Diploma Thesis

on the topic

Mortality Trends and Patterns in Mecklenburg-Vorpommern Before and After Unification.

A Study Based on Mortality, Cause of Death and Population Data.

submitted to the Faculty of Economics and Social Sciences at the University of Rostock

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Table of Contents

List of Abbreviations

AIDD	Average Inter-District Difference
CR	Comparability Ratio / Critical Ratio
CVD	Cardiovascular Diseases
DBR	Bad Doberan
DM	Demmin
e_0	Life Expectancy at Birth
EUR	Euro
FRG	Federal Republic of Germany
GDP	Gross Domestic Product
GDR	German Democratic Republic
GER	Germany
GU	Güstrow
GVA	Gross Value Added
HGW	Greifswald
HMD	Human Mortality Database
HRO	Rostock
HST	Stralsund
HWI	Wismar
ICD 9 / ICD 10	ICD Ninth / Tenth Revision
ICD	International Classification of Diseases and Related Health Problems
IHD	Ischaemic Heart Disease
LE	Life Expectancy
LWL	Ludwigslust
MST	Mecklenburg-Strelitz
MU	Müritz
MV	Mecklenburg-Vorpommern
na	not applicable
NB	Neubrandenburg
NUTS	Nomenclature of Territorial Units for Statistics
NVP	Nordvorpommern

NWM	Nordwest-Mecklenburg
OVP	Ostvorpommern
PCH	Parchim
RUG	Rügen
SDR	Standardised Death Rate
SMR	Standardised Mortality Ratio
SN	Schwerin
UER	Uecker-Randow
WHO	World Health Organisation

List of Tables

List of Figures

1 Introduction

1.1 Objective of the study

Studies on regional mortality have been conducted for several of the German Länder, also a few for the federal state of Mecklenburg-Vorpommern (MV). Notably after the German Unification in 1990, differences among Länder (the German federal states) of East Germany, one of them being Mecklenburg-Vorpommern, were compared to Länder of West Germany. Within Germany there is not only a mortality gradient between the East and West, but also between the North and South. Mortality in Mecklenburg-Vorpommern is in the highest level among all East German Länder. Not only is life expectancy low, but also other demographic factors show unfavourable trends, so that for example out of state migration and low fertility rates are resulting in accelerated population decline and ageing.

Analysis of mortality in Mecklenburg-Vorpommern is of specific scientific interest. First of all, since 1990 East Germany has undergone an enormous socio-economic transition and has also experienced an important change in mortality. In general, the mortality gap between MV and the rest of the country has diminished. Second, it is worth examining why Mecklenburg-Vorpommern is on the lower end of the range among all East German Länder. Surprisingly little research has been devoted to this topic. This study aims to fill this gap.

In this context, mortality and corresponding life expectancy are often referred to as a measure of public health. Inequality in mortality is a common phenomenon. There are various determinants of this inequality, including factors such as age and sex as well as regional, behavioural and socio-economic factors.

This study will consider variation of mortality differentials within MV and their determinants. This thesis aims to analyse all-cause mortality patterns in MV and their cause-of-death components. Variation of mortality differentials across the districts of MV and their socio-economic determinants are also discussed.

1.2 Hypotheses

Though a general overview on the mortality situation of MV is aimed at, the following hypotheses shall give a guideline through the study. They refer to several levels: to the standing of MV within the German context, to the cause of death specific mortality pattern and to the mortality across MV districts.

Hypotheses with regard to the general mortality level:

1. Mortality in Mecklenburg-Vorpommern will decrease and approach the German average level.

Several factors, such as the development of the health care system, socio-economic development and migration, are involved. Improvements in the health care system will strengthen the mortality decline after Unification. A general improvement of the socio-economic conditions will also contribute to a mortality decline in MV. On the other hand it is known, that MV lags behind the German average, which might defer the improvement. After Unification, MV experienced much emigration. Assuming a healthy migrant effect, this will have a negative impact on the mortality improvement.

Hypotheses with regard to cause-specific mortality:

2. Convergence of Mecklenburg-Vorpommern to the German average in avoidable mortality.

The improved health care situation after Unification should result in a substantial decrease of avoidable mortality. Technical medical equipment is on West German standards to date, so that mortality differentials must be traced back to other factors.

3. Excess traffic accident mortality in Mecklenburg-Vorpommern.

Given the specific road traffic circumstances in MV – rural area with many avenues – this will result in excess mortality of MV compared to the German average.

4. Decrease of suicide mortality in Mecklenburg-Vorpommern after Unification.

Since the psychosocial stress caused by political suppression stopped with the opening of the Wall, it is very likely that this reduces suicide mortality substantially.

Hypotheses with regard to mortality across districts of Mecklenburg-Vorpommern:

5. Supremacy of urban districts aggravates and hence increases inequality.

Socio-economic situation will be improving in urban areas and undergo a relative worsening in rural areas. This results in an urban-rural mortality divide and an inequality increase with respect to mortality.

6. Excess mortality in external and alcohol-related causes of death in rural districts.

External mortality will be higher in rural districts because of higher traffic accident rates since rural population depends more on cars. High unemployment and lack of societal offers evokes drinking and thus alcohol-related mortality.

7. Unemployment rate and percentage of blue-collar workers correlate positively with mortality, number of physicians and private cars and GDP correlate negatively with mortality.

A high socio-economic status on the aggregate district level leads to lower mortality. The percentage of blue-collar workers is a representative of education and the economic well-being of a district. Unemployment rate and GDP also stand for the economic development. The number of physicians is a measure of the health care provision. The number of private cars is also a measure of wealth.

2 Literature Review

2.1 Socio-demographic situation of Mecklenburg-Vorpommern

Different experiences in the two former states of Germany – the Federal Republic of Germany (FRG) and the German Democratic Republic (GDR) – left their impact on the political, social and economic situations of the current respective areas. This is also evident in their demographic patterns. The experience of the temporal German divide is referred to as a *"unique political experiment"* (McKee et al. 1996, p. 219) with respect to societal aspects.

When the Berlin Wall was built in 1961, the economic and personal circumstances in both parts of Germany were comparable. The fall of the Wall in 1989 saw the end of the divided Germany. After almost a year of negotiations and rearrangements, the German Unification agreement was executed on October 3rd 1990.

The former districts of Neubrandenburg, Rostock and Schwerin in East Germany, which constitute the Federal State of Mecklenburg-Vorpommern to date, were stamped by agriculture (Ministerium für Bau, Landesentwicklung und Umwelt des Landes MV 1995, p. 46). This is a consequence of the historical development that was marked by selective and delayed industrialisation (Albrecht in Weiß (ed.) 1996, p. 117). In all industrial sectors, there was a decline of workforce after Unification. This was especially the case for the agricultural sector. The only sector that was not concerned by the decline of workforce was the supply of services (Ministerium für Bau, Landesentwicklung und Umwelt des Landes MV 1995, p. 46).

The workforce decline, which took place after 1989, affected all districts of MV, but to a different extent. The employment decrease, and thus an increase in unemployment, affected the Eastern parts of MV more than the Western parts. Furthermore, most of the rural districts were more concerned than the urban districts. Seaside towns, where shipyards are located, received special financial attention since the preservation of this core industry was aimed at (ibid., p. 47).

The population size of MV has been falling since Unification in 1990. In 2003, the population size was 1.73 million of 16.91 million people in East Germany and 65.62 million people in West Germany (Statistisches Jahrbuch MV 2004, pp. 448–449). All demographic factors have contributed to the population decline in Mecklenburg-Vorpommern. Fertility was high until Unification and is now slightly below the German level. In the 1990s, migration was characterised by a negative migration balance, and about 90 000 people left MV between 1990 and 1999 (Kück & Karpinski 2001, p. 33). Finally, mortality has been the highest throughout Germany. This is still the case but the absolute mortality level has declined enormously.

The demographic events of fertility and migration in Mecklenburg-Vorpommern are touched upon in this section. Fertility has been higher in the GDR than in the Federal Republic of Germany since the 1970s. The former GDR districts of Neubrandenburg, Schwerin and Rostock, now Mecklenburg-Vorpommern, experienced even higher fertility than the GDR average until 1990. Mecklenburg-Vorpommern underwent a sharp decline in fertility after Unification similar to all the other East German Länder. The total fertility rate (TFR) has dropped from 1.64 in 1990 to 0.74 in 1994 (Statistical Yearbook MV 2004, p. 56). Since 1994, again, fertility rates are rising (Dinkel 2004 in Werz & Nuthmann (eds.), pp. 184–185) and the TFR at present reaches almost the level of the German average. For instance, TFR in MV was 1.28 in 2001 (Statistisches Jahrbuch MV 2004, p. 56) versus 1.35 for the whole of Germany (Statistisches Jahrbuch für die Bundesrepublik Deutschland 2003, p. 70). Though fertility shows some positive changes, the trend in migration is less positive.

Migration was influenced by political and economic conditions in the GDR as the choice of occupation was restricted and there was a shortage of housing. East-West migration and external migration was constricted after the building of the Berlin Wall in 1961. Between 1990 and 1999, the population loss due to migration was 381 000; conversely 293 000 people migrated to MV (Kück & Karpinski 2001, pp. 32–33). Since MV has a positive migration balance with the new East German Länder, the negative migration balance is thus the result of population losses to West Germany. The impact of foreign migrants is low compared to the whole of Germany, which is a result of the very low proportion of foreigners. The greatest population losses took place between 1989 and 1991, where the annual migration balance was – 29 000. In the mid-1990s, the migration balance levelled out. In 1995–2000, annual migration balance was about – 3 000 (Statistical Yearbook MV 2004, p. 59). The districts on the Western border – Nordwest-Mecklenburg and Ludwigslust – increased in population, due to cheap building land, while the rest of MV experienced losses at the same time (Dinkel in Werz & Nuthmann (eds.) 2004, pp. 188–191). Emigration is higher amongst women than men aged between 18 and 25, the most important age groups for females migration. Men also experience high emigration rates up to the age of 35. Migration losses in Mecklenburg-Vorpommern are not only the result of emigration, but also due to relatively little immigration (Fischer & Kück in Werz & Nuthmann (eds.) 2004, p. 206). Both migration flows and low fertility levels contribute to the fact that MV is a leader among the German Länder in demographic changes such as ageing (Kohler 2001, p. 7).

Migration is an important factor in demographic change and its impact on mortality can also be assessed. Migration usually occurs selectively, for example young and healthy people may migrate more, than older and sick people. This selectivity results in the so-called healthy migrant effect. As a result, the demographic and socio-economic structure of the population changes to some extent. The migration effect on life expectancy depends nonetheless upon the precision of measurements. Even extreme assumptions on the mortality of migrants only leads to marginal changes in life expectancy (Scholz in Cromm & Scholz (eds.) 2002, pp. 15–16).

2.2 Mortality in East and West Germany

The divide of the German states had strong impact on mortality. Life expectancy was slightly higher in East Germany until the early 1970s when this changed to the reverse. By the end of the 1980s, West Germany had an advantage of approximately two years in male and more than five years in female life expectancy at birth compared to East Germany (Cockerham 1999, pp. 238–240). After Unification, from 1989 to 1990, the life expectancy in East Germany declined. This decline was temporary and new rapid progress in East Germany started in 1990. Although differences in life expectancy still exist, East Germany has come close to the West German average (Nolte et al. 2000b, p. 899). The difference in life expectancy between East and West from 1999–2001 was equivalent to 1.6 years for men and 0.6 years for women, and steadily diminished after 1991. The gain in life expectancy was apparent for all age groups, with mortality in older age groups in the East being almost at the West German level. At the same time, mortality in young and middle age groups is still 40–50% above the West German level (Mai 2004, pp. 60–61).

Reasons for the described health divide as a result of the two different political systems have been addressed frequently. Differences in health care provision, environmental pollution, lifestyles and nutrition are the most common causes of the mortality differential between East and West (see for example Dinkel 1994, pp. 163–166; Nolte et al. 2000b, pp. 904–906; Heinemann et al. 1996). West Germany invested more in its public health system and therefore was able to provide better medical care. The Eastern part was not as well equipped with emergency medical aid and intensive care medicines and, thus effective mortality reduction was retarded (Mai 2004, p. 55). Nutrition improved after Unification due to higher consumption of fruits and vegetable oil (Nolte et al. 2000b, p. 905) which influence heart disease risk in a positive way. Alcohol intake remains higher in East Germany and it is probable that this accounts for some present differences (ibid., pp. 905–906). The role of environmental pollution

is not clear. Though pollution was higher in the more industrialised southern parts, mortality was higher in the northern parts of the GDR (Dinkel 1994, p. 165). There is more evidence that this geographical pattern resulted from differences in socio-economic development among East German regions (Heinemann et al. 1996, p. 23).

A further hypothesis why a mortality gap between the FRG and GDR existed is the healthy migrant effect. This refers both to selective East-to-West migration as well as to foreign migrants. The percentage of migrants in West Germany exceeded and still exceeds by far the percentage in East Germany (Dinkel 1994, pp. 166–169). As mentioned before, Mecklenburg-Vorpommern experiences significant emigration especially to Länder of West Germany. It is thought that East German emigrants are healthier and better educated than those that remain in East Germany, alternatively they leave for a training or job. In short, it may be derived that people in poor health tend to stay.

Political suppression in East Germany as an influencing factor on psychological health is another established hypothesis in the discussion about the mortality differential between East and West Germany (see for example Cockerham 1999, pp. 241–242). Measurement problems do not permit quantifiable outcomes and thus the approval or rejection of the hypothesis. Häussler and others assume that women were better able to adapt to the new situation post Unification. This is as women tend to place greater importance on social networks, and therefore did not experience a decrease in life expectancy after Unification (Häussler et al. 1995, pp. 371–372).

Further, there were some short-term factors influencing the mortality jump in the former GDR right after Unification. Traffic injuries sharply increased as a consequence of the rising number of fast cars and no speed limit (Dinkel, unpublished document, p. 6). Change in definition of live births first led to a jump in infant mortality (ibid., pp. 5–6). The FRG applied the WHO definition on live births until 1994 (Sozialministerium MV 1997, p. 24). In GDR, the condition for live birth was the combined heartbeat and lung function acting together (Dinkel, unpublished document, pp. 5–6). Some children that would have been classified as a stillbirth or abortion in East Germany would have been classified as live births in West Germany. East Germany adopted the West German definition on October 3rd 1990 (ibid., p. 24). Taking into account the small number of stillbirths and abortions, the effect of change in definition becomes negligible.

Luy allocates the life expectancy differences between East and West Germany to diseases of the circulatory system and remarks that excess mortality in this cause of death group is

particularly high for women. Diseases of the digestive system and external causes of death cause much of the excess mortality of East German men. For avoidable causes, Luy concludes that improvements in medical technology did not contribute significantly to the mortality gap between East and West Germany (Luy 2004, pp. 40–48).

