the results of the last two subgroups are closer to each other. In these countries, the health situation is better than in the Soviet Central Asian regions.

***Tab. 55 - Average standardized values (Z-scores) of each country group for females at aged 65+ (adjusted), 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Kyrgyzstan | 1.161 | 1.585 | 0.461 | -0.723 | -1.240 | 0.901 | 0.095 | -0.541 |
| Tajikistan, Turkmenistan*, Uzbekistan | 1.008 | 0.105 | 1.269 | -1.547 | -0.318 | 0.340 | 1.363 | -0.355 |
| Czech Republic, Hungary, Slovakia, Poland, Estonia, Latvia, Lithuania | -0.175 | -0.031 | -0.030 | 0.670 | 0.384 | -0.668 | -0.542 | -0.469 |
| France, Spain, USA | -1.374 | -1.089 | -1.505 | 0.467 | 0.555 | 0.617 | -0.161 | 1.810 |

Note: *Turkmenistan was calculated for 1998; Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

A summary of the female cause-specific mortality levels among the selected countries in years of the 1985 and 2005 is graphically illustrated in Figure 53. In 1985, mortality levels by the main causes of death in the selected post-communist countries were lower confronted with the levels which were started from time of independence. The cause-specific mortality levels in the low mortality populations at senior ages changed over time only in a positive way. During the analysis of female populations between the exact ages of 65 and over, it was evident that the highest values by main causes of death and mainly diseases of the circulatory system, belonged to the former Soviet Central Asian countries, and the lowest values by the main causes of death for senior females are can be found in the low mortality populations. While in the post-socialist European area, an intermediate situation was observed.

***Fig. 53 - Standardized values of cause-specific mortality levels at ages 65 + (adjusted) in the selected countries for females, 1985 and 2005***

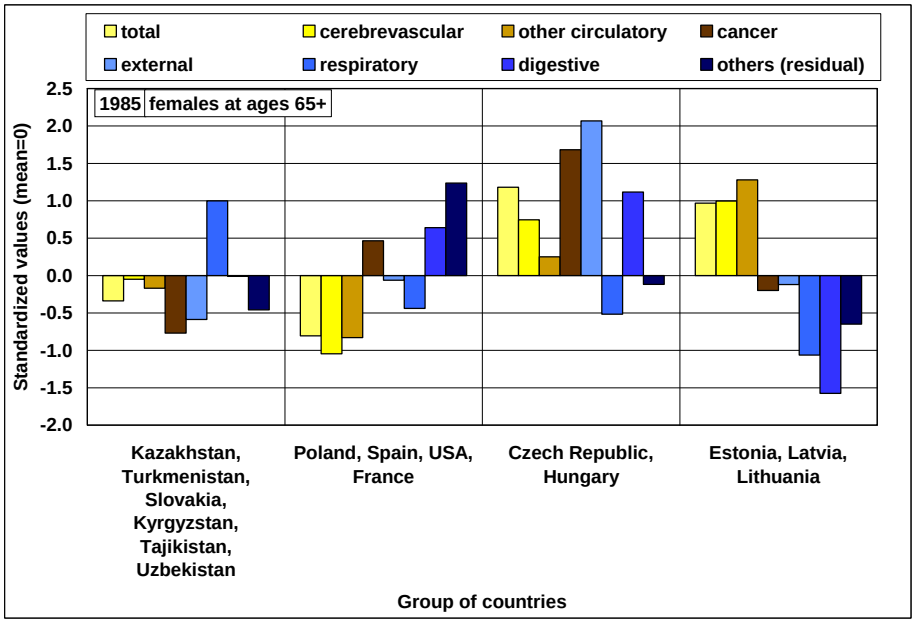
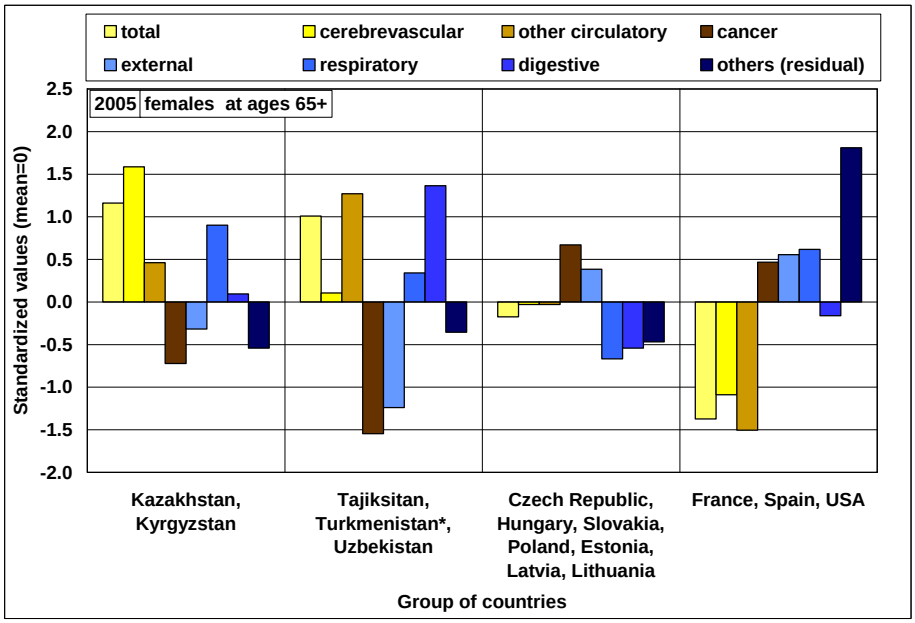


***Fig. 53 - continued***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

A summary of the cause-specific mortality levels in the selected countries between the exact ages of 65 and over analysis for both sexes in 1985 is presented. Table 56 presents the initial data for a cluster analysis for both sexes by the main causes of death which was listed previously.

***Tab. 56 – SDR (per 100,000) by main causes of death of mortality levels at ages 65 + (adjusted) in the selected countries for both sexes, 1985***

