CONTENT

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CIS	Commonwealth of Independent States
EU	European Union
EU15	EU-15 Member States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom
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
PPP	Purchasing Power Parity
TransMONEE	Monitoring situation of the women and children in Central and Eastern Europe and the Commonwealth of Independent States
UNAIDS	United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USSR	Union of Soviet Socialist Republics
WHO	World Health Organization

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

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 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. In countries such as the Baltic States, life expectancy at birth has once again been increasing since the mid of 90s. This almost succeeded in reversing the rapid decline associated with the breakup of the Soviet Union. However, rates of maternal and infant death are still unacceptably high and the use of preventive health services is low. There is little awareness and attention given to other issues, such as the prevention of HIV/AIDS.

In the research analyzed mortality changes among post-communist countries contrasted with the USA, France and Spain in the period between 1990 and 2006. This included former Soviet Union countries from Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan), Central Europe (the Czech Republic, Slovakia, Poland and Hungary), the Baltic states (Estonia, Latvia and Lithuania), and western more developed countries such as the USA, France and Spain which are represented by a “low mortality” population. These countries are categorized into four main groups in order to describe and highlight the main age-specific indicators of mortality levels developed among them.

This collapse of economic output has had negative effects on population health indicators throughout Central Asia, such as lowered life expectancy and rising adult and infant death rates. Although 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).

The situation in Central Europe was much better. The improved overall mortality level from the 1990s can be seen in the results of analysis during 2006. 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 communist 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 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.

A country's economic situation is one of the major factors which can influence the decline in mortality levels and assist in population longevity. The socio-economic situation and educational system 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. Also, factors such as living standards, efficiency of health services, sanitary conditions, the culture of the society and ecological environment can also be influential.

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 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 mortality crisis in the former Soviet Union primarily affected middle-aged men; the groups traditionally most vulnerable to the health effects of economic crisis – children and the elderly – avoided large increases in mortality during transition. In fact, infant and child mortality declined in almost all countries across the region during the 1990s.

The pre-transition rates of circulatory diseases were also significantly higher in Central Europe than in Western Europe. In the post-socialist European countries, deaths due to circulatory diseases for men in this age group declined substantially between 1989 and 2007. In the Czech Republic, for example, deaths due to cardiovascular disease fell from 354 to 170 deaths per 100 000 population between 1989 and 2007 for men aged 25 to 64 (Brainerd 2009). While nearly all developed countries have recorded significant declines in circulatory disease mortality in recent decades, the speed and magnitude of the decline in post-socialist Europe may be unprecedented. Deaths due to external causes were always much lower in post-socialist Europe than in the former Soviet Union (although about twice as high as in Western Europe), and these causes of death have changed relatively little during the transition period.

This research examined the recent demographic and socio-economic situation in the selected countries based on the Human Development Report. Also analyzed were mortality trends and patterns, changes in life expectancy at birth, and excess male mortality among the selected countries during the selected time period.

The aim of this research is to analyze mortality patterns and trends in selected post-communist countries and contrast with low mortality populations such as those of the Unites States, France and Spain between the period of 1990 and 2006. To succeed in the aim of research the following objectives are proposed:

to describe mortality development from the past;
to show recent demographic and socio-economic situations in the selected countries;
to analyze differences in total mortality measured by life expectancy at birth;
to focus on differences in the main age-specific indicators of mortality level;
to analyze excess male mortality.

In order to find results the hypotheses outlined below will be tested:

1. Improvements in socio-economic conditions are the impact of declining mortality trends in the selected countries.
2. Mortality changes over the time occurring in the societies of developed western countries are compared to post-socialist countries in socio-economic conditions and health care system will bring the convergence in mortality trends. These factors will contribute to longer and healthy lives.
3. Changes in lifestyle (healthy diet, reduced smoking and alcohol consumption and so on) will result in lowering mortality levels.
4. Despite of break up of the Soviet Union the Central Asian countries experience a “Russian pattern” of high excess male mortality which will be likely maintained in the future. While the other post-socialist countries remained in the position of the “intermediate group”.

1. Theoretical part

1.1 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 Meslé (2004) "Convergences and divergences in mortality: a new approach of health transition".

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 of Barford and others "Life expectancy: women now on top everywhere" (Barford et al. 2006) and 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) and more detailed facts were described in Thomas and Ruth article "Why women live longer than men" (Thomas and Ruth 1999).

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" (McKee, Healy and Falkingham 2002) 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. Moreover, the health situation in this region was dedicated to other pieces of work such as the Central Asia Health Review "Maternal mortality in Central Asia" (Central Asia Health Review 2008).

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" (Cockerham et al. 2004) 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. The paper by Shkolnikov et al. "Causes of the Russian mortality crisis" looks at circumstances of premature deaths of working-age men in Russia in the 1990s. 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.

The next 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 Meslé "Mortality in Eastern Europe and the former Soviet Union: long-term trends and recent upturns" (Mesle 2002) 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. Also the health crisis in the Soviet Union before and after the break up can be found in paper of Shkolnikov and Lean Commentary: N Eberstadt's "The health crisis in the USSR and sustainable mortality reversal in the post-soviet space during communism and after" (Shkolnikov and Lean 2006) and Skinnider "Dispatches from abroad: fighting maternal mortality in a former Soviet republic" (Skinnider 2000).

The formerly socialist countries of Europe and the former Soviet Union have experienced a remarkable demographic transformation in the past twenty years. One of the other facets of the demographic transformation is the unprecedented change in adult mortality rates. An upsurge of cardiovascular and external causes of mortality engendered a massive premature loss of life among working age men in the former Soviet Union in the 1990s. In contrast, cardiovascular mortality has fallen at a rapid rate across post-socialist Europe since 1989. in Brainerd's erudite article "The demographic transformation of post-socialist countries: causes, consequences, and questions (Brainerd 2009) discusses the dimensions and most likely causes of these demographic changes, and assesses the possible consequences of the changing mortality patterns.

Concerning the mortality patterns in post-socialist Central European countries a considerable amount of work has been conducted. The findings of Rychtaříková "The case of the Czech Republic. Determinants of the recent favourable turnover in mortality" (Rychtaříková 2004) 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.

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. Gaumé and Wunsch in their work "Health and death in the Baltic States" (Gaumé and Wunsch 2003) 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. 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.

Infant mortality rates in the former Soviet Union are presented in Aleshina and Redmond's article "How high is infant mortality rate in Central and Eastern Europe and the CIS?" (Aleshina and Redmond 2003). This paper examines the measurement of infant mortality in the countries of Central and Eastern Europe and the Commonwealth of Independent States. There are worrying indications that official infant mortality counts based on administrative data, may understate the true gravity of the problem. Similar work about this topic was presented by Kingkade and Sawyer's "Infant mortality in Eastern Europe and the former Soviet Union before and after the breakup" (Kingkade and Sawyer 2001).

According to the different definitions of live births and stillbirths a good explanation can be found in the paper of Anderson and Silver's "Infant mortality in the Soviet Union: regional differences and measurement issues" (Anderson and Silver 1986). Authors explained differences between Soviet and World Health Organizations definition of life births and stillbirths. The Soviet Union's definitions of live birth and infant death make reported Soviet infant mortality rates highly variable when minor improvements in registration procedures are made. Efforts to increase the completeness of registration could have induced higher reported infant mortality rates beginning around 1970. The official Soviet definition of infant mortality differs from World Health Organization recommendations. Because of this difference, even if registration of infant deaths were complete, the reported Soviet infant mortality rates should be adjusted upward by some 22-25 percent to make them consistent with the WHO definition.

One of the major pieces of information on mortality patterns and trends about each country with statistical data was presented by the European Observatory on Health Systems and Policies together with the World Health Organization. They published a country report for each of them, which covers more than just demographic information.

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.

1.2 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); Caldwell (1982); 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 XIX century. Although the first signs of it appeared in the XVIII 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 1000 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 1000 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*. 1997). 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 1000 population. 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 (Olshasky *et al*. 1997; 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*. (1997) 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*. 1997) 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 author, is sometimes determined not only by its pure research interests, but also some external ones like the science of motivation, even to political engagement (www.demoskop.ru)

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 (Rychtaříková 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 and Santow 1989, Caldwell *et al.* 1990). 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 (www.who.int) 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 (Barford *et al*. 2006). 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 (WHO).

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 in 1998, 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-21st 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 (Omran 1998).

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.

1.3 Methodology and data

1.3.1 Data sources and availability

In preparing the diploma thesis, demographic data was taken from different sources. Data on mortality (from calculated life tables) for Central Europe, Baltic States and low mortality populations was sourced from published data of the Human Mortality Database (HMD). HMD provide detailed mortality data by calendar year, age and sex. All data is available from 1950 to 2008.

Data for Soviet Central Asian countries was taken from World Health Organization (WHO). All mortality indicators were calculated by year, age and sex. Unfortunately, the calculated life tables were for 1990, 2000 and 2006, which limited the period of analysis for this study.

The selected socio-economic characteristics are used data from the World Bank Database. Data for one chapter was about the socio-economic background of the selected countries based on Human Development Report 2009. The Human Development Report is an independent publication commissioned by the United Nations Development Programme (UNDP). Its editorial autonomy is guaranteed by a special resolution of the General Assembly (A/RES/57/264), which recognizes the Human Development Report as “an independent intellectual exercise” and is “an important tool for raising awareness about human development around the world".

Demographic data on age-specific mortality indicators among selected countries was collected according to the following characteristics: period: 1990 and 2006; population aged 0-90; for males, females and both sexes.

1.3.2 Quality of data

The problem of quality in infant mortality data among former Soviet Union statistics centred upon the differences in definitions of live birth, still birth and abortion. For example, infants under 28 centimeters in length and weighing less than 1000 grams who died within the first week of life were excluded from both the numbers of live births and infant deaths according to the long-standing conventions of Soviet vital statistics (Kingkade and Sawyer 2001). In contrast, the standard international definitions of the World Health Organization which considers live births as those which exhibit some sign of life upon delivery. These 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 Commonwealth of Independent States (Aleshina and Redmond 2003).

The data collection of this study 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 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 1000 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.

Table 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 1000 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)

1.3.3 Methods

For studying mortality patterns among the selected countries, mortality (life) tables published by the Human Mortality Database and World Health Organization were used. 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. From this starting point, a number of statistics (biometric functions) can be derived and thus also included in the table:

- The probability of dying between exact ages *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 mortality rates.

The Infant Mortality Rate is defined as the number of infant deaths (one year of age or younger) per 1000 live births. The infant mortality rate is also called the infant death rate (Demographic dictionary).

The rate in a given region, therefore, is the total number of newborns dying under one year of age divided by the total number of live births during the year multiplied by 1 000.

$$IMR = {}_tD_0 / B * 1000$$

where ${}_tD_0$ is the total number of deaths under one year of age and B is the total number of live births in this year.

The 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 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.

$$e_0 = T_0 / l_0$$

where e_0 is the life expectancy at age 0. l_0 is the number of survivors and the hypothetical number of individuals who stay alive at the exact age of 0 out of 100 000 live births, given the mortality conditions of the reference period. 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 Probability of dying between the exact ages of *x* and *x+n* per year among a hypothetical cohort of 100 000 people who would experience the age-specific mortality rate of the reporting year (WHO). Taking into account the fact that for age-specific mortality analysis, published mortality (life) tables were used. The probability of dying between the exact ages of *x* and *x+n* were calculated as follows:

$${}_nq_x = 1 - l_{x+n} / l_x$$

where ${}_nq_x$ is the probability of dying between the exact ages of x and $x+n$ and l_{x+n} and the l_x number of people alive at the exact age of x and $x+n$ among a hypothetical birth cohort of 100 000.

Ratio of selected age-specific mortality indicators in individual countries were compared to similar mortality indicators of the reference country. The country with the longest life expectancy at birth in a given year was calculated in a given year by sex. And for the calculation this formula was used:

$$Ratio = {}_{(n)}q_x / {}_{(n)}q_x^{\text{ref}}$$

where ${}_{(n)}q_x$ is the probability of dying between the exact ages of x and $x+n$ in a country and ${}_{(n)}q_x^{\text{ref}}$ is the probability of dying between the exact ages of x and $x+n$ in the reference country.

For the next step regarding mortality analysis, a multivariate statistical approach was used.

A cluster analysis is a collection of statistical methods, which identifies groups of samples that behave similarly or show similar characteristics (Statistical glossary). 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 our example, can be standardized in order to provide a way of comparing them that includes consideration of their respective distributions. This is done by transforming the values into Z-scores. It is done 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, we start with an original variable (called x) obtained from a sample (or a population) with a mean of m and a standard deviation of s . 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:

$$Z = (x - m) / s$$

where x is an original variable , m is the mean and s is the standard deviation.

It means that subtracting the mean centers the distribution and dividing 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 Euclidian 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 are 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 (SS) 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. (Statistical glossary).

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 Methodological annex.

To construct figures Microsoft Excel was used

2. Historical overview and population longevity

2.1 Historical overview of mortality development in the selected countries

The Czech Republic

The Czech Republic is a landlocked country situated in central Europe. It covers an area of approximately 78 867 sq. km and has a population of 10.33 million in mid-2007. There were 5.07 million men and 5.26 million women and the population density was 133.8 people per sq. km. The number of inhabitants decreased between 1994 and 2002, but has risen markedly since 2004. Economically, the country performed well after the Velvet Revolution in 1989 and has one of the most developed industrialized economics among the new European Union (EU) Member States.

Life expectancy at birth in the Czech Republic is increasing, having reached 73.5 years for men and 80.0 years for women in 2006. This was well above the average for new EU Member States (70.4 years for men and 78.5 years for women). Since 1990 this increase has been more rapid than that observed in the EU27 countries as a whole (WHO Regional Office for Europe 2009).

At 3.33 deaths per 1000 live births in 2007, the rate of infant mortality in the Czech Republic was among the lowest in the world. Indeed, infant mortality in the Czech Republic has remained consistently below the EU15 average since 1999. Moreover, the probability of dying before the age of 5 years in the Czech Republic has remained slightly lower than the EU15 average since 1999 (WHO Regional Office for Europe 2009).

During this time, diseases of the circulatory system were the most frequent cause of death, followed by malignant neoplasm, external causes and respiratory disease (Bryndovava *et al*. 2009).

As in other developed countries, circulatory system disease was the most frequent cause of death in the Czech Republic in 2006. The standardized death rate from this cause (all ages) has decreased almost continually since 1990 and more rapidly than in the EU27. Nevertheless, at 386.3 deaths per 100 000 in 2006, it remained well above the EU27 average of 251.9 (WHO Regional Office for Europe 2009).

Malignant neoplasm was the second most common cause of death in the Czech Republic 2007. Since the 1970s the standardized rate of mortality due to malignant neoplasm has been markedly higher compared not only to the EU and Scandinavian countries, but also to other central European countries (WHO Regional Office for Europe 2009). Starting in 1990, however, neoplasm-related mortality decreased rapidly, dropping from 258.6 deaths to 212.6 deaths (all ages, per 100 000) in 2006. The latter number is only slightly higher than the average for the new EU Member States (200.6), but is still far higher than in the EU27 as a whole (175.6) (WHO Regional Office for Europe 2009).

Although the standardized rate of mortality attributed to external causes (injury or poisoning) has fallen markedly since at least 1970, these as a group have remained the third largest causes of death in the Czech Republic (2006). The downward trend for this indicator is roughly in line with that observed in the EU27 as a whole (WHO Regional Office for Europe 2009).

Respiratory system disease was the fourth most common cause of death in the Czech Republic in 2006. 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) and the average for the EU15 (46.0) (WHO Regional Office for Europe 2009).

Estonia

Estonia is the smallest of the Baltic states, the three republics that lie on the east coast of the Baltic Sea. The country is situated on the eastern border of the European Union (EU). It covers an area of approximately 45 277 sq. km and has population of 1 340 602 people when, about one third of whom live in rural areas. Since 1990, the population has decreased by 200 000, as a result of migration to the east and west, as well as natural negative growth. Trends in health status have not been as positive as economic trends (Koppel *et al*. 2008). However, they mirror trends in the other Baltic countries. At the end of the 1930s, life expectancy at birth in Estonia matched that of the Scandinavian countries, but World War II and the Soviet occupation led to a decrease followed by stagnation in life expectancy at birth. By 1950, male life expectancy at birth was still lower than it had been in the in the late 1930s. In the 1960s, and early 1970s there was no difference between life expectancy at birth of Estonian and Finnish men and women. But in 1977 a 3-years difference existed (World Bank 2008). Prior to the economic transition, life expectancy at birth was at its highest in 1988 (70.7 years), after which it fell to a low of 67.0 years in 1994. The pre-reform peak of 1988 was not overtaken until 2000. Life expectancy at birth then stabilized until 2002, after which it started to increase steadily, reaching 72.5 years in 2005. In 2005, life expectancy for Estonian women was two years less than that for Danish women, compared to eight years for men. Overall, between 1960 and 2006, men gained 2.6 and women 5.9 years on their life expectancy at birth (World Bank 2008).

Infant mortality has fallen steadily in recent years. World Bank figures show a decline from 12.4 in 1990 to 6.0 in 2005. The infant mortality rate is at 6.0 and it is higher than the EU15 average, but lower than the average of the New Member States which joined the EU in May 2004 (EU15). Decreasing steadily, as in other transition countries, the birth rate fell dramatically: 8.8 per 1000 population in 1998. Since 1998 it has increased, reaching 10.7 per 1000 population in 2005, but demographers do not expect it to reach population replacement levels. The frequency of abortions – a common method of birth control in all former Soviet republics – has declined from almost 1600 abortions per 1000 life births in 1980 to fewer than 600 per 1000 live births in 2006, but it is still almost three times higher than the EU15 average (WHO Regional Office for Europe 2007). Estonia has the second highest abortion rate after Romania and in terms of women younger than 20, Estonia ranks fourth after Sweden, Finland and Slovenia (WHO Regional Office for Europe 2007).

Cardiovascular (circulatory) diseases are the main cause of death in Estonia, accounting for 47.1% of deaths among men and 54.9% among women (2005). Although there is a downward trend in the cardiovascular mortality rate for both men and women, it still is a significant cause of premature death. In 2005 it was at a level more than double that of the EU15 and Scandinavian averages. The next most significant cause of death is cancer (malignant neoplasm) at 20.9% for men and 19.9% for women. A worrying indication is that the death rate from cancer is increasing among men, while in the EU are whole these rates are decreasing. Although declining over recent years, death due to external causes (13.9% for men, 6.7% for women) constitutes the third most significant cause of death (Koppel *et al*. 2008).

At the time of writing, fighting HIV/AIDS is the most serious health problem and the major public health and health system challenge in Estonia, as proclaimed by the Ministry of Social Affairs at the beginning of the epidemic in 2001 (Koppel *et al*. 2008). The HIV/AIDS epidemic began among injecting drug users in the northeastern part of the country, and by the end of 2007 the total number of diagnosed as HIV-positive was 6364, equal to 0.47% of the population (Health Care Board 2008). However, the actual number of HIV-infected individuals may be even higher. The Joint United Nations Programme on HIV/AIDS (UNAIDS) has estimated the HIV incidence to be as high as 10 000 (UNAIDS 2008).

Another health problem in Estonia is increasing alcohol consumption. The amount of pure alcohol consumed among the population older than 15 years has doubled since 1997. in 2004 the average amount of alcohol consumed in Estonia was 13.4 liters per capita, while the average EU27 consumption in 2003 was 9.1 liters per capita (WHO Regional Office for Europe 2007). Similar to smoking, alcohol consumption contributes to 6.7% of the total health burden in Estonia (men 12.0%, women 1.0%). Most of the alcohol related disease burden occurs among men between 45-64 years old and one third of healthy life years lost are accounted for by alcohol related external causes, such as traffic accidents and violence (Lai, Vals and Kiivet 2004; Lai *et al*. 2007).

Hungary

Hungary is located in the Carpathian basin in central Europe. The country covers a territory of 93 000 sq. km (1% of the size of Europe), more than half of which is lowlands surrounded by mountain ridges and hills. Hungary had 10.06 million inhabitants in January 2007 with about 97% holding Hungarian citizenship. Approximately 5 million Hungarians live outside the current borders of the country. A small share of them left the country during several waves of emigration, such as after the world wars, and after the 1956 revolution against communist rule. An average population density is 108 people per sq. km (Gaal 2004).

Between 1960 and 2000, the life expectancy at birth increased by only 3.5 years in Hungary compared to 9 years in the average of EU countries. Hungarian women gained 5.6 years throughout this period, while men's life expectancy at birth improved by only 1.3 years altogether. Life expectancy at birth in Hungary still remains among the lowest in Europe. In 1999 it was 71.2 years, almost seven years lower than the EU average (latest data), three years lower than the WHO European regional average, and 3.7 and 4.5 years lower than in the Czech Republic and Slovenia, respectively. In 2002, Hungarian men had a life expectancy of 68.4 years and women of 76.6 years. The increasing social differences of mortality are still more conspicuous also among women, even though they have a higher life expectancy than men. Social differences of mortality are especially great in the former socialist countries, and Hungary's example is striking even among them (Monostrori *et al.* 2010).

Mortality in Hungary had been traditionally unfavorable as compared to Western or Northern Europe, but this disadvantage decreased considerably by the 1960s. Later the handicap became greater once again. In the 1990s mortality deteriorated further due to the economic and social transformation of the country starting in 1989 (Gaal 2004).

At the same time, infant, particularly post-neonatal mortality, the probability of dying before age five as well as maternal mortality were improved substantially since the 1950s and continue to rank below the EU average. Nonetheless, infant mortality, at 8.4 per 1000 live births in 1999, still is about two times higher in Hungary than in the average of EU countries. Until 2002, infant mortality decreased further to 7.2 per 1000 live births. Infant mortality the situation in Hungary is worse than in Western and Southern Europe and even as compared to the Czech Republic. In this respect we are on the same level as Poland, but much ahead of the Southeast European former socialist states or Russia. At the same time it can not be forgotten that the improvement of infant mortality was a real success story in the course of the 20th century (Monostrori *et al.* 2010).

Looking at the causes of death, infectious diseases seem to be less of a problem. Incidence and mortality from most childhood infectious diseases, viral hepatitis, tuberculosis and AIDS continue to occur less frequently in Hungary than in the average of EU countries. In contrast, cardiovascular diseases and malignant neoplasm, digestive system diseases – including liver disease – and external causes, including suicide, are prominent in Hungary (Monostrori *et al.* 2010). Mortality from these causes continues to be higher in Hungary than in the average of EU countries. In 2001, Hungary had the highest mortality from cancer and the second highest mortality from chronic liver diseases/cirrhosis among the all countries of the WHO European region. Cancer and liver mortality had been on a constant rise since the 1970s, particularly, with respect to lung cancer. This started to improve slowly from the mid of 1990s like most other causes of death. Although suicide rates show a favourable decreasing trend since the middle of the 1980s, mortality was still almost three times higher than the EU average (Gaal 2004).

The reasons for the relatively high mortality in Hungary are complex and not fully understood. For example, there has long been concern about lifestyle, especially smoking, alcohol consumption, and the traditional unhealthy Hungarian diet. In 2000, the obesity rate among adults (19%) and alcohol consumption was higher than in most EU countries, while the share of smokers among adults (30%) was in the mid range of EU countries. In 1999 the death rate from causes related to alcohol was almost three times higher than the EU average, whilst the difference in smoking related causes were less marked, but still substantial. Current consumption of cigarettes is still above EU average, while alcohol intake has come down to EU average. Also, inequalities in income have risen substantially, partly as a result of the liberalization policy that characterized the "goulash" communism, where reform began earlier in Hungary than in other European countries. At the same time, traditional channels of social support have gradually been disappearing. The interaction of socio-economic factors, behaviour and health in Hungary is being studied (European Observatory on Health Care Systems 1999).

In the case of external causes of death improvement is conspicuous. Regarding suicide, homicide, and accidental death the position of Hungary among the countries of Europe is not too favourable. In Eastern European comparison it is not too bad, and the tendencies are encouraging (Monostrori *et al*. 2010).

Mortality and morbidity due to unhealthy lifestyles, such as high consumption of alcohol, increasing rates of smoking and a high fat and high sugar diet, are thought to be important causative factors. The factors contributing to the health status of a population are complex, however, and include social and economic factors (including historical antecedents) as well as access to good health services (Gaal 2004).

Kazakhstan

Kazakhstan is an independent republic located in the central Asian steppe. Covering 2.7 million sq. km (approximately the size of the 15 Member States constituting the European Union (EU) up to 2004 (EU15), the country is the largest of the former Soviet republics after the Russian Federation. The size of the population in Kazakhstan has decreased from 16.3 million in 1990 to 15.1 million in 2005, mainly due to outmigration of ethnic Russians and other groups. The migration balance remained negative, but declined from minus 523 500 in 1994 to minus 123 200 in 2000 (Ministry of Health 2002). Since economic recovery began in 2000, there has been substantial, although poorly recorded, immigration from other central Asian republics, mainly from Uzbekistan and Kyrgyzstan (Becker and Urzhumova 2005).

Trends in life expectancy at birth in Kazakhstan are broadly similar to those observed in the CIS, although it has remained below the CIS average and the decline after 1991 was steeper. The dissolution of the Soviet Union was followed by a dramatic decline. In Kazakhstan, life expectancy at birth dropped from 68.8 years in 1990 to 64.4 years in 1996, and then increased again to 65.9 in 2005 (WHO Regional Office for Europe 2007). However, despite the economic recovery, this still fell almost three years short of its 1990 level and was 13.7 years lower than the average life expectancy in the EU15, which was recorded at 79.6 years in 2004 (WHO Regional Office for Europe 2007).

Kazakhstan also has one of the world's largest gender gaps in life expectancy. In 2005, according to official statistics, males could expect to live for 60.4 years, while official female life expectancy at birth was 71.7 years (WHO Regional Office for Europe 2007). Male life expectancy at birth also experienced a much steeper fall than female life expectancy at birth in the first half of the 1990s, from 63.9 years in 1990 to 58.9 years in 1996 (WHO Regional Office for Europe 2007). The largest proportionate increases in mortality have occurred among males of working age. Between 1987 and 1995, mortality rates more than doubled for men aged 30–44 and rose by more than 75% for men aged 45–54 (Becker and Urzhumova 2005).

Officially recorded infant mortality has decreased since 1990, reaching 15.1 per 1000 live births in 2005 (WHO Regional Office for Europe 2007), but the recorded decline is likely to reflect growing underreporting (Becker and Urzhumova 2005). There were also substantial regional differences, with the lowest infant mortality recorded in Almaty city and the highest in Kyzyl-Orda oblast (World Bank 2004b). In all central Asian republics, serious concerns have been raised about the quality of official statistics on infant and child mortality. There are three main factors that contribute to the discrepancy between official data and estimates by international organizations: the continued use of the Soviet definition of live births (which considers infants who are born at less than 28 weeks of gestation or weighing less than 1000 grams as miscarriages unless they survive to 7 days of age) (Ministry of Health 2004); misreporting by medical staff (sometimes deliberate, to avoid investigations); and failure by parents to report births and deaths of children to the authorities (Aleshina and Redmond 2003).

The age-standardized mortality rate for selected alcohol related causes of death is also high and stood at 308 per 100 000 population in 2003, compared to 58 per 100 000 in the EU15 in 2004. Age-adjusted cancer mortality rates (at 173 per 100 000 in 2005) are comparable to those in the EU15, but significantly higher than the central Asian average of 107 per 100 000 population (WHO Regional Office for Europe 2007). There are, however, problems with the identification of causes of death (Ministry of Health 2004), which means that mortality related statistics classified by cause of death have to be treated with some caution (Kulzhanov and Rechel 2007).

Alcohol consumption, smoking, diets high in fats and low in antioxidants, and poor detection and treatment of hypertension are major contributing factors to the increase in cardiovascular mortality (McKee and Chenet 2002). According to a nationally representative survey with 2000 respondents conducted in 2001, 55.6% of men in Kazakhstan were heavy vodka drinkers (defined as consuming more than 100 gr of vodka per sitting) and only 13.8% consumed fruits on a daily basis (Cockerham, Hinote *et al.* 2004). While market liberalization has resulted in increased availability of a large number of consumer items, its effects on public health have often been detrimental. A survey of 648 vendors in Almaty in 1999–2000 found that cigarettes, alcohol, sweets, coffee and tea were widely available, but that there was only limited availability of fruits, vegetables and whole grains (Yim, Humphries *et al.* 2003).