Socio-economic differences between the two parts of Germany are still very significant. West Germany still benefits from a healthy migrant effect. Importantly, East Germany has adopted FRG legislation and now follows the FRG health care system.

2.3 Regional variation

Regional mortality variations are observed throughout the whole world. Generally, the smaller an area is, the greater the differentials (Birg 1982, p. 1).

Several studies on regional mortality in Germany have been conducted over the last few decades, with emphasis on both the interregional differential as well as the intraregional differentials. For a comprehensive overview see Cromm and Scholz (eds., 2002) who published studies on regional mortality in Germany with a focus on various regions such as Berlin, Munich, Mecklenburg-Vorpommern, East and West Germany (for other studies see for example Heins et al.1984; Gröner 1996; Helmert et al. 2003; Neubauer 1988; Kück & Müller 1997).

Few analyses of mortality and life expectancy are dedicated to the state of Mecklenburg-Vorpommern. Mai found some of the regions of Mecklenburg-Vorpommern to have the highest mortality sites within East Germany and therefore also within Germany. The regions concerned are situated in the East and in the middle of Mecklenburg-Vorpommern. Urban areas exhibit a clear mortality advantage compared to rural areas (Mai 2004, pp. 55–58).

To get an impression of the work, which is closely related to the topic of the present study, the three most important studies on mortality in MV are highlighted. Dinkel (2001) did one of the studies that explicitly analysed mortality patterns (besides fertility) in Mecklenburg-Vorpommern for the time before and after Unification. His key point was the excess mortality in Mecklenburg-Vorpommern at young adult ages for both sexes. In middle-aged men, he also found that mortality rates were by far higher than the GDR and German averages. This trend existed even before Unification. He explained the higher mortality in young adult ages with a higher traffic accident fatality rate (Dinkel 2001, pp. 27–29). A small-area analysis on regional differentials across the districts of Mecklenburg-Vorpommern conducted by Müller and Kück focuses on methodological aspects of small-area mortality analyses. They identify significant differences in life expectancy levels across the districts of Mecklenburg-Vorpommern. People in urban

districts feature higher life expectancy than people in rural districts, and this fact is even more pronounced in men than in women (Müller & Kück 1998). Another study conducted by the Ministry of Social Affairs in MV also came to this result, but further analysed the impact of certain causes of death. This study covered the years of 1985–1996, thus the transition time is included. Attention is drawn to accident mortality and mortality of the digestive organs. These causes are specified to explain the life expectancy decrease from 1989–1990 (Sozialministerium MV 1997). Statistical reports on population movements from the State Office of Statistics Mecklenburg-Vorpommern are rather descriptive (see for example Statistisches Landesamt MV 2003; for a cause of death analysis see for example Karpinski 1994).

With regard to global mortality differentials, Great Britain was often the subject of these analyses. The UK for example exhibits a strong north to south decline in mortality. Mortality is, generally lower in Southern parts with an especially bad situation in the South of Scotland and the Lancashire area (Howe 1986). A cross-national study on the mortality of Belgium, The Netherlands and the German federal states of Niedersachsen, Nordrhein-Westfalen and Rheinland-Pfalz during the 1980s, was executed by van der Veen. The regional pattern showed a privileged position of the Dutch provinces, followed by the Northern Belgium regions. Nordrhein-Westfalen, Niedersachsen and Rheinland-Pfalz took the position between the Belgium north and south. In this context, lifestyle factors such as smoking and nutrition were discussed (van der Veen 1994).

Causes of death are widely used to identify regional differences on the basis of the specific aetiology of a disease. For example respiratory diseases are allowed for environmental pollution. If there is no significant contribution of certain diseases to life expectancy, this can have two reasons. A disease either has major regional differences, but only a minor number of deaths. Alternatively, there are insignificant differences in regional patterns of causes of death, which have a considerable amount of deaths (ibid., pp. 333–342). Wolf pointed out that higher mortality rates in certain causes of death in a region do not necessarily mean that this results in general lower life expectancy (Wolf 1992, p. 259). Heart diseases, some kinds of malignant neoplasms, some respiratory diseases, car accidents and suicide account for many of the regional differences (van der Veen 1994, pp. 337–342). Another study of West German federal states by Kern and Braun discovered that respiratory diseases are exceedingly often subject to regional variation. Other big groups such as malignant neoplasms or circulatory diseases underlie variations, though they are less pronounced. Within Germany, the northern States and

Berlin experience suicide mortality above the West German average. Diseases of the digestive system occur most often in the city states in women. Accidents show a pattern of high mortality in territorial states and low mortality in city states (Kern & Braun 1987, p. 324).

Some theoretical aspects of regional mortality differentials are now given. Regions usually develop their characteristics, hence also demographic structures, on the basis of historical, geographical, climatic or economic features (de.wikipedia.org 2004). A region is therefore an area belonging together with economic and social structure and serves as a planning base (wissen.de 2004). The NUTS classification (Nomenclature of Territorial Units for Statistics) prefers units according to institutional breakdown, due to practical reasons and regions of a general nature rather than regions of a certain interest (europa.eu.int 2005). Theoretical frameworks, which could explain mortality differences between regions usually incorporate among others the following factors (based on Bobak & Marmot in Hertzman et al. (eds.) 1996, pp. 31–40; see also Luy 2004, pp. 32–33):

- Medical care: based on differences in access and quality of medical care
- Environmental pollution: causes certain diseases in certain areas
- Socio-economic situation: education enforces healthy behaviour, wealth gives higher quality of life, economic affluence permits its implementation
- Lifestyle and diet: smoking, being overweight, physical inactivity and an unhealthy diet are risk factors for many chronic diseases
- Psychosocial stress: may cause excess mortality.

These factors are widely used to explain regional differences in general (see for example Dinkel, unpublished document, pp. 13–20; Gatzweiler & Stiens 1982, pp. 50–62; van Kevelaer 1982). Usually, in mortality analyses, small-area variation is mostly explained by socio-economic differentials. Environmental pollution and supply of health care are factors of little importance (von Gaudecker 2004; Neubauer 1988, pp. 307–308). Individual behaviour, biological and genetic dispositions are the linkage between the mentioned factors (Howe 1986, pp. 390–391).

Given the strong need of regional analysis for planning, many problems are nevertheless faced in applied regional mortality analysis. Birg points at the strong need for standardisation and enumerates sex, age, and also structure of marital status, nationality and profession (Birg 1982, pp. 6–20). Furthermore, small numbers may lead to statistical insignificance. The impact of migrants cannot be traced back easily, and thus healthy migrant effects are probable. When

regarding cause of death statistics and coding practices differ, the result will be biased. As regional analyses are applied to administrative areas for practical reasons, these areas do not necessarily reflect the intended purpose. This problem of administrative units can be reduced by studying patterns of nearby regions (Rosen et al. 1985, pp. 293–296).

2.4 Mortality variation by age, sex, and socio-economic group

2.4.1 Age variation

More than half of the life table deaths in men occur beyond age 65, in women beyond age 80. Germany experienced – as all of the Western European countries – an enormous change in age-specific mortality in the last century. Infant mortality as a measure of public health can be almost neglected nowadays. In the year 2000 there were 4.4 infant deaths per 1000 live births (Statistiken zur Gesundheit 2002, p. 288). During childhood, mortality is lowest throughout the whole life span with a minimum around age ten.

Throughout the life span, male mortality is higher in each age group. Death rates increase at the age of 15, followed by a slight decrease in the age group of 20–25. Mortality in young adulthood is mostly affected by external causes of death such as car accidents. Up to approximately age 25, this is the leading cause of death. After age 25 death rates exponentially rise.

During the course of life, the pattern of causes of death changes significantly. After age 60, cardiovascular diseases (CVD) and cancer play a major role.

Changes in mortality patterns during a lifetime are generally explained by two approaches: First, lifestyle and behaviour have an impact on the occurrence of diseases that lead to death at a certain age. Second, several theories of ageing try to explain from a biological point of view the influence of ageing on people's survival (see for example Hayflick 1994). This also implies the impact of early life events like nutrition, that determine mortality later in life (see for example Bengtsson & Lindström 2000).

Kuh and others (2003) have described an approach that combines the two last mentioned ones and puts special weight on diseases. It is called life course epidemiology. The authors describe it as follows: *"A life course approach does not deny the importance of conventional risk factors, such as smoking and hypertension […]. Life course epidemiology attempts to integrate biological and social risk processes rather than draw false dichotomies between them."* Thus, the life course epidemiology tries to explain mortality and mortality differentials during adulthood by factors, which influenced the whole lifespan of humans. The risk factors are for example risk

exposure during childhood or early life stages, but also social affiliation can be a risk factor (ibid., p. 778).

2.4.2 Sex variation

Men show higher mortality in all age groups compared to women. This is not only expressed in sex and age specific mortality rates, but consequently in life expectancy. Up to the early 1980s the sex difference in many developed countries was increasing, but then reversed (Glei 2005). The narrowing gap is considered a convergence in male and female lifestyles. With regard to age-specific sex mortality differentials, the differential is highest for adolescents and young adults (Zopf 1992, p. 59).

A comprehensive literature review on why sex differentials in mortality exist was done by Luy who summarised explanatory theories (Luy 2002). There are basically two main reasons for sex variation. Firstly, because of behavioural and secondly because of biological reasons (Luy 2002, p. 415; Wingard 1984, p. 433), similar to what is seen in age variation.

Let us first throw a glance at biological factors. The primary sex ratio (sex ratio before birth) is far higher than the sex ratio at birth. This implies that male excess mortality already exists right after conception and remains throughout the whole life span. Many of the leading causes of death exhibit twofold or threefold higher death rates in men than women (Wingard 1984, pp. 438–441). Also in animals male excess mortality exists throughout the lifespan and is thus not only a human phenomenon. There is general conjecture by biological theories that there is a general protective effect of the additional x-chromosome and female hormones (Luy 2002, pp. 422–423). Furthermore, oestrogen protects premenopausal women notably from heart diseases (Zopf 1992, p. 40).

Behavioural or environmental theories are used to examine sex-specific mortality differences and refer to different lifestyles. Whereas the absolute sex differences in age 1–14 are very low, it increases rapidly after age 15. Men fall victim more often to accidents – the leading cause of death in the young adult ages. Apart from direct risky behaviour, smoking habits and diet are considered to contribute much to the gender differential in life expectancy, as are occupational hazards (see for example Waldron 1993, pp. 451–452).

Causes of death like lung cancer, accidents and ischaemic heart disease (IHD) represent major contributions to the existing sex difference. Higher lung cancer mortality in men is closely related to smoking. Higher IHD mortality in men is a good example where biological and

behavioural factors interfere. It is assumed that female sex hormones produce a protective effect and that men tend to accumulate fat in the abdominal region (ibid., p. 451).
As a consequence, women seem to have a biological advantage in survival. In years it may be one or two years of life expectancy, the remaining gap is environmental (Luy 2002, p. 412).

2.4.3 Variation by socio-economic group

Mortality differentials by socio-economic status are well known as a result of poorer health in more deprived groups. Research on mortality differentials very often trace back to socio-economic differentials, for example in regional analyses or in mortality amenable to health care.
Four factors make up one's socio-economic status in adult life. These are education, occupation, personal income and employment status. Education can influence health in an indirect way, but also directly, for example by education on smoking and healthy lifestyle. The advantage of education is its steady level after age 25 and easy measurement by counting years of education. Changing school systems and thus different levels of education must be taken into account when comparing mortality by educational level in young and old people. The occupation involves certain occupational hazards that are more pronounced in manual than in non-manual workers. Manual workers are often more exposed to occupational injuries. Specific causes of death relate to certain occupations, for example black lung from coal mining. Personal income allows for a healthier life style, although there are differences dependent on sex. Examination of income level does not necessarily reflect one's wealth, because household income plus savings furthermore earmark the financial situation. Lastly, the employment status accounts for socio-economic differences with unemployed people suffering higher mortality. Women are often out of the job market in order to be housewives and take care of their children; in this case personal income and employment status do not reflect the socio-economic status. Although some differences between these four factors exist, they are highly correlated. Education is considered the best indicator of the factors to determine socio-economic mortality differentials, presumably because it influences income and occupation the most (Spijker 2004, pp. 17–29; Zopf 1992, pp. 52–55).
Vallin describes social inequality as the result of behaviour in the following order: selection takes place on the basis of health, with healthy individuals having better chances of acquiring higher education. Living conditions then contribute to a worsening or a preservation of the health status. Finally, he considers behaviour itself as a factor, which influences the two aforementioned factors in a positive or negative way (Vallin 1995, pp. 191–192). Other risk

factors that determine the health status are material factors, psychosocial stress, biological factors and the use of and access to health care (Spijker 2004, pp. 19–20). For example, permanent binge drinking leads to a worsening in health status, and at the same time problems at the work place and money troubles may arise. A person will hence hardly be able to maintain its socio-economic status.

Mortality differentials among different socio-economic groups can be allocated to several causes of death. This refers especially to higher mortality from cardiovascular diseases in lower socio-economic groups. Trends in differential mortality due to socio-economic differences from the 1980s to the mid 1990s in Western Europe point to a clear fact. Higher socio-economic groups experienced a faster proportional decline in mortality than groups with lower socio-economic status. Even a rise in mortality rates among lower socio-economic groups could have been found from lung cancer, breast cancer, respiratory disease, gastrointestinal disease and injuries (Mackenbach et al. 2003).

Another important socio-demographic factor, which has an impact on mortality, is marital status. Married people or those who live in a long-term, stable relationship have increased life expectancies. Supporting arguments for their longer life are the protective effect of a regular life and the selective effect that healthier people are more privileged with regard to their chance of getting married (Klein 1993).

2.5 Mortality by causes of death

2.5.1 International Classification of Diseases

Before analysing and interpreting cause of death statistics, it is necessary to know the recording procedure for causes of death, as this causes some limitations in interpretation and analysis.

Causes of death are coded according to the International Classification of Diseases and Related Health Problems (ICD), currently in the 10th revision. In 1900 WHO first initiated the ICD classification. The classification uses triple digit codes for each cause of death. Triple digit codes are internationally obligatory whereas four-digit codes are only recommended (Schuster 2003, p. 16). The fourth digit is a further specification of the triple digit code and indicates for instance more precise types of a disease.

According to WHO, the underlying cause of death is *"(a) the disease or injury which initiated the train of morbid events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury"* (WHO 1993, p. 31). Only the underlying cause of

death is recorded in the national statistics (Eisenblätter et al. in Heinemann & Sinnecker (eds.) 1994, p. 354). The problem of multimorbidity is hence not included in the classification. It is obvious that the cause of death statistics therefore present only one part of a complex topic. Especially in high ages, it is assumed that people suffer several diseases.