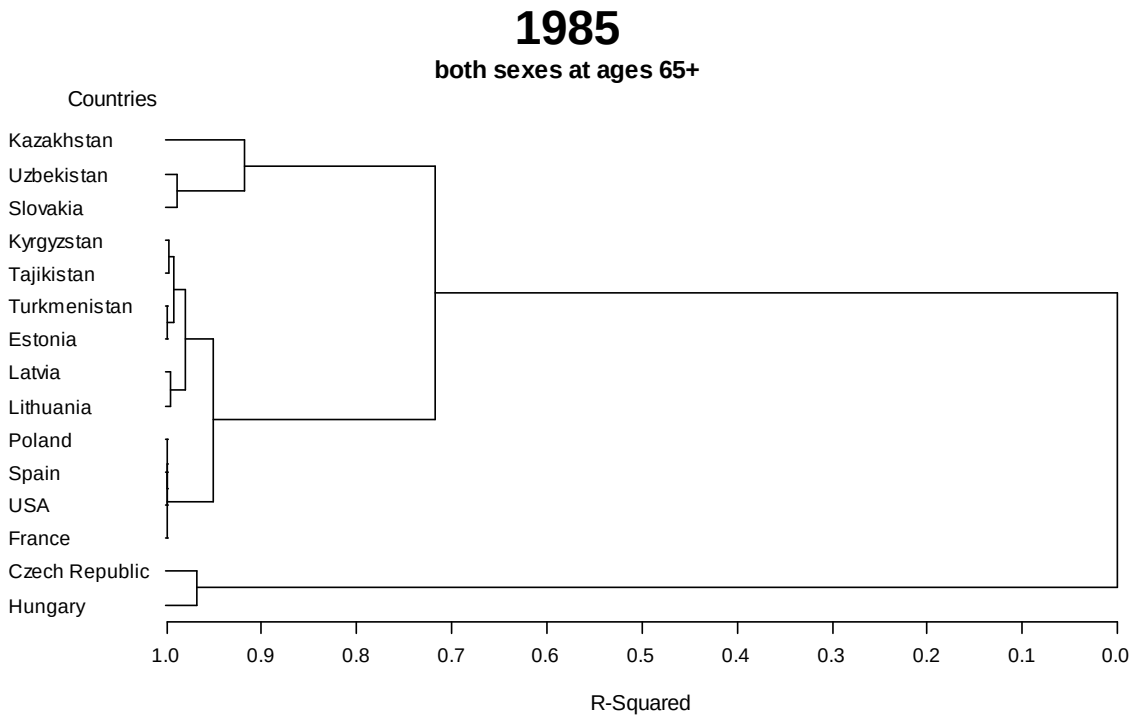
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 752 | 257 | 226 | 112 | 19 | 88 | 23 | 27 |
| Kyrgyzstan | 740 | 175 | 299 | 66 | 14 | 144 | 25 | 19 |
| Tajikistan | 595 | 108 | 263 | 61 | 10 | 96 | 21 | 36 |
| Turkmenistan | 747 | 170 | 346 | 84 | 12 | 78 | 24 | 32 |
| Uzbekistan | 696 | 133 | 373 | 60 | 10 | 76 | 20 | 25 |
| Czech Republic | 888 | 197 | 359 | 155 | 40 | 59 | 28 | 51 |
| Hungary | 794 | 98 | 379 | 113 | 22 | 106 | 26 | 50 |
| Poland | 850 | 159 | 370 | 151 | 47 | 50 | 31 | 41 |
| Slovakia | 805 | 58 | 429 | 118 | 21 | 53 | 24 | 102 |
| Estonia | 864 | 202 | 467 | 112 | 22 | 25 | 16 | 21 |
| Latvia | 870 | 233 | 432 | 105 | 23 | 39 | 14 | 23 |
| Lithuania | 792 | 109 | 461 | 101 | 22 | 64 | 12 | 24 |
| France | 680 | 84 | 182 | 140 | 35 | 50 | 32 | 157 |
| Spain | 573 | 102 | 186 | 108 | 10 | 62 | 28 | 76 |
| USA | 584 | 50 | 265 | 121 | 13 | 56 | 18 | 60 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

According to the hierarchical tree for both sexes at a senior age, the selected countries showed short distance results (see Figure 54). Clearly, this illustrates that the Czech Republic and Hungary are separated from other selected countries.

***Fig. 54 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 65 + (adjusted) in the selected countries for both sexes, 1985***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Source: Author's calculations based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

These two major groups can be further divided into four subgroups and one country outsider of this analysis (see Figure 54). Kazakhstan is a uniquely apart and an outsider of the cause-specific analysis for both sexes at a senior age. Uzbekistan and Slovakia show similarities in mortality development. The rest of the Soviet Central Asian countries (Kyrgyzstan, Tajikistan and Turkmenistan) together with the three Baltic states belong to the second subgroup. Poland and low mortality populations are in the third subgroup. The last subgroup comprises the Czech Republic and Hungary.

In Kazakhstan the highest values of the cerebrovascular diseases was observed (see Table 57). Other mortality levels by the main causes of death are higher than the total average for all subgroups. Higher cerebrovascular diseases can have a greater influence on the highest level of this disease among the Kazakhstani males between the exact ages of 56 and over.

The next two subgroups did not highlight any extreme values among the other countries (see Table 57). In the case of the first country group, their cause-specific mortality levels are higher compared with the second subgroup. Mostly, the values are higher than the total average. In the second subgroup mainly lower values by main causes of death was noted. Their results are closer to the third subgroup.

In the third subgroups, which consist of Poland and low mortality populations between the exact ages of 65 and over showed clearly low mortality patterns by the main causes of death (see Table 57). It looks like the results for males at the same age group in the same year (1985). These countries illustrated low mortality pattern by the main causes of death among the selected countries.

***Tab. 57 - Average standardized values (Z-scores) of each country group for both sexes at ages 65+ (adjusted), 1985***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 0.664 | 2.051 | -0.191 | 0.547 | 0.324 | 1.418 | 0.557 | 0.448 |
| Uzbekistan, Slovakia | 0.430 | 0.085 | 0.679 | 0.087 | -0.041 | 0.954 | 0.371 | 0.401 |
| Kyrgyzstan, Tajikistan, Turkmenistan, Estonia, Latvia, Lithuania | -0.429 | -0.425 | -0.353 | -0.441 | -0.404 | -0.450 | -0.489 | -0.540 |
| Poland, Spain, France, USA | -0.809 | -0.780 | -0.820 | -0.668 | -0.603 | -0.938 | -0.690 | -0.618 |
| Czech Republic, Hungary | 2.144 | 1.724 | 2.113 | 2.298 | 2.299 | 1.563 | 2.198 | 2.231 |

Note: Red numbers are "Highest" values, Blue numbers are "Lowest" values.

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia was taken form vital statistics

The mortality analysis by the main causes of death for both sexes at senior ages in 2005 will be presented further. Table 58 represents the initial data for a hierarchical cluster analysis of mortality levels for both sexes by the main causes of death which were listed previously.

***Tab. 58 - SDR (per 100,000) by main causes of death of mortality levels at ages 65+ (adjusted) in the selected countries for both sexes, 2005***