Kazakhstan also has very high mortality rates due to external causes (accidents, injuries, poisonings and traumas) and an increase in external cause mortality contributed to the mortality crisis in the 1990s, in particular for non-Kazakh males of working age (Becker and Urzhumova 2005). Age-standardized mortality rates increased from 118 per 100 000 in 1991 to 161 in 2005, which was close to the CIS average (159), but considerably higher than the average for the central Asian republics and Kazakhstan (81) and more than four times higher than the EU15 average (37 in 2004) (WHO Regional Office for Europe 2007). In 2005, external cause mortality in Kazakhstan was one of the highest in the WHO European Region, only surpassed by the Russian Federation and Belarus (Kulzhanov and Rechel 2007). A significant proportion of external cause mortality is due to suicide, in particular among males (49 per 100 000 male population in 2005) (WHO Regional Office for Europe 2007). Car accidents are another important cause of external cause mortality and the use of seat belts, although mandatory, is not strictly enforced. The age-standardized mortality rate for motor vehicle travel accidents among males was 20 per 100 000 in 2003, which compared to 13 per 100 000 in the EU15 in 2004 (WHO Regional Office for Europe 2007).

Kyrgyzstan

Among the five former Soviet republics of Central Asia (which include Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan), Kyrgyzstan is the next to last in area of 198,500 sq. km and in population 5.2 million inhabitants in 2006, according to the National Statistical Committee of the Kyrgyz Republic.

The official data indicate that life expectancy at birth in Kyrgyzstan was slowly worsening in the 1970s. This deterioration was then suddenly interrupted by significant improvements in the late 1980s, especially for males. This improvement, which occurred simultaneously in various Soviet Republics, has been attributed to Gorbachev’s anti-alcohol campaign (Shkolnikov *et al.* 1998). Then, in the years following the break-up of the Soviet Union, abrupt declines in life expectancy at birth occurred. Although life expectancy at birth has been increasing again since 1995, official life expectancy at birth estimates for 2003 indicate that pre-independence levels have barely been recovered.

Reported mortality trends in Kyrgyzstan require further scrutiny, because they present some singularities for which previous research has been unable to provide conclusive explanations. A first peculiarity is that reported mortality levels, especially male mortality levels, are relatively low considering the level of socio-economic development of the area. For example, during the late Soviet period, male life expectancy at birth was equivalent to levels recorded in Russia, in spite of the fact that Kyrgyzstan was a much poorer republic. Also, the declines in life expectancy at birth recorded in Kyrgyzstan in 1991-95 were smaller than those recorded in Russia. For males, life expectancy at birth in Kyrgyzstan has become higher than in Russia, in spite of increasing disparities in standards of living between the two countries.

Another source of puzzle pertains to levels and trends in infant mortality. In Kyrgyzstan, large increases in infant mortality were recorded in the 1960s and early 1970s. Such increases are not unique to Kyrgyzstan, as other parts of the Soviet Union also experienced increases during the period. Nonetheless, the increases recorded in Kyrgyzstan (and in other Central Asian Republics) started much earlier and were much larger in scale than in other Soviet Republics. These increases have then been followed by steady declines.

According to the reported information, Kyrgyzstan did not experience significant increases in infant mortality after independence. The reliability of both Soviet and post-Soviet trends in infant mortality has been questioned (Anderson and Silver 1986; Becker *et al*. 1998).

Latvia

The Republic of Latvia is located on the eastern Baltic coast, in the western part of the Eastern Europe plain. Latvia's territory is 64 589 sq. km, with a flat landscape and extensive forests covering 44% of the land area and forming Latvia's most important natural resource. In 2004, the population of Latvia was 2.3 million. The population density in 2004 was 35.8 people per km2, which lies below the average of the European Union (EU). It has been declining since independence, having fallen by approximately 13% in the period from 1990 to 2004, as a result of emigration and a combination of low birth rates and high death rates.

For those born in 2005 the life expectancy at birth is 71.1 years for both sexes, or 65.4 for men and 76.6 for women, which is the lowest among the Baltic and Nordic countries. Trends in life expectancy at birth are similar to those in other eastern European and former Soviet Union countries. Life expectancy at birth in Latvia is 10 years lower than the WHO average for males, and almost five years lower for females. However, it may be noted that life expectancy at birth actually took a dip in the early 1990s, when the lowest life expectancy at birth in the 1990s was recorded for 1994, at 60.7 years for men and 72.9 years for women.

Infant mortality remains high by western European standards, although it has fallen substantially since 1980. Conditions occurring during the pre-natal period caused 47% of all infant deaths in 2004. The under-5 mortality rate per 1000 live births also shows a decreasing trend, falling from 20.6 per 1000 live births in 1980 to 12.4 in 2000 and 9.3 in 2006.

In 2004, the main non-communicable diseases accounted for approximately 78% of all deaths in Latvia, with 53% of all deaths caused by diseases of the circulatory system and 17% by cancer. External causes were responsible for approximately 12% of all deaths and communicable diseases for less than 1% (Health Statistics Department 2006).

More than half of all deaths in Latvia are caused by diseases of the circulatory system. A comparison with other Baltic and Nordic countries shows that the mortality rate from this cause of death is the highest in Latvia. Ischemic heart disease is the single biggest killer in Latvia, causing approximately 27% of all deaths in 2005. Yet, for men and women aged 30 years or over, the Latvian mortality rate has declined substantially; younger age groups approached the EU average in 2003. Compared to the WHO average, the Latvian rate is currently lower for all age groups, although the difference is small for men aged 75 years or over. The declining trend in mortality is similar for deaths from cerebrovascular diseases for both sexes and for all age groups, with the exception of males in age groups 30–44 years and 75 years or over, for which the death rate started to increase in the late 1990s.

For both men and women in almost every age group the second cause of death is tumors. The high mortality among men is associated with smoking and use of alcohol.

Cancer causes over one in six deaths in Latvia. Whereas cancer mortality has been decreasing in all age groups below 75 years, the Latvian rates remain higher than the EU average for males and females aged 60 or over. Among elderly Latvians, both men and women, cancer death rates have constantly increased since the 1980s (Health Statistics Department 2006).

Mortality from external causes more than doubled between the late 1980s and 1994, but has decreased by over 40% since then. Even though the decline has been slow in recent years, the Latvian mortality rate has reached the EU average. Despite falling mortality, the Latvian death rates are still high for all external causes, especially for deaths from accidents, traffic accidents, accidental falls, accidental drowning and exposure to smoke, fire and flames.

Suicides are the fifth most common cause of death in Latvia, with the number of suicides exceeding the number of deaths due to traffic accidents. Mortality from suicides is higher for the working-age population. Mortality in males is 5–7 times higher than in females. Men commit suicide due to social problems, but women due to relationship problems (Health Statistics Department 2006).

In 1991–2001 the incidence of tuberculosis (TB) increased sharply. In 1994 Latvia adopted the World Health Organization (WHO) Tuberculosis Control Strategy as the basis for its National Tuberculosis Control Programme, thus enabling timely diagnosis, treatment and prevention according to world standards. In 1995 the directly observed treatment short-course (DOTS) strategy was initiated, which provided the use of TB drugs under the direct control of a medical worker. In 1997 DOTS was implemented in the whole country, including prisons. At the end of 2004, a WHO collaboration centre for treatment, research and education in multi-drug resistant tuberculosis (MDR-TB) was established in Latvia. Whereas these activities have reduced the incidence of TB, its spread remains high in Latvia. In 2005 it was 61.3 per 100 000 population, compared to 84.9 per 100 000 in 2001 (the sixth highest incidence within the WHO European Region, according to the WHO Regional Office for Europe Health for All database).

Lithuania

The Republic of Lithuania is situated on the east Baltic coast and covers 65 300 sq. km. Due to natural decrease and high emigration the population has been decreasing for the last twenty years. In 2009, there were 3339.4 thousand inhabitants in Lithuania, i.e. 18.7 thousand less than in 2008. With the decreasing number of births and an increase in life expectancy at birth the Lithuanian population is aging. At the beginning of 2010 20.9% of the population in the country was aged 60 and older compared with 19% in 2000. At the beginning of 2010 every sixth male and every fourth female were over 60 years old. The number of children under 15 years old was 28.4% less than the number of older aged inhabitants (Gaidelytė, Želvienė and Jaselionienė 2009).

Trends in life expectancy at birth and in overall mortality resemble trends in the other Baltic states and the newly independent states. In the 1970s, life expectancy at birth was close to the EU average but subsequently, owing to slightly deteriorating trends, the gap increased. In 1985, Gorbachov’s anti-alcohol campaign resulted in a sharp improvement in life expectancy at birth, with a gradual deterioration back to the same, pre-campaign level by about 1992. The decline, associated with the socio-economic crisis, continued until 1994 and then reversed (European Observatory on Health Care Systems 2000). Life expectancy at birth in Lithuania was 65 years for men and 77 years for women in 2007. In comparison with other new European

Union (EU) Member States, life expectancy at birth in Lithuania falls within those countries with high life expectancy for women only (World Health Organization 2009). The difference in life expectancy at birth between males and females is about 10 years. Together with other Baltic states and some newly independent states, this difference is among the widest in Europe. In most regions, differences in male life expectancy were due mainly to external causes and in female life expectancy at birth to cardiovascular diseases (Gaidelytė, Želvienė and Jaselionienė 2009). In 2009 the life expectancy at birth for a Lithuanian male was 67.5 years, 1.2 years longer than in 2008; life expectancy at birth for females was 78.6 years, i.e. 1 year longer than in 2008. There is still a significant difference in the average female and male life expectancies at birth (more than 11 years). The life expectancy at birth of Lithuanian male is the shortest in the European Union and that of female is also shorter than in the majority of EU countries (World Health Organization 2009).

Comparing the death rates from main causes between countries can indicate how far the observed mortality might be reduced. As almost all the causes underlying the deaths attributed to cardiovascular diseases, cancer and accidents are influenced by collective and individual habits and behaviour, a wide variety of health promotion and prevention measures can bring about changes to reduce health risks and thus disease and premature deaths (European Communities and World Health Organization 2001).

As in most European Region countries, the leading causes of death in Lithuania are diseases of the cardiovascular system, cancer and external causes (correspondingly responsible for about 52%, 20% and 15% of deaths). The relative contribution is quite different, however, to the averages for Western Europe.

In 2006, cardiovascular diseases and cancer accounted for 54.3% and 18.2%, respectively, of all deaths (17). The largest percentage of deaths due to cardiovascular diseases was caused by ischemic heart disease (62.8%) and cerebrovascular diseases (24%). The majority of people who died from circulatory system diseases were 60 years of age and older. Cardiovascular diseases and cancer are the leading causes of deaths in most countries of the WHO European Region, although their share varies between the countries (World Health Organization 2009).

19.3% of all deaths were caused by malignant neoplasm. Compared to 2008, more deaths occur due to cancer of colon and rectum and fewer deaths occur to stomach, breast, cervix uteri, and prostate cancer. Mortality due to cervix uteri cancer has decreased by 13%, stomach cancer – by 11% (World Health Organization 2009). The level of premature cancer mortality in Lithuania is close to the average for the reference countries, but exceeds the EU average by about 20–30% (European Communities and World Health Organization 2001).

Even though the number of deaths due to external causes decreased by 3.8% in 2006, the mortality rate resulting from these causes remains high, in particular in young and medium aged population groups. Suicides were the most widespread external cause of death (almost 20% of all external causes), followed by road traffic accidents (16.8%), injuries from falls (10.4%), and alcohol poisoning (9.1%). Lithuania has the highest death rate from suicide of all EU countries (World Health Organization 2009). Compared with 2006, the rate in 2009 for external causes decreased by 12.9%. The mortality rate resulting from these causes still remains high, in particular among young and middle-aged people. Suicides were the most widespread external cause of death – 27.3% of all deaths from external causes, 11% died from traffic accidents, 8.5% from falling and 8.3% from alcohol poisoning (Gaidelytė, Želvienė and Jaselionienė 2009).

Poland

The Republic of Poland is the largest country in Eastern Europe in population and in area and covering 312 685 sq. km. In the end of 2007 Poland had a population of 38 115 000, which translates into average population density of 122 people per sq. km. The Polish economy is based on industry and agriculture. After a severe downturn in the late 1980s and early 1990s, the economy showed signs of recovery and on most measures have grown steadily since the mid 1990s. The Polish stabilization programme implemented in 1990 entailed unexpectedly heavy social costs including rising poverty levels (Golinowka and Sowa 2006).

In the post-war period, Poland experienced relatively strong improvement in mortality. Life expectancy at birth in the 1950s rose from 56.1 to 64.9 for men and from 61.7 to 70.6 for women. A rising tendency, although much weaker, was also observed in the 1960s. In the next two decades, the improvement came to a halt. While for women, life expectancy at birth increased by less than 2 years during this period, there was nearly no change for men. What is more, one even observed some temporary ups and downs in male life expectancy. These developments contributed to a further increase in the gender gap in mortality that was already widening in the 1960s (the gap in life expectancy grew from 5.6 years in 1960 to 8.7 in 1989) (Kuszewski and Gericke 2005). The fall of the communist regime is marked by a sudden rise in mortality for all age groups. This phenomenon was, however, only a temporary one and since 1992 a continuous fall in mortality has been observed. As a result, female life expectancy increased by nearly 4 years (to 79.2 in 2004) and that for men rose by 4.5 years (to 70.7 in 2004) compared to 1991. The improvement in mortality was strongest for infants (Golinowka and Sowa 2006).

Infant mortality is an indicator not only sensitive to the health status of a society, but one which also reflects the living conditions of the population. In the period following the Second World War, the infant mortality rate in Poland was very high – over 110 deaths per 1000 live births. Since the 1950s, the infant mortality rate has slowly but continuously declined and public health and prevention programmes for mothers and infants have been undertaken. Nevertheless, at some points the falling trend in infant mortality stagnated – which is observable in the late 1970s and early 1980s (Golinowka and Sowa 2006). The main risk factors associated with infant mortality are low birth weight and premature births. Although in 1970 the share of premature and low-weight births in the total number of births was 7.3%, by 1990 it had increased to 8%. In the late 1980s about 60% of infant deaths were related to these factors (Golinowka and Sowa 2006). Research indicates that birth weight and premature births stem from ecological factors (toxins and air, ground and water pollution), the poor health status of pregnant woman and poor living conditions (ibid), hard labour during pregnancy and use of cigarettes, alcohol and drugs (European Observatory on Health Care Systems 1999). In regions with high degrees of environmental pollution, infant mortality has been higher than the national average (Kuszewski and Gericke 2005). Over recent years, a substantial decrease in infant mortality has been observed. In 2003, the infant mortality rate was 7.0 per 1000 live births, but it is still higher than the average rate for EU countries (4.9 per 1000 live births in 2003) (Golinowka and Sowa 2006).

Given the trends described above, we expect that the improvement in mortality observed since 1992 will continue in the future. With time, however, the rates of decline will weaken, converging to those observed in the most developed countries of Europe. The slowdown in mortality improvement can be explained by the fact that the sudden drop in mortality during the 1992-2004 periods was most probably the result of a rapid increase in living standards and the spread of a healthy life style. This trend will continue for some time as Poland's level of economic development will converge to the EU average. In our opinion there is, however, no reason to believe that in the long term life expectancy in Poland will increase faster than it has been observed so far in the most developed countries in Europe (Kuszewski and Gericke 2005).

Improvements in mortality rates are associated with falls in the number of deaths attributable to circulatory system diseases. These diseases, including ischemic heart disease, atherosclerosis, hypertension, stroke and other heart diseases, are the main causes of death in Poland. In 1996 half of men's deaths (43%) and half of those for women (53%) were caused by circulatory diseases (European Communities and World Health Organization 2001). Thus, any gains in preventing and curing these diseases correspond to significant decreases in mortality rates: in the 1990s, overall mortality rates fell owing to the drop in the number deaths related to circulatory system diseases. This process indicated that Poland had entered an epidemiological transformation period that is identified by a fall in mortality rates and a declining number of deaths caused by diseases characterized by modern civilization (so-called 'civilization' diseases) (Golinowka and Sowa 2006).

Slovakia

Slovakia is located in the very heart of Europe, covering 49 035 sq. km. between 1991 and 2001 the number of economically active persons increased by 48 000. Though their share in the total population remained unchanged, they composed almost half of the total population (49.6%). The number of women in the economically active population increased slightly from 46.9% in 1991 to 47.7% in 2001 (European Observatory on Health Care Systems 2000).

Slovak life expectancy at birth for males was above the average of the reference countries in the mid-1980s, but has deteriorated in the early 1990s to below the average. After that, the Slovak average lifespan started to increase again, remaining above the average of reference countries until 1998, but declined below the average of reference countries in 1999. The difference from the EU average has increased from five years to 7.5 years since the mid-1980s. A similar pattern was found for females. Life expectancy at birth was the highest among the reference countries in 1987, but it fell in the late 1980s towards the average of reference countries. Life expectancy at birth subsequently increased to 77 years, but has been static since the early 1990s (European Observatory on Health Care Systems 2000). Female life expectancy at birth in the EU has been more than four years longer than in Slovakia in the late 1990s. The combined effect of these changes have been that, in the late 1990s, life expectancy at birth in Slovakia has fallen from the mean of the EU to below the average of the reference countries. The gender difference in life expectancy has increased in almost all of the reference countries. In 1999, the difference had increased to 9.5 years in Slovakia. This is above the average of the reference countries (8.1 years) and the EU average (6.4 years in 1997). Large regional differences in life expectancy at birth are reported: the variation between the areas with longest and shortest life expectancy is approximately three years for women but up to ten years for men (Ministry of Health, 1997a). There is a clear connection between life expectancy, education and employment, with those districts with high unemployment rates or with high proportions of inhabitants having only elementary education having the lowest life expectancy (Hlavačka, Wágner and Riesberg 2004).In 2002 the life expectancy of men was 69.8 years and of women 77.6; a substantial improvement in a relatively short time. During the 1990s Slovaks had a higher life expectancy than the populations of most other EU-accession countries. Yet growth slowed and ranked below the EU-15 average from 2000 onwards. In 2002 life expectancy at birth was 73.9 years compared to the EU-15 average (79.0, 2001).

The values of cardiovascular diseases for males aged 0–64 years in Slovakia increased in the late 1980s, but fell below the average of the reference countries in the 1990s. Despite this improving position, the Slovak rate is more than double the EU rate, which has been declining since the 1970s. For females aged 0–64 years the Slovak rate followed the average of reference countries in the 1980s, but the decline in Slovakia has been more rapid than that of the reference countries since 1990. As for males, the female value is still more than double the EU rate (European Observatory on Health Care Systems 2000).

The most numerous causes of death continue to be diseases of the circulatory system, which account for more than half of all deaths (54.5% in 2002). Similarly, cancer remains a major health problem causing 22% of all deaths. Although mortality from ischemic heart disease ranked well above the EU-15 average, cancer-related causes of death were similar. Infant mortality decreased from 10.9 per 1000 live births in 1991 to 7.6 in 2002 and ranked above the EU-15 average (Hlavačka, Wágner and Riesberg 2004).

Non-communicable diseases that are partly related to unhealthy lifestyles such as sedentary habits, unhealthy diet, smoking and bad stress management, still represent the major health problem in Slovakia. Slovakia is one of the countries with the lowest number of newly registered AIDS cases (0.04 per 100 000 inhabitants in 2002) compared to the EU-15 averages (2.39). Newly registered tuberculosis cases (18.1 per 100 000) were substantially higher than the EU-15 average (10.8) in 2002. Overall, communicable diseases currently are well under control in Slovakia and the immunization rate has been maintained at high levels (95%–99%) for many years (Hlavačka, Wágner and Riesberg 2004).

Comparing the death rates from main causes between countries can indicate how far the observed mortality might be reduced. As almost all the causes underlying the deaths attributed to cardiovascular diseases, cancer and accidents are influenced by collective and individual habits and behaviour, a wide variety of health promotion and prevention measures can bring about changes to reduce health risks and thus disease and premature deaths (European Observatory on Health Care Systems 2000).

Spain

Spain, with a population of 44 108 530 people (as at 1 January, 2005), covers 505 955 sq. km and has the third largest surface area in Western Europe. Health indicators in Spain have been improving constantly since the 1970s. The life expectancy at birth in Spain is one of the best in the world and was 83.15 years for females and 76.42 for males in 2003. Life expectancy at birth for women was the highest in the EU in 2003 (Duran, Lara and van Waveren 2006).

One of the reasons for the improvement in life expectancy indicators is lower infant mortality rates. Infant mortality has been rapidly decreasing since the mid-1970s, at a rate very similar to average EU levels. In 1970, the rate was 20.78 per 1000 live births, while in 2003 it was 3.92. According to the United Nations Development Programme (UNDP) Human Development Report for 2004 (UNDP 2004), the indicator on infant mortality in Spain is second only to Sweden worldwide, along with Denmark, Finland, France, Germany and Norway (Duran, Lara and van Waveren 2006).

Significant inequalities in health in Spain have been reported (Ministry of Health and Consumer Affairs 2003). Despite the higher life expectancy at birth for females, their self-perceived health status is worse. This difference between genders also persists throughout all age groups. In 2003, according to the latest available Spanish National Health Survey (ENSE), 75.7% of men and 71.3% of women said that their health status was good or very good. However, 32.9% of women compared with 24.3% of men declared that their health status was poor (a difference of 8.6 percentage points). As for self-perceived health status, 38.6% of the lowest social class compared with 22.1% of the higher social class declared in 2003 that their health was very poor. National Health Surveys in 1993 and 2003 show a decrease in self-perceived poor health for both genders (Duran, Lara and van Waveren 2006).

The main causes of death in Spain are diseases of the circulatory system. The second largest and increasing cause of death since the 1970s has been malignant neoplasm. Mortality from cancer of the trachea/ bronchus/lung has doubled since 1970 which might be attributed to the smoking habits of the population. Mortality due to diseases of the circulatory system has been reduced twofold since 1970. Nevertheless, these diseases accounted for almost one third of all deaths in 2003. Mortality due to mental disorders and diseases of the nervous system has also been increasing since the 1970s, while mortality due to external causes shows a slight decrease during the same period.

According to WHO, there were 28.1% of daily smokers in Spain in 2003 (European Health for All database, January 2006). According to national statistics, the prevalence of daily smokers was 31.0% and 36.1% in 2003 and 1993 respectively (Ministry of Health and Consumer Affairs 2004). Important legislative measures have been adopted since January 2006 in order to reduce the prevalence of smoking. Alcohol consumption and alcohol related causes of death in Spain have been decreasing since the 1980s. The proportion of the population with overweight and obesity problems in Spain, however, is increasing. In 1987, 7.4% of the Spanish population older than 18 years were obese (6.9 % men and 7.9% women), while in 2003, 13.3% of the population were affected by obesity (13.3% men 13.9 % women) (INE 2003). It was reported that 54.5% of the population are physically inactive during their leisure time (INE 2003).

Traffic and occupational accidents are significant public health problems in Spain. During 2003, 5399 people died and more than 26 000 were seriously injured due to traffic accidents. It was estimated that economic costs resulting from traffic accidents amount to approximately 2% of GDP (Ministry of Health and Consumer Affairs 2005). Interventions to tackle the issue of traffic accidents include epidemiological studies, media and education campaigns, and intersectoral collaboration. As for occupational injuries, according to the 2002 EU Social Situation Report (Eurostat 2003), Spain occupies the fourth position after Denmark, Sweden and Belgium (thus no longer having the highest incidence rate in the EU, as was the case in the mid-1990s) (Duran, Lara and van Waveren 2006).

Tajikistan

Tajikistan is the poorest of the former Soviet republics. Its territory of 143 100 sq. km are primarily mountainous, with the high Pamir mountain range in the south and lowland plains in the west. In 2007, approximately 74% of its 6.7 million populations lived in rural areas. Contrary to trends in most other countries, the share of the population living in rural areas has increased between 1990 and 2007. Tajikistan's population density was 48.2 people per sq. km in 2007. Tajikistan has a very young population. In 2007, 38% were below 15 years of age, a decline from 43.2% in 1990 (World Bank, 2009a).

A recalculation of life tables according to World Bank estimates of infant and child mortality showed that actual life expectancy in Tajikistan might be as much as 13.4 years lower than the official statistics suggest (Rechel *et al.* 2005). According to a WHO World Health Report, estimated life expectancy in Tajikistan in 2004 was 63 years at birth, approximately 10 years lower than the officially reported life expectancy of 73.3 years in 2004 (WHO Regional Office for Europe, 2010).

The first years of independence were accompanied by a massive deterioration of the population's health status, through the rise of some communicable and non-communicable diseases and deteriorating access to health services, particularly for poor groups of the population. There has been a significant increase of communicable diseases, such as tuberculosis, as well as of diseases caused by micronutrient deficiencies. One of the main factors affecting the health status of the population is the present socioeconomic situation, characterized by widespread poverty (Khodjamurodov and Rechel 2010).

Infant, child and maternal mortality are key indicators of the Millennium Development Goals (World Bank, 2003). However, estimates of infant and maternal mortality in Tajikistan vary significantly according to source and methodology, and accurate estimates are difficult to obtain. In Tajikistan, the Soviet definition of a live birth continues to be used for both medical and civil registration, although a transition to the WHO definition of a live birth was adopted by Ministry of Health Decree No. 202 of 28 April 2008 (Khodjamurodov and Rechel 2010).

According to official statistics, the infant mortality rate fell from 40.4 to 14.1 per 1000 live births between 1990 and 2005 (WHO Regional Office for Europe, 2010). Results from various household surveys, however, show a significantly higher infant mortality rate. The Demographic and Health Survey of 2002 estimated that an infant mortality rate of around 86.9 per 1000 live births existed during the period 1997–2001, and the Tajikistan Living Standards

Survey in 1999 estimated an infant mortality rate of around 78 per 1000 live births during the period 1994–1998. Infant mortality rates vary considerably by rayon. According to the Multiple Indicator Cluster Survey conducted by the United Nations Children's Fund (UNICEF) in 2000, in some areas of the country, actual infant mortality in 1993 was 95 per 1000 live births (UNICEF, 2000). The Multiple Indicator Cluster Survey in 2005 estimated infant mortality at 65 per 1000 live births (State Committee on Statistics, 2006). Although these estimates are generally associated with considerable confidence intervals, they suggest that the actual infant mortality rate is much higher than shown in official statistics. According to WHO estimates, infant mortality in Tajikistan in 2004, at 91 per 1000 live births, was higher than in any other country in the WHO European Region (WHO Regional Office for Europe, 2010).

Acute respiratory infections, diarrhea and prenatal conditions are the main registered causes of infant mortality. However, the number of deaths from unknown causes has increased in recent years, indicating shortcomings of death certification. The major causes of death within the first year of life are all preventable: meningitis/encephalitis (20%), acute diarrhea (17%), severe malnutrition (16%), pneumonia (14.4%), severe anemia (12.6%), bacterium/ septicemia (9.9%) and measles (9.9%). According to a recent UNICEF-sponsored study (Guerra et al., 2003), infectious diseases continue to be a major cause of infant and child mortality. Most of the infant deaths (71%) occur in the first week of life. The Ministry of Health and donor organizations are addressing the high infant mortality rates through programmes directed at the root causes of infant mortality. According to the UNICEF study, communicable diseases account for 58% and malnutrition for 42% of post-neonatal deaths, and these are two of the priority programme areas for the Ministry of Health (Khodjamurodov and Rechel 2010).

Maternal health remains another major challenge. As is the case with infant mortality rates, estimates of maternal mortality in Tajikistan differ from official statistics, although both sources indicate a declining trend. According to official data, maternal mortality has decreased by more than half from its peak at 124.4 per 100 000 births in 1993 to 43.4 in 2006 (WHO Regional Office for Europe, 2010). It is likely that these figures underreport actual maternal mortality, as there are a large number of home deliveries. It has been estimated that, in 1995, the actual maternal mortality rate was 123 per 100 000 live births (Hill et al., 2001) rather than the officially recorded 97.7 (WHO Regional Office for Europe, 2010).

According to UNICEF, maternal mortality in Tajikistan can be attributed to poor antenatal care, inadequate health services during delivery, and transportation problems, particularly in rural areas (Guerra et al. 2003). In 2008, 40.2% of all deliveries took place at home, reaching 80% in some of the country's regions. Reasons for the high share of unsafe deliveries at home include the poor health care infrastructure and the lack of telephone communication and reliable means of transport. Out of all home deliveries, more than 60% are carried out without medical assistance, resulting in significant health risks. The high level of maternal and prenatal mortality is also related to the poor quality of antenatal and delivery care, which suffers from a lack of materials and equipment and the poor training of health personnel (Skinnider 2000; Guerra *et al*. 2003).

Turkmenistan

Turkmenistan is a country situated in Central Asia that became independent with the dissolution of the Soviet Union in 1991. In 2006, Turkmenistan had a population of 5.4 million people, with 42.1% living in urban areas and 57.9% living in rural areas (Rechel, Sikorskaya and McKee 2009).