The general accuracy of cause of death statistics and the prevailing coding practice has been addressed in order to assess the quality of cause of death statistics. A famous German study was conducted in 1987 in Görlitz, an East German city with 80 000 inhabitants where 97% of the deceased were examined by autopsy. The autopsy results were then compared to the death certificates, which were filled out by the attending physician in the GDR. In 53% of all deaths identical causes were found, in a further 18% of these cases minor differences were observed. Major differences, that is, the crossing of a disease group, were found in the remaining 29% of cases. Circulatory diseases, endocrine and metabolic disorders were overrepresented in the death certificates. On the other hand, infectious diseases, neoplasms, respiratory, digestive, and genitourinary diseases were underrepresented (Modelmog et al. 1992).

Several changes took place by each revision of the ICD. ICD 9 – in use in Germany from 1979 to 1997 – had 17 chapters with 138 groups and was expanded to 21 chapters in ICD 10, which comprises of 261 groups (Schuster 2003, p. 18). For the first time in all the revisions, an alphanumeric code was introduced with ICD 10 in 1998. Codes now consist of a letter as the first character and are followed by two or three figures. In ICD 9, codes consisted of three or four figures. The introduction of the alphanumeric code made it possible to expand the number of chapters and codes. As a result, some categories of ICD 9 can be reclassified into several ICD 10 categories (ibid., p. 18).

This leads to a comparability problem between revisions. Some groups underwent major changes in classification. However, 95% of all deaths remained in comparable chapters. As an example for reclassification, respiratory diseases decreased around 25%. This is mostly due to a reallocation of pneumonia, which is now partly within the group of infectious diseases as a result of altered coding rules. Consequently, the group of infectious diseases has risen (Office of National Statistics UK 2002, pp. 75–76).

Comparability studies or bridge coding studies deal with this problem and give evidence to what extent changes took place. In England and Wales and the United States, such studies have been conducted by coding the deaths in a certain period to both, ICD 9 and ICD 10.

Comparability ratios were then calculated dividing the deaths of a certain cause in ICD 10 by the deaths of the same cause in ICD 9. If the ratio is one, this means that the ICD revision had no impact on this cause in respect of coding. Ratios greater than 1 indicate a greater allocation of deaths to this cause in ICD 10 than in ICD 9. Those ratios can be applied to the number of deaths and to death rates in order to get an expected time trend (Office of National Statistics UK 2002; Anderson et al. 2001). A comparable study for Germany is not known.

As such comparability studies do not exist for France, Meslé and Vallin invented another approach to solve the problem of breaking time series. They matched causes of death from different ICD revisions and elaborated correspondence and transition tables. In the easy case items either remain the same, have to be split up or merged. A more complex case emerges when causes have to be both split up and merged. With the help of the transition tables diseases can be classified from one classification to the other and vice versa (Meslé & Vallin 1996).

Differing regional coding practices make comparisons difficult. This applies also to East and West Germany. The new Länder of East Germany adapted the West German coding practice on October 1st 1990. Before, physicians were responsible for ICD coding. The West German coding practice determines that physicians fill in a death certificate, actual coding is done by personnel at the State Offices of Statistics (Brückner 1993, p. 257). Mortality rates by causes of death state significantly higher cardiovascular mortality in the GDR, on the other hand lower cancer mortality, both to a considerable extent (Dinkel, unpublished document, p. 10; Dinkel 2004, pp. 27–28). After 1992, when the West German coding practice was fully adapted by East Germany, those differences to West Germany diminished and the cause of death patterns became very similar. Changes in cause of death groups from one year to another usually do not exceed 5% (Brückner 1993, p. 268). The substantial change in mortality in the whole cause of death pattern can thus not be explained merely by expected changes after Unification. Brückner assumes that instead of choosing the underlying cause of death, the final state of a disease was often chosen as cause of death. For example, diabetes mellitus and pneumonia often occur as a disease, but they are rather final state than the underlying cause of death (ibid., p. 270). As for differential cause of death statistics, Dinkel advises against *"excessive interpretation"* (Dinkel, unpublished document, p. 12). Luy comes to the conclusion that the analysis of cause of death structure is not reasonable for the time of the German divide (Luy 2004, p. 4).

Further restraints regarding cause of death statistics are the implementation of new diagnostic methods and diagnostic fashion, which is the occasional preference of certain diseases. In addition, differing autopsy rates may influence cause of death statistics by the correction of under and over registered causes of death (Eisenblätter et al. in Heinemann & Sinnecker (eds.) 1994, pp. 366–367).

2.5.2 Major classes of causes of death

Diseases of the circulatory system, cancer, respiratory and digestive diseases plus external causes of death are the five predominant groups of causes of death in Germany. Approximately 90% of all deaths are assigned to these five groups.

The predominance of external causes of death in adolescence is followed by cancer in the middle adult age groups and by cardiovascular diseases in older adult ages. While respiratory diseases gain in importance after age 70, diseases of the digestive system are more common among the middle old.

Circulatory diseases account for about 50% of all deaths in women and for around 40% in men. Resulting diseases that belong to the class are ischaemic heart diseases (IHD) and cerebrovascular disorders. Among IHD there are arthroscleroses and myocardial infarction; stroke constitutes a major part of cerebrovascular disorders. These diseases usually occur in old adult ages and are very cost-intensive. Almost 70% of the insurance expenditures on cardiovascular diseases are spent on people aged 64 and above (Gesundheitsbericht für Deutschland 1998, p. 450).

Myocardial infarction constitutes the most frequent single cause of death where a coronary artery is concluded. The majority of the patients have symptoms such as angina pectoris some time before the infarction takes place. The lethalness from a heart attack is high, especially in the time right after the occurence (ibid., pp. 161–164). Stroke, also called apoplexia, belongs to the group of cerebrovascular disorders and is characterised by an immediate cerebral circulatory disorder. Because of their higher general life expectancy, women are more affected by strokes (ibid., pp. 165–168).

Unchangeable risk factors for CVD are age and sex. Behavioural risk factors are poor diet, smoking, excessive alcohol consumption, physical inactivity and psychosocial factors. They may lead to obesity, high cholesterol level, hypertension and diabetes and then lead to the *"cardiovascular endpoints"* like coronary heart disease, myocardial infarction, stroke and congestive heart failure (Mamun 2003, pp. 8–9). Prevention is possible with regard to behaviour

as the risk factors are widely known. Though excessive alcohol consumption is a risk factor, moderate alcohol consumption has a protective effect on CVD mortality. This holds true especially for France and is part of what is known as the French paradox (Spijker 2004, p. 20; Ferrières 2004). Risk factors not only exist at adult ages, malnutrition even during gestation for example leads to higher risk of IHD in adult ages (Spijker 2004, p. 22).

On the second rank of prevalence, there are malignant neoplasms. Within the group of malignant neoplasms, lung cancer constitutes the biggest share in men and breast cancer in women. Many different risk factors form the aetiology of cancer. It is assumed that 80% of all cancers may be caused by behavioural and environmental factors (Howe 1986, p. 395–402). Risk factors are for example smoking, congenital conditions, radiation, exposure to asbestos or dietary habits. Increasing cancer incidence at increasing ages is considered a combination of an accumulated influence of carcinogens as well as longer exposure time due to higher life expectancy (Statistiken zur Gesundheit 2002, p. 186). Apart from a healthy life style and avoidance of other environmental exposures, the prevention of cancer is rather difficult. For breast cancer, it is thought that early first pregnancies as well as long periods of lactation have a protective effect. In general, screening programs try to intensify early diagnosis and better chances of survival through early treatment. This applies for instance to breast cancer, cancer of the cervix and, to cancer of prostate (Gesundheitsbericht für Deutschland 1998, pp. 173–193).

Recent studies on cancer survival show that cancer survival is enhanced and mortality rates are decreasing in certain cancers. Better treatment and screening have led to a reduction of death rates especially in breast cancer, cancers of the colon, rectum and bladder and skin cancer (Richards et al. 2000)

Diseases of the respiratory system comprise of, among others, influenza, pneumonia and chronic lower respiratory diseases. They are characterised by airflow obstructions. Estimates assume that 3–5 millions of Germans are affected by chronic obstructive pulmonary disease (de.wikipedia.org 2005). Pneumonia is another severe disease, where mostly old people and people with general bad health are affected. Respiratory diseases constitute the only group where East Germany has a lower mortality than West Germany. Smoking, environmental pollution, dust exposure at work, infections and inheritance are the most common risk factors (Gesundheitsbericht für Deutschland 1998, pp. 227–236).

Digestive diseases account for a certain amount of deaths in the middle adult age. This is because of the composition of diseases. Especially amongst men, diseases of the digestive system are dominated by chronic liver disease. As digestion constitutes a large process, many organs are involved, for example the oesophagus, colon and rectum, pancreas and stomach. A balanced diet is recommended in order to prevent digestive diseases.

2.5.3 Avoidable causes of death

The concept of avoidable mortality was first developed by Rutstein and colleagues in the 1970s (Nolte & McKee 2004, p. 16). They created a list of conditions from which death should not occur in the presence of timely and effective medical care (ibid., p.16–19). Avoidable mortality or premature mortality shall provide a comparative measure of public health and medical care, which identifies differences in health care quality or health status across regions, social class and time (Wiesner 1990, pp. 1165–1166; Mansfield et al. 1999, p. 897; Simonato et al. 1998, p. 628; Nolte & McKee 2004, p. 42).

Conditions amenable to health care are conditions, which are treatable, and thus *"Amenable conditions are defined as those from which it is reasonable to expect death to be averted even after the condition has developed."* On the other hand, *"Preventable conditions typically include those for which there are effective means of preventing the condition from occurring"* (Nolte & McKee 2004, pp. 51–52). This definition can also be referred to as a distinction between causes amenable to health care and causes amenable to health policy.

Other authors set the boundaries between the groups in a different way. Very common is the distinction into conditions which are avoidable due to primary or due to secondary prevention. Primary prevention includes particularly immunisation with respect to infectious diseases such as diphtheria, tetanus and polio; safety policies aim at reducing motor vehicle accidents; health behaviour is a further important factor in primary prevention. Primary prevention aims to reduce exposures. Conditions, which could be prevented by secondary prevention, comprise of screening programs as well as better medical treatment (Forster 1996, pp. 48–49; Simonato et al. 1998, pp. 624–626).

Simonato and others split secondary prevention into secondary and tertiary prevention and defined it as follows. Secondary prevention is based upon early detection and treatment whereas improved treatment and medical care determine tertiary prevention (Simonato et al. 1998, pp. 624–626).

Attention should be drawn on the differing definition of the several groups of prevention and must be considered when comparing studies. In the concept proposed by Nolte and others, diseases that respond to immunisation for instance are included in the group of conditions amenable to health care, rather than in the group of preventable conditions (Nolte et al. 2002, p. 1907).

A series of diseases can be attributed to primary and secondary prevention and then, secondary prevention will dominate (Nolte & McKee 2004, p. 52). IHD is one of these cases as it is subject to medical care and health behaviour. Because of this and the high prevalence rate, IHD is often treated separately (Forster 1996, pp. 51–52; Nolte et al. 2002, p. 1907).

Death rates from premature mortality should decline faster than overall mortality if given that health care is efficient (Simonato et al. 1998, p. 624; Charlton & Velez 1986, p. 295). In a study on avoidable mortality across Europe, Simonato and others found this to be true and observed the greatest decline in causes that are assigned to treatment and better medical care (Simonato et al. 1998, pp. 626–629). To measure the impact of mortality amenable to health care, Nolte and McKee calculated the contribution of 35% from mortality amenable to health care to the total life expectancy increase in the 1990s in West Germany (Nolte & McKee 2004, p. 79).

Problems with studies on avoidable mortality may arise because of differing cause of death coding practices, but grouping into broad groups – for example primary and secondary prevention – should reduce such errors to a minimum. A further limitation is the clear distinction between avoidable and non-avoidable causes of death. This problem also covers the age limit, which seems sometimes arbitrary. Several researchers chose age 64, more recent studies take age 74 as upper age limit until which deaths are considered premature. Several causes of death, e.g. respiratory diseases or diabetes mellitus have different age limits according to their aetiology (Kunst et al. 1988, pp. 226–227; Forster 1996, p. 49; Nolte & McKee 2004, p. 53).

Differential avoidable mortality may be caused by differences in socio-economic status, by age or place and, by medical care supply (Mansfield et al. 1999, pp. 894–895; Kunst et al. 1988, p. 236–239). Although a strong relationship between avoidable causes of death with health system indicators is expected, studies have shown that the association is weak and inconsistent. The regional pattern of avoidable mortality in Europe is similar to the one of all cause mortality and not reflected by medical care supply. According to Kunst and others, socio-economic indicators explain variation better (Kunst et al. 1988, pp. 236–239).

2.5.4 External and alcohol-related causes of death

External causes of death are the leading cause of death group among young adults. Accidents, suicide and homicide are representatives of causes within this group. Whereas homicide occurs only sporadically in Germany, accidents and suicide account for most of the deaths. In 1995, 4.5% of all deceased died from external causes in Germany (Gesundheitsbericht für Deutschland 1998, p. 280).

Severe injuries are not always fatal; disability is often a consequence, which is expected to result into premature death. In attempted suicides, every sixth case is fatal and in traffic accidents every 55th case. Other accidents such as accidents at work or during leisure activities are less fatal. Prevention of accidents and therefore prevention of death is a very serious concern in accidents. It comprises of occupational health and safety and behaviour, but also personal risk assessment factors (ibid., p. 280).

Motor vehicle accidents and suicide are very common external causes of death and shall be discussed further.

The relationship between car density and car accidents has often been studied. But this does not seem to be the only indicator of traffic accident mortality. Beeck and others have studied the interdependence of economic development and traffic accident mortality. The major result was that after a period of increasing affluence, fleet and motor vehicle deaths, a period of still growing affluence goes hand in hand with motor vehicle mortality that levels out. Rationale for this trend is that the increasing prosperity becomes protective after the point of saturation and the mortality decreases (van Beeck et al. 2000). An important factor, which might also apply to Mecklenburg-Vorpommern, is the connection of car accidents and rural residence (Campos-Outcalt et al. 2003). Other determinants of injury mortality and its variation are found in socio-economic factors (Hasselberg et al. 2001).

At present, suicide mortality is decreasing. It occurs more often in East Germany than in West Germany and suicide is a rather male phenomenon. In 1995, 71.6% of people who committed suicide in Germany were men and 28.4% were women. The female age structure for suicide indicates higher rates in upper age groups. The standardised mortality rate in 1995 was 17.5 per 100 000 inhabitants in East Germany, in West Germany it was 13.9. Risk groups for suicide or intentional self-harm are people with mental illness, those who already attempted suicide, people who are addicted to alcohol or drugs, but also consists of old and lonely people (Gesundheitsbericht für Deutschland 1998, pp. 223–226).