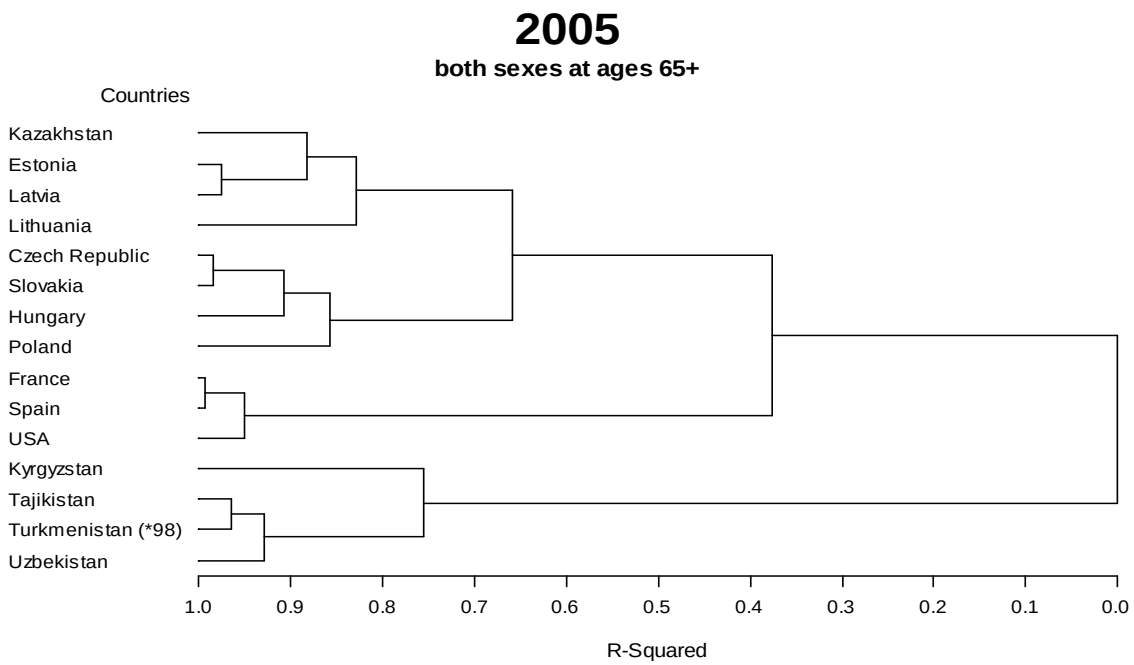
| Countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 766 | 143 | 389 | 98 | 20 | 46 | 23 | 48 |
| Kyrgyzstan | 747 | 186 | 326 | 59 | 14 | 90 | 27 | 46 |
| Tajikistan | 705 | 90 | 415 | 43 | 6 | 56 | 27 | 67 |
| Turkmenistan (*98) | 700 | 57 | 482 | 47 | 8 | 38 | 26 | 43 |
| Uzbekistan | 719 | 129 | 422 | 36 | 9 | 33 | 28 | 61 |
| Czech Republic | 631 | 77 | 288 | 149 | 18 | 26 | 19 | 54 |
| Hungary | 687 | 66 | 369 | 136 | 13 | 45 | 24 | 35 |
| Poland | 696 | 87 | 333 | 136 | 24 | 37 | 27 | 52 |
| Slovakia | 585 | 66 | 243 | 137 | 16 | 37 | 21 | 66 |
| Estonia | 641 | 99 | 295 | 136 | 21 | 19 | 18 | 53 |
| Latvia | 687 | 151 | 278 | 128 | 22 | 18 | 17 | 73 |
| Lithuania | 655 | 86 | 336 | 127 | 28 | 29 | 18 | 32 |
| France | 471 | 32 | 118 | 124 | 23 | 36 | 19 | 120 |
| Spain | 496 | 48 | 126 | 114 | 11 | 59 | 24 | 113 |
| USA | 539 | 31 | 182 | 120 | 7 | 62 | 16 | 121 |

Note: Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations, (*98) means that according to the lack of data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In 2005, the age-specific mortality levels by main causes of death were differentiated between the two major country groups (see Figure 55). Central Asian countries, excluding Kazakhstan are the first country group, and Kazakhstan, post-socialist Europe together with low mortality populations are the second. The major two groups were divided into four subgroups according to a hierarchical tree. A similarity in the mortality pattern by causes of death was observed in Kazakhstan and the three Baltic states. The Central European countries are in the third subgroup. France, Spain and the United Sates are in the third subgroup. The other Central Asian republics (Kyrgyzstan, Tajikistan, Turkmenistan *(98) and Uzbekistan) are in the last subgroup.

***Fig. 55 - Dendogram resulting from the hierarchical analysis of cause-specific mortality levels at ages 65+ (adjusted) in the selected countries for both sexes, 2005***




Note: Euclidean distance, Ward method, entry data transformed in Z-scores.
Turkmenistan (*98) means that data for Turkmenistan was calculated for 1998

Source: Author's calculations based on data from www.who.int population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the first subgroup high external causes of morbidity and mortality and low respiratory system diseases were observed (see Table 59). Kazakhstan together with all the Baltic states, experienced average values by main causes of death, which are represented in intermediate levels. But some values of the main causes of death for both sexes at senior ages are higher than the total average for all subgroups.

***Tab. 59 - Average standardized values (Z-scores) of each country group for both sexes at ages 65+ (adjusted), 2005***

| Group of countries | All causes | Cerebrovascular diseases | Other diseases of the circulatory system | Malignant neoplasm | External causes of death | Diseases of the respiratory system | Diseases of the digestive system | Others (residual) |
|---|---|---|---|---|---|---|---|---|
| Kazakhstan, Estonia, Latvia, Lithuania | 0.439 | 0.569 | 0.166 | 0.414 | 0.972 | -0.758 | -0.635 | -0.474 |
| Czech Republic, Slovakia, Hungary, Poland | 0.018 | -0.354 | 0.014 | 0.854 | 0.261 | -0.315 | 0.109 | -0.476 |
| France, Spain, USA | -1.646 | -1.171 | -1.554 | 0.336 | -0.992 | 0.554 | -0.770 | -0.384 |
| Kyrgyzstan, Tajikistan, Turkmenistan*, Uzbekistan | 0.777 | 0.663 | 0.985 | -1.520 | -0.322 | 0.658 | 1.138 | 1.780 |

Note: *Turkmenistan was calculated for 1998, Red numbers are "Highest" values, Blue numbers are "Lowest" values.