The life expectancy at birth was 66.1 years in 1998 (WHO 2008b). Female life expectancy at birth increased from 68.4 in 1989 to 72.9 in 2006, while male life expectancy at birth increased from 61.8 in 1989 to 66.2 in 2006 (UNICEF 2008a). Life expectancy at birth in Turkmenistan was far below the Central Asian average in much of the 1990s, in particular for females. Since then, a remarkable improvement has been reported, of 4 years for males between 1997 and 2006 and more than 5 years for females. Since 1998, as these data have not been reported to WHO, the officially recorded life expectancy in Turkmenistan is now very close the average life expectancy at birth for the remaining Central Asian countries (Rechel, Sikorskaya and McKee 2009).

The latest infant mortality data reported to WHO referred to 1998, when official data recorded 32.78 infant deaths per 1000 live births, down from 54.78 in 1989 (WHO 2008b). More up-to-date data have been reported to the TransMONEE database, indicating that infant mortality had declined to 12.1 infant deaths per 1000 live births in 2006 (UNICEF 2008a). However, when interpreting this data it should be borne in mind that, as mentioned above, official data throughout Central Asia underestimates infant mortality. According to WHO estimates, real infant mortality in Turkmenistan in 2004 was 80 infant deaths per 1000 live births (WHO 2008b). According to UNICEF, the leading causes of infant mortality are acute respiratory infections, accounting for about 70% of infant deaths, and diarrhea (UNICEF 2008b). In January 2007, Turkmenistan began using the international live birth definition recommended by WHO (Ministry of Health and Medical Industry 2006), which will help to establish more accurate data on infant mortality. Adoption of the WHO live birth definition was one of the policy recommendations of our 2005 report and international agencies, including USAID, UNICEF, UNFPA and UNAIDS, had advocated for this policy change since 2002 (USAID 2007b).

According to the data reported by Turkmenistan to the TransMONEE database of UNICEF, maternal mortality declined from 55.2 maternal deaths per 100 000 live births in 1989 to 4.3 in 2006. As shown in Figure 5, this is a ratio far below the Central Asian average. Indeed, the ratio would be lower than the maternal mortality recorded in the Netherlands in 2006, which stood at 4.4 (WHO 2008b). Further doubts about the accuracy of maternal mortality data reported by Turkmenistan to UNICEF arise from a comparison with the data reported to the WHO database, which indicate 15.63 maternal deaths per 100 000 live births (WHO 2008b).

There is no reliable data on the current pattern of non-communicable diseases, although it can be assumed that it broadly resembles that observed in the late 1990s, with a high burden of cardiovascular diseases, infectious diseases, and diseases of the respiratory system (WHO Regional Office for Europe 2005). Recent data on lifestyle factors, such as alcohol and tobacco consumption, are also unavailable. A presidential decree from 2000 banned smoking in public places, but it is unclear how well implemented this decree is. Turkmenistan has so far not developed a national tobacco control action plan and has also so far not acceded to the WHO Framework Convention on Tobacco Control. However, advertising alcoholic beverages and tobacco products in the media is banned and healthy living has been made a compulsory subject at school (Government of Turkmenistan 2008b).

Like other countries in Central Asia, Turkmenistan has become one of the routes for trafficking drugs from Afghanistan to the rest of the former Soviet Union and Western Europe and this was associated with an increased consumption of illegal drugs in Turkmenistan. In a 2005 report, the ambiguous role of President Niyazov was noted concerning the involvement of high-ranking officials in drug trade and the failure to participate in regional efforts aimed at curtailing the trafficking of drugs (Rechel and McKee 2005). According to official statistics reviewed by in country researchers, nearly 1800 people were newly registered as drug users in 2006, declining to 1615 people in 2007. Overall, 33 600 drug addicts were registered officially in 2006, with 32 380 in 2007. 880 people were reported to have died from an overdose in 2006 and 707 people in 2007 (Rechel, Sikorskaya and McKee 2009).

The United States of America

The United States has a total resident population of 310 729 000 in 2006. It is a very urbanized population, with 81% residing in cities and suburbs as of mid-2005 (the worldwide urban rate was 49%).

Life expectancy at birth is a measure often used to gauge the overall health of a population. Shifts in life expectancy at birth are often used to describe trends in mortality. Life expectancy at birth is strongly influenced by infant and child mortality. From 1900 through 2006, life expectancy at birth increased from 46 to 75 years for men and from 48 to 80 years for women. Improved access to health care, advances in medicine, healthier lifestyles, and better health are factors underlying decreased death rates among older Americans.

Disorders related to short gestation and low birth weight, and congenital malformations, is the leading causes of death during the neonatal period (less than 28 days of life). Results from a new analysis of preterm-related causes of death show that 37% of infant deaths in 2005 were due to preterm-related causes. From 2000–2006, there was little progress in lowering the U.S. infant mortality rate. The infant mortality rate decreased 2.6%, from 6.87 per 1,000 live births in 2005 to 6.69 in 2006. The 2006 infant mortality rate was 77% lower than in 1950 due to annual declines from 1960–2000. Infant mortality rates fell fairly rapidly from 1950 to 1980, then more slowly until 1995, and have continued to decline since 1995. Infant mortality rates have declined for most racial and ethnic groups, but large disparities among the groups remain. During 1995–2006, the infant mortality rate was consistently highest for infants of non-Hispanic black mothers. Infant mortality rates were also high among infants of American Indian or Alaska Native mothers and Puerto Rican mothers. Infants of Central and South American mothers, Asian mothers, and Cuban mothers had lower infant mortality rates (MacDorman and Mathews 2008).

In 2006, a total of 2.4 million deaths were reported in the United States. The overall age-adjusted death rate was 46% lower in 2006 than in 1950. The reduction in overall mortality since 1950 was driven mostly by declines in mortality from heart disease, stroke, and unintentional injuries (U.S. Departament of Health and Human services 2009).

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 stroke (cerebrovascular disease), the third leading cause of death, had declined 76% since 1950. Heart disease and stroke mortality are associated with risk factors such as diabetes, high cholesterol, high blood pressure, smoking, and dietary factors. 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. Departament of Health and Human services 2009).

Overall age-adjusted death rates for cancer, the second leading cause of death, rose between 1960 and 1990 and then declined. Between 1990 and 2006, overall death rates for cancer declined 16%. The trend in the overall cancer death rate reflects in part the trend in the death rate for lung cancer. Since 1970, the death rate for lung cancer for the total population has been higher than the death rate for any other cancer site (Reynold and Crimmins 2010).

Chronic lower respiratory diseases were the fourth leading cause of death in 2006. These diseases included bronchitis, emphysema, and asthma. The age-adjusted death rate for CLRD in 2006 was 43% higher than the rate in 1980.

The fifth leading cause of death in 2006 was unintentional injuries. Age-adjusted death rates for unintentional injuries declined during the period 1950–1992. Since 1992, the unintentional injury mortality rate has gradually increased. Despite recent increases, the death rate for unintentional injuries in 2006 was 49% lower than in 1950 (Reynold and Crimmins 2010).

The sixth leading cause of death in 2006 was diabetes. Following a period of decline in the 1970s and some fluctuation in the early 1980s, the age-adjusted death rate for diabetes increased 48% between 1986 and 2002. As the prevalence of diabetes increases, there have been efforts to improve reporting of diabetes on death certificates, and changes in death rates for diabetes over time may reflect those efforts. The rate has decreased slightly since 2002. The rate in 2006 was 8% lower than the rate in 2002 (U.S. Departament of Health and Human services 2009).

Uzbekistan

Uzbekistan is a doubly landlocked country located in central Asia. Four other landlocked former Soviet republics – Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan – surround the 447 400 sq. km of Uzbekistan's sandy deserts, dunes and river valleys to the north, east and west respectively (Ahmedov *et al.* 2007).

The population of Uzbekistan has grown steadily for many decades. Population growth peaked between the 1960s and the 1990s. During this time, the population increased by two and a half times, with growth rates of approximately 3% per year (Ahmedov *et al.* 2007).

Similarly to the other central Asian republics, the demographic profile in Uzbekistan has changed since 1991. The economic recession from 1991 to 1995 caused a decline in living standards, which could be a factor in decreasing fertility, birth rate, as it might no longer have been feasible to maintain large families. In 1995 the life expectancy at birth in Uzbekistan was 67.9 years. This rate is comparable to the averages in the newly independent states of the former USSR and the central Asian republics but is about 10 years less than the average in the European Union (EU). Women in Uzbekistan live an average of 5.6 years longer than men, and this difference has changed only slightly. The gap in life expectancy at birth between Uzbekistan and Western Europe narrows after children reach 15 years of age, but the EU rates are improving, whereas the estimated life expectancy at birth in Uzbekistan has gradually declined. This is the pattern in all of central Asia. The exact causes of this trend are unknown, although explanatory factors include the worsening of the environment: in particular, shortage of water and pollution of water resources and air pollution. Other factors may be related to the consequences of the dissolution of the USSR, including the decline in average income, the rise in income inequality, employment insecurity and unemployment and the deterioration of social services. The socio-economic transition may have a stronger effect in the years to come owing to a larger effect on children and adolescents compared with older people (Ahmedov *et al.* 2007).

Premature mortality is not high in Uzbekistan; infant and maternal mortality, however, have been of concern for the last few decades. Infant mortality is among the highest of the NIS. Uzbekistan had 22.3 infant deaths per 1000 live births in 1998, although this was below the average for the central Asian republics. The main causes of infant death are unknown. Infant mortality has been high since Soviet times. After independence, infant mortality decreased from 35.5 per 1000 live births in 1991 to 22.7 in 1997. This in turn can partly be related to a decrease in fertility and abortion rates (Ahmedov *et al.* 2007). The early neonatal mortality rate (the number of deaths in infants under 1 week of age in a year) has declined by 46% since 1989. In 1997, there were 4.7 neonatal deaths per 1000 live births. It was 18.3 in 2001; the rate remains high in comparison with other CIS and European countries, according to the 2003 UNICEF Social Monitoring report. According to UNICEF, Uzbekistan has the lowest infant-mortality rate among the Central Asian CIS states, while Turkmenistan has the highest - 20.1 deaths per 1000 live births. The reasons for the high infant mortality rates in Central Asia -according to UNICEF, up to 12 times higher than in the more developed countries - were given as poverty, the poor health and nutrition of pregnant women, infectious diseases, and low-quality medical care. According to UNICEF Uzbekistan's infant-mortality rate is actually much higher, but the country's official figures are obtained using the Soviet definition of infant mortality rather than the internationally accepted World Health Organization definition. (www.uzreport.com).

Diseases of the circulatory system are the most common cause of death in Uzbekistan, accounting for 65.6% of age-standardized mortality in 2005 (WHO Regional Office for Europe 2007). The mortality rate from diseases of the circulatory system has increased since the 1980s, a development that mirrors the trends in other countries of central Asia and the Commonwealth of Independent States (CIS), but contrasts with trends in western Europe, where mortality from diseases of the circulatory system has continuously declined in the last few decades. These developments have resulted in a significant divergence between the rates in Uzbekistan and Western Europe. In 2005, age-standardized mortality rates from diseases of the circulatory system were more than three times higher than the average in the EU15 in 2004 (WHO Regional Office for Europe 2007).

Ischemic heart diseases and cerebrovascular conditions 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 ischemic heart disease (WHO 2005). Malignant neoplasm (cancer) is the second most prevalent cause of death, closely followed by accidents and infectious diseases (WHO 2005). Age-standardized mortality rates from malignant neoplasm are two and a half times lower than the EU15 average (WHO Regional Office for Europe 2007), equally affecting both genders (WHO 2005).

More than half of the mortality related to infectious conditions in 2000 was attributable to tuberculosis (WHO 2005). Although aggregate mortality rates from infectious diseases have continuously decreased since the second half of the 1980s, mortality attributable to tuberculosis has almost doubled since reaching its lowest point in 1990. This trend in tuberculosis mortality is similar to the trends observed in other countries of the former Soviet Union. It is related to the economic decline, breakdown of public support systems, and impoverishment of large parts of the population associated with the transition towards a market economy in these countries. In 2002, the mortality rate attributable to tuberculosis was 30 times higher than the EU15 average. It affected predominantly males whose mortality rate attributable to tuberculosis was almost two and a half times that of females (WHO Regional Office for Europe 2007).

Males are also more likely to die from various types of injuries. Mortality due to injuries is almost three times more common among males than among females. Motor vehicle traffic accidents, accidental drowning, and suicide or self-inflicted injuries account for almost two thirds of all mortality from external causes (WHO 2005).

2.2 Population longevity

Longevity is defined as life expectancy above the average lifespan of a living creature (plant, animal, human) (Demographic dictionary), or more generally “long life”. Typically, longevity is achieved by healthy lifestyles and supportive environments. The term longevity is often used in the sciences, focusing on the reproduction of populations - demography, gerontology – to explore patterns of aging in developing methods to increase life expectancy at birth. According to the calculations of some scientists, the mean life span is 95 ± 2 years. The Gerontology Research Group validates current longevity records by modern standards and maintains a list of super centenarians. While many other invalidated longevity claims exist, record-holding individuals include:

- Jeanne Calment (1875–1997, 122 years, 164 days): the oldest person in history whose age has been verified by modern documentation. This defines the modern human life span, which is set by the oldest documented individual who ever lived

- Shigechiyo Izumi (1865–1986, 120 years, 237 days, disputed): the second oldest human ever recognized by the Guinness Book of World Records; this is questioned by some scholars, who believe that conflation of dates or names has compromised the authenticity of Izumi's age

There are at least two important reasons for people living longer: Firstly, healthy lifestyles in terms of improved nutrition, hygiene, and a growing emphasis on physical and mental exercise have contributed to greater longevity. Another crucial factor has been medical progress, which has reduced infant and maternal mortality rates significantly. 100 years ago, the life expectancy at birth was 46.4 years for men and 52.5 years for women. Nowadays, a newborn boy spends an average of 81.7 years on earth, while girls can even expect a life that lasts 87.8 years. In other words, life expectancy at birth has doubled during the last century (Demographic dictionary).

Increased longevity lies at the core of the fact the group of people over 80 years of age will triple in the next 50 years to come: from 3.2 million (3.9 percent of the population) to 9.1 million (12.1 percent). Even more impressively, the group of people over 100 years will grow by a factor of 16 during the same time period (2000: 7,200, 2050: 114,700) (Lehr 2007).

The gender differential in longevity has for many years been a subject of interest for social scientists. Sociologists and anthropologists explain the differential by adopting the evolutionary theory of sexual selection against a socio-cultural background (Carey and Loperato 1995). Epidemiologists explore the relationship between life expectancy at birth and socio-economic factors, such as wealth inequality and social status by gender (Wilkinson, 1996). Medical professionals approach the issue by investigating gender-differentiated medical technologies and human biology. For instance, Perls and Fretts (1998) emphasize the unique role of the menopause in female longevity.

Female longevity is the product of evolutionary forces and one might wonder what physiological mechanisms have evolved to support the preferential survival of women over men. Sex hormones are thought to be important factors in determining the relative susceptibilities of the genders to aging and disease. Less obvious is the contribution that menstruation might make to longevity. Because of the monthly shedding of the uterine lining, premenopausal women typically have 20 percent less blood in their bodies than men and a correspondingly lower iron load. Because iron ions are essential for the formation of oxygen radicals, a lower iron load could lead to a lower rate of aging, cardiovascular disease and other age-related diseases in which oxygen radicals play a role. Indirect support for this theory comes from studies at the University of Kuopio in Finland and the University of Minnesota Medical School. In these studies, male volunteers who made frequent blood donations had less oxidation of LDL cholesterol-a key step in the development of atherosclerosis and heart disease.

Women also have a slower metabolism than men-a distinction that makes them more prone to obesity. But there may also be an inverse relation between metabolic rate and life span. Evidence of this link comes from animal studies of food restriction, which slows metabolic processes: in experiments sponsored by the National Institute on Aging, monkeys that ate 30 percent less of the same diet as their free-feeding peers seemed to age more slowly.

Studies of so-called clock genes in microscopic worms have also demonstrated the connection between metabolic rate and life span. Siegfried Hekimi of McGill University has observed that worms with particular mutations in these genes live five times as long as normal animals and have much slower physiological functions. Although it is still not known why men's metabolism rates are faster than women's, it is becoming clear that this difference is present almost from the moment of conception, when male embryos divide faster than female ones. The faster metabolic rate may make men's cells more vulnerable to breakdown, or it may simply mean that the male life cycle is completed more promptly than the female one.

Finally, chromosomal differences between men and women may also affect their mortality rates. The sex-determining chromosomes can carry genetic mutations that cause a number of life-threatening diseases, including muscular dystrophy and hemophilia. Because women have two X chromosomes, a female with an abnormal gene on one of her X chromosomes can use the normal gene on the other and thereby avoid the expression of disease (although she is still a carrier of the defect). Men, in contrast, have one X chromosome and one Y chromosome, and so they cannot rely on an alternative chromosome if a gene on one of the sex chromosomes is defective (Thomas and Ruth 1999).

Nowadays, Japan is the country with the longest life expectancy in the world. According to the most recent data from the Ministry of Health, Labor, and Welfare, the life expectancy at birth in Japan was 78.32 years for men and 85.23 for women in 2002. This was an increase of 0.25 years for men and 0.30 years for women over the previous year. Looking at countries around the world, Hong Kong has the longest life expectancy for men at 78.4 years, followed by Japan, and Iceland at 78.1 years in 2000. Japan had the highest life expectancy for women, followed by Hong Kong at 84.6 years and Switzerland at 82.6 years in 2000. In many respects, the western states are doing relatively well in health care and longevity.

Future mortality and survival are, however, difficult to predict and specialists disagree on not only the level but also the direction of future trends. James Vaupel, director of the Max Planck Institute for Demographic Research, argues that the Social Security projections are too pessimistic. He notes that Social Security Administrations (SSA) forecast is that female life expectancy in the more developed countries will gradually rise from 79.5 years today to 83.4 years in 2050. According to this forecast projected level of life expectancy in 2050, half-a-century from today, is less than current life expectancy at birth in Japan and France, and is 13 to 14 years less than likely Japanese and French female life expectancy in 2050. Vaupel further suggests that it is unrealistic for Social Security Administration to assume that the United States will be unable to match the level of life expectancy in half-a-century that is already attained in other countries today.

3. Demographic and socio-economic background of the selected countries

"Wealth is evidently not the good we are seeking,
for it is merely useful for the sake of something else."
(Aristotle)

Human development is a developmental model that concerns much more than the rise and fall of national incomes. It is about creating an environment in which people can develop their full potential and lead productive, creative lives in accordance with their needs and interests. Consequently, this brings the focus back onto the people. People are the real wealth of nations. Development is thus about expanding the choices people have, to lead lives that they value and improving the human condition so that people will get the chance to feel fulfilled. It is thus about much more than economic growth, which is only a means —if a very important one —of enlarging people's choices (Human Development Reports (UNDP) 2009).

According to the Human Development Report, the following variables were selected which show socio-economic development for each country. In order to illustrate the position of the selected countries in this field, data from 2007 was chosen because the worldwide economic crisis had not begun.

The Human Development Index (HDI) is a summary measure of human development. HDI is expressed as a value between 0 and 1. It measures the average achievements in a country in the three basic dimensions of human development (Human Development Glossary):

- A long and healthy life, as measured by life expectancy at birth
- Knowledge, as measured by the adult literacy rate (accounting for two-thirds of the total) and the combined primary, secondary and tertiary gross enrolment ratio (accounting for the remaining one-third)
- A decent standard of living, as measured by GDP per capita in purchasing power parity (PPP) terms in US dollars

The Adult Literacy Rate (ALR) is the portion of the adult population aged 15 years and older which is literate. To calculate the ALR, the number of literates aged 15 years and over is divided by the corresponding total population aged 15 years and over, then multiplied by 100 (Human Development Glossary).

Gross Domestic Product (GDP) per capita is an approximation of the value of goods produced per person in the country. This is equal to the country's total GDP divided by the total number of people in the country (Human Development Glossary).

Human Poverty Index 1(HPI-1) is the level of human poverty (describe). HPI measures deprivations in the three basic dimensions of human development (Human Development Glossary):

- A long and healthy life – vulnerability to death at a relatively early age, which is measured by the probability at birth of not surviving to the age of 40
- Knowledge – exclusion from the world of reading and communications, as measured by the adult literacy rate
- A decent standard of living – lack of access to overall economic provisioning, as measured by the unmeasured average of two indicators, the percentage of the population not using an improved water source, and the percentage of children considered underweight for their age

The Gender-related Development Index (GDI) measures achievement in the same basic capabilities as the HDI does, but takes note of inequality in achievement between women and men. The methodology used imposes a penalty for inequality, such a fall when the achievement levels of both women and men in a country go down or when the disparity between their achievements increases. The greater the gender disparity in basic capabilities, the lower a country's GDI compared with its HDI. The GDI is simply the HDI discounted, or adjusted downwards, for gender inequality (Human Development Glossary).

The Gini Index, named after the Italian statistician Corrado Gini (1884-1965), is a standard economic measure of income inequality, based on the Lorenz Curve. A value of 0 expresses total equality whereas a value of 100 represents maximal inequality. If a society's score is closer to 0.0 on the Gini scale, it has perfect equality in income distribution. When a score is closer to 100, only one person is responsible for the household's income. It is also used as a measure of other distributional inequalities, such as market share (Human Development Glossary).

A healthy life expectancy at birth is the average number of years that a person can expect to live in "full health". Taken into account are years lived in full health, disease and/or injury free (Human Development Glossary).

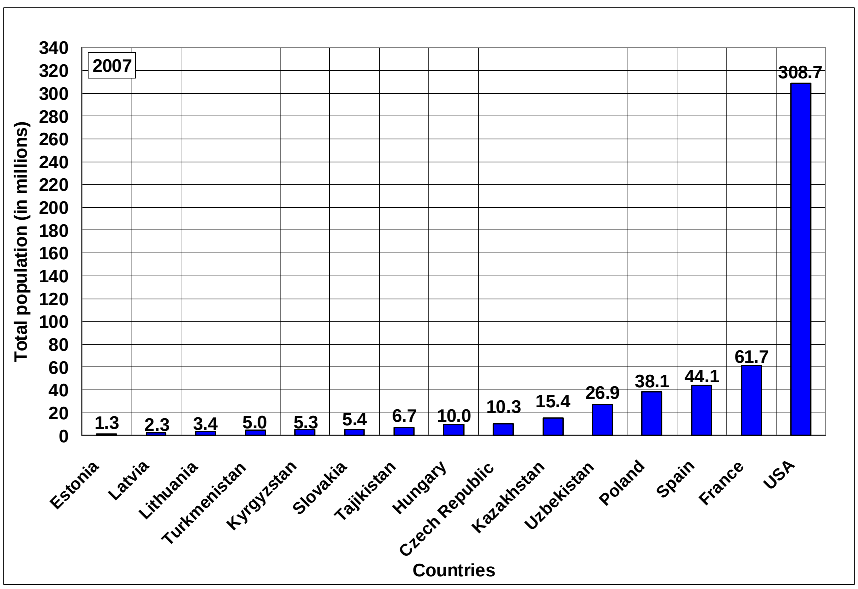
Unhealthy life expectancy is the average number of years that a person can expect to live in "poor health". Taken into account are years lived in poor health due to disease and/or injury. An unhealthy life expectancy as a percentage of total life expectancy calculated from the difference between life expectancy and healthy life expectancy, expressed in percentage (Human Development Glossary).

3.1 Recent demographic development in selected counties

The description of the recent demographic situation in the selected countries began with the total population size.

Figure 1 shows that the smallest population is observed in Estonia (about 1 million) and the highest one being the United States ref. Countries were placed into the following groups according to their population size: small, medium, large, and largest. The group with smallest population is comprised of countries whose population sizes were less than 10 million. In the group containing medium-sized populations, the countries contained between 10 and 30 million inhabitants. In the large group the population number accounted for 30 to 50 million people. The group with the largest population included countries with 60 million or more. Another factor is the territorial size of the countries. For example, half of the countries with less than 10 million inhabitants have a small territorial size, while on the other hand the USA is 4th largest country by total area in the world.

Figure 1 - Total population size (in millions) in the selected countries, 2007

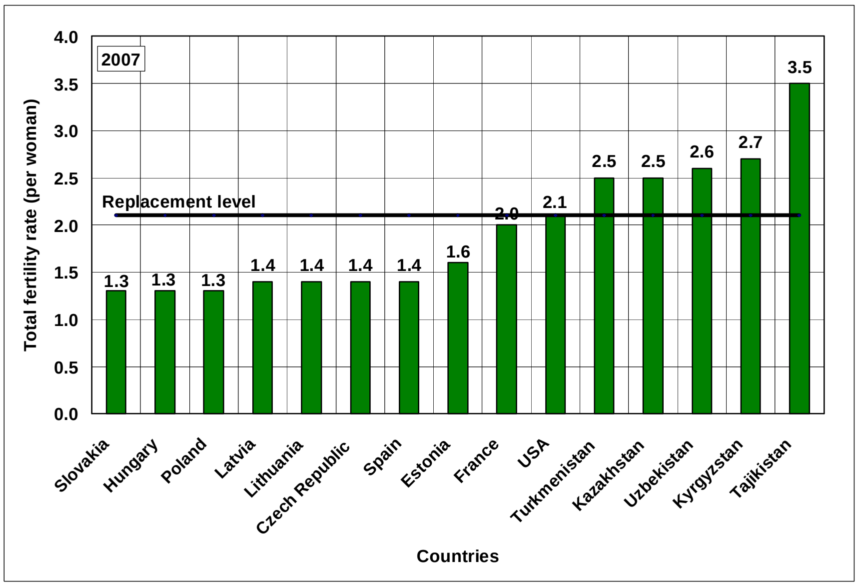


Source: Human Development Report 2009

The total fertility rate is the average number of live born children per woman considered to be of reproductive age within a given generation of women. In Figure 2, the four country groups can be distinguished, displaying the lowest, low, high, and highest levels of the total fertility rate. The lowest fertility group included the countries of Slovakia, Hungary and Poland with TFR 1.3 and less. The next group which displayed a low fertility level (TFR: 1.4 – 1.6) comprised of the three Baltic states together with the Czech Republic and Spain. A high fertility rate was observed in more developed countries, such as France and the USA (TFR at replacement level 2.0 – 2.1). All Central Asian republics represent the group with the highest fertility rate where TFR is 2.5 or more. In 2007 European countries fell below the replacement level, with some belonging to the lowest low fertility group. The decrease in the value of the total fertility rate can be related to such factors as female labor force participation, the mass use of modern hormonal contraception, and gradual improvements in the work-life balance. Nowadays, post socialist Central European countries have transformed from traditional to modern. Difficulties related to the transition period. On the other hand, central Asian countries are trying to keep traditions and customs alive, for example many households are expected to have a high number of children.

Fertility in selected countries started to shift to older ages.

Figure 2 - Total fertility rate in the selected countries, 2007



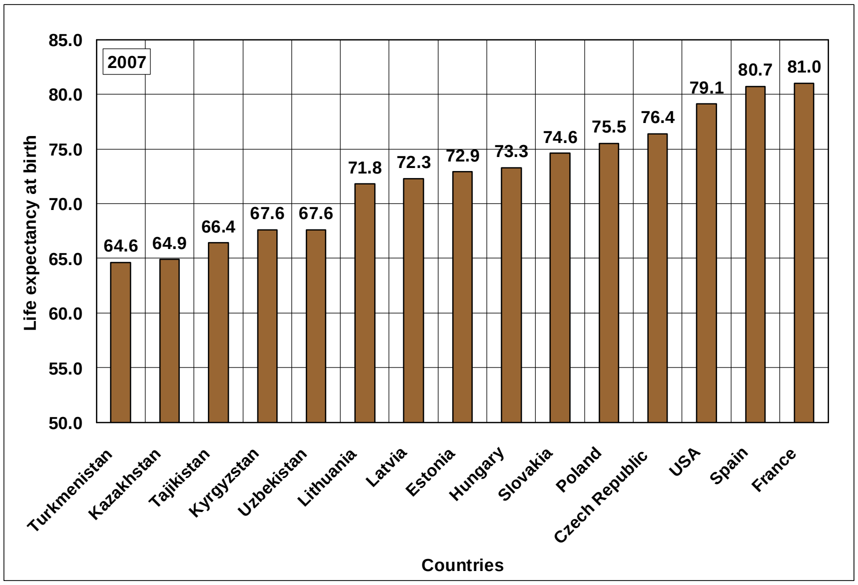
Source: www.worldbank.org

Indicators derived from conditions regarding mortality and morbidity provide a good picture of overall population health. These indicators include life expectancy at birth, healthy life expectancy at birth, and unhealthy life expectancy as a percentage of total life expectancy.