Causes of death directly related to alcohol are for example alcohol dependence syndrome, alcoholic psychoses, poisoning by alcohol, and liver cirrhosis. Eighty-five percent of all deaths due to liver cirrhosis can be allocated to alcohol abuse (Spijker 2004, p. 20). As alcohol related diseases can take several years to develop, the alcohol related mortality at a certain point in time always reflects the alcohol consumption patterns of the years before (Baker & Rooney 2003, p.8).

Nonetheless, other diseases also develop through excessive alcohol consumption. A study by Nizard and Munoz-Perez examined the overall impact of alcohol on diseases. By analysing death certificates, they found out that alcohol was mentioned in numerous diseases, which were not further specified as alcoholic. This applies to violent deaths, cancer of liver and larynx, pancreatitis, epilepsy and others (Nizard & Munoz-Perez 1994). As a consequence, alcohol-related mortality will be underestimated, especially when also regarding external causes of death that occur under the influence of alcohol. Alcohol is furthermore a force of premature death with alcoholics having a tenfold higher mortality risk in a ten year period than the average (Gesundheitsbericht für Deutschland 1998, p. 96). As a result, the life expectancy of people with chronic alcohol diseases is reduced by 23 years (ibid., p. 251).

2.5.5 Other causes of death

Although the described diseases cover most of the deaths, several diseases shall be mentioned, too.

Diabetes mellitus, as an endocrine disease, is referred to as a disease of civilisation that around 5% of the German population suffers from. Prevalence is noticeably higher in East than in West Germany. Modern lifestyles and nutrition, combined with physical inactivity are described risk factors. At increasing ages, prevalence also rises (Thefeld 1999, p. S85).

ICD 10 chapter XVIII – symptoms, signs, abnormal findings, ill-defined causes – is usually considered as an indicator of quality of the coding practice. A low proportion of this group is aimed at in order to ensure the diseases are coded accurately. It comprises unknown and unspecified causes as well as Sudden Infant Death Syndrome.

Infectious diseases are widespread; nevertheless, people hardly die from these diseases in western countries. A common cold can be cured quite easily. Other infectious diseases such as AIDS, tuberculosis, malaria or hepatitis require treatment that is more intensive. Many infectious diseases lost their strength in industrialised countries because of nationwide vaccinations and improved treatment facilities.

3 Data and Methods

3.1 Data used

The present study focuses on regional analysis. *"In European politics, a region is the layer of government directly below the national level."* (en.wikipedia.org 2004) When applying this definition to a region of Germany, the term region refers to the German Länder (federal states), one of them being Mecklenburg-Vorpommern. The German Länder relate to level 1 of the NUTS classification (Nomenclature of Territorial Units for Statistics). NUTS 2 levels are "Regierungsbezirke" in Germany, however they do not exist in Mecklenburg-Vorpommern. The subsequent level NUTS 3 then refers to urban and rural districts. Mecklenburg-Vorpommern has six urban and 12 rural districts with an average size of 100 000 inhabitants. Analysis level of this study is mainly Länder and district level. In addition, East and West Germany and the total of Germany are used for comparisons.

Mecklenburg-Vorpommern was created out of the districts Rostock, Neubrandenburg and Schwerin after Unification. Nevertheless, it is referred to the aggregate of these districts when MV before Unification is mentioned. East Germany comprises of all the new Länder until 1998 in this study. Due to altered data registration, Berlin West is included in East Germany from 1998 onwards.

Federal Statistical Offices of Germany provided data on population size on Länder level (NUTS 1) for the period 1980–2002 as of 31st December of the referring year. The regions in the GDR are not consistent with the Länder nowadays; data was counted back until 1982. Aggregated data on East Germany is available from 1980 onwards. Mid-year population was obtained by calculating the arithmetic mean of year x and year x+1. With regard to the state of Sachsen-Anhalt, data was only available up to age group 75+. By subtracting the sum of all East German Länder except Sachsen-Anhalt from the German total from of the Human Mortality Database (HMD; mortality.org 2005), this could be corrected so that data was finally available up to age group 90+ in all considered regions.

Numbers of deaths for East and West Germany were retrieved from the HMD (mortality.org 2005) for the years 1980–97. Data was available in single age groups up to age 110. For Germany, numbers of deaths were also retrieved from HMD for the years 1991–99 and summed up from East and West Germany for the years before.

A problem occurred with deaths for the years 1998–2002. As the causes of death are only available up to age 85+ and for the life table construction data is required up to age 90+. Therefore, deaths from West Germany (as the sum of all causes of death) were subtracted from the deaths from HMD on Germany. Age group 85+ was split up into two age groups 85–90 and 90+ according to the age distribution of deaths from Germany.

Population data and number of deaths on districts within MV (NUTS 3 level) for the period 1982–2001 were obtained from the State Office of Statistics MV. Population data were available in single age groups up to age 90+. Numbers of deaths were available up to age 110 for 1982–96, and up to age 90+ from 1997–2001. Numbers of deaths for Mecklenburg-Vorpommern (NUTS 1 level) for the year 2002 were retrieved from a statistical report in 5-year age groups up to age 90+ (Statistisches Jahrbuch MV 2003). Furthermore, for the years 1994–97, data on some causes of death was obtained in single age groups up to age 110. The list of causes of death is shown in the annex, Table A 1.

Causes of death on NUTS 1 level were obtained in four-digit codes from 1980–2002 in 5-year age groups (0–1; 1–5; 5–10; …; 80–85; 85+). For the years 2001–02, the coding was only available in three-digit codes. Cause-of-death data for the period from 1980–97 is coded in ICD 9; Germany introduced ICD 10 coding in 1998.

Data on causes of death coded in ICD 9 and ICD 10 were recoded into ICD 10 main groups and subgroups according to a list provided by Eurostat (European Communities 2002, pp. 116–117). The selection list is shown in the annex, Table A 2.

Socioeconomic indicators like the number of physicians, unemployment rate and others were taken from Statistical Yearbooks MV for the years 1994–2001 (Statistisches Jahrbuch MV 1995–2004). All indicators are standardised for population size, e.g. by giving indicators per 100 000 inhabitants. A description of the indicators is given below in Table 1.

3.2 Methods and measures for mortality analysis

In order to calculate life expectancy, life tables were calculated based on population and mortality data in 5-year age groups up to age 90+ (0–1; 1–5; 5–10; …; 85–89; 90+). Formulae were adapted from Preston and colleagues (2001, p. 38–70). Fractions of age intervals ${}_{n}a_{x}$ were retrieved from the German life table 1999–2001, provided by the German Federal Statistical Office (Statistisches Bundesamt 2004, p. 27–28). For the fraction of the last age interval ${}_{\infty}a_{90}$ the reciprocal of the death rate m_{90+} was taken. These fractions were applied to

all years and regions in the same manner. Confidence intervals of life expectancy were calculated using the formulae for the sample variance of life expectancy proposed by Chiang (1984, p. 163):

$S_{e_\alpha}^2 = \sum_{i=\alpha}^{w-1} p_\alpha^2 [(1-a_i)n_i + e_{i+1}]^2 S_{p_i}^2$ whereas $S_{p_i}^2 = \frac{q_i(1-q_i)}{P_i}$.

To test whether two life expectancies significantly differ from each other, a test was conducted. Null hypothesis is $H_0 : e_0(1) = e_0(2)$ and alternative hypothesis $H_1 : e_0(1) \neq e_0(2)$. The critical ratio CR is computed by the formula

$$CR = \frac{e_0(1) - e_0(2)}{\sqrt{S_{e_i}^2(1) + S_{e_i}^2(2)}}.$$

Normal distribution is used and hence the critical ratio compared to 1.96 and 2.33, the 95% and 99% significance level (Chiang 1984, p. 164–165; Müller and Kück 1998, p. 21).

Standardised death rates (SDR) were calculated using the European Population Standard proposed by Eurostat (European Communities 2002, p. 115) with its given population share up to age 85+.

$SDR = \sum_{i=1}^{w} M_i^j C_i^S$ whereas M_i^j is the death rate of population j in age group i. $\sum_{i=1}^{w} C_i^S = 1$ is the proportion of age group i in the standard population (Preston et al. 2001, p. 24).

The SDR is a method of direct standardisation and states the level of mortality, which could be expected if the observed population had the same age structure as the standard population. Since the European Population Standard is a unisex standard, it can also be used to compare among sexes.

Indirect standardisation was performed when calculating standardised mortality ratios (SMR). SMR is the number of deaths observed divided by the expected numbers of death. Formulae on SMR was retrieved from Armitage and Berry (1994, pp. 439–440), formula for the referring variance was retrieved from Chiang (1984, pp. 103–108):

$SMR = \frac{\sum_{i=1}^{w} D_i^j}{\sum_{i=1}^{w} M_i^S P_i^j}$ with D_i^j as the observed number of deaths in age group i in population j and P_i^j as the observed population size of population j. The death rate of the standard population is M_i^S.

SMR allows for local age and sex structure compared to an expected level of deaths. When SMR was applied to the districts of Mecklenburg-Vorpommern, the overall mortality structure of Mecklenburg-Vorpommern was taken as standard. SMR values of districts hence indicate districts with mortality below and above average. With regard to small numbers, for instance by causes of death across districts of Mecklenburg-Vorpommern, confidence intervals are important. The variance of SMR is therefore calculated as

$$Var(SMR) = \sum_{i-1}^{w} w_i^2 \frac{M_i^j}{P_i^j}(1 - M_i^j) \text{ with } w_i = \frac{P_i^j}{\sum_{i=1}^{\infty} M_i^S P_i^j}.$$

Decomposition of differences in life expectancy by age and cause of death was applied using the formulae presented by Andreev (Shkolnikov et al. 2001, pp. 35–37). Advantage of decomposition of life expectancy is the weighting of age groups so that younger age groups have higher impact on the remaining life expectancy than older age groups. Nusselder and Mackenbach (2000, p. 141) explain this fact that *"(1) only a small proportion of the population is exposed to changes in mortality rates at advanced ages, as not everyone survives up to these ages and (2) the remaining life expectancy at older ages is much smaller, reflecting the high risks of mortality at older ages."* Positive and negative deviations are possible whereas a positive value indicates that population 1 has a higher than population 2 and vice versa. Contributions – negative and positive – of all age groups sum up to the total difference observed in life expectancy. Decomposition is based on life tables up to age 90+.

Average inter-district difference (AIDD) of life expectancy was calculated as a measure of interregional inequality. It was computed by applying a dispersion measure of mortality to life expectancy at birth proposed by Moser and colleagues (2005, p. 203):

$AIDD = \frac{1}{2(W_z)^2} \sum_i \sum_j [(\left| e_{0_i} - e_{0_j} \right|) W_i W_j]$ with i and j being regions, z the whole region, e_0 the life expectancy at birth. The weights W have the property $W_z = \sum_i W_i = \sum_j W_j = 1$. The calculated values express the average inter-regional deviation. Mean life expectancy is calculated by multiplying life expectancy of district i with proportion of population size in district i on the sum of all districts. (This does not equal the life table life expectancy because life table calculations are based on stationary populations.)

Temporary life expectancy was computed by applying the formula proposed by Arriaga (1984, p. 84–85):

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

A chi-square test for goodness of fit with k-1 degrees of freedom (with k = number of districts) was applied to find out in which causes of death there is variation across districts from the average mortality level (Diehr et al. 1990, pp. 751–753). Chi square values are calculated by the common formula

$$X^2 = \sum \frac{(O-E)^2}{E} = \sum \frac{(\sum_{i=1}^{k} D_i^j - \sum_{i=1}^{k} M_i^S P_i^j)^2}{\sum_{i=1}^{k} M_i^S P_i^j}$$ with O = observed numbers of death and E = expected numbers of death (for other denotation see description of SMR above).

A Lexis graph (Andreev 1999) is used for illustration of excess mortality over time and age. Time is displayed on the x-axis, age on the y-axis. Hence, the diagonal represents cohorts. For the purpose of this study, age-specific probabilities of dying from two different regions were divided by each other and then multiplied by 100. In this way, excess mortality is expressed in ratios. A ratio of 110 hence indicates 10% higher mortality of one population compared to another in the specific age group.

Cause-specific mean age at death was calculated using life table populations. The weighted sum of all cause-specific mean ages at death result in the life expectancy as derived from life tables. For further explanation and formulae see Scholz and Schott (1992). Since cause of death data was only available up to age 85+, the death rate for age group 85+ was applied to age group 85–90 and 90+ in the life table application.

Analysis of factors that influence life expectancy was undertaken for the time points 1994–97 and 1998–2001, as well as for the factors of change between 1994–97 and 1998–2001. A rearrangement of MV districts in 1994 does not permit the use of earlier data; population data on district level was only available until 2001. Dependent variable in the ecological analysis is life expectancy for males and females. Explaining factors included in the ecological analysis were physicians per 100 000 inhabitants, proportion of blue-collar workers, unemployment rate, number of private cars per 100 000 inhabitants, GDP per capita, and if the district is rural or urban. The latter variable is thus dichotomous with the values 0 = urban and 1 = rural. Table 1 explains the calculation of the variables. Factors of temporal change are the absolute change of the independent variables from 1994–97 to 1998–2001.

Table 1: Description of socio-economic indicators for districts of Mecklenburg-Vorpommern for 1994–2001

Indicator	Description	Availability of data
Unemployment rate	Arithmetic mean of the respective 4-year period	all years available
Physicians per 1 000 inhabitants	Interpolation for the missing year Arithmetic mean of the period as of 31st December each year	1996 missing
Number of private cars per 1 000 inhabitants	Arithmetic mean of the 4-year period as of 31st December each year	all years available
Share of blue collar workers	Interpolation for the missing year Arithmetic mean of the 4-year period as of 30th September 1994, other years as of 30th June	2001 missing
GDP at market prices of 1995 per inhabitant in EUR	Gross Value Added (GVA) at marked prices for the years 1994–96; Gross Domestic Product (GDP) at market prices 2000–01 Conversion of GVA to GDP by application of conversion factor Adjustment for inflation by calculation of market prices of 1995 Interpolation for the missing years Arithmetic mean of the 4-year period	1997–99 missing

Source: Statistical Yearbooks Mecklenburg-Vorpommern 1995–2004

Pearson correlation coefficient indicates correlation. For the regression models, linear regression models with the selection method “stepwise” were chosen. The criterion for an independent variable to enter the regression equation was that the significance level of its F value was less than 0.05, for removal, the significance level of F had to be greater than 0.1 (probability of F refers to the significance level of the partial correlation coefficient between dependent and independent variable).

3.3 Problems of analysis

Small numbers of population and deaths are a common problem of all small-area analyses. This applies to the small-area analysis on district level within MV where population size differs between 50 000 inhabitants in Wismar and 200 000 in Rostock. Therefore, the life table calculations were performed using 5-year periods. Still, some districts do not exhibit deaths in certain years in some very young age groups. The analysis on causes of death within MV was done – according to data availability – for the 4-year period of 1994–97. Since the subdivision into causes of death leads to a reduction of number of deaths, confidence intervals and significance tests are necessary, for example for SMR.