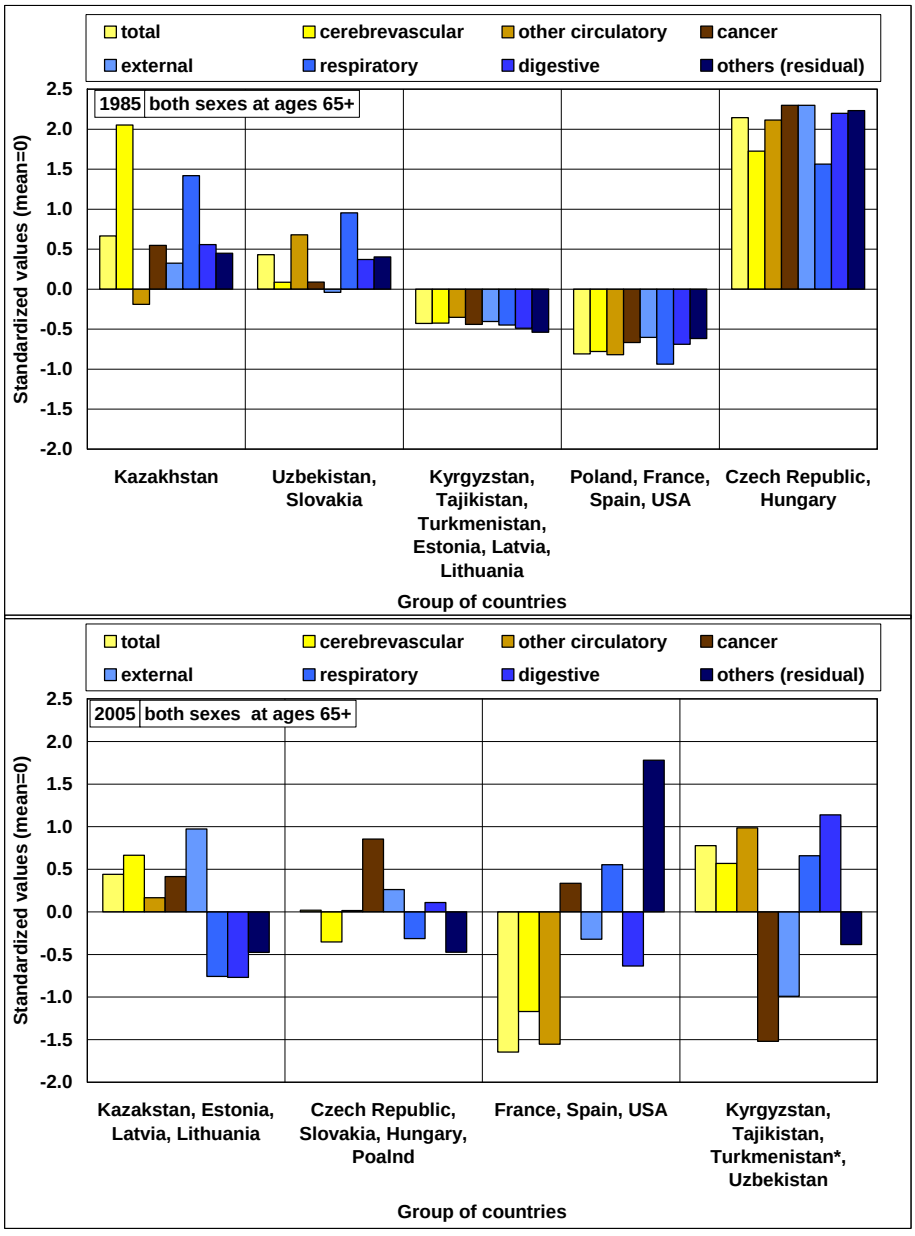
Source: Author's calculation based on data from www.who.int, population data for Tajikistan was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the second subgroup, only two extreme values were highlighted (see Table 59). They are: high malignant neoplasm and low other causes of death. The mortality pattern between the exact ages of 65 and over in these countries is more stable compared with other countries. Some of other causes of death are lower than the total average. The third subgroup which comprises of

low mortality populations during the analysis showed low values of the all causes, total cardiovascular diseases, external causes of death and digestive system diseases (see Table 59). Both sexes at senior ages in this subgroup are not in a risk age group. In the Central Asian countries, except for Kazakhstan, a high mortality pattern was observed (see Table 59). High rates of all causes, total cardiovascular mortality, respiratory and digestive system diseases and other causes of death were registered. Also in this subgroup a low value of the cancer mortality was highlighted.

Finally, the result of the cause-specific mortality levels for both sexes between the exact ages of 65 and over is presented in Figure 56.

***Fig. 56 - Standardized values of cause-specific mortality levels at ages 65+ (adjusted) in the selected countries for both sexes, 1985 and 2005***




Note: Standardized values: mean=0, standard deviation=1, Turkmenistan* means that data for Turkmenistan was calculated for 1998

Source: Author's calculation based on data from www.who.int, data for the Czech Republic and Slovakia (1985) was taken form vital statistics; population data for Tajikistan (2005) was taken from http://esa.un.org/wup2009/unup/index.asp?panel=1

In the beginning of the analysis (1985), the highest mortality levels were observed in Kazakhstan, the Czech Republic and Hungary (see Figure 56). In the other selected countries the mortality condition by the main causes of death was lower. At the end of the study period (2005) in Kazakhstan, the Czech and Hungarian populations at senior ages for both sexes situation improved considerably. In the other selected post-communist countries, the cause-specific mortality levels have positively changed. France, Spain and the USA keep low mortality patterns by the main causes of death.

## Conclusion

The presented analysis of this research showed the result of the cause-specific mortality patterns in the selected countries. Following the collapse of the Soviet Union, countries were hit with an economic crisis. While the research analyzed was taken from this time of economic uncertainty, it was compared with data from countries where the economic situation was considerably more stable.

It is mainly the socio-economic situation and education which enforces healthy behavior while wealth gives a higher quality of life. Economic affluence permits that the implementation of these factors are influenced by psychosocial stress which may cause excess mortality (Bobak and Marmot 1996). Although unknown at the time, mortality was increasing in the former Soviet Union and stagnating in Central and Eastern Europe, marking the beginning of unprecedented and long-term mortality reversal. This deviance from the general regularity of continuous mortality decline demonstrated that certain combinations of socio-economic and socio-psychological conditions with epidemiological patterns may cause significant mortality reversals in national populations (Nolte, McKee, and Gilmore 2004). However it is mainly the socio-economic situation and education which enforces healthy behavior, while wealth gives a higher quality of life. Economic affluence permits that the implementation of these factors are influenced by psychosocial stress which may cause excess mortality. All selected countries experienced different patterns of demographic development along with changes in socio-economic conditions for individuals. The main differences are associated with different levels of development in their economy, financials, and social services.

Regarding to the overall mortality levels which measured by the life expectancy at birth showed homogeneity within the macro-regions between the years of 1985 and 2005, respectively. Also, slightly improvements in the selected countries were noted. Among the selected macro-regions in the both time periods the Central Asian region were less developed socio-economic and demographic positions. In 1985, the lowest expectation of life belonged to this region where it is less than 66 years for males and less than 72 years for females. Since their independence, mortality levels in these countries small increase was observed (less than 69

years for men and less than 74 years for women). The highest life expectancy at birth was found in the low mortality populations where more than 71 years for males and more than 78 years for females. By end of the study period (2005) their expectation of life slightly increased by around 5 years for men and 4 years for women. The intermediate level of average life span was noted in the post-socialist European area among the other selected countries. A large gender gap in life expectancy was observed in the three Baltic states and the shortest one was in the Central Asian countries.

Regarding to the highest cause-specific mortality levels among the selected countries in the former Soviet Central Asian republics was found. The influence of changes in the politic, socio-economic and other sphere which is experienced post-communist countries after the collapse of the socialist regime and since their independence. The most frequent diseases among the Central Asian men were cerebrovascular diseases, external causes and diseases of the digestive system. In the beginning of study period (1985) Kazakhstan cerebrovascular diseases was extremely high among the countries of this region. In the end of analyzing period (2005) Kazakhstan and Kyrgyzstan showed a similarity in their mortality pattern and most of the highest death rates were found in these countries. The female mortality conditions showed significantly better result compared with males. In the countries of this region low values of cancer and external causes over time was observed. Significantly, the other diseases of the circulatory system were rose by the end of analysis. In 1985, Kazakhstan was out of the Central Asian country group, but till the end of selected period it showed similarities with Kyrgyzstan females. Moreover, the mortality due to the cerebrovascular diseases among Kazakhstan females was decreased.