Figure 3 illustrates that less developed countries have a low life expectancy at birth, for instance the former soviet central Asian republics. The three Baltic States belong to the high mortality group, while post-socialist Central European countries are in the higher life expectancy group. More developed countries like United States, Spain and France represent the longest life expectancy at birth group. Low level of life expectancy at birth was observed among Central Asian republics. In these countries depend on several factors such as high values of infant and adult mortality, also, no little role played socio-economic condition in the country. The post-socialist European level after transition period was closer to western level. Low mortality populations showed high life expectancy at birth among others.

With an increase in life expectancy throughout the developed world driven mainly by people living longer, an important question is raised: are people spending these extra years of life in "poor health"? The issue of a "healthy life expectancy" stresses that the increase in life expectancy alone is not important. What is important is that people are living longer lives in better health. Figure 4 shows the average number of years spent in good or so called "full health" and also in "poor health".

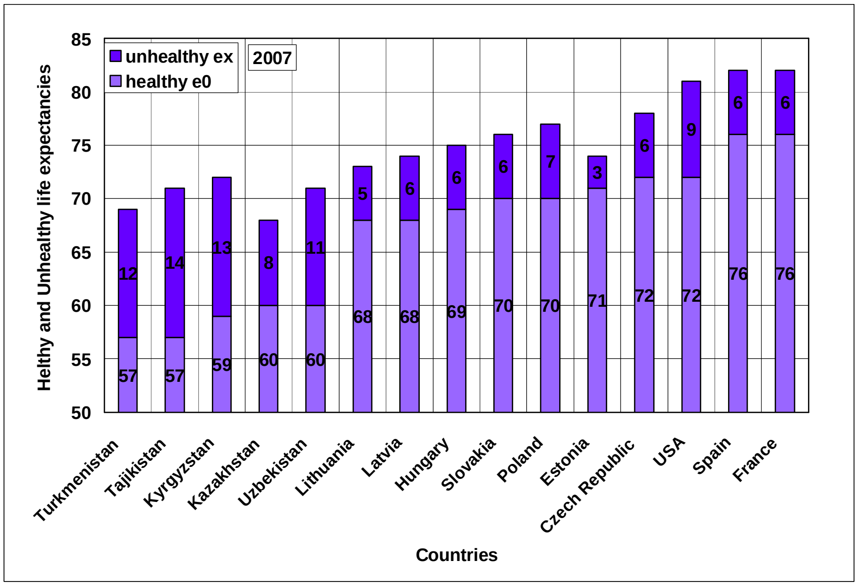
Figure 3 - Life expectancy at birth in the selected countries for both sexes, 2007



Source: Human Development Report 2009

Healthy life expectancy at birth for both sexes in Tajikistan in 2007 was 57. This means that people born in 2007 could expect to lose an average of 12 years of their life to a disability, while the population in developed countries could expect to lose just 6 years. The five countries with the lowest healthy life expectancy belong to central Asia. Even when a person is considered to be in "full health", they still have a very short lifespan. The reasons for this gap in lifespan include lifestyle factors, such as smoking and a diet high in fat and extremely low in antioxidants. This poor quality diet also results from traditional preferences for fatty foods and animal products rather than fruits and vegetables. Household food supplies are limited due to the restricted access of farmlands and markets. Another factor is the poor detection and treatment of hypertension. In this period of transition, problems concerning 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. Since the collapse of the Soviet Union, alcohol consumption and smoking have begun to play a smaller role. However, they have become more common among adolescents and young people, partnered with a rise in the use of illicit drugs (Khodjamurodov and Rechel 2010). The coefficient of correlation between these two indicators is equal to $r = -0.802$. This result shows that a Healthy life expectancy at birth compared with an Unhealthy life expectancy as a percent of the total life expectancy have a strong negative correlation to each other. In other words, the two variables are different, but the points are close enough together to fit a line (Statistical glossary).

Figure 4 - Healthy life expectancy at birth and unhealthy life expectancy as a percentage of total life expectancy in the selected countries for both sexes, 2007



Note: sorted according to healthy life expectancy at birth and Coefficient of correlation between these indicators r =-0.802
Source: Human Development Report 2009

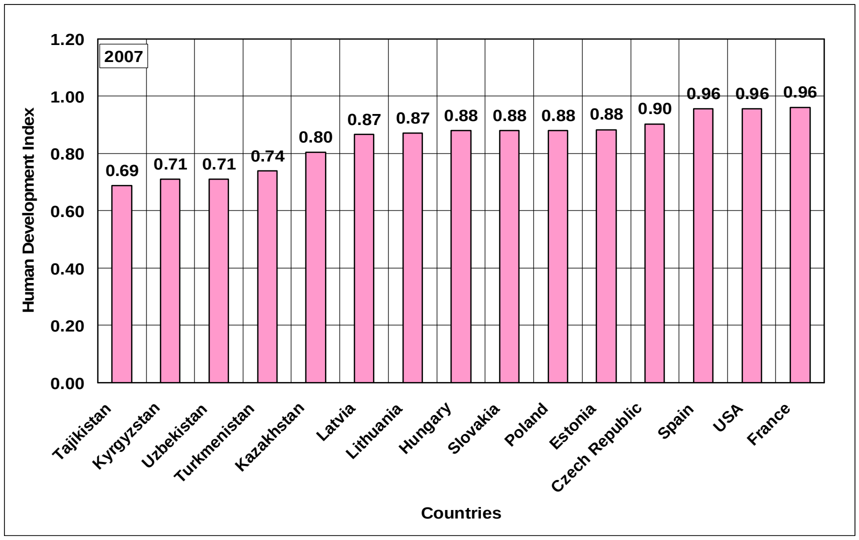
3.2 Social-economic situation in selected countries

A country's health system should aim to achieve three goals: good health, responsiveness to the expectations of the population, and fairness in financial contributions. The WHO's measurement of a country's overall health system performance is a composite index of five measures adjusted for national wealth and education level: average health attainment for the population, its distribution within the population, responsiveness to patients, health attainment distribution within the population and financial contributions.

The Human Development Index (HDI), intended to counter the international preoccupation with economic indicators, contains three measures: life expectancy at birth, adult literacy and income per capita in GDP (US$ PPP). According to Figure 5 we can compare HDI among the selected countries. The results of this comparison show a low value HDI in central Asian states and a higher value in the countries of the central European and Baltic republics. The highest values belong to Spain, the USA and France due to a longer lifespan, higher income, and higher level of education.

Education is seen as intrinsically important for human development. Education is therefore a key element in the fulfillment of the human condition. Figure 6 shows the portion of the adult population aged 15 years and over which is literate. Firstly, we should take into account that education systems are different. For example, in Kazakhstan after finishing secondary school you can easily begin your university studies. In the United States, entering a university is very difficult due to high costs. In order to study for free, you need to stand out, for example show exemplary talent in a particular sport.

Figure 5 - Human Development Index in the selected countries for both sexes, 2007



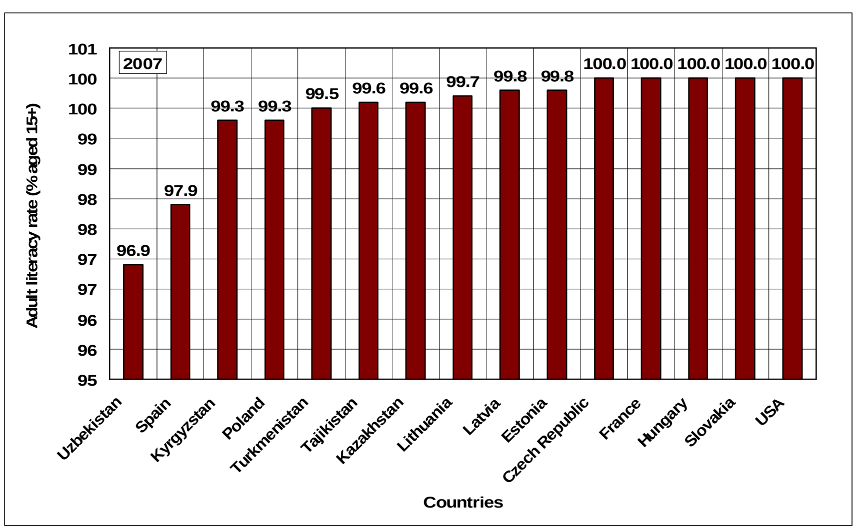
Source: Human Development Report 2009

Literacy rates measure a self-reported situation. External factors may influence people to describe themselves in a way that is different from what they would otherwise report. For instance, social stigmatization or pride might lead the individual to answer “yes” when the answer in actuality should be “no”; while expectations to benefit from social assistance programmes might have the opposite effect (Human Development Report 2009).

In collecting literacy data, many countries estimate the number of literate people based on self-reported data. Some use educational attainment data as a proxy, but measures of school attendance or grade completion may differ. Because definitions and data collection methods vary across countries, literacy estimates should be used with caution.

Figure 6 illustrates the ALR the percentage of people aged 15 and above who can with understanding both read and write a short, simple statement. In half of the countries studied, the ALR value is more than 95%. Educational attainment not literacy in some countries

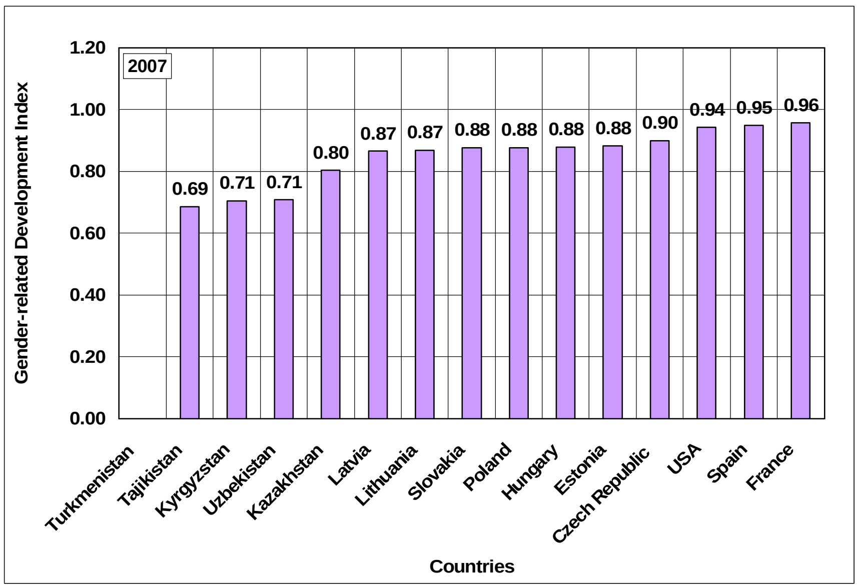
Figure 6 - Adult literacy rate as a percentage of aged 15 and above in the selected countries, 1999-2007



Source: Human Development Report 2009

The Gender-related Development Index (GDI), developed by the United Nations, is one indication of the standard of living. This indicator shows inequalities in achievement between women and men. Figure 7 represents GDI in selected countries, but not for all. There is no data available for Turkmenistan. Due to traditions and customs, the integration of central Asian women into the developmental process and their participation in economic and political activities is relatively low. The Eastern woman's typical progression is from wife to mother, followed by caretaker of the home. In contrast, high levels of GDI are observed in Latvia, Lithuania, Slovakia, Poland, and Hungary, with the highest level observed in France.

Figure 7 - Gender-related Development Index in the selected countries, 2007

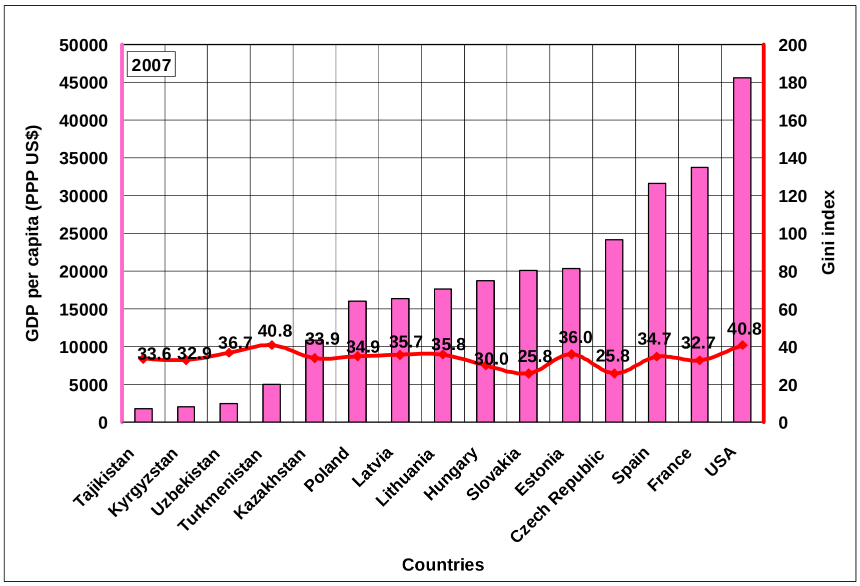


Source: Human Development Report 2009

The Gini index is fundamentally simple in that it can be compared across countries and easily interpreted. GDP statistics are often criticized as they do not represent changes for the whole population; however, the Gini coefficient demonstrates how income has changed for the poor and rich. If the Gini coefficient is rising as well as the GDP, poverty is not necessarily improving (Economical glossary). Figure 8 illustrates GDP per capita (PPP US$) on one side and the Gini index on the second. Using a GDP per capita (PPP S$) basis is arguably more useful when comparing generalized differences in living standards on the whole between nations because it takes into account the relative cost of living and the inflation rates of the countries, rather than using just exchange rates which may distort the real differences in income (Economic Glossary).

When describing countries they can be divided in four groups: the first country group with a low level of GDP consists of all central Asian states. The second group with a higher GDP includes Poland, Latvia, Lithuania and Hungary. The next group of countries, whose GDP falls between 20000 and 25000 US$ per capita, belongs to Slovakia, Estonia and the Czech Republic. Obviously, the highest level of GDP is observed in Spain, France and the USA. According to the Gini index the grouping of countries is different. If the income inequality value is closer to 0, perfect equality is observed (everyone has the same income). A score of 100 means perfect inequality (one person has all the income, everyone else has nothing). In Slovakia, the Czech Republic, Hungary, France and Kyrgyzstan the values of the Gini index fall between 25 and 33, showing a lower level of income inequality among these selected countries. With a higher level of inequality is the second group, containing Tajikistan, Kazakhstan, Spain and Poland. The next two groups of countries have a slightly larger gap of income inequality compared to the first two. In the higher group there are three Baltic states and Uzbekistan. Lastly, the highest inequality in income distribution is observed in Turkmenistan and the United States. The coefficient of correlation between these two indicators is equal to r = -0.0003. This result shows that the GDP per capita (US$) and Gini index have a weak negative correlation to each other. These two variables are different to the other and their points on the graph are dispersed (Statistical dictionary).

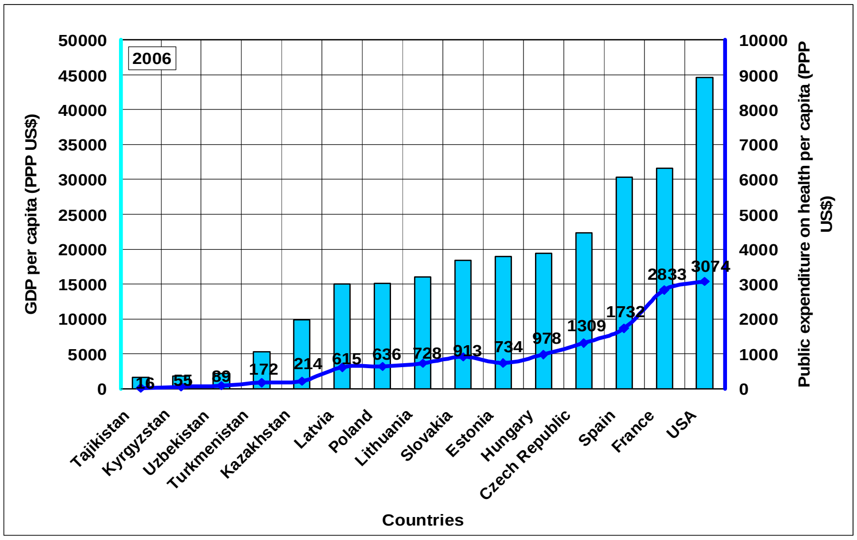
Figure 8 - GDP per capita (PPP US$) and Gini index in the selected countries, 2007



Note: Coefficient of correlation between these indicators r =-0.0003
Source: Human Development Report 2009

The last indicator describes population health expenditure per capita (PPP US$). Health expenditure includes the provision of health services, family planning activities, nutrition activities and emergency aid designated for health. However, this excludes the provision of water and sanitation. Globally in 2006, expenditure on health was about 8.7% of gross domestic product. This translates to about US$ 716 per capita on the average. Figure 9 illustrates health expenditure in selected countries ranging from a very low value of 1% in Tajikistan to a high level of 9% in France. If a country has a high GDP per capita, public expenditure on health will also be high. Literature on income and health shows that health tends to decline at lower income levels. In contrast, an increase in income means an improvement in health (Berkman and Kawachi 2000). This easily explains the trend which is observed in central Asia: they have low life expectancies, a low level of public expenditure on health and a low level of GDP. An opposite situation is observed in more developed countries: a high level of GDP coupled with a high life expectancy at birth. The coefficient of correlation between these indicators is equal to r = 0.954. This means that GDP per capita (PPP US$) and Public expenditure per capita (PPP US$) have a strong positive correlation to each other. It means that these two variables have the same changes but the points are more close together and form a line (Statistical glossary).

Figure 9 - GDP per capita (PPP US$) and Public expenditure on health per capita (PPP US$) in the selected countries, 2006



Note: Coefficient of correlation between these indicators r = 0.954
Source: Human Development Report 2009, www.worldbank.org

3.3 A hierarchical analysis based on all selected indicators

A hierarchical cluster analysis (based on Euclidean distance and Ward method) performed on all selected indicators (TFR, Healthy life expectancy at birth, Unhealthy life expectancy, Adult literacy rate, GDP per capita (PPP US$) and Gini index) in the selected countries clearly illustrates how the countries are currently divided according to the similarities on demographic and socio-economic variables in the countries (see Figure 10).

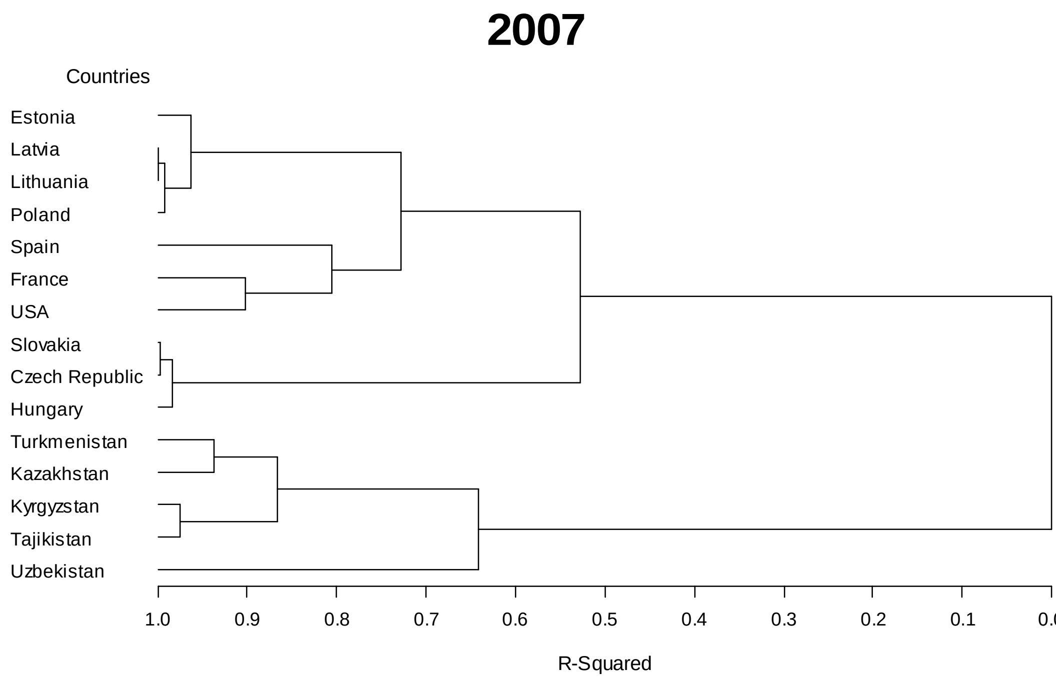
Table 2 – Demographic and socio-economic indicators in the selected countries for both sexes, 2007

Countries	TFR	Healthy e_0	Unhealthy ex	ALR	GDP (PPP US$)	Gini index
Kazakhstan	2.5	60	8	99.6	10863	33.9
Kyrgyzstan	2.7	59	13	99.3	2006	32.9
Tajikistan	3.5	57	14	99.6	1753	33.6
Turkmenistan	2.5	57	12	99.5	4953	40.8
Uzbekistan	2.6	60	11	96.9	2425	36.7
Czech Republic	1.4	72	6	100.0	24144	25.8
Hungary	1.3	69	6	100.0	18755	30.0
Poland	1.3	70	7	99.3	15987	34.9
Slovakia	1.3	70	6	100.0	20076	25.8
Estonia	1.6	71	3	99.8	20361	36.0
Latvia	1.4	68	6	99.8	16377	35.7
Lithuania	1.4	68	5	99.7	17575	35.8
France	2.0	76	6	100.0	33674	32.7
Spain	1.4	76	6	97.9	31560	34.7
USA	2.1	72	9	100.0	45592	40.8

Note: Public expenditure on health per capita (PPP US$) do not include, because data is only for 2006 and *Countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations*
Source: Human Development Report 2009

According to the description (or analysis) of demographic development and socio-economic situations in the selected countries, they are obviously divided into four groups (see Figure 10). Each country groups shows similarities in development. Moreover, they share a similar historical background.

Figure 10 - Dendogram resulting from main age-specific indicators of mortality level in the selected countries for both sexes, 2007



Note: Public expenditure on health per capita (PPP US$) do not included, because data is only for 2006.
Source: Human Development Report 2009

The country groupings show the result: there are obvious differences between former Soviet Central Asia and the post-socialist European area paired with more developed western countries. These two major country groups can be divided into four subgroups.

The similarities in development among the Baltic countries and Poland were observed in 2007. Following the collapse of the socialist regime these countries started to develop in a European way. The second group is comprised of Spain, France, and the USA: countries which have had a similar development. The third group Hungary together with the Czech Republic and Slovakia (former Czechoslovakia which share more than half a century of history). The Central Asian republics, in their modern form, are still young among the selected countries. They are in the midst of extremely complex social, political and economic transition.

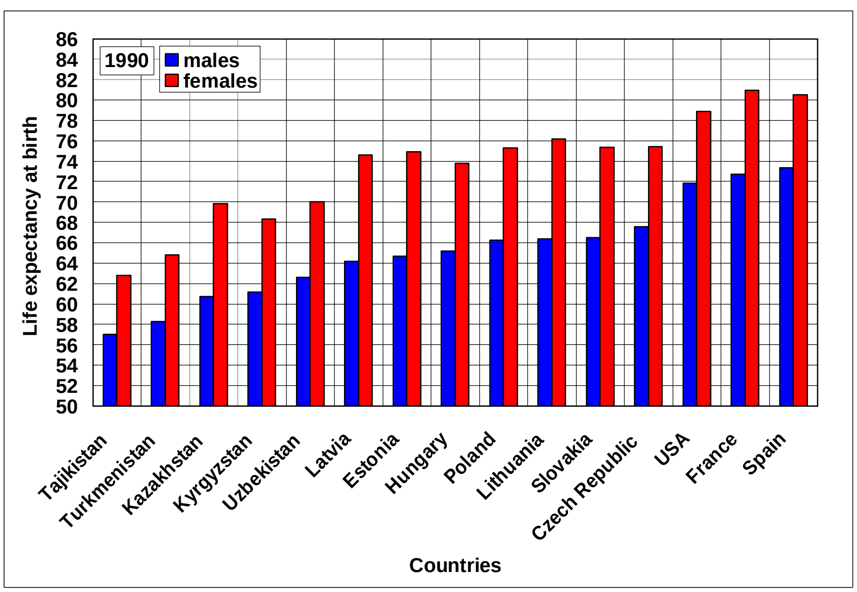
Finally, all selected countries experienced different patterns of demographic development along with changes in socio-economic conditions for individuals. The main differences are associated with different levels of development in their economy, financials, and social services. However, the cluster analysis based on the selected variables (see Table 3) showed how countries are both distinguished and combined. Thus, the similarities and dissimilarities in the selected variables display the convergence and divergence of the selected countries with each other.

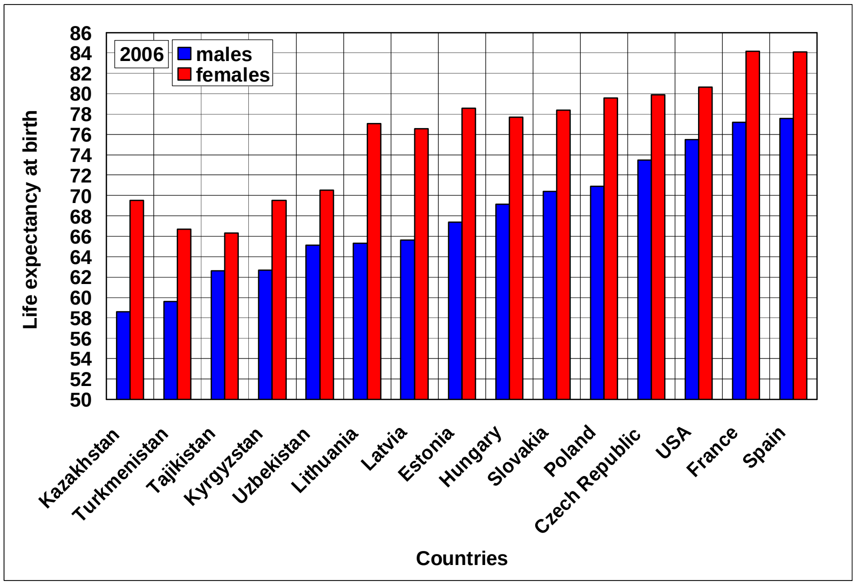
4. Analytical part

4.1 Changes in life expectancy at birth in selected countries between 1990 and 2006

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. It's likely that life expectancy by age 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 20th 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 1990, life expectancy at birth in the world was 65.0 years and it reached 68.5 years in 2006 (www.worldbank.org).

Figure 11 - Life expectancy at birth in the selected countries, 1990 and 2006





Note: sorted according to male's life expectancy at birth
Source: www.mortality.org, www.who.int

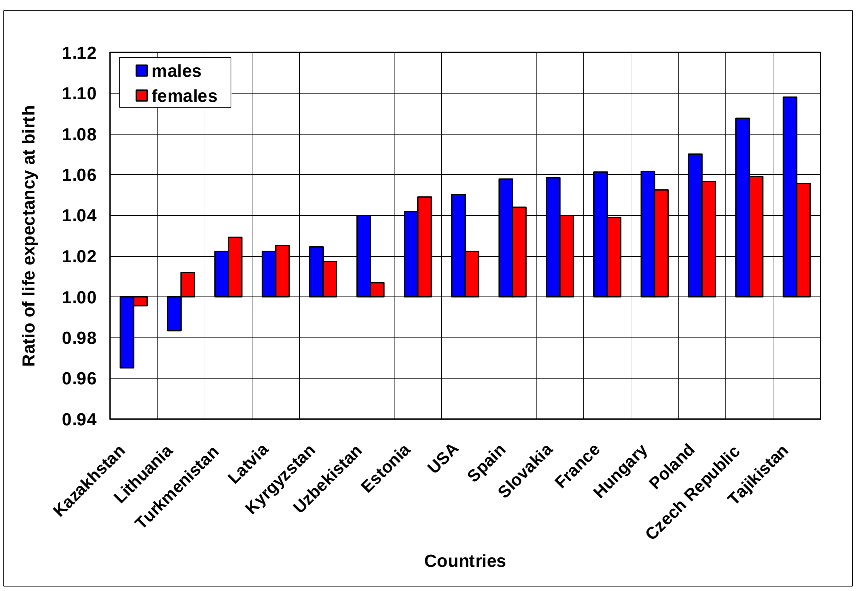
To understand the low life expectancy at birth in Central Asia among selected countries, the impact of the economic crisis that occurred after the collapse of the Soviet Union must be explored. Equally, issues such as increasing poverty and deteriorating health also deserve to be discussed. There may also be an increase in deaths from alcohol. This assumption would be consistent with the fact that the region recorded in the period 1990 and 2006 a sharp decline. In contrast, life expectancy at birth rose sharply in the late 1980's because of the anti-alcohol campaign. According to Figure 11 in 1990 life expectancy at birth among Tajik males was 57.0 years and 62.8 years for females. While in 2006 this value increased to 62.6 years for males and 66.3 years for females. Tajikistan's situation requires separate consideration (McKee. Healy and Falkingham 2002). Significantly, the dramatic decline in life expectancy at birth in the early 1990s coincided with the civil war. Contrastingly, the situation in other Central Asian countries was different, where life expectancy at birth was higher than in Tajikistan. In Uzbekistan, Kyrgyzstan and Turkmenistan life expectancy at birth increased by 1.3 - 2.5 years for males, and 0.5 – 1.9 years for females comparing the years 1990 and 2006. Kazakhstan's life expectancy at birth decreased between 1990 and 2006 by 2.1 years for males and 0.3 years for females. Kazakhstan also 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 1990s, from 60.7 years in 1990 to 58.6 years in 2006. The decrease in life expectancy at birth in Kazakhstan in the 1990s is largely due to an increase in mortality from cardiovascular diseases, in particular among middle-aged males. The age-standardized mortality rate from ischemic heart disease for males increased from 405 per 100 000 male population in 1989 to 611 per 100 000 in 1996, declining again to 525 in 2005 (WHO Regional Office for Europe 2007). 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 1990, the lowest value of life expectancy at birth among the selected Central European countries was observed in Hungary (65.2 years – males, 73.8 – females). Nowadays the situation in Central European countries has positively changed as one country after another has resumed its health progress. In 2006, life expectancy at birth increased by 3.9 – 5.9 years for males and 3.0 – 4.5 years for females.