Differing definitions of live births between GDR and FRG have been described in chapter 2.2 with regard to differential mortality situations. For time series analysis, another change of definition has to be mentioned. In April 1994, a further change in definition of live birth took place in Germany. Before, stillborn children with birth weight below 1 000 g were defined as miscarriage. After the change of definition, stillbirths are now newborns without one of the three life signs heart beat, breathing and pulsating umbilical cord with birth weight below 500 g (Nolte et al. 2000a, p. 88).

The transition from ICD 9 to ICD 10 led to several reallocations. Table 2 displays so-called comparability ratios (CR) of several selected causes of death. Comparability ratios are calculated as

$CR_i = \frac{D_{i,ICD10}}{D_{i,ICD9}}$ with deaths D and cause of death i (Anderson et al. 2001).

Since these comparability ratios are not available for Germany, it is referred to the two studies quoted in Table 2 (Anderson et al. 2001; Office of National Statistics UK 2002). It gives an appreciation of the degree of the ICD change and comparableness.

Table 2: Transition of selected causes of death from ICD 9 to ICD 10

ICD 10 Chapter	Cause of death	ICD 9 code	ICD 10 code	Comparability ratio acc. to Anderson et al. (2001) and 95% confidence interval	Comparability ratio acc. to Office of National Statistics UK (2002) and 95% confidence interval
II	Malignant neoplasms	140-208	C00-C97	1.099 (1.069; 1.129)	1.022 (1.020; 1.023)
IX	Diseases of the circulatory system	390-459	I00-J99	0.998 (0.998; 0.999) major cardiovascular diseases: ICD 9 codes 390-434, 436-448; ICD 10 codes	1.043 (1.041; 1.044)
X	Respiratory diseases	460-519	J00-J99	*group split up into different parts - not comparable*	0.765 (0.761; 0.769)
XI	Liver cirrhosis	571	K70, K73, K74	1.037 (1.031; 1.042)	1.03 (1.001; 1.049)
XX	Transport accidents	E800-E848	V01-V99	0.998 (0.997; 0.999) incl. E929.0 and E929.1 and Y85	1.007 (0.997; 1.017)
XX	Suicide	E950-E959	X60-X84	0.996 (0.995; 0.997) incl. X87.0	0.999 (0.996; 1.001)

Source: Anderson et al. (2001); Office of National Statistics UK (2002)

There is some evidence that coding practices differ regionally. Dinkel (2001, pp. 26–27) remarks that cardiovascular mortality has been higher in the GDR and cancer mortality has been lower than in FRG. After adoption of the West German coding practice this difference diminished and differences are no longer found. This has to be taken into account when evaluating cause-specific mortality data.

The selection and grouping of avoidable causes of death differs from one study to another. Direct comparability to other studies is therefore not always given. Primary and secondary prevention are sometimes both adequate for a certain cause of death (Nolte and McKee 2004). Age limits set were adopted from Nolte and McKee (2004) and Nolte and colleagues (2002) (Table with all avoidable causes and age limits are shown in the annex, Table A 4). Both sexes have the same age limits, mostly age 74. Naturally, this does not reflect reality, but no better solution has yet been found and agreed upon (see for example Nolte and McKee 2004, p. 53).

Causes of death on MV districts were available only for the years 1994–97 and restricted to certain groups of causes of death (Annex: Table A 1). For example, the analysis of the whole group of cardiovascular diseases is not possible.

Attention has to be drawn at ecological fallacy when analysing the relationship between mortality level and socio-economic indicators on aggregate level. Statistical relationships may indicate interdependences, which do not exist on individual level (Rosén et al. 1985, p. 294). The indicators for an ecological analyses therefore have to be chosen with care.

4 Results I – Mortality patterns of Mecklenburg-Vorpommern and comparison with East and West Germany

The mortality of the Mecklenburg-Vorpommern (MV) region in East Germany is analysed over time and compared to the mortality of East Germany as a whole – the so-called "New Länder" – and also to West Germany (the "Old Länder"). The mortality level is informative only within the context of development over time and the comparison to other regions.

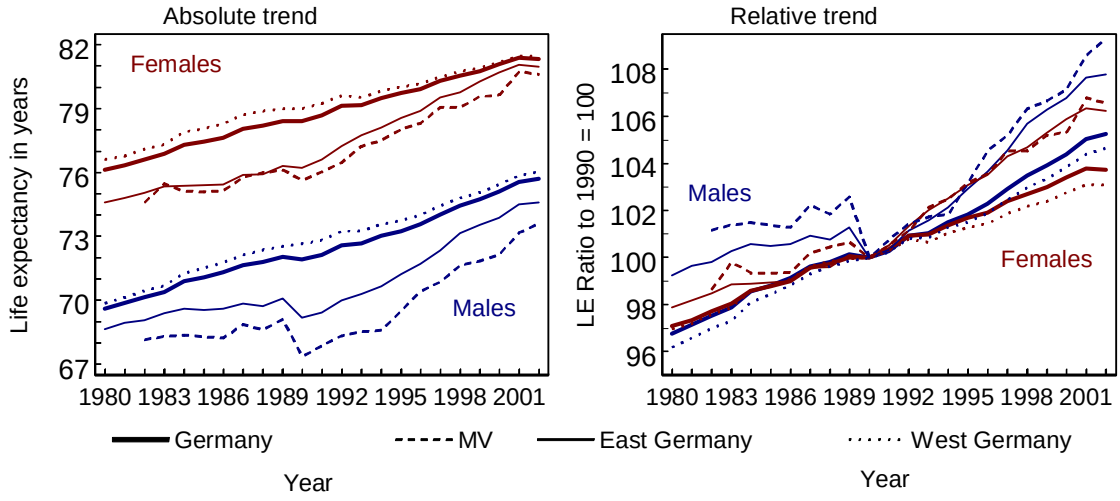
In chapter 4.1, an overview of the general mortality and life expectancy trend from 1980 until 2002 is given by comparing MV to the united Germany as well as to East and West Germany. This development is supplemented by an age-specific description in chapter 4.2.

4.1 General level of mortality and length of life

Mortality has decreased enormously in Mecklenburg-Vorpommern in the examined period from the early 1980s until 2002. The collateral of mortality – life expectancy – increased during this time by more than five years in men and six years in women. Mecklenburg-Vorpommern, East and West Germany all experienced this mortality improvement, though there are notable differences, which are not surprising when considering the very different initial situations of the two states. The general pattern of life expectancy can be described as follows, and as seen in Figure 1. Mecklenburg-Vorpommern is running at the bottom of the life expectancy trend, that is, it exhibits the highest mortality. Mecklenburg-Vorpommern follows the East German pattern although on a magnified mortality level. East Germany experienced lower life expectancy than West Germany throughout the whole period. The German average lies in between East and West Germany and this is due to population size dominated by the West German trend. The strong hierarchical nature of mortality is evident, with Mecklenburg-Vorpommern on the highest mortality level, East Germany performing slightly better and West Germany taking the superior position. This is seen throughout the study period, although the gap between Mecklenburg-Vorpommern and East Germany generally very much lessened over time. By the end of the analysed period, the differences in the average length of life in East and West Germany account for around one year in men and less than half a year in women.

When taking a closer look at the trend of life expectancy within Germany there are two remarkable issues. First of all, there was a decrease in life expectancy from 1989–90 in East Germany and, secondly a substantial nearing to the West German level of length of life that can be observed for the period from 1990 until now. Referring to the first point, after a period of

Figure 1: Absolute and relative trends in life expectancy at birth in 1980–2002 for males and females

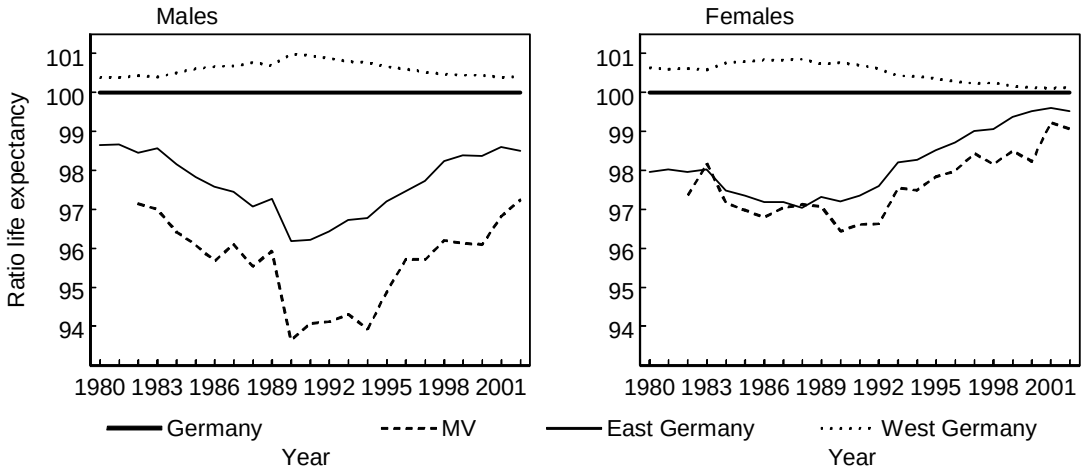


Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany

increasing life expectancy, East Germany including Mecklenburg-Vorpommern experienced a drop in the year after Unification. In Mecklenburg-Vorpommern this decline is stronger than in East Germany and more distinct in men than women. In men, it accounts for almost two years in length of life in Mecklenburg-Vorpommern. On the other hand, West Germany shows an almost linear trend in rising life expectancy. In the second graph with 1990 as reference year, the decrease in life expectancy is seen as there are values above 100 before the year 1990. Men in Mecklenburg-Vorpommern take a particular position as they have constantly higher values before Unification than in the year 1990. As for the point mentioned secondly – the East German approach to the West German level – this fact is most important in females when regarding the absolute values. Around the year 2000, the difference between Mecklenburg-Vorpommern with the lowest life expectancy and West Germany with the highest life expectancy of the considered regions, the difference diminished to even less than a year in women and around one year difference in men, whereas it was more than four years in 1990. Nevertheless, men in Mecklenburg-Vorpommern experience the fastest growth rate in the time after Unification. Women in East Germany and Mecklenburg- Vorpommern also realised faster life expectancy growth rates than the average. In conclusion, Mecklenburg-Vorpommern gained most in life expectancy since the early 1990s and assimilates to the German average.

Figure 2 shows how Mecklenburg-Vorpommern and East Germany are approaching the German average. Life expectancy from Germany was taken as a standard and life expectancy

Figure 2: Life expectancy in Mecklenburg-Vorpommern, East and West Germany for 1980–2002 compared to the whole of Germany for males and females



Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany

for the years 1980–2002 from Mecklenburg-Vorpommern, East and West Germany were compared to it. Germany is fixed at 100 and thus deviations are expressed as percentages. Female life expectancy diverged until the mid 1980s and is then approaching the German average. A sharp life expectancy increase set in after 1990. Mecklenburg-Vorpommern remains on a slightly lower level than East Germany, but women in both regions have life expectancies that are less than 2% lower as for Germany by the end of the observed period. This differs significantly from the life expectancy trend experienced by men. Notably there is a more distinct difference between Mecklenburg-Vorpommern and East Germany and thus between Mecklenburg-Vorpommern and West Germany. Also in men, life expectancy in MV and East Germany diverged from the German average before Unification. This trend was beginning to be reversed by the early 1990s. After Unification, the increase was not as pronounced as in women. This leads to the mentioned relatively higher mortality of men at present.

The slight mortality decrease in the period from the early 1980s until Unification is followed by a strong mortality improvement of East German states during the 1990s. Especially East German women decreased mortality to a larger extent than West German women did.

Overall, the strong hierarchical character of mortality, that is the domination by West Germany, followed by East Germany and then MV, remains throughout the study period, but the magnitude decreases over time. The mortality decline experienced in the past 20 years favoured particularly women. After a decrease in life expectancy from 1989 to 1990, the trend

reversed into a convergence in the 1990s between Mecklenburg-Vorpommern, East Germany and West Germany. MV experienced the fastest rise in life expectancy after 1990.

4.2 Age-specific mortality patterns

Age-specific probabilities of dying by 10-year age groups in Table 3 give a preliminary clue to the trend in age-specific mortality of MV while also displaying the mortality levels. A substantial decline in infant mortality took place from the early 1980s to now. However, the change in definition of what constitutes a live birth impedes an exact comparison. Further mortality reductions took place in almost all age groups but mostly in older ages. Women experienced a decline of more than 50% at age 60+; the decline in men was also strong but not as pronounced as in women. The reduction happened particularly between 1990–92 and 2000–02. An exception of the decline was for the age group 10–19 as there was only a slight decrease in men and women.