During the 1990s a decrease in mortality in Central Europe rose due to several factors, one being a reduction of mortality. It seems that Central Europe has become more heterogeneous in repeating historical inequalities in health conditions. During the transition period, the health situation started to improve more rapidly than in the other post-socialist countries. The import of modern medications and medical technologies was accompanied by a change in dietary habits, reduced smoking, decreased alcohol consumption, and increased physical activity. These all play a role in the decrease of male mortality. High mortality populations of former socialist Europe still have a higher risk of cardiovascular mortality than the "West". The recent favourable development in the "former East" is fragile and can easily be halted by insufficient advances in primary and secondary prevention (Rychtarikova 2004). By looking at the case of Central Europe we can project that in the near future Central Asia will have better results in the mortality level. Between the selected time periods in post-socialist European area improvements was observed, especially in the three Baltic states. In 1985, their cause-specific mortality levels in other diseases of the circulatory system, cancer and external causes of death slightly were improved. The cause-specific mortality condition among males in Central European countries also changed in a positive way. In the case of female cause-specific mortality levels in the countries of Central Europe together with the three Baltic states were reduced. Outsiders of this country group were Slovakia and Poland in 1985. However, in 2005, in the mortality conditions among these two states slightly was improved.

During the analysis, in low mortality populations which are a reference country group in this study mainly the lowest level of the cause-specific mortality values was noted during the

whole analysis. The cause-specific mortality levels form the low mortality populations all other selected causes of death after the twenty years time period mostly were declined. In these countries clear "low mortality" pattern was observed. However, in the values of these country group a few decreases was found. They are in Spain and the USA their death rates by other remaining causes of death were increased. The largest decline was in male's mortality level of other diseases of the circulatory system where SDR by this disease approximately was halved. In general, the cause-specific mortality levels in low mortality populations were notably decreased compared with other selected countries.

## REFERENCE

Ahmedov, M., Azimov, R., Alimova, V., and Rechel, B. (2007). Uzbekistan: Health System Review. *Health System in Transition* vol. 9, no. 3.

Aleshina, N. and Redmond, G. (2003). How High is Infant Mortality Rate in Central and Eastern Europe and the CIS?. Innocenti. Florence: UNICEF Innocenti Research Centre (Working Paper no. 95).

AlphaGalileo (2010). Ways to cut cancer deaths in Europe highlighted by new study [electronic resource]. The world's independent source of research news. http://www.alphagalileo.org/ViewItem.aspx?ItemId=66083&CultureCode=en

Andreev, E., Biryukov, V. and Shaburov, K. (1994). Life expectancy in the former USSR and mortality dynynamics by cause of death: regional aspect. *European Journal of Population* 10(1994): 275–285.

Austad, S. (2006). Why women live longer than men: sex differences in longevity. *Gender Medicine* vol. 3, no. 2: 79–92.

Baizhumanova, A. and Sakamoto, J. (2010). Cancer in Kazakhstan: Present situation on Cancer. *Annals of Cancer Research and Therapy* vol. 18, no. 2, pp. 65–68, 2010.

Becker, C. and Urzhumova, D. (2005). Mortality recovery and stabilization in Kazakhstan, 1995–2001. *Economics and Human Biology* 3: 97–122.

Bobadilla, J., Costello, A., and Mitchell, F. (eds); Committee on Population, National Research Council (1997). *Premature Death in the New Independent States*. Washington, D.C.: National Academy Press.

Bobak, M. and Marmot, M. (1996). East-West mortality divide and its potential explanations: proposed research agenda. *BMJ* 312: 421–425.

Boyle, P. and Ferlay, J. (2005). Cancer incidence and mortality in Europe, 2004. *Annals of Oncology* 16: 481–488.

Brainer, E. (2010). The Demographic Transformation of Post-Socialist Countries. Causes, Consequences, and Questions. United Nations University – WIDER. (Working Paper no. 2010/15).

Brhel, P. (2002). Occupational Respiratory Diseases in the Czech Republic. Industrial Health 2003, 41, 121–123. (World report).

Bryndovava, L., Pavlokova, K., Roubal, T., Rokosova, M. and Gaskins, M. (2009). Czech Republic: Health System Review. *Health System in Transition* vol. 11, no. 1.

Caldwell, J., Findley, S., Caldwell, P., Santow, G., Cosford, W., Braid, J. and Broers-Freeman, D. (eds.), (1990). *What We Know About Health Transition*: *The Cultural, Social and Behavioural Determinants of Health*. Canberra: Australian National University Press (2 vols).

Caldwell, J. and Santow, G. (1991). Preface. *Health Transition Review,* 1, 1±2.

Canudas-Romo, V. (2003). *Decomposition Methods in Demography*. Amsterdam: Rozenberg Publishers.

Caselli, G., Mesle, F. and Vallin, J. (2002). Epidemiologic transition theory exceptions. *Genus* vol. 58, no. 1, pp. 9–52.

Cockerham, W. (1997). The social determinants of the decline of life expectancy in Russia and Eastern Europe: A lifestyle explanation. *Journal of Health and Social Behavior* 38: 117–130.

Cockerham, W., Hinote, B., Abbott, P. and Hearpfed, C. (2004). Health lifestyles in central Asia: the case of Kazakhstan and Kyrgyzstan. *Social Science & Medicine* 59(2004): 1409–1421.

Dobrossy, L. (2002). Cancer mortality in central-eastern Europe: facts behind the figures. Lancet Oncology vol. 3, pp. 374–81.

European Observatory on Health Care Systems (2008). Health System in Transition profile in brief: Kyrgyzstan 2008. *Health System in transition*.

Gigele, I., Rozentale, G. and Skrule, J. (2007). The gender gap in life expectancy. State Agency Public Health Agency, Latvia. (The report has been developed within the framework of the EU Transition Facility Programme 2005 Project "Development of Public Health Monitoring and Reporting System" No LV/2005-IB/SO/01).

Godinho, J., Novotny, T., Tadesse, H. and Vinokur, A. (2004). HIV/AIDS and Tuberculosis in Central Asia. Country profile Kazakhstan. Washington, DC, World Bank. (World Bank Working paper, no. 20).

Golinowka, S. and Sowa, A. (2006). Health and Morbidity in the Accession Countries. Country Report – Poland. (ENEPRI Research Report, no. 29, AHEAD WP2).

Guillot, M. (2007). Mortality in Kyrgyzstan since 1958: Real patterns and data artifacts. *Espace, Population, Societies* 2007–1, pp. 113–126.

Guillot, M., Gavrilova, N., Torgashova, L. and Denisenko, M. (2011). *Mortality in Central Asia before and after the break-up of the Soviet Union: Evidence from Kyrgyzstan*. Paper prepared for the 12th International Academic Conference on Economic and Social Development, National Research University "Higher School of Economics", Moscow, April 5–7, 2011.

Guo, G. (1993). Mortality trends and causes of death: A comparison between Eastern and Western Europe, 1960s–1980s. *European Journal of Population* 9(1993): 287–312.

Health Statistics Department (2006). Statistical overview on health and health care in Latvia, 2006.

Hemstrom, O. (1999). Does the work environment contribute to excess male mortality?. *Social Science and Medicine* 49 (1999), 879±894.