The low male life expectancy at birth is observed in the Baltic countries group. The lowest value in 1990 was 64.2 years in Latvia and in 2006 it was 65.3 years in Lithuania. In 2006 the lowest female life expectancy at birth was observed in Latvia at 76.5 years among Baltic states. When comparing the beginning and the end of the periods of study, male life expectancy at birth decreased by 1.1 years in Lithuania and increased only by 1.4 years in Latvia. In the years 1990 and 2006 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 Baltic States. During these years, male excess mortality reached its highest value, the gap between male and female life expectancy at birth was about 11 years.

The relatively high standard of health care, sanitary culture and economic development on the territory of France, Spain and the USA determined a higher level of life expectancy at birth in comparison with the other selected countries. Between 1990 and 2006 the life expectancy at birth in Spain which was the highest among observed countries, rose from 73.3 to 77.6 years for males, whereas life expectancy at birth among French females increased from 81.0 to 84.1 years in the same period of time.

Figure 12 – Ratio of life expectancy at birth in 2006 to life expectancy at birth in 1990 in the selected countries.



Note: sorted according to male's life expectancy at birth
Source: www.mortality.org, www.who.int

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.

4.2 Mortality patterns and trends in post-communist countries compared with low mortality populations

The main differences and similarities in mortality development will be addressed through a detailed analysis of age-specific mortality profiles in selected countries. The aim of this analysis is to:

- Study age-specific mortality profiles and compile a typology of country differences according to age-specific mortality intensities.

Instead of five year age groups broad age categories were selected: infant mortality, child mortality, young adult mortality, adult mortality, older adult mortality, old age and the oldest age mortality intensities. All mortality indicators according to selected age categories were computed from life (mortality) tables. The reasons for selecting these categories are highlighted below:

Infant mortality rate is defined as being the number of children dying under a year of age divided by the number of live births that year (Demographic dictionary). The infant mortality rate is an important measure of the well-being of infants, children, and pregnant women because it is associated with a variety of factors, such as maternal health, quality and access to medical care, socio-economic conditions, and public health practices.

Child mortality is measured by the probability of dying between the exact ages of 1 and 15 and was chosen because: firstly, it is easier to find out the life status of a child, because children do not change their residence so often and they seldom take another family name; Secondly, each child is placed under medical observation, therefore it is possible to detect all the exposure and effects of previous fetal development. They are verified more exactly because in these cases the pathology examination is obligatory.

Young adult mortality is measured by probability of dying between the exact ages of 15 and 30. It is a population who enters to a reproductive age and starts to deliver children. Over half a million women die each year in the world due to complications during pregnancy and birth. The vast majority of these deaths are preventable. Maternal health has a particularly close relationship to the right to the highest attainable standard of health. Until now, maternal death is one of the major causes of high mortality in Central Asian countries.

Adult mortality is measured by the probability of dying between the exact ages of 30 and 45. In these years of life people have already graduated from university and have a job. High working age mortality is primarily observed in Central Asia and Baltic countries.

Older adult mortality is measured by the probability of dying between the exact ages of 45 and 60. The level of adult mortality is becoming an important indicator for the comprehensive assessment of the global mortality patterns.

Old age mortality is measured by the probability of dying between the exact ages of 60 and 75 and was chosen because of the proportion of mortality that occurs at an older age in the overall mortality increases, and questions arise about how old age mortality varies over time and across different groups. Importantly, the answers can provide critical insights into the effectiveness of investments to reduce mortality through medical care, behavioral change, and other interventions both early and late in life.

The oldest age mortality is measured by the probability of dying between the exact ages of 75 and 90. This was chosen primarily because the last available age for selected countries was 90 and secondly, to observe population longevity. Nowadays, in more developed countries life expectancy at birth continues to increase. This increase in life expectancy at birth is caused by adult mortality, in particular the mortality of the oldest age group. The mortality of this age group is falling drastically, and paradoxically, this decrease has not been studied greatly beyond statistical descriptions. Little is still known of its causes and mechanisms (Verdiell 2007).

Widespread discrepancies in definitions and reporting procedures for live births and infant deaths have also been documented in a survey of European countries, including a number of former socialist East European countries as well as the Baltic republics of the former Soviet Union (Aleshina and Redmond 2003), and to a more limited extent, in earlier work by the United Nations (1985). Of course, the artifacts affecting cross-national differences in reported IMRs are not limited to matters of definition, but also include differential completeness and accuracy of registration of live births and infant deaths. (Kingkade and Sawyer 2001). The data used in the analysis was taken from authentic sources, which were not amended in any way.

The main age-specific indicators of the mortality level for selected post-communist and low mortality population countries separated for males, females and both sexes in 1990 and 2006 respectively. These variables were used for the hierarchical cluster analysis based on Euclidean distance and Ward method. Table 3 shows mortality indicators in 1990 for males in selected countries.

Table 3 - Main age-specific indicators of mortality levels in the selected countries for males, 1990

Countries	IMR	${}_{14}q_1$	${}_{15}q_{15}$	${}_{15}q_{30}$	${}_{15}q_{45}$	${}_{15}q_{60}$	${}_{15}q_{75}$
Kazakhstan	0.0570	0.0205	0.0356	0.0787	0.2324	0.5421	0.9117
Kyrgyzstan	0.0683	0.0207	0.0313	0.0797	0.2031	0.4987	0.8969
Tajikistan	0.0988	0.0402	0.0283	0.0755	0.2210	0.5803	0.9468
Turkmenistan	0.0937	0.0298	0.0300	0.0698	0.2249	0.5523	0.9190
Uzbekistan	0.0702	0.0252	0.0233	0.0592	0.1842	0.4700	0.8674
Czech Republic	0.0126	0.0046	0.0163	0.0439	0.1820	0.5255	0.9326
Hungary	0.0165	0.0054	0.0228	0.0737	0.2323	0.5151	0.9178
Poland	0.0212	0.0062	0.0227	0.0605	0.1975	0.4923	0.9051
Slovakia	0.0140	0.0049	0.0182	0.0572	0.2120	0.5137	0.9139
Estonia	0.0137	0.0116	0.0356	0.0762	0.2148	0.5314	0.9045
Latvia	0.0143	0.0134	0.0359	0.0813	0.2209	0.5301	0.8973
Lithuania	0.0111	0.0092	0.0295	0.0774	0.2045	0.4690	0.8548
France	0.0085	0.0040	0.0201	0.0381	0.1169	0.3330	0.8255
Spain	0.0083	0.0049	0.0218	0.0329	0.0977	0.3310	0.8236
USA	0.0106	0.0049	0.0237	0.0412	0.1155	0.3662	0.8097

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.mortality.org, www.who.int

Table 4 clearly illustrates that the infant mortality rate in Tajikistan and Turkmenistan is about 12 times higher than in Spain. Child mortality in these countries showed some of the highest values among the selected countries. In Central Asian republics high mortality was observed in young ages. The vulnerable age groups in these countries are the under 15s. If a newborn baby can survive in the first 15 years of its life then the risk factors of dying will be lower. In Central Europe the situation is better than in Central Asia. This could be the result of several factors, for example, Central Asia is characterized by high child mortality and moderate adult mortality. The excess years of lost life are overwhelmingly due to excess mortality among boys and girls under 5 years old (80.4% of Expected Years of Life Lost (EYLL)). The causes include respiratory infections (56.6% of EYLL), diarrheal diseases (17.0% of EYLL) and perinatal conditions (10.8% of EYLL) dominate (Becker and Hemley 1998). Age-specific indicators of the mortality level are about twice as high as Spain. However, in the Czech Republic mortality at the ages of 1 and 30 was lower than Spain's level. This mortality pattern could be due to several factors, such as the low external causes of death in Central European countries in the 1990s. In the Baltic states a similar situation was observed, akin to that of Central Europe. In low mortality populations: the mortality levels in the USA and France are similar to the Spanish level. This could possibly be because of a higher standard of living and more developed socio- economic conditions in these countries.

Table 4 – Ratio of main age-specific indicators of mortality levels to the reference country Spain (the longest life expectancy at birth in 1990) in selected countries for males, 1990

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	6.8628	4.2263	1.6323	2.3876	2.3772	1.6377	1.1071
Kyrgyzstan	8.2214	4.2709	1.4347	2.4208	2.0778	1.5067	1.0891
Tajikistan	11.8905	8.2841	1.3006	2.2918	2.2608	1.7532	1.1497
Turkmenistan	11.2708	6.1396	1.3753	2.1183	2.3007	1.6686	1.1158
Uzbekistan	8.4428	5.1973	1.0670	1.7975	1.8843	1.4200	1.0532
Czech Republic	1.5126	0.9542	0.7469	1.3335	1.8625	1.5876	1.1324
Hungary	1.9892	1.1132	1.0469	2.2362	2.3770	1.5561	1.1144
Poland	2.5560	1.2828	1.0424	1.8360	2.0206	1.4874	1.0990
Slovakia	1.6823	1.0162	0.8370	1.7356	2.1694	1.5519	1.1097
Estonia	1.6510	2.3998	1.6341	2.3118	2.1971	1.6053	1.0983
Latvia	1.7184	2.7588	1.6483	2.4682	2.2603	1.6014	1.0895
Lithuania	1.3297	1.8867	1.3536	2.3488	2.0920	1.4168	1.0379
France	1.0193	0.8213	0.9208	1.1559	1.1964	1.0061	1.0023
USA	1.2804	1.0149	1.0872	1.2507	1.1821	1.1063	0.9832
Spain	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

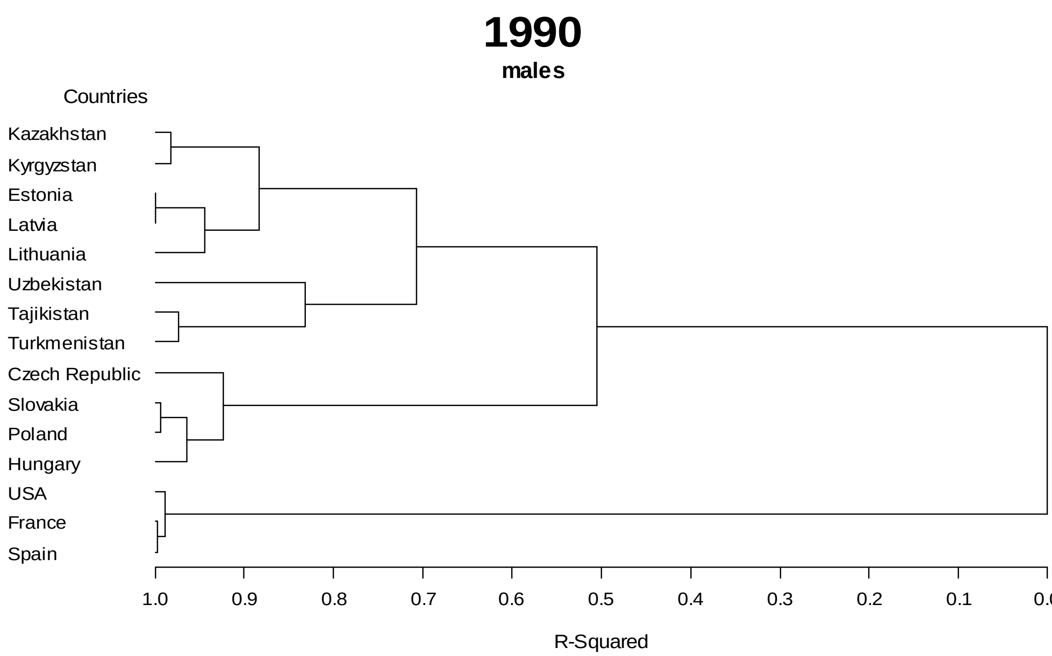
Note: q_x / q_x^{ref} (Every country/Spain) and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

The dendrogram can be defined as a graphical representation of country grouping based on the results of hierarchical cluster analysis. This is a tree plot where each step of hierarchical clustering is represented as a fusion of two branches of the tree into a single one source. It is a branching diagram representing a hierarchy of categories based on the degree of similarity or number of shared characteristics between clusters (countries). The branches represent clusters obtained on each step of hierarchical clustering.

The result of grouping countries in a cluster analysis can be clearly seen in Figure 13. Specifically, the selected countries are divided into two big groups and four subgroups.

All post-socialist countries are in the first group and the more developed countries in the second. The first subgroup is represented by Kazakhstan, Kyrgyzstan, Estonia, Latvia and Lithuania. The second subgroup is represented by Uzbekistan, Tajikistan and Turkmenistan. The third subgroup includes all Central European countries and the USA, France and Spain are depicted in the fourth subgroup.

Figure 13 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in the selected countries for males, 1990



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

Table 5 highlights groups of countries with low and high values. Among the selected countries, both high young adult, adult and old adult mortality are observed in three Baltic states together with Kazakhstan and Kyrgyzstan. Together with such indicators as infant, child, old and the oldest age, mortality intensities are above the average value for the selected countries. Excess working age male mortality in these countries is related to several factors. For example, male jobs are on average unhealthier than female jobs. Also the lifestyle of males is more detrimental, because of factors such as higher smoking and alcohol consumption (Bygbjerg and Meyrowitsch 2007).

The second subgroup of countries is represented by Uzbekistan, Tajikistan and Turkmenistan where high infant, child and old age mortality levels are reported. The high infant mortality rate which increased throughout the 1990s can be partly explained by the reclassification of stillbirths to infant deaths by Soviet definition. The high value of old age mortality depends on the health care system in these countries. In this period socio-economic conditions were not good. For instance, GDP per capita (US$) was an average 676 US$ in this group, while the Central Asian countries average amounted to 856 US$.

Low young adult mortality and high value of the oldest age mortality was observed in the Central European countries. High mortality in the oldest age group shows that people survive until later life due to the several facts such as good health care systems and perfect life conditions for the population. Infant and child mortality rates in post-communist Central European countries were below average among the selected countries. In some countries, the worsening of mortality at the adult and higher age group was short-lived and followed by improvements in health. This was rapid in some countries, such as Poland and the Czech Republic, and delayed in others, such as Hungary (Monostrori *et al.* 2010).

In the last subgroup, the United States, France and Spain, the results showed a low level of all selected indicators. The one exception was young adult mortality, although this indicator was still below average level. For instance, The United States spends more on health per capita than any other country, a trend that continues to increase. Major sponsors for health care include private health insurers and public programs such as Medicaid and Medicare. Furthermore, these countries spend a larger share of its gross domestic product (GDP) on health than any other major industrialized country in the world. In 2006, the United States, France and Spain devoted 9 – 15% of its GDP to health, compared with 11% in Switzerland, the country with the next highest share (WHO 2006).

Table 5 - Average values of each country group for males, 1990

Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Kyrgyzstan, Estonia, Latvia, Lithuania	0.0329	0.0151	0.0336	0.0786	0.2151	0.5143	0.8931
Uzbekistan, Tajikistan, Turkmenistan	0.0875	0.0317	0.0272	0.0682	0.2100	0.5342	0.9111
Czech Republic, Slovakia, Poland, Hungary	0.0161	0.0053	0.0200	0.0588	0.2060	0.5117	0.9173
France, Spain USA	0.0091	0.0046	0.0219	0.0374	0.1101	0.3434	0.8196
Average	0.0364	0.0142	0.0257	0.0608	0.1853	0.4759	0.8853

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

All selected mortality indicators provide information about levels of life, but also about political, socio-economic status and medicine levels in the country. Undoubtedly, if post-communist countries had had a similar history in the past, after the break up of the Soviet Union, the former USSR countries would have developed in a different way.

Compared with 1990, the situation in post-communist countries is more stabilized in 2006 for reasons such as the transformation to a new political system, and a changing economic position. At the same time, in more developed Western countries, the socio-economic and political stability has continued to remain solid.

Table 6 shows data in the selected countries for the male population in 2006. These age-specific indicators were used for cluster analysis and illustrate the development after 16 years.

Table 6 - Main age-specific indicators of mortality levels in the selected countries for males, 2006

Countries	IMR	${}_{14}q_1$	${}_{15}q_{15}$	${}_{15}q_{30}$	${}_{15}q_{45}$	${}_{15}q_{60}$	${}_{15}q_{75}$
Kazakhstan	0.0291	0.0106	0.0545	0.1394	0.3065	0.6115	0.9146
Kyrgyzstan	0.0386	0.0092	0.0253	0.0881	0.2223	0.5749	0.8696
Tajikistan	0.0631	0.0175	0.0211	0.0489	0.1687	0.5837	0.9577
Turkmenistan	0.0525	0.0128	0.0432	0.1059	0.2628	0.5572	0.9220
Uzbekistan	0.0433	0.0123	0.0190	0.0512	0.1716	0.5324	0.8660
Czech Republic	0.0040	0.0026	0.0113	0.0246	0.1160	0.3653	0.8469
Hungary	0.0064	0.0033	0.0117	0.0444	0.2060	0.4538	0.8487
Poland	0.0067	0.0032	0.0145	0.0422	0.1621	0.4049	0.8262
Slovakia	0.0073	0.0040	0.0123	0.0369	0.1553	0.4424	0.8668
Estonia	0.0058	0.0039	0.0275	0.0615	0.2102	0.4772	0.8634
Latvia	0.0083	0.0052	0.0226	0.0798	0.2410	0.5140	0.8732
Lithuania	0.0074	0.0053	0.0298	0.0867	0.2487	0.4962	0.8647
France	0.0042	0.0021	0.0105	0.0242	0.0922	0.2460	0.7179
Spain	0.0041	0.0023	0.0092	0.0210	0.0782	0.2488	0.7338
USA	0.0074	0.0030	0.0191	0.0309	0.0966	0.2794	0.7223

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.mortality.org, www.who.int

Table 7 shows the differences in the mortality pattern in the selected countries. For a better illustration, the mortality level ratio of main age-specific mortality indicators to the benchmark country Spain was calculated. The reason for choosing Spain as a benchmark country was because it experienced the longest life expectancy at birth in 2006 among the selected countries. When comparing the infant mortality rate between the period 1990 and 2006, significantly it continues to rise in Central Asia. In 1990 the highest value was observed in Tajikistan and Turkmenistan, although in 2006 the group of countries also includes Uzbekistan. This could be the result of such factors as nutrition related issues and several prenatal diseases (contracted) during delivery, which are contributing to the high level of infant mortality. Another factor was the poor access to health care in several regions of these countries, which forced women to deliver their children at home (UNICEF). In the Baltic state group, all of the countries have higher values of young adult, adult and older adult death probabilities than Spain. Significant growth in investment, especially financial resources, into the health care system may explain this fact. The number of procedures of medical services also had an increased effect on overall mortality in post-socialist European countries.

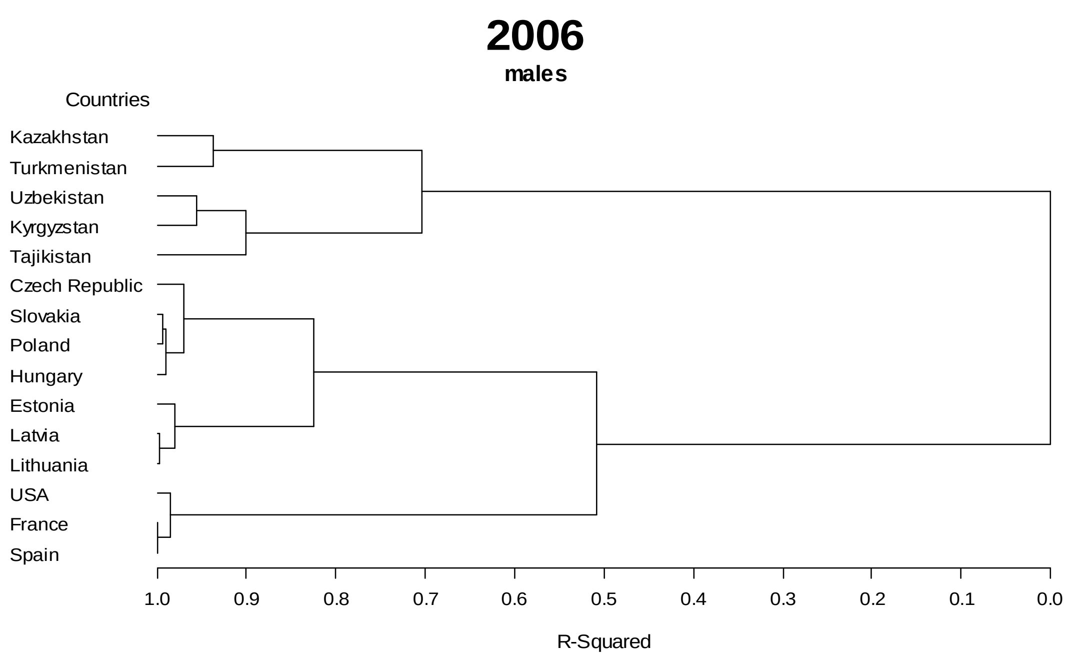
Table 7 – Ratio of main age-specific indicators of mortality levels to the reference country Spain (the longest life expectancy at birth in 2006) in selected countries for males, 2006

Countries	IMR	${}_{14}q_1$	${}_{15}q_{15}$	${}_{15}q_{30}$	${}_{15}q_{45}$	${}_{15}q_{60}$	${}_{15}q_{75}$
Kazakhstan	7.1073	4.5453	5.9450	6.6487	3.9217	2.4575	1.2463
Kyrgyzstan	9.4171	3.9516	2.7629	4.1999	2.8445	2.3106	1.1851
Tajikistan	15.4000	7.5190	2.3035	2.3319	2.1588	2.3457	1.3051
Turkmenistan	12.7927	5.5134	4.7106	5.0502	3.3620	2.2392	1.2565
Uzbekistan	10.5561	5.2990	2.0695	2.4415	2.1956	2.1396	1.1801
Czech Republic	0.9707	1.1335	1.2340	1.1753	1.4838	1.4680	1.1541
Hungary	1.5585	1.4214	1.2709	2.1159	2.6353	1.8237	1.1566
Poland	1.6366	1.3786	1.5796	2.0139	2.0739	1.6273	1.1260
Slovakia	1.7854	1.7297	1.3403	1.7584	1.9864	1.7781	1.1812
Estonia	1.4098	1.6925	3.0033	2.9350	2.6894	1.9177	1.1766
Latvia	2.0146	2.2205	2.4663	3.8067	3.0836	2.0657	1.1900
Lithuania	1.7951	2.2660	3.2485	4.1335	3.1823	1.9943	1.1784
France	1.0146	0.8923	1.1491	1.1564	1.1791	0.9885	0.9783
USA	1.8073	1.2671	2.0807	1.4725	1.2365	1.1227	0.9843
Spain	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note: q_x / q_x^{ref} *(Every country/Spain)* and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

According to the country grouping for 2006, the countries can be divided into two major groups (see Figure 14). Soviet Central Asian republics are clustered into one group, whereas the post-socialist Central European countries and Baltic states together with low population countries are categorized in the second. After the collapse of the socialist regime, the European part of the post-socialist countries is closer to the "western" mortality pattern. These two major groups can be further divided into four subgroups. Kazakhstan and Turkmenistan are in the first subgroup. Uzbekistan, Kyrgyzstan and Tajikistan belong to the second subgroup and both subgroups showed similarities in mortality patterns. Central European countries with Baltic states are in the third subgroup. Western more developed countries are in the last group. Central European countries with Baltic states have shifted over time towards low mortality populations. For example, this may be due to the positive lifestyle changes among a large segment of the population, especially in terms of nutrition (growth in consumption of healthy diets, in part because of the broad range), improving the quality of the environment. More detailed information can be found in Table 8.

Figure 14 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in the selected countries for males, 2006



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

High mortality between the ages of 15 and above is observed in Kazakhstan and Turkmenistan (see Table 10). Also infant and child mortality indicators are above average among the observed countries. In these countries excess male mortality remains high during the working age. Moreover, old and the oldest mortality levels are soaring. Less people survive to old ages and those who do survive, experience high mortality. Socio-economic conditions and health care systems are not well developed in Central Asia. However, in these countries GDP per capita has recently increased. From the 1990s, GDP per capita increased to 3645 US$ (31%) for Kazakhstan and from 881 to 4357 US$ (20%) in Turkmenistan. But public health expenditure as a percentage of GDP rose by 1 % for both republics. The second subgroup of countries (Uzbekistan, Kyrgyzstan, and Tajikistan) underpins the high infant and child mortality patterns. Also, mortality levels in other age groups are above the average level. In 1990, the high values of infant and child mortality indicators were observed in Uzbekistan, Tajikistan and Turkmenistan among the selected countries. After 16 years the situation is similar, and there has been little improvement in the development of this region. Central European and Baltic countries are in the "intermediate group" without any extreme values. After the collapse of the post-communist regime these countries started to improve their economic situation, while also paying more attention to health care. Only the oldest age mortality value is higher than the average level among the selected countries. In the last low mortality population group really low values among the selected countries were observed. Consequently, low mortality populations reflect the best hygienic conditions, the greatest advances in medicine, bacteriology, chemistry, public education, and intellectual progress.

Table 8 - Average values of each country group for males, 2006

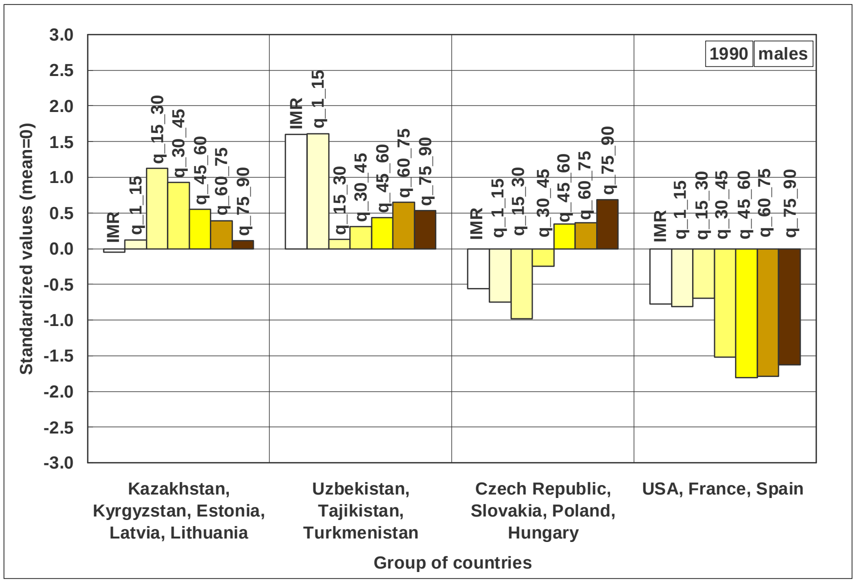
Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Turkmenistan	0.0408	0.0117	0.0488	0.1226	0.2846	0.5843	0.9183
Uzbekistan, Kyrgyzstan, Tajikistan	0.0483	0.0130	0.0218	0.0627	0.1875	0.5637	0.8978
Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Lithuania	0.0065	0.0039	0.0185	0.0537	0.1913	0.4505	0.8557
France, Spain USA	0.0052	0.0025	0.0129	0.0254	0.0890	0.2581	0.7247
Average	0.0252	0.0078	0.0255	0.0661	0.1881	0.4641	0.8491

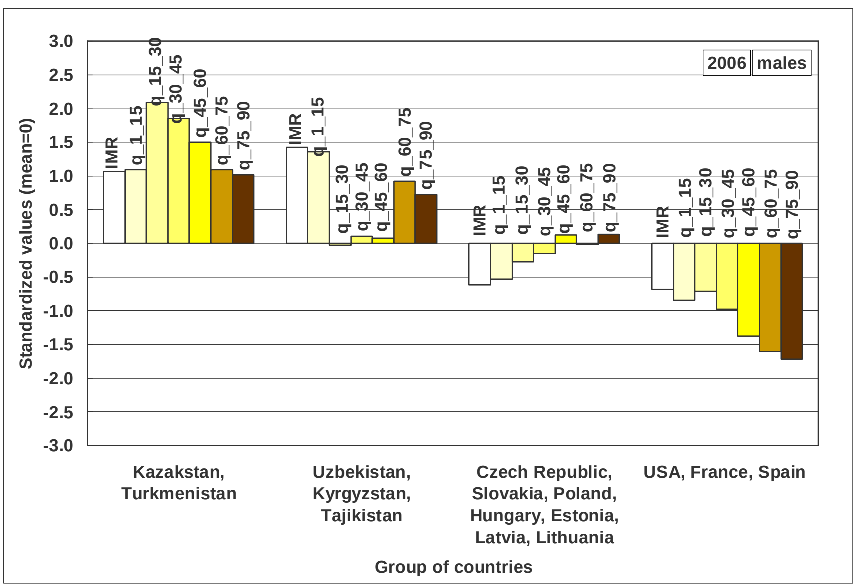
Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

Figure 15 clearly provides a summary of comparison between the male mortality pattern in 1990 and 2006 among the selected countries. Mortality indicators in the selected countries are standardized where mean is equal to zero and standard deviation to one. According to Figure 5 the Baltic states show mortality behavior like "migrant" countries, in essence, they have migrated from a "high" mortality level at the ages of 15 and above in 1990, to an "intermediate" level of mortality in 2006. A "co-countries" pattern was observed in the USA, France and Spain. During the mortality analysis it can be obviously seen that these Western more developed countries have a similarity and showed a "low mortality" pattern.