This time comparison showed the probabilities of dying in MV before and shortly after Unification and in the latest period. Following, an age-specific comparison of East and West Germany over time is examined. Ratios of age- and sex-specific probabilities of dying in MV with reference base East and West Germany are shown in the mortality surface of Figure 3. A value of 100 indicates the same mortality level, a value of 120 for example represents a mortality 20% higher than in the reference population. Blue indicates a lower mortality level than the reference base and grey a slightly higher mortality. The darker the red, the higher the

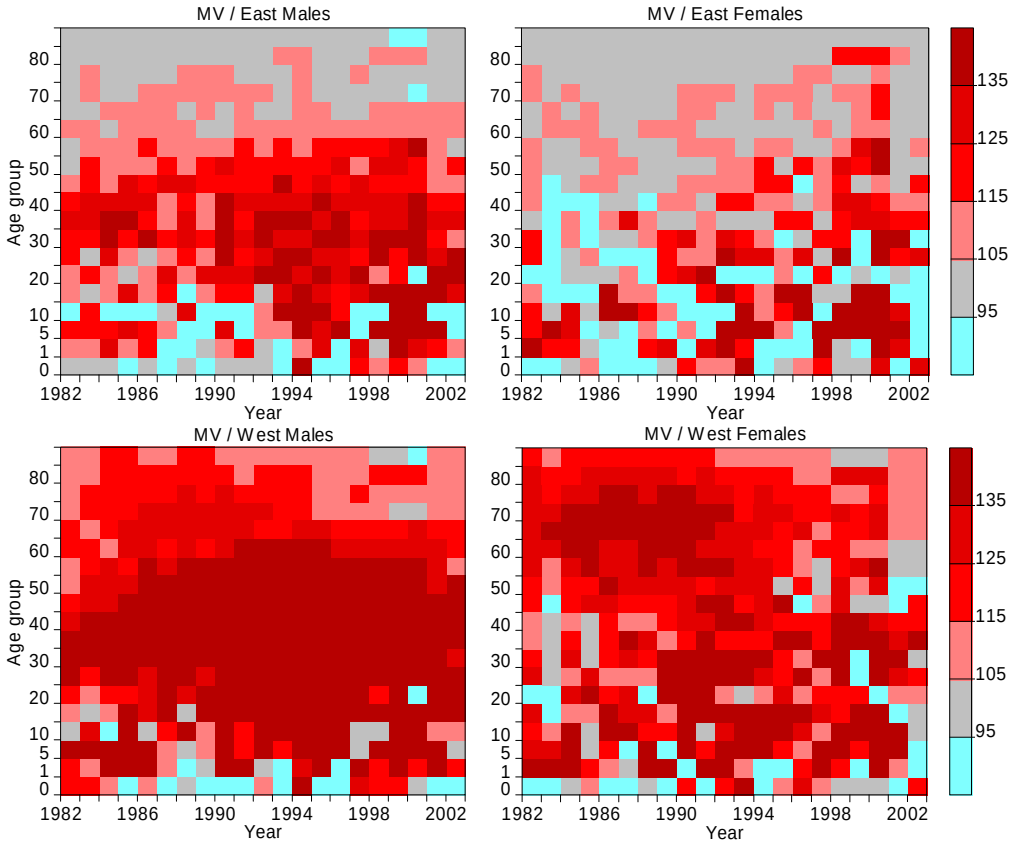
Table 3: Age-specific probabilities of dying per 1000 in Mecklenburg-Vorpommern in 1983–85, 1990–92 and 2000–02

	Males			Females		
Age	1983–85	1990–92	2000–02	1983–85	1990–92	2000–02
0-1	11.3	6.2	3.9	8.4	5.4	3.8
1-9	0.6	0.4	0.3	0.4	0.3	0.2
10-19	0.7	0.8	0.7	0.3	0.3	0.2
20-29	1.5	1.9	1.2	0.5	0.6	0.3
30-39	2.5	3.6	1.9	0.9	1.1	0.7
40-49	5.6	6.7	4.8	2.2	2.5	1.8
50-59	13.2	14.9	10.3	6.1	5.9	4.4
60-69	30.8	31.0	22.0	16.8	15.6	9.6
70-79	82.2	78.3	48.8	51.4	48.0	29.9
80-89	187.8	172.3	131.7	144.9	127.9	100.0
90+	383.0	337.1	241.4	333.3	301.9	203.6

Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

ratio, and thus the higher the excess mortality of MV is. When comparing the Mecklenburg-Vorpommern mortality situation to the one in East Germany, the first striking fact is that excess mortality of MV has increased during the 90s. As for men, between age 15 and 49 the highest excess mortality is found. This excess mortality is most pronounced in this age group post Unification. Ratios of age- specific probabilities of dying are 125 and above. Excess mortality even merged into a larger age group representation, comprising of most age groups up to 65. Slightly lower probabilities of dying in MV were found in the years of childhood and the very old ages. Random fluctuations have to be taken into account. Mortality differentials between the regions are smaller for women than for men in general. The ratios of MV to East Germany show excess mortality in MV in the young and middle adult ages. Consistent female excess mortality cannot be clearly referenced to certain age groups. The female pattern is dominated by unclear

Figure 3: Mecklenburg-Vorpommern / East Germany ratio of age-specific annual probabilities of dying in 1982–2002 and Mecklenburg-Vorpommern / West Germany ratio of age-specific annual probabilities of dying in 1982–2002 on Lexis maps for males and females



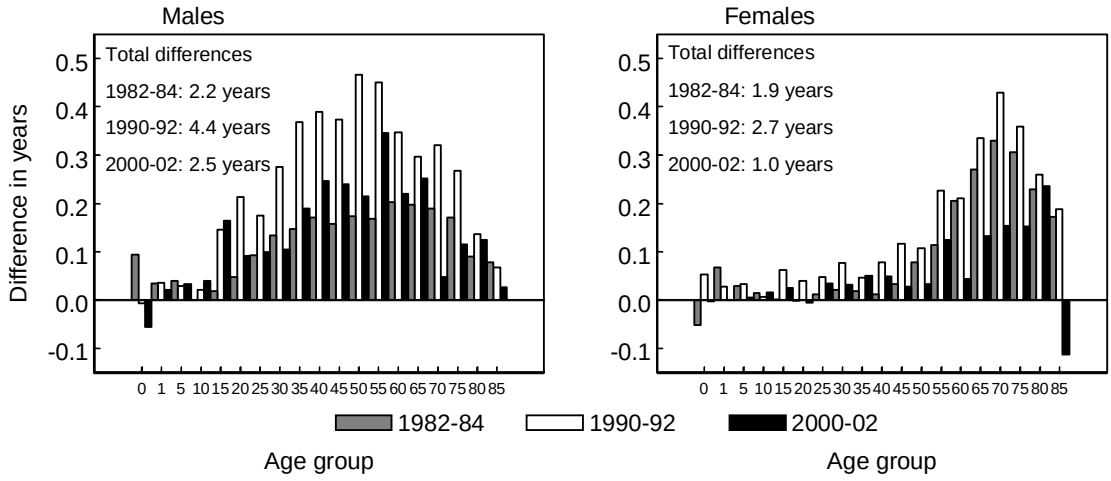
Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany

trends but with a trend towards slightly increasing excess mortality.

More distinct age-specific differences persist between MV and West Germany. Before Unification, the excess mortality was noticeable in all ages above 20 in men. In women this was the case for all ages above 50 and there were random variations for women below the age of 50. In men, the age-specific pattern shifted towards higher ratios in the younger age groups and lower ratios in old ages and thus, smaller mortality differences. Trends in women are subject to more variations. Directly after Unification, the difference of mortality diverged in all age groups, which is expressed in higher ratios. In general, excess mortality diminished during the 1990s so that some age groups in MV underwent an absolute and relative mortality improvement. In some age groups, this resulted in a mortality ratio below 95 around the year 2000. Thus, this means that MV women exhibit lower mortality than the West German average. This holds true for the age group 0–4, some age groups around the age of 20, between 45 and 64 and, further, above age 85.

It is well known that the level of life expectancy is a complex interplay of the level of mortality rates and their specific age distribution. Therefore, the impact of certain age groups on life expectancy and the referring differences is now explored by means of decomposition by age. The periods 1982–84, 1990–92 and 2000–02 were analysed in order to compare points before and shortly after Unification and in the latest period under study (Figure 4). This comparison was restricted to MV and Germany. A positive contribution indicates that Germany exhibits

Figure 4: Decomposition of differences in life expectancy between Germany and Mecklenburg-Vorpommern by age groups in 1982–84, 1990–92 and 2000–02 for males and females



Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany

lower mortality and thus higher life expectancy and hence, if there is a negative value this means that mortality is lower in Mecklenburg-Vorpommern.

Some key points which go beyond the analysis of ratios before, shall be mentioned. The general pattern observed before states the differences in life expectancy between MV and Germany from 1982–84 to 1990–92, which is then followed by a convergence until 2000–02. Age groups affected change over time. Whereas the age group 35–75+ amounts for 80% of the difference in the period 1982–84 in men, the main impact then shifts to the age group 35–74 in the latter periods. The total difference in life expectancy between MV and Germany amounts for 2.2 years in 1982–84, for 4.4 years in 1990–92 and then decreases to 2.5 years in 2000–02. Women's life expectancy differences constitute 1.9 years in 1982–84, then 2.7 years and in 2000–02 one year. Also in women, a shift that places more importance towards lower age groups is evident. In 1982–84 the age group 55–75+ was the most important age group accounting for around 85% of the life expectancy difference, and then in the latter periods concentrated on the age group 55–74.

For both sexes, the younger adult ages – age 15 to 34 – experienced a gain in importance from 1982–84 to 1990–92 and then remained on a comparable level. A relative mortality worsening in MV compared to Germany took place. Infant mortality is rather low compared to the German average. This fact is expressed in the negative contributions in 2000–02 both in men and in women; nevertheless it plays only a minor role. Also before, there was a negative contribution of infant mortality to life expectancy and is thus diminishing the life expectancy difference. After the adoption of the West German definition of what constituted a live birth, the difference in infant mortality in present times must be traced back to a real mortality difference rather than to a difference in definition. As for the differing definition of live birth, this results into incomparableness of infant mortality in 1982–84 and 1990–92 between East and West German regions.

In short, mortality reductions in MV took place in almost every age group during the 1990s. The biggest differences are observed for the time around Unification and diminish afterwards. High age groups account for most of the life expectancy differential between MV and Germany in women, in men these are the low high ages around age 60.

5 Results II – Mortality by causes of death in Mecklenburg-Vorpommern

5.1 Overview on cause-specific mortality

Regional mortality differences between Mecklenburg-Vorpommern, East and West Germany have been pointed out in chapter 4. The in-depth analysis of causes of death shall give further insights into the reasons of the differential.

Basis of the selection of causes of death was the "European shortlist on causes of death" (European Communities 2002, pp. 116–117). The selection list is shown in the annex as Table A 2. All causes of death described in this chapter can be allocated to this table and ICD codes can be looked up. An overview of standardised death rates (SDR) by most of these causes of death is provided in Table A 3 (in the annex). It consists of the years 1985–89, 1992–96 and 1998–2002 for the administrative units of Mecklenburg-Vorpommern, Germany, East and West Germany. This table gives an overview of the composition of broad groups of causes of death for the time before Unification, the mid-1990s and the latest period available. For example, lung cancer is the most common type of cancer among men and breast cancer among women.

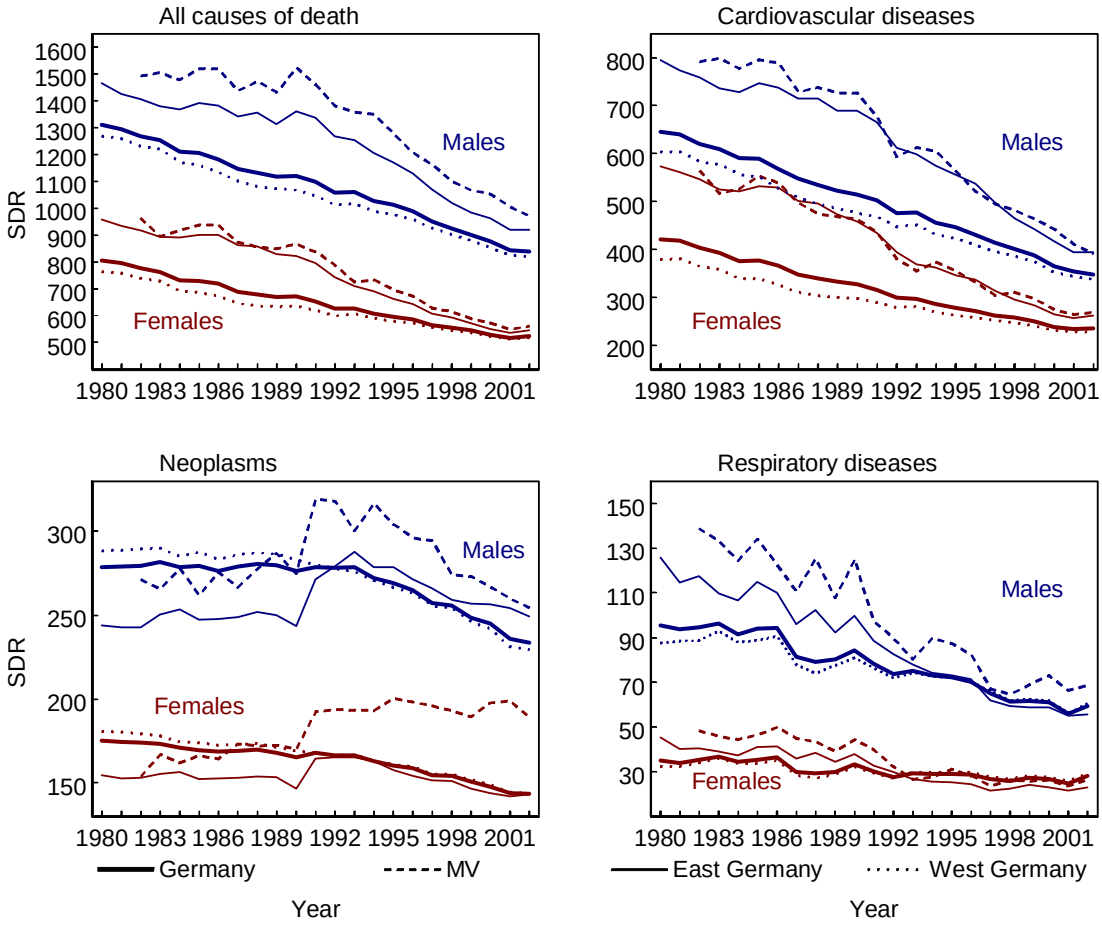
The age distribution of causes of death points out that some causes prevail in young and others in old ages. External causes for example prevail in young adults. Alcohol-related causes of death have their major impact in middle adult ages. Cancer, respiratory and circulatory diseases prevail in high ages. Notably alcohol-related causes gained importance from 1985–89 to 1998–2002 (Figure A 1 in the annex).

5.2 Major classes of causes of death

Cardiovascular diseases (CVD), neoplasms, respiratory diseases are the most common causes of death according to their prevalence in MV and Germany. Males in MV are an exception because external causes of death have a bigger share, as well as digestive diseases after Unification; for women in MV in the period after 1991 external causes also had a bigger share than respiratory diseases, but this has reversed again in the late 1990s.

The age-standardised death rates (SDR) for the three main groups are shown in Figure 5 for the period 1980–2002 together with SDR of all causes. The European Population Standard of age structure is in use (European Communities 2002, p. 115). The impact of the change to ICD 10 in 1998 is not clearly identifiable from the trend in SDR. Biggest changes in mortality took place around Unification.

Figure 5: Standardised death rates by main groups of causes of death per 100 000, 1980-2002 for males and females



Source: Own calculations with data from State Offices of Statistics Germany

The mortality trend of MV is characterised by a decline since Unification and only a slight mortality decrease before it, with some fluctuation. Standardised death rates for CVD (ICD 10 chapter IX) decline in men from an initial level of almost 800 per 100 000 in 1982 to 400 in 2002. Women experience also a bisection; SDR decreased from 560 to 270. Oscillations with short periods of stable or even increasing CVD mortality occur sporadically. The year of Unification is associated with a stronger decline but then followed by a slight increase in the early 1990s. As a result of the changes, CVD mortality is now on the same level as the East German average that is in turn getting closer and closer to the German average. Causes of death generally share the mortality decrease but some significant differences exist, for example in cancer mortality (ICD 10 chapter II). After 1990, MV experienced a sharp increase in cancer mortality. This reversed again towards declining mortality in men since the mid 1990s. In women, SDR in cancer remained since then at a level of approximately 200 deaths per 100

thousand inhabitants. The SDR in women of East Germany is equal to the German average after the increase from 1990 to 1991. In MV, no decline in cancer mortality took place since.