Hlavacka, S., Wagner, R., and Riesberg, A. (2004). Health care systems in transition: Slovakia. Copenhagen, WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies. *Health System in Transition* vol. 6, no. 10.

Hoffmann, R. (2008). *Socio-economic Differences in Old Age Mortality*. The Springer series on demographic methods and population analysis. Dordrecht: Springer.

Ilkhamov, F. and Jakubowski, E. (2001). Health care system in Transition – Uzbekistan. *European Observatory on Health Care Systems* vol. 3, no. 6.

Kabar (2010). Breast Cancer Awareness Events to be held in Kyrgyzstan, 2010. [electronic resource]. http://eng.kabar.kg/index.php?option=com_content&task=category&id=9&sectionid=1&cid=1275&Itemid=61

Kahn, K. (2006). Dying to make a fresh start: Mortality and health transition in a new South Africa. Umea University Medical Dissertation, New series, no. 1056, ISSN 0346–6612 ISBN 91–7264-173-8.

Khodjamurodov, G. and Rechel, B. (2010). Tajikistan: Health System Review. *Health System in Transition* vol. 12, no. 2.

Klugman, J., Schieber, G. and Heleniak, T. (1996). A survey of health reform in Central Asia. Washington, D.C.: The World Bank. (World Bank technical paper no. 334).

Koppel, A., Kahur, K., Habicht, T., Habicht, J., Saar, P. and van Ginneken, E. (2008). Health System Review – Estonia. *Health System in Transition* vol. 10, no. 1.

Krumins, J. (2001). *The mortality consequences of the onset of transition: case of Latvia*. Prepared for the 14th IUSSP General Population Conference, Salvador, Brazil, 18-24 August 2001.

Kulzhanov, M. and Rechel, B. (2007). Kazakhstan: Health System Review. *Health System in Transition* vol. 9, no. 7.

Kuszewski, K. and Gericke, C. (2005). Poland: Health System Review. *Health System in Transition* vol. 7, no. 5.

Leon, D., Chenet, L., Shkolnikov, V., Zakharov, S., Shapiro, J., Rakhmanova, G., Vassin, S., and McKee, M. (1997). Huge variation in Russian mortality rates 1984-94: artifact, alcohol, or what?. *Lancet* vol. 350, pp. 382–388.

Leung, M., Zhang, Jie and Zhang, Junsen (2004). An economic analysis of life expectancy by gender with application to the United States. *Journal of Health Economics* 23 (2004): 737–759.

Mackenbach, J. (1994). The epidemiologic transition theory. *Journal of Epidemiology and Community Health* 48: 329± 332.

Makinen, I.H. (2000). Eastern European transition and suicide mortality. *Social Science & Medicine* 51(2000): 1405±1420.

McKee, M., Sanderson, C., Chenet, L., Vassin, S., and Shkolnikov, V. (1998). Seasonal variation in mortality in Moskow. *Journal of Public Health Medicine* vol. 20, no. 3, pp. 268–274.

McKee, M., Healy, J., and Falkingham, J. (2002). *Health care in Central Asia*. European Observatory on Health Care Systems series. Buckingham: Open University Press, Philadelphia.

Mesle, F., Shkolnikov, V., and Vallin, J. (1992). Mortality by cause in the USSR in 1970–1987: the reconstruction of time series. *European Journal of Population* 8 (1992), pp. 281–308.

Mesle, F., Vallin, J., Hertrich, V., Andreev, E., and Shkolnikov, V. (1992). Causes of death in Russia: assessing trends since the 50s. In *Population of Central and Eastern Europe. Challenges and opportunities*, (eds) by Kotowska, I. and Jozwiak, J. (Statistical Publishing Establishment, Warsaw, 2003), pp. 389–414.

Mesle, F. and Vallin, J. (1996). Reconstructing long-term series of causes of death. *Historical methods* vol. 29, no. 2, pp. 72–87.

Mesle, F. (2002). Mortality in Eastern Europe and the former Soviet Union: long term trends and recent upturns. Rostock: Max Planck Institute for Demographic Research (Paper presented at the IUSSP-MPIDR seminar on "Determinants of diverging trends in mortality", Rostock, 19–21 June 2002).

Mesle, F. (2006). Causes of death among the oldest-old: validity and comparability, in Jean-Marie Robine et.al. (ed.). Human Longevity, Individual Life Duration, and the Growth of the Oldest-Old Population, pp. 191–214. *Springer* (International Studies in Population, vol 4).

Millennium Development Goals' Report for Kazakhstan (2007). UN Country Team and the Government of Republic of Kazakhstan. (http://www.undp.kz/userfiles/File/mdgr2007_eng.pdf).

Ministry of Health (2004). National Programme of Health Reform and Development for 2005–2010, approved by presidential decree on 13 September 2004. Astana, Ministry of Health.

Monostrori, J., Ori, P., Molnar, E. and Speder, Z. (2010). *Demographic portrait of Hungary 2009*. Budapest: Demographic Research Institute, HCSO.

Nadar, S. and GYN, Lip (2002). Commentary: Secular trends in cardiovascular disease. *Journal of Human Hypertension* (2002) 16, pp. 663–666.

Newman, A. and Brach, J. (2001). Gender gap in longevity and disability in older persons. *Epidemiologic Reviews* vol. 23, no. 2, pp. 343±350.

Niederlaender, E. (2006). Causes of death in the EU. *Population and social conditions* 10, 2006.

Nolte, E., McKee, M. and Gilmore, A. (2004). Morbidity and mortality in transition countries in the European context. (Background paper for the thematic session "Morbidity, mortality and reproductive health: Facing challenges in transition countries: the former Soviet Union" at the European Population Forum 2004).

Oksuzyan, A., Juel, K., Vaupel, J., and Christensen, K. (2008). Men: good health and high mortality. Sex differences in health and aging. *Aging Clinical and Experimental Research* 2008 Apr, 20(2): 91–102.

Oksuzyan, A., Brønnum-Hansen, H. and Jeune, B. (2010). Gender gap in health expectancy. Springer-Verlag. *European Journal of Ageing* 7 (2010): 213–21.

Olshansky, J. and Ault, B. (1986). The fourth stage of the epidemiologic transition: The age of delayed degenerative diseases, *The Milbank Quarterly* vol. 64, no. 3, p. 355–391.

Olshansky, J., Carnes, B., Rogers, R. and Smith, L. (1998). Emerging infectious diseases: the Fifth stage of the epidemiologic transition?. *World Health Statistics Quarterly/Rapport trimestriel de statistiques sanitaires* vol. 51, no. 2–3–4, pp. 207–217.

Omran, Abdel R. (1971). The epidemiologic transition: A theory of the epidemiology of population change. *Milbank Memorial Fund Quarterly* vol. 49, no.4, pp. 509–538.

Omran, Abdel. (1982). Epidemiologic transition. *International Encyclopedia of Population* vol. 1, ed. J.A. Ross. London, p. 172–183.

Pechholdova, M. (2010). Four decades of cause-specific mortality in the Czech Republic, West Germany and France. [PhD thesis]. Prague: Charles University in Prague, Department of Demography and Geodemography, Demographic Program.