Finally, male mortality trends in the selected countries showed a heterogeneous picture. However, it clearly illustrates that post Soviet Central Asia countries showed the highest mortality level among the selected countries.

Figure 15 - Standardized values of main mortality indicators in the selected countries for males, 1990 and 2006





Note: Standardized values: mean=0, standard deviation=1
Source: Author's calculations based on data from www.mortality.org, www.who.int

The USA, France and Spain are always in the lowest mortality group. While Central European countries and Baltic States are in an intermediate position between high and low levels of mortality. However, it evidently shows that changes in health care, associated with the socio-economic transition. Also the development of medicine and the changes in lifestyle (slight decreases in smoking and alcohol consumption) have played a role in the decline male mortality.

Women live longer than men. Indeed, in the more developed countries today women live 6 years longer than men on average. This difference varies from country to country. For example, in 1990 Latvia had the largest gap among the selected countries, with a male–female difference in life expectancy at birth of 10.5 years. This gender gap among Latvian life expectancy at birth is due to the divergent trends in the child and adult mortality during the 1990s. There has been no increase in the health status of adults, but a slow improvement in infant and children health. Decline in life expectancy affected by changes of infant mortality (Krumins 2001). Factors associated with high rates of infant deaths can be better understood by examining the two components of the infant mortality rate: neonatal mortality (deaths during the first twenty-eight days) and post neonatal mortality (deaths between twenty-eight days and one year). Neonatal mortality is associated with prematurity, low birth weight, and congenital defects, whereas post neonatal mortality is associated with diarrhea from poor sanitation and improper milk processing, communicable diseases, and pneumonia. Improvements in prenatal care and intensive care services for low-birth weight babies influence neonatal mortality rates, while control of infectious disease and better nutrition affect post neonatal mortality (Aleshina and Redmond 2003). Conversely, Tajikistan experienced one of the lowest gender differences, with a gap of only 5.8 years. It can be related to the several years of the civil war in Tajikistan. Mortality gaps are also found in the more developed world, although there are small differences.

In Table 9 illustrates initial data for the hierarchical cluster analysis between females in the selected countries in 1990.

Table 9 - Main age-specific indicators of mortality levels in the selected countries for females, 1990

Countries	IMR	${}_{14}q_1$	${}_{15}q_{15}$	${}_{15}q_{30}$	${}_{15}q_{45}$	${}_{15}q_{60}$	${}_{15}q_{75}$
Kazakhstan	0.0570	0.0205	0.0356	0.0787	0.2324	0.5421	0.9117
Kyrgyzstan	0.0683	0.0207	0.0313	0.0797	0.2031	0.4987	0.8969
Tajikistan	0.0988	0.0402	0.0283	0.0755	0.2210	0.5803	0.9468
Turkmenistan	0.0937	0.0298	0.0300	0.0698	0.2249	0.5523	0.9190
Uzbekistan	0.0702	0.0252	0.0233	0.0592	0.1842	0.4700	0.8674
Czech Republic	0.0126	0.0046	0.0163	0.0439	0.1820	0.5255	0.9326
Hungary	0.0165	0.0054	0.0228	0.0737	0.2323	0.5151	0.9178
Poland	0.0212	0.0062	0.0227	0.0605	0.1975	0.4923	0.9051
Slovakia	0.0140	0.0049	0.0182	0.0572	0.2120	0.5137	0.9139
Estonia	0.0137	0.0116	0.0356	0.0762	0.2148	0.5314	0.9045
Latvia	0.0143	0.0134	0.0359	0.0813	0.2209	0.5301	0.8973
Lithuania	0.0111	0.0092	0.0295	0.0774	0.2045	0.4690	0.8548
France	0.0085	0.0040	0.0201	0.0381	0.1169	0.3330	0.8255
Spain	0.0083	0.0049	0.0218	0.0329	0.0977	0.3310	0.8236
USA	0.0106	0.0049	0.0237	0.0412	0.1155	0.3662	0.8097

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.mortality.org, www.who.int

The ratio of the main age-specific mortality indicators to the benchmark country-France (which experienced the longest value of life expectancy at birth in 1990 among the selected countries) are shown in table 10. It clearly elucidates that high female infant mortality was observed in Tajikistan (13 times higher than in France) and Turkmenistan (about 11 times higher than in France). High infant mortality related to, at first, different definitions of live birth and stillbirth, and in the second, the condition of poverty and inferiority in these countries. The highest child mortality was in Tajikistan. In other post-communist countries the mortality level was about 2-3 times higher than in France. The next paragraph seeks to explain the reasons for this.

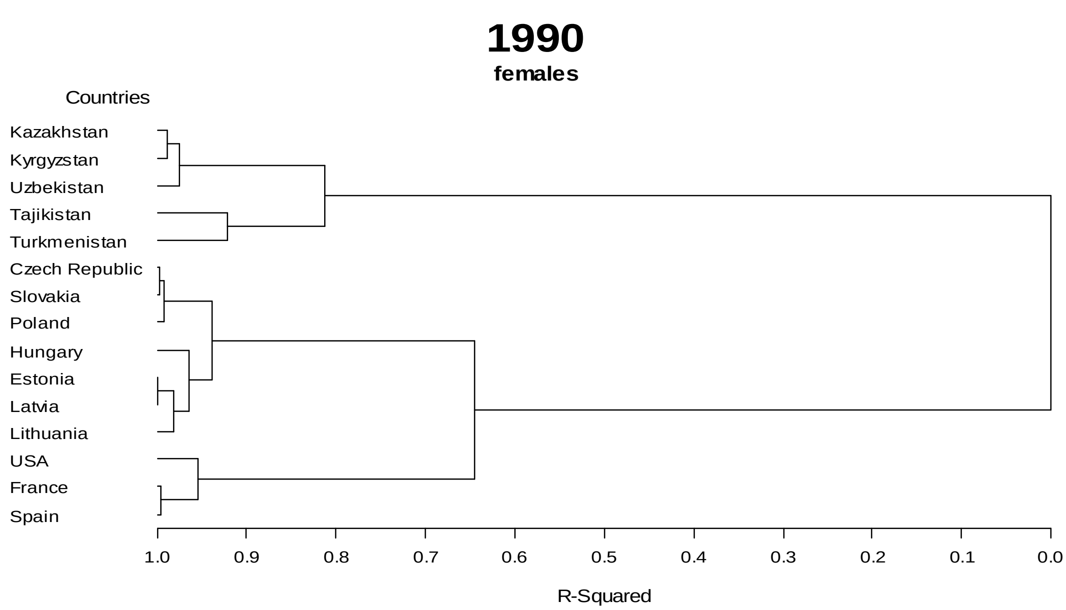
Table 10 - Ratio of main age-specific indicators of mortality levels to the reference country France (the longest life expectancy at birth in 1990) in selected countries for females, 1990

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	6.9283	4.3046	2.4197	2.0152	2.2588	2.2818	1.2612
Kyrgyzstan	9.1083	6.3130	2.4579	2.3424	2.2794	2.1816	1.2869
Tajikistan	13.1274	11.5874	3.3497	3.4954	2.8594	2.7803	1.3137
Turkmenistan	10.7277	8.7960	2.8740	2.5447	2.9755	2.7653	1.3304
Uzbekistan	8.1688	5.3252	2.0971	2.0635	2.1482	2.1327	1.1781
Czech Republic	1.4586	1.1327	0.9053	1.1262	1.5273	1.9955	1.2816
Hungary	2.1146	1.4402	1.2578	1.9865	2.0320	2.0383	1.2592
Poland	2.6624	1.4735	0.9100	1.3600	1.5932	1.8456	1.2180
Slovakia	1.6178	1.4532	0.9638	1.2763	1.6602	1.8944	1.2553
Estonia	1.5541	2.5544	1.5205	1.4238	1.6111	1.9849	1.2311
Latvia	1.6752	2.4510	1.6136	1.6198	1.7725	1.9729	1.2137
Lithuania	1.5653	1.8422	1.1642	1.6473	1.5909	1.7055	1.1676
Spain	1.0955	1.2420	1.0212	0.8275	0.8619	1.0853	1.0590
USA	1.3424	1.2299	1.2218	1.1524	1.3892	1.4555	0.9787
France	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note: q_x / q_x^{ref} *(Every country/France)* and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

According to the results of similarities in female mortality, patterns of the selected countries were divided into two major groups (see Figure 16). Soviet Central Asian states are in one group; and post-communist European areas with low mortality countries in the second. These two major groups have been distributed into four subgroups. Kazakhstan, Kyrgyzstan and Uzbekistan belong to the first subgroup, while the Soviet Central Asian countries (Tajikistan and Turkmenistan) are shown in the second. Central Europe and Baltic states form the third group. The last subgroup of countries comprises the USA, France and Spain. More detailed information can be seen in Table 13.

Figure 16 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in the selected countries for females, 1990



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

Average values of each subgroup for the female population in 1990 observed high and low values of age-specific mortality indicators (see Table 11). Significantly, Tajikistan and Turkmenistan were included in the high mortality group of all ages. Such extremely high infant mortality can be explained with reclassification of definition (from the Soviet to WHO definition). The probability of dying at the age of 15 and 49 related to extremely high maternal deaths in these countries. A lot of women still die giving birth in Central Asia which may explain these figures. In contrast, Central Europe and Baltic countries created one "intermediate" level group of mortality. The probability of dying at all ages showed lower values than the total average of the selected countries. Low mortality levels were observed in the USA, France and Spain. This country group is more developed socio-economically and demographically than the others. GDP per capita (US$) in the low mortality group is an average 91%, and when the GDP per capita (US$) in other country groups, it is 9% on average.

Table 11 - Average values of each country group for females, 1990

Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Kyrgyzstan, Uzbekistan	0.0507	0.0153	0.0154	0.0332	0.1071	0.3425	0.8330
Tajikistan, Turkmenistan	0.0749	0.0293	0.0206	0.0468	0.1402	0.4320	0.8867
Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Lithuania	0.0113	0.0051	0.0079	0.0231	0.0809	0.2991	0.8265
France, Spain USA	0.0072	0.0033	0.0071	0.0154	0.0521	0.1839	0.6791
Average	0.0360	0.0133	0.0127	0.0296	0.0951	0.3144	0.8063

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

In 2006 after the collapse of the Soviet Union, post-communist countries had political and socio-economic transitions. When some of these selected countries started embracing a whole new developmental approach, some of them improved their positions.

Table 12 shows mortality analysis data for females in the selected countries and highlights some improvements from the 1990s.

Table 13 illustrates the values of age-specific mortality indicators ratio to the lowest female life expectancy at birth among the selected countries in 2006. It clearly reveals that female infant mortality in Central Asia is still high. For example, in Tajikistan, Kyrgyzstan and Turkmenistan values are more than 10 times as high as the French level. High risk ages for a newborn baby in these countries are the under 15s.

Table 12 - Main age-specific indicators of mortality levels in the selected countries for females, 2006

Countries	IMR	$_{4}q_{1}$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	0.0222	0.0068	0.0202	0.0488	0.1323	0.3913	0.8815
Kyrgyzstan	0.0323	0.0087	0.0137	0.0374	0.1190	0.4099	0.8652
Tajikistan	0.0493	0.0164	0.0129	0.0334	0.1372	0.4950	0.9260
Turkmenistan	0.0377	0.0128	0.0234	0.0454	0.1533	0.4604	0.8775
Uzbekistan	0.0316	0.0075	0.0121	0.0287	0.1059	0.4152	0.8393
Czech Republic	0.0027	0.0015	0.0036	0.0119	0.0519	0.2021	0.7514
Hungary	0.0052	0.0023	0.0041	0.0180	0.0836	0.2426	0.7597
Poland	0.0053	0.0024	0.0040	0.0138	0.0630	0.2008	0.7174
Slovakia	0.0057	0.0025	0.0035	0.0128	0.0609	0.2338	0.7839
Estonia	0.0032	0.0029	0.0073	0.0169	0.0739	0.2142	0.7377
Latvia	0.0071	0.0035	0.0068	0.0231	0.0923	0.2489	0.7859
Lithuania	0.0064	0.0036	0.0076	0.0255	0.0828	0.2295	0.7710
France	0.0032	0.0016	0.0039	0.0116	0.0418	0.1188	0.5374
Spain	0.0032	0.0016	0.0032	0.0097	0.0315	0.1126	0.5945
USA	0.0061	0.0023	0.0071	0.0176	0.0583	0.1932	0.6102

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.mortality.org, www.who.int

In the Czech Republic and Spain a lower value of infant mortality than in France was observed. Low infant, child and young adult mortality in the Czech Republic related to decreasing external causes of death. The low mortality levels in Spain can be explained by the increasing public health expenditure in 2006, it was approximately 72%. Equally, pharmaceutical expenditure has been the main cost increase factor in Spain in recent years. In 2006, for example, the growth of pharmaceutical expenditure was about 7% and made up 22% of total public health expenditure (World Bank database).

Table 13 - Ratio of main age-specific indicators of mortality levels to the reference country France (the longest life expectancy at birth in 2006) in selected countries for females, 2006

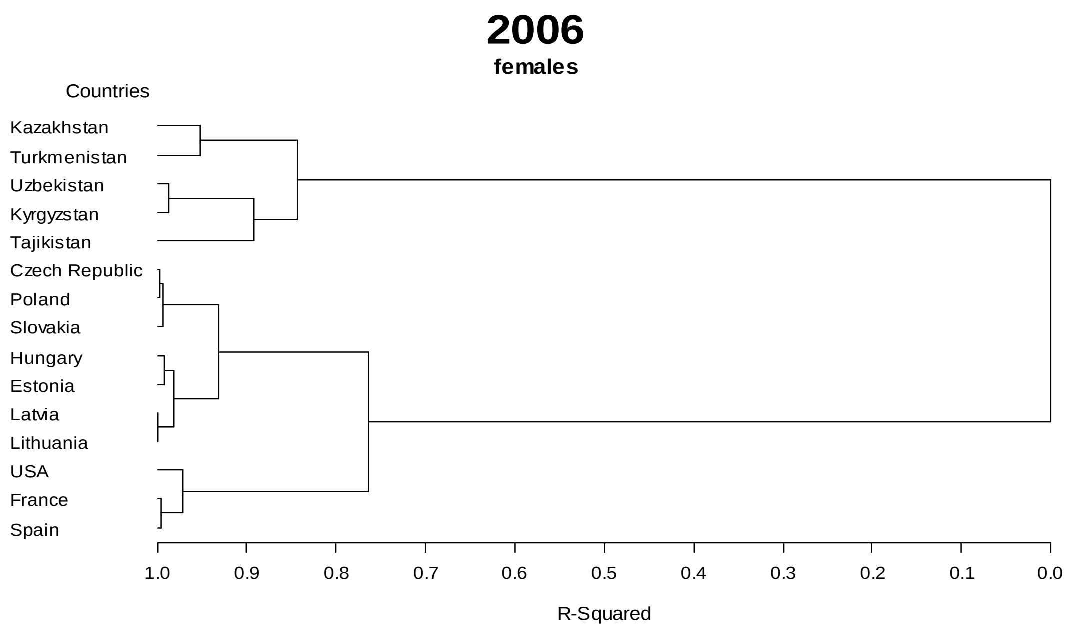
Countries	IMR	$_{4}q_{1}$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	6.8824	4.3036	5.1741	4.2064	3.1648	3.2942	1.6401
Kyrgyzstan	10.0093	5.5024	3.5019	3.2226	2.8484	3.4512	1.6098
Tajikistan	15.2508	10.3382	3.2965	2.8780	3.2830	4.1675	1.7231
Turkmenistan	11.6811	8.0705	5.9921	3.9118	3.6681	3.8760	1.6328
Uzbekistan	9.7957	4.7558	3.0986	2.4732	2.5346	3.4961	1.5617
Czech Republic	0.8421	0.9615	0.9146	1.0252	1.2410	1.7019	1.3982
Hungary	1.6068	1.4712	1.0491	1.5488	2.0008	2.0425	1.4136
Poland	1.6533	1.4905	1.0235	1.1923	1.5073	1.6902	1.3349
Slovakia	1.7740	1.5609	0.8873	1.1024	1.4564	1.9682	1.4586
Estonia	0.9752	1.8353	1.8584	1.4537	1.7679	1.8031	1.3725
Latvia	2.1981	2.1921	1.7324	1.9955	2.2082	2.0957	1.4623
Lithuania	1.9783	2.2540	1.9509	2.1960	1.9814	1.9320	1.4346
Spain	0.9938	1.0380	0.8149	0.8325	0.7540	0.9477	1.1061
USA	1.8885	1.4662	1.8241	1.5130	1.3957	1.6269	1.1354
France	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note: q_x / q_x^{ref} *(Every country/France)* and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

According to the female population hierarchical tree, in 2006 a big gap between Soviet Central Asian and post-socialist European areas with more developed countries existed (see

Figure 17). These two major groups are further divided into four subgroups. The first one comprises Kazakhstan and Turkmenistan. In the second subgroup Uzbekistan, Kyrgyzstan and Tajikistan are listed. Central European countries with three Baltic states represent the third subgroup. The last subgroup is the USA, France and Spain. Yet again, the same ostensibly "low mortality" pattern in these countries was observed. However, these "low mortality" patterns are a result of the countries in comparison.

Figure 17 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in the selected countries for females, 2006



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

Kazakhstan and Turkmenistan had the highest young adult, adult, older adult and the oldest age mortality values (see Table 14). High young adult, adult and older adult mortality could be related to very high maternal mortality in this region. Improvement of maternal health is one of the eight Millennium Development Goals which was adopted at the 2000 Millennium Summit. This goal has not yet been achieved in Kazakhstan. Moreover, the introduction of live birth criteria as of 2008 will result in the increase of infant mortality registration in Kazakhstan, which makes the achievement of this goal less probable. Nevertheless, recognizing the importance of introducing this criterion the Government has declared a temporary moratorium on administrative measures. In this programme a complexity of measures were stipulated in order to resolve socially important health problems and to reduce maternal and infant mortality while systematizing specific approaches and measures successfully tested in the world (Millennium Development Goals' Report for Kazakhstan 2007).

The second group with high levels of infant, child and old age mortality is represented by Uzbekistan, Kyrgyzstan and Tajikistan. Mortality of the under 15s age group increased up to 8 times on average than in the more developed countries. It is because of poverty, the poor health and nutrition of pregnant women, infectious diseases, and low quality of medical care reference. However, it should be noted that the underreporting of maternal mortality is not a problem unique to Turkmenistan, but something that has been reported in all countries of Central Asia. In Uzbekistan, maternal mortality is considered to have arisen from a criminal offence and is subject to criminal investigations, creating an incentive to underreport cases of maternal deaths (Ahmedov *et al.* 2007). Investigations in a number of regions in Kazakhstan revealed distortions, irregularities and underreporting of cases of maternal deaths (Kulzhanov and Rechel 2007). In the case of Turkmenistan, UN agencies estimated that maternal mortality stood at 31 per 100 000 live births in 2000 (WHO 2008b).

The United States, France and Spain kept the position of having low mortality levels. They showed quite a large improvement in the health of the population in contrast to the other countries. 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.

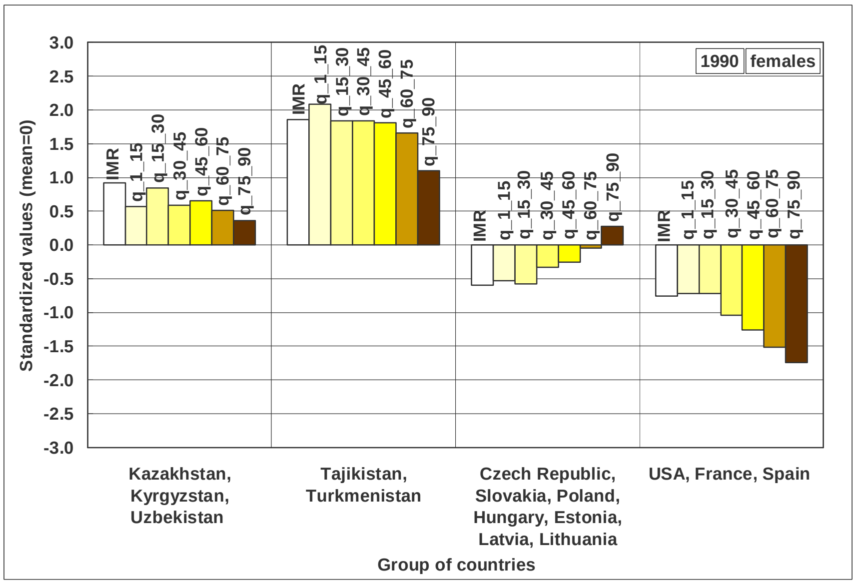
Table 14 - Average values of each country group for females, 2006

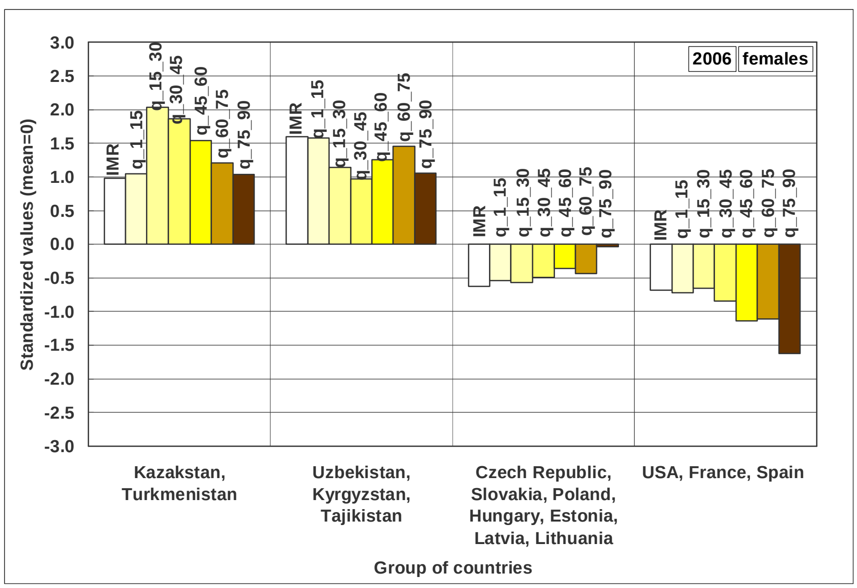
Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Turkmenistan	0.0300	0.0098	0.0218	0.0471	0.1428	0.4258	0.8795
Uzbekistan, Kyrgyzstan, Tajikistan	0.0377	0.0109	0.0129	0.0332	0.1207	0.4400	0.8768
Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Lithuania	0.0051	0.0027	0.0053	0.0174	0.0726	0.2245	0.7581
France, Spain USA	0.0042	0.0019	0.0047	0.0129	0.0439	0.1415	0.5807
Average	0.0192	0.0063	0.0112	0.0277	0.0950	0.3080	0.7738

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

Figure 18 clearly illustrates changes in the mortality patterns among the selected countries. The "co-countries pattern" in the female population was observed in the United States, France and Spain. After the break up of the socialist regime in Central European countries and Baltic states, these countries had an increased risk of cardiovascular diseases and other health-related problems such as hypertension, high blood cholesterol levels, and obesity. The freedom to choose one's physician in these countries, access highly effective drugs (beta-blockers, satins, ACE inhibitors, calcium channel blockers and so on) and significant improvements to the mobility and technical equipment of mobile emergency health services may have contributed to these statistics (Burcin and Kucera 2007). A healthy lifestyle can modify the effect of the aforementioned risk factors and consequently decrease morbidity and mortality levels (Rychtaříková 2004). In Central Asian female populations so called "migrant" countries were observed. These countries moved from higher to the highest mortality level country group. Girls in Central Asia may be an exception, as limited evidence suggests that their stature has declined significantly compared to boys. Adults are well fed, have a high fat diet, are heavy smokers and drinkers and their self-perceived health is poor. Moreover, high levels of mortality are a serious concern both among children and reproductive-aged women. For example, Tajikistan faces high a maternal mortality crisis among the Central Asian republics. According to statistics produced by the UNFPA and the Population Reference Bureau, 100 women die for every 100 000 live births in Tajikistan. As in other parts of Central Asia, most deaths occur in rural areas where women normally deliver at home. The health care facilities that are available often lack even basic medical supplies, including bed sheets, according to the London-based Institute for War and Peace Reporting (Central Asia Health Review 2008).

Figure 18 - Standardized values of main mortality indicators in the selected countries for females, 1990 and 2006





Note: Standardized values: mean=0, standard deviation=1
Source: Author's calculations based on data from www.mortality.org, www.who.int

Not surprisingly, in the 1970s many demographers expected continuous progress and future mortality convergence. However, presently, although not then known, 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 (Shkolnikov 2004). Nowadays, 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.

Table 15 illustrates the main age-specific indicators of mortality in the selected countries for both sexes for the hierarchical cluster analysis.

Table 15 - Main age-specific indicators of mortality levels in the selected countries for both sexes, 1990

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	0.0435	0.0124	0.0160	0.0312	0.1085	0.3555	0.8459
Kyrgyzstan	0.0572	0.0182	0.0162	0.0363	0.1095	0.3399	0.8631
Tajikistan	0.0824	0.0333	0.0221	0.0542	0.1374	0.4332	0.8811
Turkmenistan	0.0674	0.0253	0.0190	0.0395	0.1430	0.4308	0.8923
Uzbekistan	0.0513	0.0153	0.0139	0.0320	0.1032	0.3323	0.7901
Czech Republic	0.0092	0.0033	0.0060	0.0175	0.0734	0.3109	0.8596
Hungary	0.0133	0.0041	0.0083	0.0308	0.0976	0.3176	0.8445
Poland	0.0167	0.0042	0.0060	0.0211	0.0766	0.2875	0.8169
Slovakia	0.0102	0.0042	0.0064	0.0198	0.0798	0.2951	0.8419
Estonia	0.0098	0.0074	0.0101	0.0221	0.0774	0.3092	0.8257
Latvia	0.0105	0.0071	0.0107	0.0251	0.0852	0.3074	0.8140
Lithuania	0.0098	0.0053	0.0077	0.0255	0.0764	0.2657	0.7831
France	0.0063	0.0029	0.0066	0.0155	0.0480	0.1558	0.6707
Spain	0.0069	0.0036	0.0068	0.0128	0.0414	0.1691	0.7102
USA	0.0084	0.0035	0.0081	0.0179	0.0667	0.2268	0.6564

Note: Both sex indicators calculated as the simple average of male and female respective indicators and 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.mortality.org, www.who.int

The ratio of main age-specific mortality indicators to the benchmark country France showed that mortality levels at all ages in Central Europe and Baltic states were about 2 times higher (see Table 16). In the USA and Spain very similar patterns with France were observed. The "low mortality" country group revealed a relatively lower level of mortality among the selected countries. In Central Asia the various age groups are under 1. The infant and child mortality rates are more than 10 times higher than the French level. This will be explored further in the following paragraphs.