The third main group of causes of death comprises of all respiratory diseases (ICD 10 chapter X). Progress was especially remarkable in MV where the pace of decrease was steeper compared to East or West Germany. The SDR has halved among men and decreased by more than 40% among women. Women are now on the level of the German average whereas respiratory mortality in men is still 15% higher.

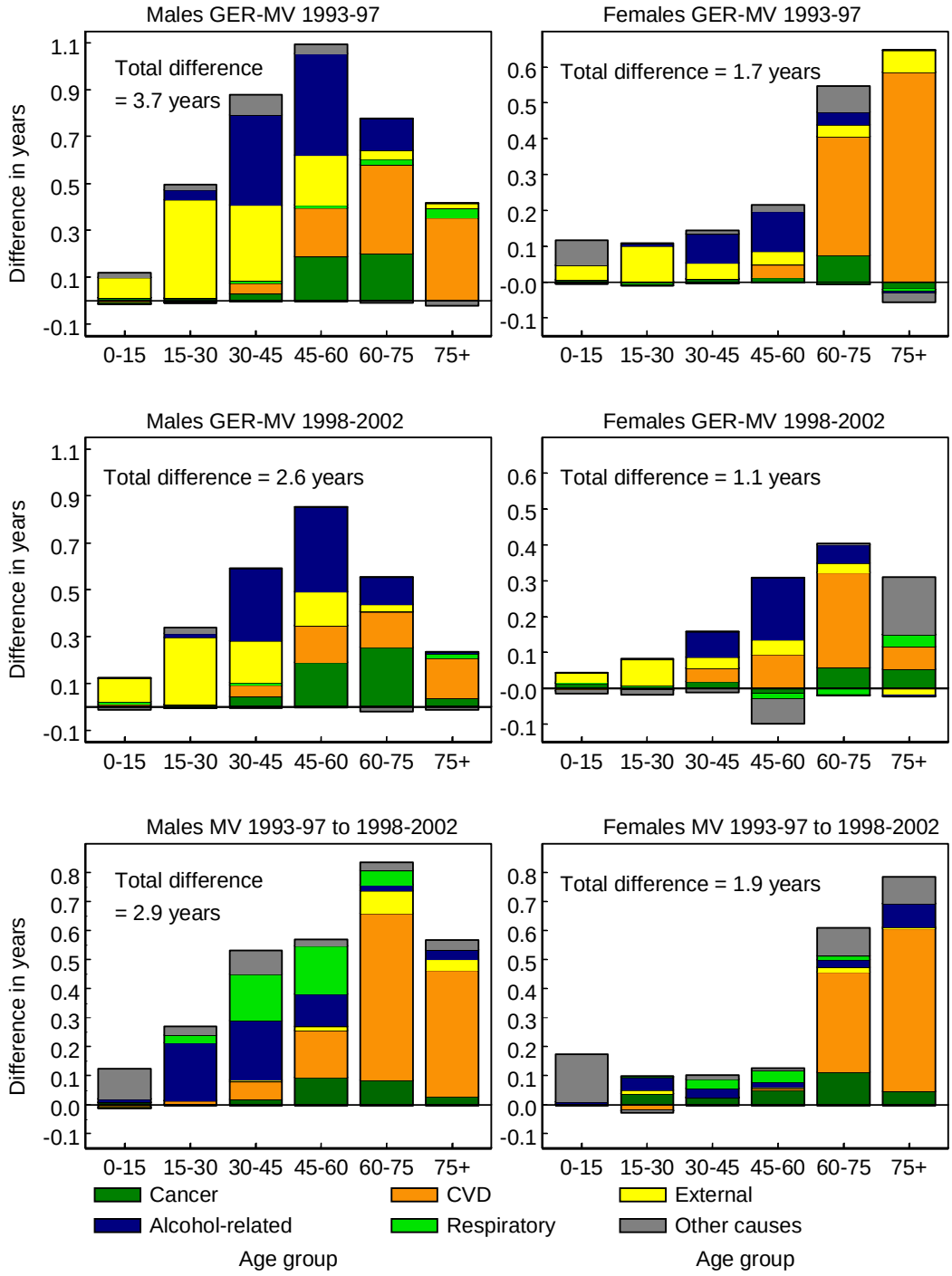
In short, MV experienced faster declines in CVD and respiratory mortality than the German average from the beginning of the 1980s until now; the sharpest decline took place after 1990. Men do not only have higher all-cause mortality, but also higher cause-specific mortality, although the differences are diminishing. Cancer mortality shows a sharp increase from 1990 to 1991. This sudden increase points at a change in definitions as mentioned in chapter 2.5. Cancer mortality is declining in men but stagnating in women.

With regard to the ICD change from ICD 9 to ICD 10 in 1998, in cardiovascular mortality no visual alteration is seen. Studies on the impact of this ICD change point to ambivalent results with slight declines in the US and a slight decrease in the UK. As well, cancer mortality remained rather stable. Respiratory diseases underwent major changes. Due to a change of coding rules, many deaths formerly put to respiratory diseases fall into several other groups in ICD 10, hence a decrease took place (Office of National Statistics UK 2002, pp. 77–78; Anderson et al. 2001, p. 6–24). In Figure 5, this fact cannot be seen.

After this overview on the cause-of-death specific mortality level, a glance will be thrown at the impact of these causes. What is most interesting is the impact of causes of death on the difference in length of life between MV and the German average. This is done by means of decomposition of life expectancy (Figure 6). In order to find out, which causes are associated with the life expectancy increase in MV, the life expectancy 1993–97 and 1998–2002 is furthermore decomposed. For practical reasons, external and alcohol-related causes of death are given in Figure 6 too, though they are described in chapter 5.4.

CVD mortality in men constitutes 26% (1.0 of 3.7 years of total difference) in 1993–97 and 20% (0.5 of 2.6 years) in 1998–2002 of the differences in life expectancy between Germany and MV. In women, the impact is more pronounced: 56% (0.9 of 1.7 years) in the first and 40% (0.5 of 1.1 years) in the second period of 1998–2002 of the life expectancy difference can be allocated to CVD. Both in men and in women, the major impact of this class of causes of death is in the

Figure 6: Decomposition of differences in life expectancy between Germany and Mecklenburg-Vorpommern by age and causes of death in 1993–97 and 1998–2002 and the change from 1993–97 to 1998–2002 in Mecklenburg-Vorpommern for males and females



Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany
Please note: External causes of death exclude those that are alcohol-related (Accidental poisoning by alcohol)

very high age groups. While CVD lost importance, cancer gained. In 1993–97, the life expectancy difference in men was made up to 12% by cancer, whilst it was 20% in 1998–2002. The corresponding figures for women are 5% and 11%. Those age groups which are mostly affected are high age groups. Respiratory diseases and other causes have little explanatory power to explain the life expectancy gap between Germany and MV. The life expectancy increase in Mecklenburg-Vorpommern from 1993–97 to 1998–2002 is attributable to alcohol-related, respiratory and circulatory causes in men. 1.9 years of the male life expectancy increase of 2.9 years can be allocated to these three causes. Young and middle adult ages experienced a decrease in external mortality, whereas respiratory diseases decreased between age 30 and 60. CVD mortality had the biggest influence (1.2 of 2.9 years) and affected high age groups. This applies also to women, where only CVD have considerable impact on the life expectancy increase. Improvements in CVD mortality accounted for 0.9 years of the 1.9 years of life expectancy increase.

In conclusion, CVD have more weight to explain life expectancy differences between Germany and MV and are more important in women though the impact is decreasing. The impact of cancer is increasing and more important in men. Cancer mortality has its impact in old ages, CVD mortality in the very old ages. Respiratory diseases can be neglected to explain the differences in length of life. Decreasing mortality in circulatory diseases is responsible for the majority of the life expectancy increase in MV.

Table 4: Life expectancy and cause-specific mean ages at death in Mecklenburg-Vorpommern and Germany 1998–2002

	Males		Females	
	MV	Germany	MV	Germany
Life expectancy at birth	72.48	75.13	79.91	81.04
Mean age at death by cause				
Cancer	69.17	70.71	71.44	72.28
Cardiovascular diseases	75.69	76.09	80.83	81.07
Respiratory diseases	76.76	76.60	79.63	79.66
External causes of death	48.72	53.85	65.96	66.39
Transport accidents	34.76	39.16	42.66	44.08
Suicide	51.63	53.61	61.07	57.84
Alcohol-related causes of death	54.90	59.15	58.46	62.51

Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics in Germany

To complete the picture, the cause-of-death specific mean age at death is given in Table 4.The period covered is 1998–2002.

Cause-specific mean age at death is lower than overall life expectancy in cancer. People dying on CVD experience a longer life than the average. The mean age at death in respiratory diseases in men is higher than the average life expectancy; however it is lower in women. Other listed cause-specific mean ages at death are treated beneath.

5.3 Avoidable causes

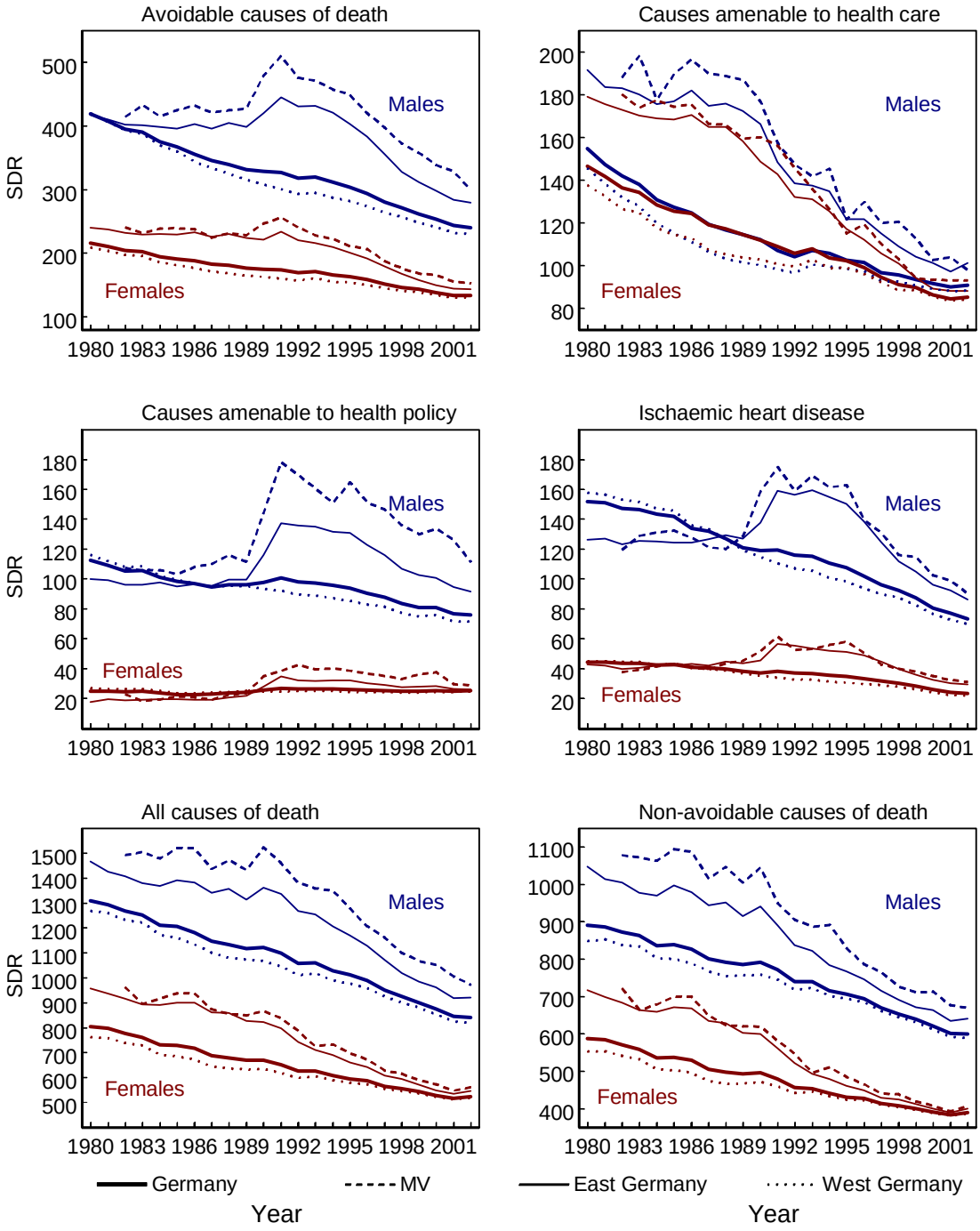
Out of the many existing lists of avoidable causes of death, two lists provided by Nolte and others. (2004, p. 66 and 2002, p. 1907) were adapted and combined. Causes included are specified in Table A 4 (see annex) with referring ICD 9 and ICD 10 codes and age limits. Classification was done according to a first group which comprises causes amenable to health care and a second group with causes considered responsive to health policy. This permits the analysis of different structures and policy implications which underlay these groups. Given the large amount of deaths from ischaemic heart disease, this disease is analysed separately though it mainly belongs to the group of causes amenable to health care (ibid., p. 1907).

Some of the diseases included are frequent causes of death. These are for instance diabetes, ischaemic heart and cerebrovascular disease, diseases of the respiratory system or female breast cancer. Other causes of death like infectious diseases and maternal deaths occur scarcely nowadays since much effort has already been done to fight these causes.

Figure 7 shows SDRs of several groups of avoidable causes of death. Causes amenable to health care, causes amenable to health policy and ischaemic heart disease are shown separately; the graph with avoidable causes of death is the aggregation of these three groups. For comparison reasons, SDR of non-avoidable causes is mapped as well as all-cause mortality.

The differences between the different groups are striking. Now the short-term mortality increase in MV after Unification can be directly allocated to avoidable causes of death. The trend in SDR of non-avoidable causes of death has a slight increase in mortality from 1989–90, which might also be due to random fluctuation as seen in the 1980s. For all avoidable causes of death combined, there is a substantial convergence from MV and East Germany to the favourable West German trend. Again, this trend is more pronounced in men. Men in MV experienced a rise in avoidable mortality by approximately 20% from 1989–91, whereas it was 12% in women

Figure 7: Standardised death rates of avoidable causes of death per 100 000, 1980-2002 for males and females



Source: Own calculations with data from State Offices of Statistics Germany

at the same time. Afterwards the decrease in avoidable mortality performed much faster in MV than in West Germany.