Phillips, D.R. (1994). Does epidemiological transition have utility for health planners?. *Social Science and Medicine* 38, vii±x.

Phillips, D. R. and Verhasselt, Y. (eds.) (1994). *Health and Development*. London: Routledge.

Post-soviet (2011). Pochemu kazahi vybirayut smert'? [Why Kazakhs choose death?]. Central Asia [electronic recourse]. http://www.postsovet.ru/blog/asia/65897.html

Rechel, B., Sikorskaya, I. and McKee, M. (2009). Health in Turkmenistan after Niyazov. *European Centre on Health of Societies in Transition*. London School of Hygiene and Tropical Medicine.

Remak, E., Robert, I., and Nemeth, R. (2006). Health and Morbidity in the Accession Countries Country Report – Hungary. (ENEPRI Research Report No. 28/November, 2006).

Rogers, R. and Hackenberg, R. (1987). Extending epidemiologic transition theory. *Social Biology* vol. 34, p. 234–243.

Rowe, L. and Rechel, B. (2006). "Fighting tuberculosis and HIV/AIDS in Northeast Europe: sustainable collaboration or political rhetoric?" *European Journal of Public Health* 16(6): 609–14.

Rychtarikova, J. (2004). The Case of the Czech Republic. Determinants of the recent favourable turnover in mortality. *Demographic Research* Special Collection 2, Article 5, 2004, p. 105–138.

Sans, S., Kesteloot, H. and Kromhout D. (1997). The burden of cardiovascular diseases mortality in Europe. *European Heart Journal* 18(1997): 1231–1248.

SAS/STAT 9.2 User's Guide (2008). SAS Institute Inc. 2008. SAS/STAT® 9.2 User's Guide. Gary, NC: SAS Institute Inc.

Shkolnikov, V., Mesle, F. and Vallin, J. (1995). Health crisis in Russia: I. Recent trends in life expectancy and causes of death from 1970 to 1993. *Population* 4±5, 907±944.

Shkolnikov, V. M., Valkonen, T., Begun, A. and Andreev, E. M. (2001). Measuring inter-group inequalities in length of life. *Genus* LVII: 33–62. (http://www.demogr.mpg.de/cgi-bin/publications/paper.plx?pubid=926)

Smallman-Raynor, M. and Phillips, D. (1999). Late stages of epidemiological transition: health status in the developed world. *Health and Place*, vol. 5, p. 209–222.

Stankuniene, V., Jasilionis, D. and Krumins, J. (1999). Social differences in mortality, morbidity, and health-related behaviour during transition: research findings in the three Baltic countries. *Revue Baltique*, 14, 9–36.

Thomas, T. and Ruth, C. (1999). Why Women Live Longer than Men. Harvard Medical School

UNAIDS (2006). Kazakhstan: epidemiological fact sheets. Geneva, World Health Organization/Joint United Nations Programme on HIV/AIDS (December 2006 update).

U.S. Department of Health and Human Services, Health Resources and Services Administration (2009). Women's Health in USA, 2009.

Vallin, J. and Mesle, F. (2004). Convergences and divergences in mortality. A new approach to health transition. *Demographic Research* Special Collection 2, Article 2, 2004, p. 11–44.

Weisz, G. and Olszynko-Gryn, J. (2009). The Theory of Epidemiologic Transition: the Origins of a Citation Classic. *Journal of the History of Medicine and Allied Sciences* vol. 65, issue 3, p. 287–326.

World Bank (1985) World Bank Databank online. [electronic resource]. http://databank.worldbank.org/ddp/home.do?Step=1&id=4

World Bank (2005). World Bank Databank online [electronic resource]. http://databank.worldbank.org/ddp/home.do?Step=1&id=4

World Bank (2006). World Bank Databank online [electronic resource]. http://databank.worldbank.org/ddp/home.do?Step=1&id=4

WHO ENHIS. Environment and Health Information System. Health effects of the environment, Cardiovascular diseases. [electronic resource]. http://www.euro.who.int/en/what-we-do/data-and-evidence/environment-and-health-information-system-enhis/health-effects-of-the-environment/cardiovascular-diseases.

WHO online database. World Health Organization [online database]. www.who.int.

WHO Regional Office for Europe (2007). European Health for All database (HFA-DB) [online database]. Copenhagen, WHO Regional Office for Europe.

WHO Regional Office for Europe (2009). European Health for All database (HFA-DB) [online database]. Copenhagen, WHO Regional Office for Europe [January update] (www.who.int).

# APPENDIX:

## Methodological annex

## Methodological annex

For the cluster analysis of this research was used SAS 9.2 software. In SAS 9.2 software we used SAS/STAT which provides comprehensive statistical tools for a wide range of statistical analyses, including cluster analysis, analysis of variance and so on. In SAS/STAT used three procedures. There are DISTANCE, CLUSTER and TREE procedures.

The DISTANCE procedure computes various measures of distance, dissimilarity, or similarity between the observations (rows) of a SAS data set. These proximity measures are stored as a lower triangular matrix or a square matrix in an output data set (depending on the SHAPE= option) that can then be used as input to the CLUSTER, MDS, and MODECLUS procedures. The input data set might contain numeric or character variables, or both, depending on which proximity measure is used. For further use in PROC CLUSTER, distance or dissimilarity measures such as METHOD=EUCLID or METHOD=DGOWER should be chosen. In our case we used METHOD=EUCLID.

```
title '1985';

proc distance data=Data85 out=Dist method=Euclid;
where sex="male";
var interval(Total -- Others / std=Std) ;
id Countries;
run;
```

An output SAS data set called `Dist` that contains the distance matrix is created through the OUT = `Dist`. METHOD=EUCLID requests that Euclidean (which also is the default) distances should be computed. With help of the statement WHERE we can easily choose gender `sex="male"`. The VAR statement lists the variables `(Total -- Others)` along with their measurement level to be used in the analysis. An interval level of measurement is assigned to those variables. Since variables with large variances tend to have more effect on the proximity measure than those with small variances, each variable is standardized by the STD method (all variables Z scored) to have a mean of 0 and a standard deviation of 1. This is done by adding "`/ std=Std`" at the end of the variables list. The ID statement specifies that the

variable Countries should be copied to the OUT= data set and used to generate names for the distance variables. The distance variables in the output data set are named by the values in the ID variable.

For print result of the procedure DISTANCE can be used procedure PRINT.

```
title2 'males';
proc print data=Dist;
run;
```

The output window of SAS 9.2 software illustrates in Annex 1.