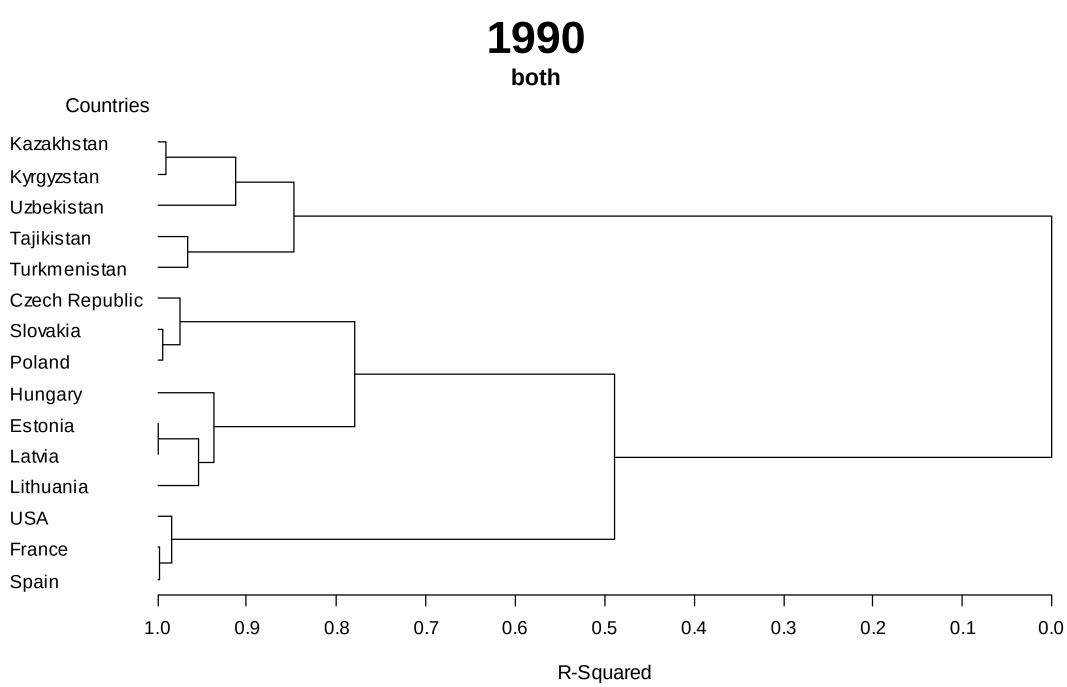
Table 16 - Ratio of main age-specific indicators of mortality level to the reference country France (the longest life expectancy at birth in 1990) in selected countries for both sexes, 1990

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	6.8163	4.7929	1.9330	2.0510	2.0662	1.8362	1.1748
Kyrgyzstan	8.5098	5.6668	1.7810	2.1660	1.8948	1.7155	1.1764
Tajikistan	12.2881	10.7158	1.8925	2.4203	2.1721	2.0732	1.2217
Turkmenistan	10.9173	8.0292	1.8357	2.0386	2.2295	2.0112	1.2106
Uzbekistan	8.2346	5.9073	1.3913	1.7021	1.7419	1.6412	1.1078
Czech Republic	1.4732	1.1496	0.8345	1.1457	1.5482	1.7110	1.1979
Hungary	2.0210	1.3909	1.1669	1.9496	2.0000	1.7033	1.1779
Poland	2.5736	1.5248	1.0771	1.5223	1.6610	1.5953	1.1509
Slovakia	1.6366	1.3278	0.9226	1.4363	1.7687	1.6546	1.1736
Estonia	1.5919	2.7677	1.7117	1.8333	1.7708	1.7196	1.1564
Latvia	1.6814	2.9781	1.7464	1.9861	1.8553	1.7131	1.1438
Lithuania	1.4156	2.1063	1.3943	1.9207	1.7027	1.5029	1.0947
Spain	1.0298	1.2278	1.0700	0.8542	0.8434	1.0230	1.0252
USA	1.2929	1.2332	1.1909	1.1024	1.1049	1.2130	0.9799
France	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note: q_x / q_x^{ref} *(Every country/France)* and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

According to the hierarchical tree, the selected countries showed long distance results (see Figure 19). Clearly, this illustrates that the countries are divided into two major groups of mortality patterns. These two major groups can be further divided into four subgroups. All Central Asian republics show similarities in mortality development. This is why they are together in the first subgroup. The Czech Republic, Slovakia and Poland are from the second subgroup. The third subgroup comprises Hungary and Baltic states. The USA, France and Spain are in the last subgroup.

Figure 19 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in selected countries for both sexes, 1990



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

The result of the hierarchical analysis is illustrated in Table 17. All Central Asian republics had high mortality in all ages. The reclassification of infant deaths to stillbirths also appears to have increased in the 1990s. In some countries, the deaths of older infants may be recorded as deaths of children aged over one year. Furthermore, it is clear that in a few countries, the registration of births and infant deaths is less than complete: unregistered births and deaths are not included in official statistics. It must be added that most of this hard evidence pertains to CIS countries (Aleshina and Redmond 2003). High mortality levels in other ages related with inequalities emerged during the 1990s. 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 rise as health workers demand salaries commensurate with their skills and responsibilities.

Table 17 - Average values of each country group for both sexes, 1990

Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, Turkmenistan	0.0690	0.0241	0.0236	0.0556	0.1667	0.4535	0.8814
Czech Republic, Slovakia, Poland	0.0140	0.0046	0.0126	0.0367	0.1369	0.4042	0.8783
Hungary, Estonia, Latvia, Lithuania	0.0124	0.0079	0.0201	0.0515	0.1511	0.4057	0.8552
France, Spain USA	0.0082	0.0040	0.0145	0.0264	0.0811	0.2636	0.7493
Average	0.0259	0.0101	0.0177	0.0425	0.1340	0.3818	0.8411

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

Health gains are not yet evident on broad measures such as life expectancy at birth and maternal mortality, since such gains must be made against the impoverishment of the population (McKee, Healy and Falkingham 2002). In the Czech Republic, Slovakia and Poland low young adult mortality was observed. During the 1990s a decrease in mortality in this country group emerged, and was primarily due to the reduction of mortality in the older age group, but with a delay of 25-30 years after the decrease had occurred in Western Europe (Rychtaříková, 2004). Hungary and three Baltic states showed lower infant and child mortality than average for the selected countries. Mortality ages of 15 and above in these countries are higher than average. During the entire study, the United States, France and Spain have always showed a "low mortality". 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.

Initial data for mortality analysis in selected countries for both sexes uses the same aforementioned indicators (see Table 18).

Table 18 - Main age-specific indicators of mortality levels in the selected countries for both sexes, 2006

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	0.0257	0.0087	0.0374	0.0941	0.2194	0.5014	0.8980
Kyrgyzstan	0.0355	0.0090	0.0195	0.0627	0.1707	0.4924	0.8674
Tajikistan	0.0562	0.0170	0.0170	0.0411	0.1530	0.5393	0.9419
Turkmenistan	0.0451	0.0128	0.0333	0.0756	0.2080	0.5088	0.8998
Uzbekistan	0.0375	0.0099	0.0155	0.0399	0.1388	0.4738	0.8526
Czech Republic	0.0034	0.0021	0.0074	0.0183	0.0839	0.2837	0.7992
Hungary	0.0058	0.0028	0.0079	0.0312	0.1448	0.3482	0.8042
Poland	0.0060	0.0028	0.0092	0.0280	0.1125	0.3028	0.7718
Slovakia	0.0065	0.0033	0.0079	0.0248	0.1081	0.3381	0.8253
Estonia	0.0045	0.0034	0.0174	0.0392	0.1420	0.3457	0.8005
Latvia	0.0077	0.0043	0.0147	0.0515	0.1666	0.3815	0.8295
Lithuania	0.0069	0.0044	0.0187	0.0561	0.1658	0.3628	0.8179
France	0.0037	0.0018	0.0072	0.0179	0.0670	0.1824	0.6277
Spain	0.0037	0.0020	0.0062	0.0153	0.0548	0.1807	0.6641
USA	0.0068	0.0026	0.0131	0.0242	0.0775	0.2363	0.6662

Note: Both sex indicators calculated as the simple average of male and female respective indicators and 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.mortality.org, www.who.int

Table 19 shows the ratio of age-specific mortality indicators to the benchmark country Spain. The reason of choosing Spain as a reference country can be explained by the fact that it had the lowest value of life expectancy at birth in 2006 among selected countries. During the whole study, it can obviously be seen that the Soviet republics of Central Asia show "high infant and child mortality" patterns among the selected countries. Whereas the USA, France and Spain are a "low mortality" patterns.

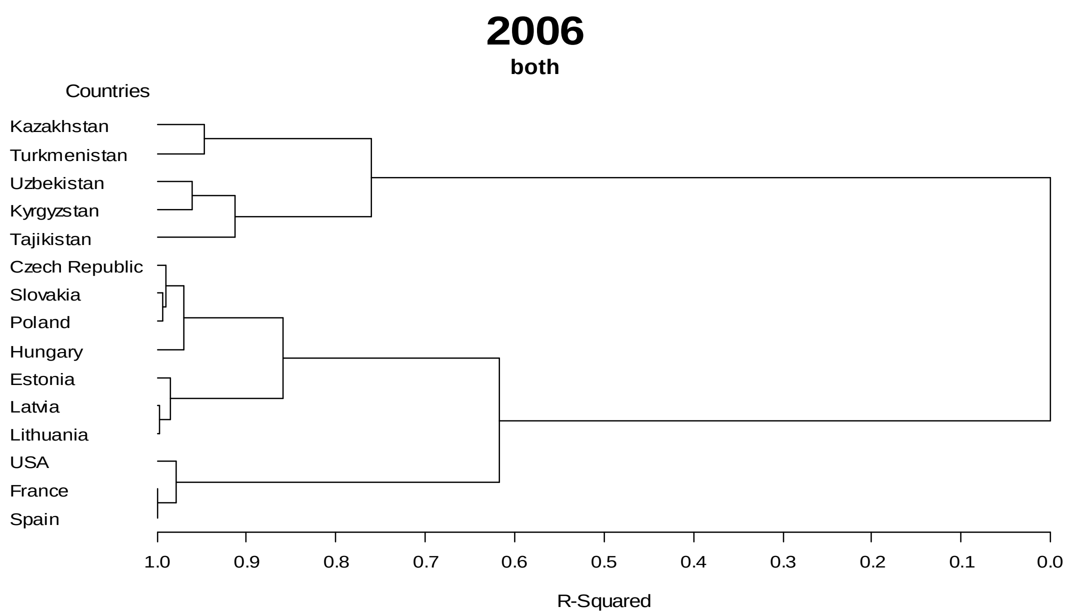
Table 19 - Ratio of main age-specific indicators of mortality levels to the reference country Spain (the longest life expectancy at birth in 2006) in selected countries for both sexes, 2006

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	7.0274	4.3801	6.0492	6.1454	4.0008	2.7747	1.3522
Kyrgyzstan	9.7045	4.5102	3.1584	4.0962	3.1126	2.7251	1.3060
Tajikistan	15.3762	8.5295	2.7525	2.6868	2.7895	2.9847	1.4182
Turkmenistan	12.3365	6.4497	5.3919	4.9394	3.7938	2.8156	1.3548
Uzbekistan	10.2490	5.0022	2.5163	2.6085	2.5306	2.6222	1.2838
Czech Republic	0.9166	1.0478	1.2052	1.1930	1.5303	1.5701	1.2033
Hungary	1.5841	1.4197	1.2751	2.0354	2.6405	1.9270	1.2109
Poland	1.6484	1.4024	1.4962	1.8305	2.0523	1.6759	1.1622
Slovakia	1.7852	1.6362	1.2755	1.6215	1.9706	1.8711	1.2427
Estonia	1.2216	1.7238	2.8169	2.5601	2.5903	1.9130	1.2054
Latvia	2.1012	2.1755	2.3785	3.3621	3.0390	2.1110	1.2491
Lithuania	1.8810	2.2269	3.0282	3.6618	3.0229	2.0081	1.2315
France	1.0109	0.9217	1.1692	1.1706	1.2214	1.0093	0.9451
USA	1.8482	1.3274	2.1213	1.5813	1.4130	1.3077	1.0032
Spain	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note: q_x / q_x^{ref} (Every country/Spain) and countries grouping according to macro-regions: Central Asia, Central Europe, Baltic states and low mortality populations
Source: Author's calculations based on data from www.mortality.org, www.who.int

In 2006 the age-specific mortality level was differentiated between the two major country groups. Central Asian countries being the first country group, and post-socialist Europe together with low mortality populations being the second. The selected countries were divided into four subgroups according to the hierarchical tree (see Figure 20). A similarity in the mortality pattern was observed in Kazakhstan and Turkmenistan. The other Central Asian republics (Uzbekistan, Kyrgyzstan and Tajikistan) are in the second subgroup. The Central European countries and Baltic states are in the third subgroup. The United Sates, France and Spain are in the last.

Figure 20 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in selected countries for both sexes, 2006



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

During the post-Soviet era Kazakhstan was one of the transition nations with the most marked increases in mortality (see Table 20). This rise is of central importance, since low levels of premature mortality constitute a major component of social well-being. Furthermore, economic measures of prosperity are of limited value like welfare indicators in Kazakhstan and other formerly Soviet republics. This is primarily because of a highly uneven distribution of benefits. Very high mortality ages of 15 and above can be related to causes of death. For example, cardiovascular mortality is exceptionally high – the risk of death from cardiovascular disease alone is greater than the risk of death due to all causes in the United States, both for men and women (Becker and Urzhumova 2005). In the case of Turkmenistan, high mortality was the consequence of president Saparmurat Niyazov's regime, since 1991, the Turkmen government has since made drastic cutbacks to the health care system. In the next group of countries high infant and child mortality rates were observed. Most infant and child deaths result from a combination of malnutrition and preventable or treatable diseases such as acute respiratory infections, diarrhea, measles and malaria. Poverty reduction and improved living conditions, along with improved health care, would eliminate many of these deaths. Low mortality at the age of 30 and above relate to several facts such as the increase in the number of treatments provided by health care services (for example, the changes in cardio surgical techniques). The last group represents low mortality among the selected countries. They are trying to implement various prevention programmes targeting risk groups of their population (HIV/AIDS screening, breast cancer and so on).

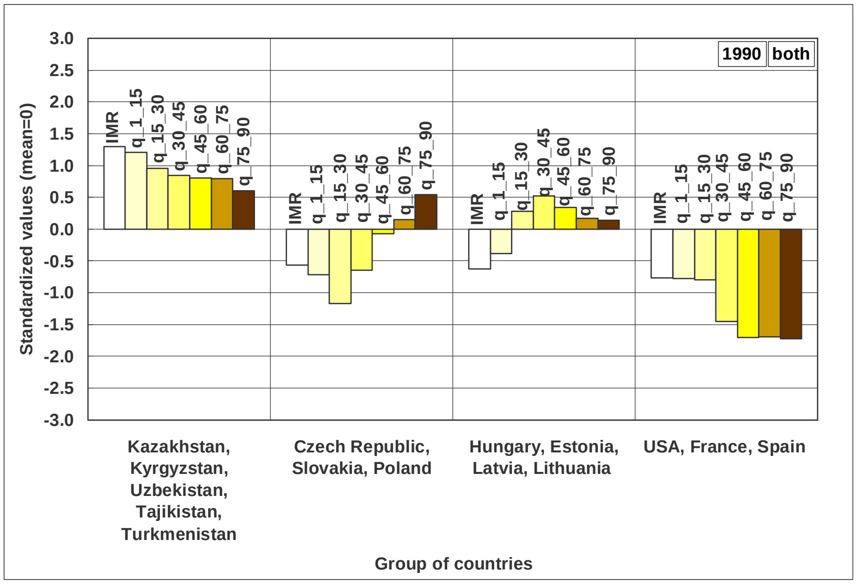
Table 20 - Average values of each country group for both sexes, 2006

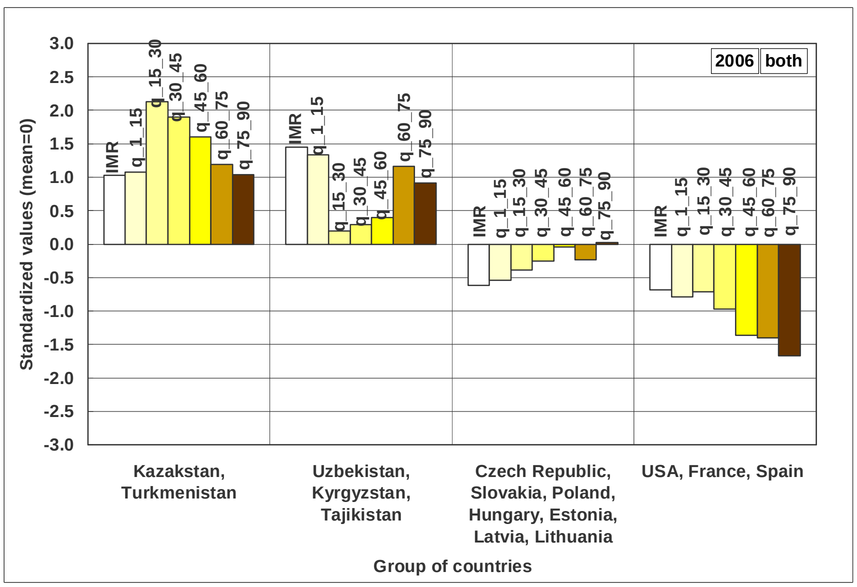
Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Turkmenistan	0.0354	0.0108	0.0353	0.0849	0.2137	0.5051	0.8989
Uzbekistan, Kyrgyzstan, Tajikistan	0.0430	0.0120	0.0174	0.0479	0.1541	0.5019	0.8873
Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Lithuania	0.0058	0.0033	0.0119	0.0356	0.1320	0.3375	0.8069
France, Spain USA	0.0047	0.0022	0.0088	0.0191	0.0664	0.1998	0.6527
Average	0.0222	0.0070	0.0184	0.0469	0.1416	0.3861	0.8115

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

Figure 21 showed changes in mortality patterns in the selected countries. Heath patterns of the former Soviet republics of Central Asia exhibit some similarities, but also considerable differences. Tajikistan has been ravaged by a civil war. The health of women in Turkmenistan, especially in rural areas, stands out as being much worse than in any other part of former Soviet Union. Kazakhstan has developed increased levels of motor vehicle fatalities despite having a much lower automobile density than the USA. Moreover, it appears that motor vehicle fatality risk is greatest in the poorest parts of Kazakhstan. The changes in lifestyle of western populations are considered as a major determinant of mortality reduction during the fourth stage of the epidemiological transition. People in former socialist countries of Europe had experienced unhealthy lifestyles (heavy smoking and drinking, diet based on saturated fat and so on) and outdated diagnostic and medical technologies including medications (Rychtaříková, 2004). Also a considerable improvement and decrease of overall mortality in the past decades goes back primarily to the diminishing of cardiovascular mortality. Nevertheless, cardiovascular mortality is still very unfavorable in international composition.

Figure 21 - Standardized values of main mortality indicators in selected countries for sexes, 1990 and 2006





Note: Standardized values: mean=0, standard deviation=1
Source: Author's calculations based on data from www.mortality.org, www.who.int

Finally, mortality trends in the selected countries for both sexes are different. From 1990 western countries developed their socio-economic position and increased health expenditures. As a result of such activities they decreased mortality rates and had a healthier population. After the break up of the Soviet Union, Central Asian republics tried to stabilize their health care systems. And nowadays, they have improved their socio-economic conditions and developed health expenditures close to the levels observed in more developed countries in the beginning of the studied period.

4.3 Excess male mortality in selected countries

Excess male mortality is measured as the male to female ratio of the probability of dying at a given age. Researchers have long known that women outlive men on average, and more recently have discovered that men have higher mortality risks across their entire lifespan reference. 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).

For the analysis of excess male mortality, the ratio of male to female probabilities of dying at the selected age groups in 1990 was used (see Table 21).

Table 21 –Ratio of male to female main mortality indicators in selected countries, 1990

Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	1.3107	1.6546	2.2242	2.5175	2.1410	1.5249	1.0778
Kyrgyzstan	1.1944	1.1401	1.9246	2.1958	1.8544	1.4674	1.0392
Tajikistan	1.1986	1.2048	1.2802	1.3931	1.6084	1.3398	1.0746
Turkmenistan	1.3902	1.1763	1.5778	1.7687	1.5729	1.2821	1.0299
Uzbekistan	1.3676	1.6448	1.6777	1.8509	1.7844	1.4147	1.0978
Czech Republic	1.3723	1.4197	2.7204	2.5159	2.4808	1.6904	1.0850
Hungary	1.2447	1.3026	2.7444	2.3919	2.3797	1.6221	1.0867
Poland	1.2703	1.4672	3.7770	2.8684	2.5799	1.7123	1.1080
Slovakia	1.3760	1.1785	2.8635	2.8893	2.6583	1.7405	1.0855
Estonia	1.4057	1.5833	3.5436	3.4499	2.7743	1.7183	1.0955
Latvia	1.3574	1.8969	3.3681	3.2376	2.5942	1.7246	1.1023
Lithuania	1.1241	1.7259	3.8335	3.0296	2.6750	1.7650	1.0916
France	1.3487	1.3842	3.0360	2.4561	2.4339	2.1377	1.2308
Spain	1.2078	1.3569	3.2288	2.5676	2.3603	1.9576	1.1596
USA	1.2622	1.3906	2.9342	2.3061	1.7310	1.6149	1.2336

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.mortality.org, www.who.int

The grouping of countries with similarities in excess male mortality among the selected countries can be divided into two major groups. The post-communist countries show similarities in excess male mortality and the second group is post-socialist Europe together with low mortality populations. For a more detailed analysis, these two major country groups have been divided into four subgroups (see Figure 22). Soviet Central Asian republics are in the first subgroup. The second subgroup comprises Spain and Central European countries. The three Baltic states are in the third subgroup. The United States and France form in the last subgroup.

Figure 22 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in selected countries, 1990

Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

According to the average value of country groups, the highest values of excess male mortality for all ages except child mortality belong to the Central Asian republics (see Table 22). 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 of external and cardiovascular causes of death. During these years, excess male mortality reached its highest value. In the second group, high excess male child mortality was observed. In Central European countries and Spain newborn survival patterns posing hazard to the first 15 years of life were observed. Low mortality between the ages of 1 and 60 was apparent in the three Baltic countries. Low infant, old and the oldest age excess male mortality were in the United States and France. These more developed countries showed a "low mortality" pattern. The period of this mortality decline was also a period of major shifts in the causes of infant deaths. As infant mortality declined, infectious diseases became less important, whereas the relative importance of complications in childbirth and prematurity increased. Although male infants have higher mortality from most causes of death, the sex differential varies by cause. The decline in deaths from infection is likely to affect males and females differently. Because females have more vigorous immune responses and greater resistance to infection, female infants have lower mortality from infections and respiratory ailments. The male disadvantage begins in utero, when gonadal steroid production already differs strongly by sex. Males are more likely to be born prematurely and to suffer from respiratory conditions in the prenatal period. Thus, an increase in survival among premature infants may affect the sex balance of mortality (Drevenstedt *et al.* 2008).

Table 22 - Average values of each country group, 1990

Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Uzbekistan, Tajikistan, Kyrgyzstan, Turkmenistan	1.2923	1.3641	1.7369	1.9452	1.7922	1.4058	1.0639
Czech Republic, Slovakia, Hungary, Poland, Spain	1.2942	1.3450	3.0668	2.6466	2.4918	1.7446	1.1049
Estonia, Latvia, Lithuania	1.2958	1.7354	3.5818	3.2390	2.6812	1.7359	1.0965
USA, France	1.3054	1.3874	2.9851	2.3811	2.0824	1.8763	1.2322
Average	1.2969	1.4580	2.8426	2.5530	2.2619	1.6907	1.1244

Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

A hierarchical analysis of excess male mortality among the selected countries in 2006 illustrated data in Table 23.

Table 23 –Ratio of male to female main mortality indicators in selected countries, 2006

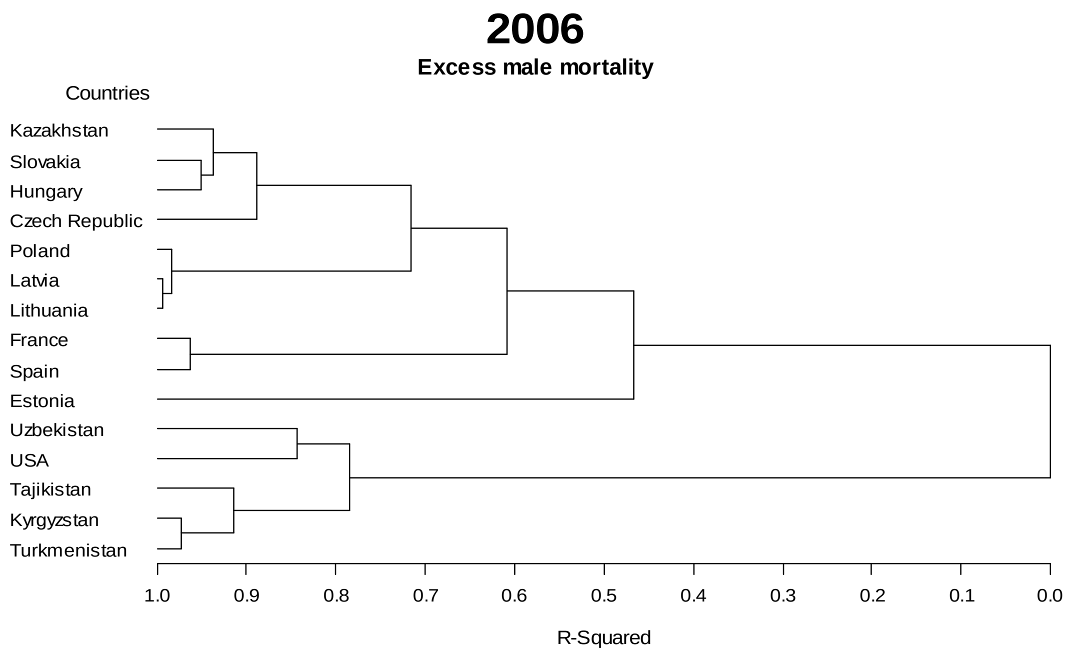
Countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan	1.3107	1.6546	2.2242	2.5175	2.1410	1.5249	1.0778
Kyrgyzstan	1.1944	1.1401	1.9246	2.1958	1.8544	1.4674	1.0392
Tajikistan	1.1986	1.2048	1.2802	1.3931	1.6084	1.3398	1.0746
Turkmenistan	1.3902	1.1763	1.5778	1.7687	1.5729	1.2821	1.0299
Uzbekistan	1.3676	1.6448	1.6777	1.8509	1.7844	1.4147	1.0978
Czech Republic	1.3723	1.4197	2.7204	2.5159	2.4808	1.6904	1.0850
Hungary	1.2447	1.3026	2.7444	2.3919	2.3797	1.6221	1.0867
Poland	1.2703	1.4672	3.7770	2.8684	2.5799	1.7123	1.1080
Slovakia	1.3760	1.1785	2.8635	2.8893	2.6583	1.7405	1.0855
Estonia	1.4057	1.5833	3.5436	3.4499	2.7743	1.7183	1.0955
Latvia	1.3574	1.8969	3.3681	3.2376	2.5942	1.7246	1.1023
Lithuania	1.1241	1.7259	3.8335	3.0296	2.6750	1.7650	1.0916
France	1.3487	1.3842	3.0360	2.4561	2.4339	2.1377	1.2308
Spain	1.2078	1.3569	3.2288	2.5676	2.3603	1.9576	1.1596
USA	1.2622	1.3906	2.9342	2.3061	1.7310	1.6149	1.2336

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.mortality.org, www.who.int

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 23).`

Figure 23 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 all the Soviet Central Asian republics, and the second group is the post-socialist European part together with low population countries. These two major groups are further divided into the four country subgroups and one unique country. Kazakhstan, Slovakia, Hungary and the Czech Republic are in the first subgroup and countries such as Poland, Latvia and Lithuania are in the second group. Similarities in excess male mortality were observed in France and Spain. Estonia is the unique country in this analysis. The last subgroup contains other Central Asian states (Uzbekistan, Tajikistan, Kyrgyzstan and Turkmenistan) with the USA.