***Annex 1 – The output window of SAS 9.2 software from procedure PRINT***

1985 13:35 Monday, August 29, 2011
males

| Obs | Countries | Kazakhstan | Kyrgyzstan | Tajikistan | Turkmenistan | Uzbekistan | Czech_ Republic |
|---|---|---|---|---|---|---|---|
| 1 | Kazakhstan | 0.00000 | . | . | . | . | . |
| 2 | Kyrgyzstan | 4.02391 | 0.00000 | . | . | . | . |
| 3 | Tajikistan | 5.25763 | 3.11391 | 0.00000 | . | . | . |
| 4 | Turkmenistan | 3.92559 | 2.08260 | 2.80361 | 0.00000 | . | . |
| 5 | Uzbekistan | 4.73481 | 2.41636 | 1.51448 | 1.90846 | 0.00000 | . |
| 6 | Czech Republic | 4.14798 | 4.25050 | 4.65254 | 3.39657 | 3.77048 | 0.00000 |
| 7 | Slovakia | 4.52333 | 2.89759 | 3.55320 | 2.38414 | 2.62595 | 2.05028 |
| 8 | Hungary | 4.59185 | 4.59074 | 5.63731 | 3.97213 | 4.64989 | 2.73690 |
| 9 | Poland | 5.67012 | 5.04896 | 4.10527 | 3.41140 | 3.80919 | 3.84684 |
| 10 | Estonia | 4.65504 | 4.85426 | 5.42127 | 4.15050 | 4.26713 | 2.49889 |
| 11 | Latvia | 4.35633 | 4.60334 | 5.12103 | 4.03593 | 4.01921 | 2.66412 |
| 12 | Lithuania | 4.90385 | 4.32432 | 4.59652 | 4.07775 | 3.72130 | 3.16281 |
| 13 | France | 5.18891 | 4.96426 | 3.36986 | 4.22008 | 3.77272 | 3.81309 |
| 14 | Spain | 5.52644 | 4.33577 | 2.61232 | 4.09297 | 2.94896 | 3.91349 |
| 15 | USA | 5.76266 | 4.58413 | 2.98298 | 4.19576 | 2.99209 | 3.47885 |

| Obs | Slovakia | Hungary | Poland | Estonia | Latvia | Lithuania | France | Spain | USA |
|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | . |
| 2 | . | . | . | . | . | . | . | . | . |
| 3 | . | . | . | . | . | . | . | . | . |
| 4 | . | . | . | . | . | . | . | . | . |
| 5 | . | . | . | . | . | . | . | . | . |
| 6 | . | . | . | . | . | . | . | . | . |
| 7 | 0.00000 | . | . | . | . | . | . | . | . |
| 8 | 2.56321 | 0.00000 | . | . | . | . | . | . | . |
| 9 | 3.74458 | 4.81662 | 0.00000 | . | . | . | . | . | . |
| 10 | 3.34872 | 3.44397 | 4.13530 | 0.00000 | . | . | . | . | . |
| 11 | 3.47195 | 3.90443 | 4.20425 | 0.76692 | 0.00000 | . | . | . | . |
| 12 | 3.30751 | 4.26469 | 3.95418 | 1.89219 | 1.58667 | 0.00000 | . | . | . |
| 13 | 3.55952 | 4.66561 | 3.75856 | 5.09913 | 5.03417 | 4.58208 | 0.00000 | . | . |
| 14 | 3.31674 | 5.07385 | 4.85113 | 5.26892 | 5.09343 | 4.69027 | 2.31025 | 0.00000 | . |
| 15 | 3.27982 | 5.19462 | 4.09065 | 4.28211 | 4.04764 | 3.40472 | 2.74226 | 1.93209 | 0 |

Source: SAS 9.2 software

The next procedure what was used in analysis is a procedure CLUSTER. The CLUSTER procedure hierarchically clusters the observations in a SAS data set by using one of 11 methods. Cluster analysis divides data into groups (clusters) that are meaningful, useful, or both. Cluster analysis groups data objects based only on information found in the data that describes the objects and their relationship. The goal is that the objects within a group be similar (or related) to one another and different from (or unrelated to) the objects in other groups. The greater is the similarity (or homogeneity) within a group and the greater the difference between groups, the better or more distinct the clustering. In PROC CLUSTER we used a METHOD=WARD.

```
ods graphics on;
proc cluster data=Dist method=Ward outtree=Tree noprint;
id Countries;
run;
```

The ods graphics on statement asks procedures to produce ODS graphics where possible. Ward's minimum-variance clustering method is specified by the `method=Ward`. The OUTTREE= option creates an output SAS data set called `Tree` that can be used by the TREE procedure to draw a tree diagram.

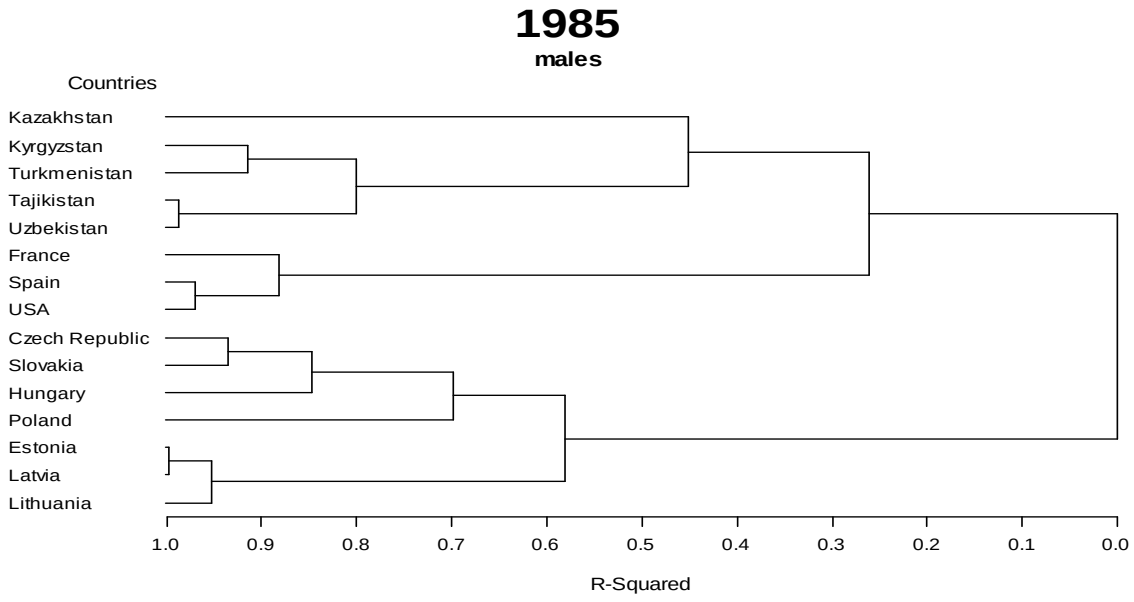
While this process may be interesting, it is hard to follow on the printout. For this reason, cluster analyses are usually reported based on plots of the clustering history, referred to as tree diagrams or dendograms. In SAS, there is a procedure to create such plots called PROC TREE. This procedure uses the output dataset from PROC CLUSTER. The code is simply:

```
axis1 order=(0 to 1 by 0.1);
proc tree data=Tree haxis=axis1 horizontal;
height _rsq_;
id Countries;
run;
```

PROC TREE has options and statements available to "dress up" the plot by altering its shape and labeling. The details relating to these options will be left to the reader. The HEIGHT statement specifies the variable _RSQ_ (the squared multiple correlation) as the height variable.

Annex 2 shows the final result of the cluster analysis. It is a dendogram figure which is a output window of procedure TREE.

***Annex 2 – The output window of SAS 9.2 software from procedure TREE***




Source: SAS 9.2 software