Figure 23 - Dendogram resulting from the hierarchical analysis of the main mortality indicators in selected countries, 2006



Note: Euclidean distance, Ward method, entry data transformed in Z-scores
Source: Author's calculations based on data from www.mortality.org, www.who.int

The-average values of each country group are illustrated in Table 24. The data for Slovakia, Hungary and the Czech Republic revealed low levels of excess child mortality due to faster developments in male mortality than expected. Kazakhstan is in this group because of higher female mortality. In the second subgroup high levels of excess male infant mortality were experienced differences in Soviet and WHO definitions of live births and stillbirths. For instance, if they survive for less than a full seven days (or 168 hours), they are considered as miscarriages, and not counted at all. The mortality level in other age groups is higher than the total average for the selected countries. The next country group could be evidence in revealing low levels of excess male mortality at the oldest age. Estonia suffered from low excess male mortality in all ages except child mortality. Several factors, including declines in infections, an increase in hospital births, medical advancements to improve birth outcomes, and better nutrition, have contributed to lower infant mortality there (Koppel *et al*. 2008). Low mortality levels in Estonia could be due to the fact that there has been a faster decline in male mortality than expected.

Uzbekistan, USA, Tajikistan, Kyrgyzstan and Turkmenistan showed high excess male mortality at the ages of 1 and above (see Table 27). In Soviet Central Asian republics the so called "Russian mortality pattern", more specifically, high excess male mortality at working ages. The United States is a country which experienced the recent trend of a faster decrease in male mortality. For the past two decades, life expectancy at birth for men grew much faster than for women in the USA. One explanation, offered 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).

Table 24 – Average values of each country group, 2006

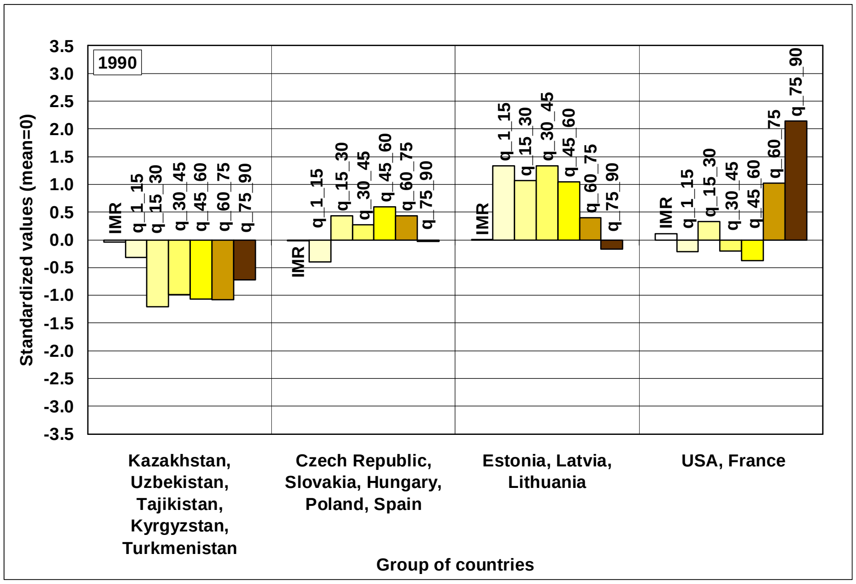
Group of countries	IMR	$_{14}q_1$	$_{15}q_{15}$	$_{15}q_{30}$	$_{15}q_{45}$	$_{15}q_{60}$	$_{15}q_{75}$
Kazakhstan, Slovakia, Hungary, Czech Republic	1.3207	1.5833	3.0612	2.5700	2.3917	1.7833	1.0969
Poland, Latvia, Lithuania	1.1906	1.4418	3.6218	3.3007	2.7292	2.0815	1.1281
France, Spain	1.2826	1.3636	2.7869	2.1304	2.3425	2.1407	1.2851
Estonia	1.8349	1.3553	3.7909	3.6489	2.8447	2.2282	1.1705
Uzbekistan, USA, Tajikistan, Kyrgyzstan, Turkmenistan	1.2898	1.2072	1.9152	1.9392	1.6176	1.3040	1.0611
Average	1.3837	1.3902	3.0352	2.7178	2.3851	1.9075	1.1483

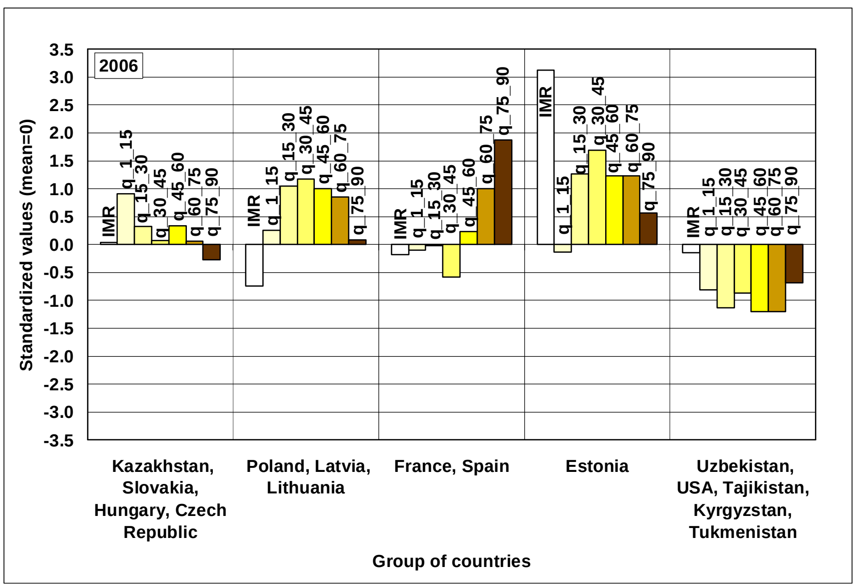
Note: Red numbers are "High" values, Blue numbers are "Low" values.
Source: Author's calculations based on data from www.mortality.org, www.who.int

Conclusively, the comparison of excess male mortality in both 1990 and 2006 provides several useful insights. Primarily, that high mortality levels were observed in the former Soviet Central Asian countries (see Figure 24). During the period of independence males have been an economically active segment regardless of socio-economic development in these countries. In addition, Kazakhstan takes the "migrant country" position. In 1990 Kazakhstan was in the high excess male mortality group, and in 2006 interestingly moved to the group with low child mortality. This could be due to high levels of female mortality during this period. Central European republics keep the position of being in the "intermediate group". Between the periods 1990 and 2006 the Baltic states had the "lowest group" of excess male mortality among the selected countries.

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 health and wellbeing 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, 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.

Figure 24 - Standardized values of main mortality indicators in selected countries, 1990 and 2006





Note: Standardized values: mean=0, standard deviation=1
Source: Author's calculations based on data from www.mortality.org, www.who.int

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).

CONCLUSION

The presented analysis of this research showed the result of the 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 (Shkolnikov 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.

Another related finding is that the overall health costs increased together with an increase in GDP. 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 costs, and probably the most important, is the inefficiency of the health system.

During the 1990s a decrease in mortality in Central Europe rose due to several factors, one being a reduction of mortality in the older age group. 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 (Rychtaříková 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.

The change in lifestyle of western populations is considered a major determinant of mortality decrease during the fourth stage of the epidemiological transition. People in former socialist countries of Europe had experienced unhealthy lifestyles (heavy smoking and drinking, diet based on saturated fat and so on) and outdated diagnostic and medical technologies including medications. For instance, the Czech Republic, as regards harmful lifestyles, an obsolete health care system, and a high circulatory mortality, belonged to the former socialist settings. The end of the Communist era was the beginning of a new social, political, and economic stage. The open market has given way to imports from the West, including access to healthier food (fruits, vegetables), and wider variety of foodstuffs. The health care system has also been transformed particularly in the area of prevention, diagnostics and therapy, including cardiovascular pharmacotherapy, cardio logical procedures, and cardiac surgery.

However, the increased risk of cardiovascular diseases and many others is associated with risk factors such as hypertension, high blood cholesterol levels, and obesity or overweight. A healthy lifestyle can modify the effect of the aforementioned risk factors and consequently decrease morbidity and mortality levels (Rychtaříková 2004).

During the analysis different patterns of mortality were observed among the selected countries. In the Soviet Central Asian republics males have been an economically active segment regardless of socio-economic development during the period of independence. In this country group a "Russian pattern" of high excess mortality at the working ages was observed. Between the periods 1990 and 2006 Central European republics kept the position of being in the "intermediate group". In the same time period, the Baltic states had the "lowest group" of excess male mortality among the selected countries. Excess male mortality tends to be a result of more adverse conditions in terms of the environment among the selected countries. Low income, for instance, is often associated with exposure to environmental hazards at work such as noxious substances and the risk of accidents. Increasing mortality from accidents, especially in manufacturing was observed. Equally, poor housing conditions such as crowding, air pollution and noise may also be a contributory factor. These situations may affect health and wellbeing 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, 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.

Mortality trends in the selected countries showed a heterogeneous picture. However, it illustrates that the former Soviet Central Asia countries showed the highest mortality level among the selected countries. The United States, France and Spain represented "low mortality" patterns while Central European countries and Baltic states keep an "intermediate" position between high and low levels of mortality. However, it shows that changes in health care associated with the socio-economic transition and the development of medicine along with changes in lifestyle (slight decreases in smoking and alcohol consumption) have played a role in the mortality rate of decline.

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 Working Paper no. 95. Florence: UNICEF Innocenti Research Centre.

Anderson B. and Silver B. (1986). Infant Mortality in the Soviet Union: Regional Differences and Measurement Issues. Population and Development Review, vol.12, no.4 (December 1986).

Austad S.N. (2006). Why women live longer than men: sex differences in longevity. Gend Med 3:79–92.

Barford A., Dorling D., Smith G. and Shaw M. (2006). Life expectancy: women now on top everywhere. BMJ 332:808.

Becker C. M., Bibosunova D. I., Holmes G. E., Ibragimova and Margarita M. (1998). Maternal Care vs. Economic Wealth and the Health of Newborns: Bishkek, Kyrgyz Republic and Kansas City, USA, World Development, vol. 11, pp. 2057-2072.

Becker C. and Hemley D. (1998). Demographic Change in the Former Soviet Union During the Transition Period. World Development, vol. 26, no. 11, p. 1957-1975.

Becker C.M. and Urzhumova D.S. (2005). Mortality recovery and stabilization in Kazakhstan, 1995– 2001. Economics and Human Biology, 3:97–122.

Berkman L.F. and Kawachi I. (Eds) (2000). Social Epidemiology. Health Education Research, vol. 18, issue 3. p. 404-407.

Bobak M. and Marmot M. (1996). East-West mortality divide and its potential explanations: proposed research agenda. BMJ. 1996;312:421–425.

Brainerd E. (2009).The Demographic Transformation of Post-Socialist Countries: Causes, Consequences, and Questions. UNU-WIDER Conference “Reflections on Transition: Twenty Years After the Fall of the Berlin Wall”, Helsinki, 2009.

Bryndovava L., Pavlokova K., Roubal T., Rokosova M., Gaskins M. (2009). Czech Republic: Health System Review. Health System in Transition, vol. 11, no. 1.

Burcin B. and Kucera T. (2007). Mortality. Population Development in the Czech Republic 2007, p. 57-71.

Caldwell, J.C. and Santow, G. (Eds.), (1989). Selected Readings in the Cultural, Social and Behavioural Determinants of Health. In: Health Transition Series, no. 1. Australian National University Press, Canberra.

Caldwell, J.C., Findley, S., Caldwell, P., Santow, G., Cosford, W., Braid, J., Broers-Freeman, D. (Eds.), (1990). What We Know About Health Transition: The Cultural, Social and Behavioural Determinants of Health. Australian National University Press, Canberra (2 vols).

Caldwell, J.C. and Santow, G. (1991). Preface. Health Transition Review 1, 1±2.

Carey A.D. and Loperato, J. (1995). The bio-cultural evolution of the male–female mortality differential. Mankind Quarterly 36, 3–28.

Caselli G., Mesle F. and Vallin J. (2002). Epidemiologic transition theory exceptions, Genus, vol. 58, no. 1, p. 9-52.

Central Asia Health Review (2008). Maternal mortality in Central Asia. Online magazine dedicated to the promotion of health and human rights in Central Asia. Special report. (http://www.cahr.info/index_files/page0023.htm).

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 WC, Hinote BP *et al.* (2004). Health lifestyles in central Asia: the case of Kazakhstan and Kyrgyzstan. Social Science and Medicine, 59:1409–1421.

Drevenstedt G.L., Crimmins E.M., Vasunilashorn S. and Finch C.E. (2008). The rise and fall of excess male infant mortality. PNAS, 105: 5016-5021.

Duran A., Lara J. and van Waveren M. (2006). Spain: Health System Review. Health System in Transition, vol. 8, no. 4.

European Observatory on Health Care Systems (1999). Health System in Transition – Hungary, 1999.

European Observatory on Health Care Systems (2000). Health System in Transition – Lithuania, 2000.

European Observatory on Health Care Systems (1999). Health System in Transition – Poland, 1999.

European Communities and World Health Organization (2001). Highlights on Health in Poland 2001.

European Observatory on Health Care Systems (2000). Health Care System in Transition – Slovakia.

European Observatory on Health Care Systems (2000). Health Care System in Transition – Turkmenistan.

Eurostat (2003). The social situation in the European Union 2002. Brussels, Joint publication of the European Commission and Eurostat.

Gaal P. (2004). Health care systems in transition: Hungary. Copenhagen, WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies, 2004.

Gaumé C. and Wunsch G. (2003). Health and death in the Baltic States. Prepared for the Eurepean Population Conference, Warsaw, 26-30 August 2003.

Gjonca A., Tomassini C., Vaupel J. (1999). Male-female Differences in Mortality in the Developed World. MPIDR Working paper WP 1999-009.

Golinowka S. and Sowa A. (2006). Health and Morbidity in the Accession Countries. Country Report – Poland. ENEPRI Research Report, no. 29, AHEAD WP2.

Government of Turkmenistan (2008b). National Report Submitted in Accordance with Paragraph 15 (A) of the Annex to Human Rights Council Resolution 5/1. Geneva, United Nations General Assembly, Human Rights Council, Working Group on the Universal Periodic Review, Third session, 1–15 December 2008.

Guerra R *et al.* (2003). Using verbal autopsy to assess the path to death: infant and maternal mortality in Dushanbe and Khatlon Oblast, Tajikistan. Dushanbe, UNICEF, Ministry of Health, Istituto Superiore di Sanità (Italy).

Health Statistics Department (2006). Statistical overview on health and health care in Latvia.

Hemstrom O. (1999). Does the work environment contribute to excess male mortality? Social Science and Medicine, 49 (1999) 879±894.

Hill K *et al*. (2001). Estimates of maternal mortality for 1995. Bulletin of the World Health Organization, 79(3):182–193.

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, 2004.

Hoffmann R. (2008). Socio-economic Differences in Old Age Mortality. Springer Science and Business Media (http://books.google.com/books?id=Cafsx_FdBcQC&pg=PA16&dq=Kranich+and+Vitt+2003&hl=en&ei=yfXsTOf8KemK4garrshs&sa=X&oi=book_result&ct=result&resnum=1&ved=0CCYQ6AEwAA#v=onepage&q=Kranich%20and%20Vitt%202003&f=false Google book online).

Human Development Report (2009). United Nation Development Programme. [online statistical annex] (http://hdr.undp.org/en/media/HDR_2009_EN_Indicators.pdf).

Ib Christian Bygbjerg and Dan W. Meyrowitsch (2007). Global Health Transition. Danish Medical Bulletin, vol. 54, no. 1.

INE (2003). Spanish National Health Survey 2003. Madrid, National Statistics Institute. (http://www.ine.es/inebase/cgi/um?M=%2Ft15%2Fp419&O=inebase&N=&L=0, accessed January 2006).

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.

Khodjamurodov G. and Rechel B. (2010). Tajikistan: Health System Review. Health System in Transition, vol. 12, no. 2.

Kingkade W. and Sawyer C. (2001). Infant Mortality in Eastern Europe and the Former Soviet Union Before and After the Breakup. Paper presented at the IUSSP Conference, Salvador de Bahia, Brazil, 19-24 August, 2001.

Koppel A., Kahur K., Habicht T., Habicht J., Saar P., 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.

Lai T., Habicht J., Reinap M., *et al*. (2007). Costs, health effects and cost effectiveness of alcohol and tobacco control strategies in Estonia. Health Policy, 84(1):75–88.

Lai T., Vals K. and Kiivet R .(2004). Burden of disease in Estonia: burden of disease and health risks. Tallinn, Ministry of Social Affairs.

Lean D.A., Chenet L., Shkolnikov V.M., Zakharov S., Rakhmanova G., *et al*. (1997). Huge variation in Russian mortality rates 1984-94: artifact, alcohol, or what? Lancet, 350: p. 393-8.

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

Lehr U. (2007). Populatoin ageing. The Online-Handbook Demography of the Berlin-Institute.

MacDorman M.F. and Mathews M. S. (2008). Recent Trends in Infant Mortality in the United States. NCHS Data Brief, no. 9, October 2008.

Mackenbach, J.P. (1994). The epidemiologic transition theory. Journal of Epidemiology and Community Health 48, 329± 332.

McKee M. and Chenet L. (2002). Patterns of health. In: McKee M, Healy J, Falkingham J. Health care in central Asia. Buckingham, Open University Press: 56–57.

McKee M., Sanderson C. and Chenet L., et al. (1998). Seasonal variation in mortality in Moskow. Journal of Public Health Medicine, vol. 20, p. 268-274.

McKee M., Healy J. and Falkingham J. (2002). Health care in Central Asia. European Observatory on Health Care Systems series, Open University Press, Buckingham, Philadelphia

Mesle F. (2002). Mortality in Eastern Europe and the former Soviet Union: long-term trends and recent upturns. Paper presented at IUSSP/MPIDR Workshop "Determinants of Diverging Trends in Mortality" Rostock, June 19-21 2002

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 (2002). Health of population and health care of Republic of Kazakhstan, 1991–2001. Astana, Ministry of Health.

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.

Ministry of Health and Consumer Affairs (2003). HIV and AIDS in Spain: multispectral plan 2001–2005, indicators: actualization, November 2003. Ministry of Health and Consumer Affairs.

Ministry of Health and Consumer Affairs (2005). National health survey 2003, Madrid, Ministry of Health and Consumer Affairs.

Ministry of Health of the Slovak Republic (1997a). National action programme on environment and health. Bratislava, 1997.

Monostrori J., Ori P., Molnar E., Speder Z. (2010). Demographic portrait of Hungary 2009. Demographic Research Institute, HCSO, Budapest.

Morand O. (2002). Economic Growth, Longevity, and the Epidemiological Transition. Department of Economics Working Paper Series, Working Paper 2002-07, July 2002

Murray C., Lopez A., Wibulpolrasert S. (2004). Monitoring global health: time for new solutions. BMJ., vol. 329.

Oksuzyan A, Juel K., *et al* (2008). Men: good health and high mortality. Sex differences in health and aging. Aging Clin Exp Res 20(2):91–102.

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, p. 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, p. 509- 538.

Omran Abdel R. (1977). Epidemiologic transition the US: the health factor in population change. Population Bulletin 32(2), p. 3-41.

Omran, Abdel. (1982). Epidemiologic transition. International Encyclopedia of Population, vol. 1, ed. J.A. Ross. London, p. 172-183.

Omran Abdel R. (1983).The epidemiologic transition theory: a preliminary update, Journal of Tropical Pediatrics, vol. 29, p. 305-316.

Perls T.T. and Fretts R.C. (1998). Why women live longer than men? Scientific American.

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. Routledge, London.

Rechel B. and McKee M. (2005). Human rights and health in Turkmenistan. London, London School of Hygiene & Tropical Medicine.

Rechel B *et al*. (2005). Are the health Millennium Development Goals appropriate for Eastern Europe and central Asia? Health Policy, 73:339–351.

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 & Tropical Medicine, Keppel Street, London WC1E 7HT, United Kingdom.

Reynold S.L. and Crimmins E.M. (2010). Trends in the ability to work among men and women in the older American population: 1997–2007. Eur J Ageing, Springer-Verlag, October 2010.

Rychtaříková 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.

Shkolnikov V. M., Cornia G., Leon D. and Mesle F. (1998). Causes of the Russian mortality crisis, World Development, vol. 26, no. 11, pp. 1995-2011.

Shkolnikov V. and Lean D. (2006). Commentary: N. Eberstadt's 'The health crisis in the USSR' and sustainable mortality reversal in the post-Soviet space during communism and after. International Journal of Epidemiology 2006;35:1406–1409.

Shkolnikov V. (2004). Introduction to the Special Collection of papers on "Determinants of Diverging Trends in Mortality". Demographic Research, Special Collection 2, Article 1, 2004, p. 1-10.

Skinnider M. (2000). Dispatches from abroad: fighting maternal mortality in a former Soviet republic. Canadian Medical Association Journal, 163(12):5.

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.

Sudarė / Completed by: Gaidelytė R., Želvienė A. and Jaselionienė J. (2009). Health Statistics of Lithuania 2009. Lithuanian Ministry of Health Information Centre of Institute of Hygiene, Vilnius, 2010.

Thomas T. and Ruth C. (1999). Why Women Live Longer than Men. Harvard Medical School

UNAIDS (2008). Epidemiological fact sheets on HIV/AIDS and sexually transmitted infections - 2006: Estonia. Geneva, Joint United Nations Programme on HIV/AIDS. (http://www.unaids.org/en/CountryResponses/Countries/estonia.asp, accessed 21 March 2008).

UNDP (2004). Human Development Report 2004. New York, United Nations Development Programme.(http://hdr.undp.org/reports/global/2004/pdf/hdr04_complete.pdf, accessed September 2005).

UNICEF (2000). Multiple indicator cluster survey. Dushanbe, United Nations Children's Fund.

UNICEF (2008a). TransMONEE database, 2008 edition.

USAID (2007b). "Turkmenistan Converts to WHO Live Birth Standard". (http://www.usaid.gov/locations/europe_eurasia/press/success/2007-02-24.html, accessed 9 December 2008).

U.S. Departament of Health and Human services, Centers for Disease Control and Prevention, National Center for Health Statistics (2009). Health, United States, 2009 with Special Feature on Medical Technology. DHHS no. 2010 – 1232.

Vallin J., Meslé F. (2004). Convergences and divergences in mortality. A new approach of health transition. Demographic Research, Special Collection 2, Article 2, 2004.

Verdiell N. C. (2007). Old mortality a State of Art. Bellaterra Juny de 2007.

Watson P. (1995). Explaining Rising Mortality among men in Eastern Europe. Social science and Medicine, vol. 41, no. 7, p. 923-234.

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.

WHO Regional Office for Europe (2005). Highlights on health in Turkmenistan, 2005. Copenhagen, WHO Regional Office for Europe.

WHO (2005). WHO Statistical Information System (WHOSIS) [web site]. Geneva, World Health Organization (http://www.who.int/whosis/en/, accessed 27 October 2005).

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 (2007). European Health for All database (HFA-DB) [offline database]. Copenhagen, World Health Organization Regional Office for Europe (January edition).

WHO (2008b). Health for all database, July 2008 edition. 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).

WHO Regional Office for Europe (2010). European Health for All database [online database]. Copenhagen, WHO Regional Office for Europe. (www.who.int).

Wilmoth J. (2009). Increase of Human Longevity: Past, Present and Future. Institute for Population and Social Security Research. Tokyo, Japan 2009.

World Bank (2003). The Millennium Development Goals in Europe and central Asia. Washington, DC, World Bank (www.worldbank.org).

World Bank (2004b). Dimensions of poverty in Kazakhstan, vol. 1: policy briefing. Washington, DC, World Bank (www.who.int).

World Bank (2008) [online database]. World development indicators 2007. Washington, DC, International Bank for Reconstruction and Development/World Bank (www.worldbank.org).

World Bank (2009a). World development indicators 2009. Washington, DC, World Bank (www.worldbank.org).

World Health Organization (2009). Environment and Health Performance Review: Lithuania.

Yim A, Humphries D *et al.* (2003). Food, alcohol and cigarette availability and consumption in Almaty, Kazakhstan: results and appraisal of a rapid assessment. Public Health Nutrition, 6(8):791–800.

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 '1990';

proc distance data=Data out=Dist method=Euclid;
where sex="male";
var interval(IMR -- q_75_90 / 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 `(IMR -- q_75_90)` 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

1990 23:53 Wednesday, November 24, 2010
males

Obs	Countries	Kazakhstan	Uzbekistan	Tajikistan	Kyrgyzstan	Turkmenistan	Czech_ Republi
1	Kazakhstan	0.00000	.	.	.	.	.
2	Uzbekistan	2.90293	0.00000	.	.	.	.
3	Tajikistan	2.64299	3.20971	0.00000	.	.	.
4	Kyrgyzstan	1.19487	1.99838	2.60712	0.00000	.	.
5	Turkmenistan	1.73886	2.36190	1.28066	1.61739	0.00000	.
6	Czech Republic	4.31023	3.36339	5.03153	3.98582	4.37003	0.0000
7	Slovakia	3.57990	2.95299	4.64272	3.28734	3.86897	1.1775
8	Hungary	2.73163	3.07317	4.22781	2.62681	3.42801	2.3618
9	Poland	2.99609	2.46175	4.33871	2.61425	3.44858	1.6660
10	Estonia	1.60431	3.30565	3.98036	2.04067	3.10454	3.7434
11	Latvia	1.52140	3.36476	3.94786	1.98894	3.09792	4.0331
12	Lithuania	2.63437	2.76818	4.66033	2.30455	3.67695	3.5315
13	USA	5.47732	3.69995	6.73479	4.75889	5.78381	4.0228
14	France	5.82424	3.90324	6.94412	5.07202	6.03999	3.8842
15	Spain	6.06697	4.15948	7.15613	5.32739	6.26655	4.1931

Obs	Slovakia	Hungary	Poland	Estonia	Latvia	Lithuania	USA	France	Spain
1	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	.	.	.	.
7	0.00000	.	.	.	.	.	.	.	.
8	1.29788	0.00000	.	.	.	.	.	.	.
9	0.89782	1.19408	0.00000	.	.	.	.	.	.
10	2.99589	2.13742	2.35387	0.00000	.	.	.	.	.
11	3.21937	2.27614	2.59028	0.41154	0.00000	.	.	.	.
12	2.63483	2.05469	1.94995	1.74115	1.71858	0.00000	.	.	.
13	3.99369	4.56116	3.53912	4.74662	4.91071	3.52305	0.00000	.	.
14	3.95711	4.64843	3.61683	5.11215	5.29339	3.89235	0.82508	0.00000	.
15	4.35885	5.05601	3.98000	5.35476	5.54973	4.23413	0.89511	0.59934	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.

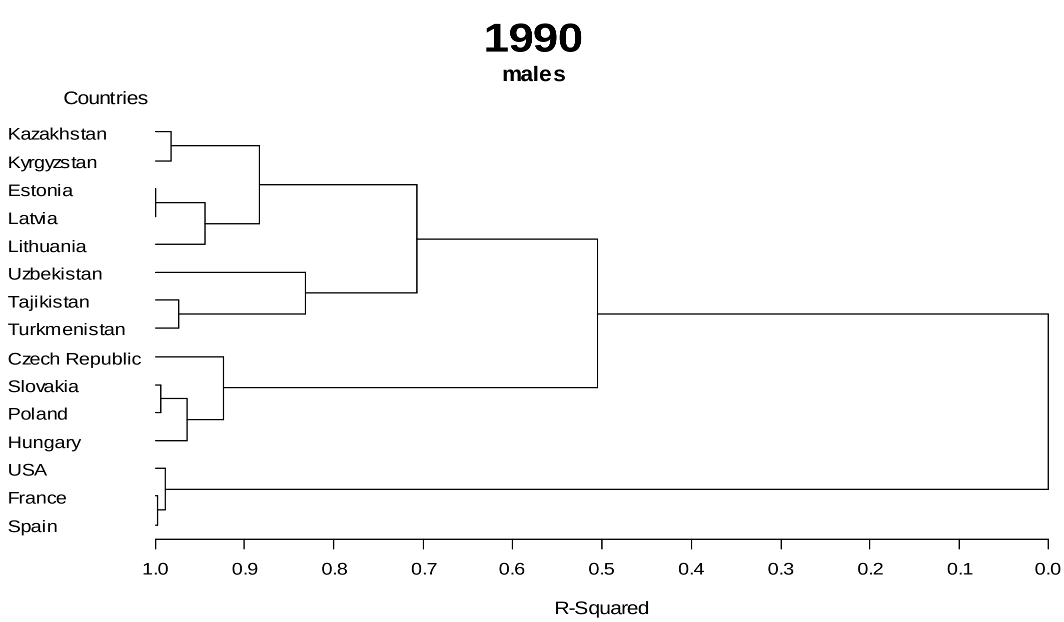
While this process may be interesting, it is hard to follow on the printout. For this reason, cluster analyses are usually reported based on plots of the clustering history, referred to as tree diagrams or dendograms. In SAS, there is a procedure to create such plots called PROC TREE. This procedure 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