A closer look at the three groups of avoidable mortality – mortality amenable to health care, to health policy and ischaemic heart disease – shall be taken. Progression of SDR in causes

amenable to health care is unusual with regard to the sex-specific trend. Males and females undergo a similar development throughout the observed period. Usually, males are on a much higher mortality level than women in all regions under consideration (MV, East Germany, and West Germany) and can be compared sex-specifically. This does not apply to causes amenable to health care where MV and East Germany follow a trend differing from West Germany. The SDR level in MV was between 180 and 200 per 100 000 in the early 1980s, it is now around 100, both for men and women. The steepest decrease occurred in the first years after Unification. On the other hand, the West German trend exhibits a faster mortality decline during the 80s which levels off in the 90s.

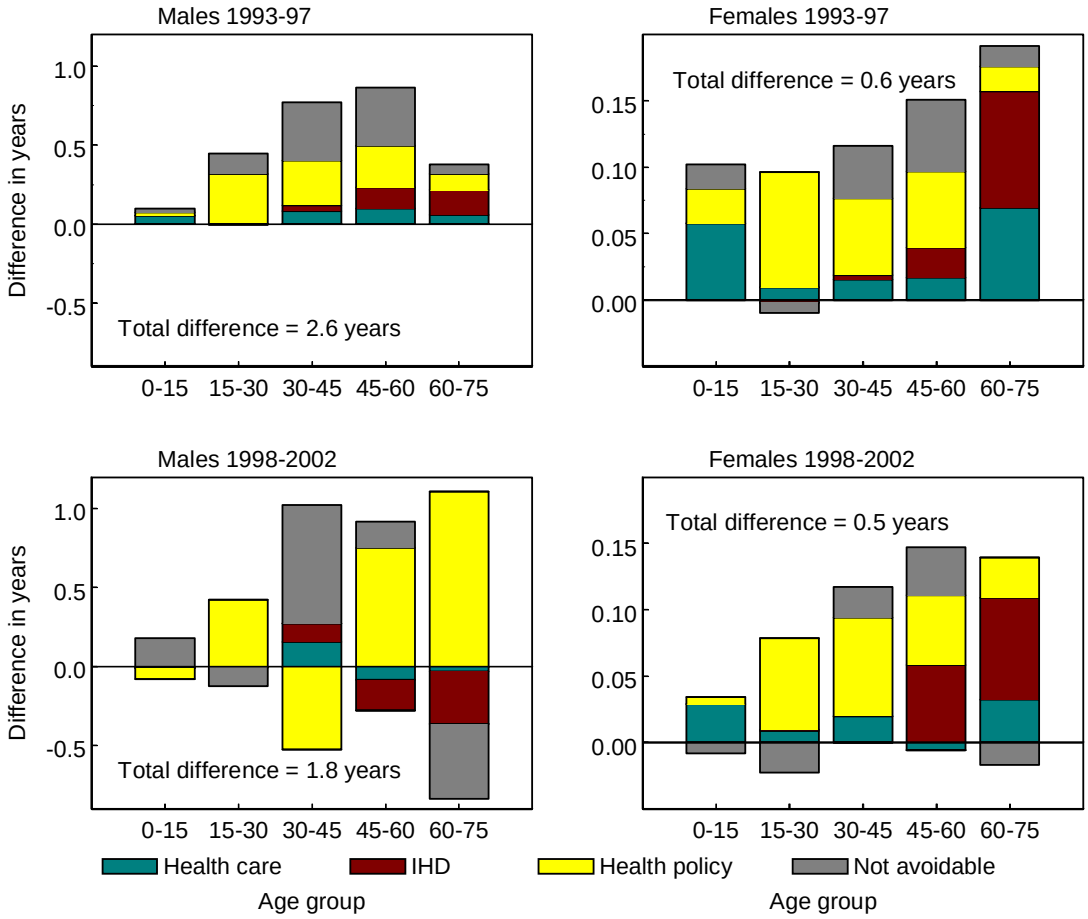
During the 1980s, mortality amenable to heath policy in MV was approximately at the German average level. After 1990, there is a sharp rise in these causes in MV. The effect is about the same for both men and women. Nevertheless, women are on a generally lower mortality level from causes amenable to health policy. Men experienced a decrease from this cause-of-death group throughout the 1990s. By 2002, the mortality level for men in MV is 70% above the German average. The mortality level for causes amenable to health policy of women decreased slowly until the late 1990s. It came close to the German average level now.

The trend in IHD mortality is similar to the trend in mortality amenable to health policy described above. Nevertheless, MV experienced a faster decline during the 1990s.

Again, a look is taken on the influence of the different avoidable cause of death groups. Given the age limit of 74 years, decomposition was applied to the temporary life expectancy from age 0–74. Avoidable causes gained in importance from 1993–97 to 1998–2002 and consequently the non-avoidable causes of death lost importance. The contribution of non-avoidable causes is negligible for women in 1998–2002. Also the causes of death responsive to health care lost importance, implicating a convergence of mortality rates from age 0–75. IHD turned from higher male mortality in MV to lower mortality in 1998–2002. Women underwent a different trend. The proportion of IHD mortality increased in the two periods and IHD mortality explains around 30% of the difference in temporary life expectancy in 1998–2002. Major explanatory power does the group of causes of death responsive to health policy have. This holds good in both periods, with increasing trend. Middle adult ages are mostly concerned.

The difference in temporary life expectancy difference from age 0–74 is between MV and Germany is largely attributable to avoidable causes. Among the avoidable causes of death, causes responsive to health policy, hence prevention, make up the biggest differences.

Figure 8: Decomposition of temporary life expectancy up to age 75 between Germany and Mecklenburg-Vorpommern by avoidable causes of death in 1993–97 and 1998–2002 for males and females



Source: Own calculations with data from the Human Mortality Database (mortality.org 2005) and State Offices of Statistics Germany

All in all, for non-avoidable mortality there was a steady decline during the 1980s and 90s. On the other hand, there was a rise in mortality from avoidable causes of death from 1989–91, which is attributable to causes amenable to health policy and to ischaemic heart disease. Mortality amenable to health care did decline from the beginning of the observed period in the 1980s. Its impact to the life expectancy difference between MV and Germany is decreasing as well. No sex-specific trend is seen in mortality amenable to health care. Mortality amenable to health policy and ischaemic heart disease mortality both register a sharp increase after Unification. Though men and women are concerned to the same extent, it is more remarkable in men given the higher overall male mortality level in these causes. For both men and women, causes amenable to health policy explain most of the life expectancy difference between MV and Germany in 1993–97 and 1998–2002.

The influence of the ICD classification change cannot be clearly identified but there is some evidence that there is only a minor overall change. For the big group of IHD mortality, little change has been observed. Some of the other causes observed an increase like skin cancer, leukaemia, diabetes mellitus or cerebrovascular diseases. On the other hand, a decrease in respiratory diseases is observed (Office of National Statistics UK 2002, pp. 75–79).

5.4 External and alcohol-related causes

External causes of injury and poisoning (ICD 10 chapter XX) include motor-vehicle accidents, suicide, homicide, falls and other minor groups. Alcohol-related causes of death described in this analysis are alcoholic psychoses and alcohol dependence syndrome, liver cirrhosis and accidental poisoning by alcohol (ICD 9 codes 291, 303, 571, and E860; ICD 10 codes F10, K70, K73–K74, and X45). These are the causes of death commonly associated with alcohol abuse. Nonetheless, many other diseases, such as pulmonary tuberculosis and liver cancer, may be caused by excessive alcohol consumption. Motor vehicle accidents as well as homicide and suicide may also be attributable to excessive alcohol consumption as acute consequences, but they are less clearly classifiable.

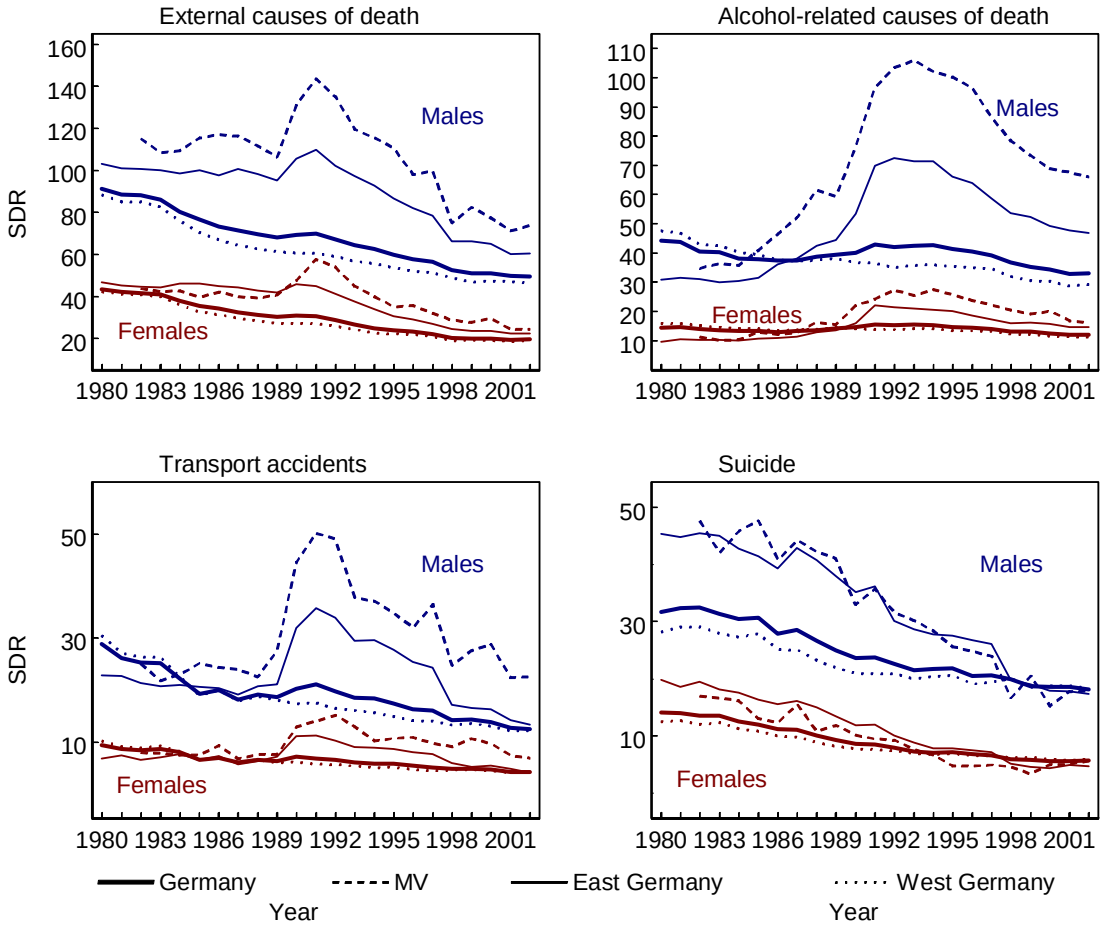
The age distribution of external and alcohol-related causes of death (Figure A 1) shows that external causes of death occur most often during childhood and young adult ages. They are the prevailing causes of death in these ages. An increase in the proportion of external causes from 1985–89 to 1998–2002 is mostly remarkable for women. Alcohol-related causes of death also gained importance in the age groups 30–60. Men and women are concerned by this increase.

SDR of external and alcohol-related causes of death are displayed in Figure 9.

Accidents (especially car accidents) and suicide account for most of the external causes of death (Table A 3). Suicide mortality steadily declines. Transport accidents account for a certain share of the increase in external mortality in the early 1990s. Whereas this increase in external causes experienced by women is half-attributable to traffic accidents, in men the increase is almost fully attributable to traffic accidents. Still, the traffic accident mortality level of MV exceeds the German average over 50%. Suicide mortality declined in both sexes, but faster in men; nowadays there is hardly any difference between the analysed regions. Suicide hence does not contribute to the mortality differential between Germany and MV anymore.

Alcohol-related mortality in MV also underwent an increase around Unification. However, the increase set in during the 1980s and alcohol-related SDR reached its peak in 1992. The bulge seen in men is especially remarkable and the decline that follows starts only in 1996. Alcohol-

Figure 9: Standardised death rates of external causes of death and injury, of transport accidents, of suicide and of alcohol-related causes of death per 100 000 in 1980-2002 for males and females



Source: Own calculations with data from State Offices of Statistics in Germany

related mortality in MV in the early 90s is approximately 150% higher than the German average in men and twofold as large in women. Though the second half of the 1990s is remarkable and alcohol-related mortality is on a low level compared to the three main groups of causes of death, men in MV still experience twofold higher alcohol-related mortality than the German average in 2002.

Getting back to the impact on life expectancy differences, Figure 6 is further analysed. The impact of external and alcohol-related mortality on the life expectancy difference between Germany and MV is enormous. Though the death rates are low compared to CVD or cancer, the two mentioned groups make up nearly 60% of the difference in male life expectancy. This is because life expectancy as a measure is more sensitive to changes in death rates at younger ages. In 1993–97, 2.1 years of life expectancy could have been gained if MV had the same

mortality rates in external and alcohol-related causes of death as the German average out of a total difference of 3.7 years in men. In 1998–2002, the total life expectancy difference diminished to 2.6 years, of which 1.6 years could have been gained. External causes have more impact on the life expectancy difference than alcohol-related causes in 1993–97, this reversed in 1998–2002. In both periods, the age distribution shows that the impact of external causes of death is dominating in young adult ages. In middle adult ages, it shifts to alcohol-related causes. One should certainly recognise that both groups of causes of death are closely inter-related.

Although women exhibit a different mortality pattern, some similarities can be seen. This is firstly the predominance of external causes in 1993–97 on the difference in life expectancy between Germany and MV, which shifts to alcohol-related mortality in 1998–2002. Secondly, the impact of certain age groups in the two considered cause-of-death groups is the same as in men, with external causes having most impact in young adult ages and alcohol-related causes gaining impact in middle adult ages. The general contribution of the two cause groups is 0.5 years in both periods. Given the total life expectancy difference of 1.7 years in 1993–97 and 1.1 years in 1998–2002, the relative contribution raises from 32 to 42%.

The observed increasing impact on the life expectancy difference between Germany and MV of alcohol-related compared to external causes is seen in the SDR as well. In SDR, the sudden increase in external mortality after 1989 was followed by a fast decline. This is not the case for alcohol-related causes where the increase extended over several years and the decrease took place slowly. Nonetheless, decreasing alcohol-related mortality is responsible for 0.4 years of the life expectancy increase in 2.9 years that took place in Mecklenburg-Vorpommern from 1993–97 to 1998–2002 in men.

Cause specific expected ages at death for external and alcohol-related causes are considerably lower in MV compared to the German average (Table 4). Men in MV dying of external causes in 1998–2002 were on average aged 49. More extreme values are observed in transport accidents with an expected age at death of 35 years for men. For men committing suicide expected age at death was 52 years and for those dying of alcohol-related diseases it was 55 years. Women show a different pattern since those dying of alcohol-related causes die younger than women dying of external causes. The mean age at death for transport accidents is 43 years in MV and 61 years for suicide.

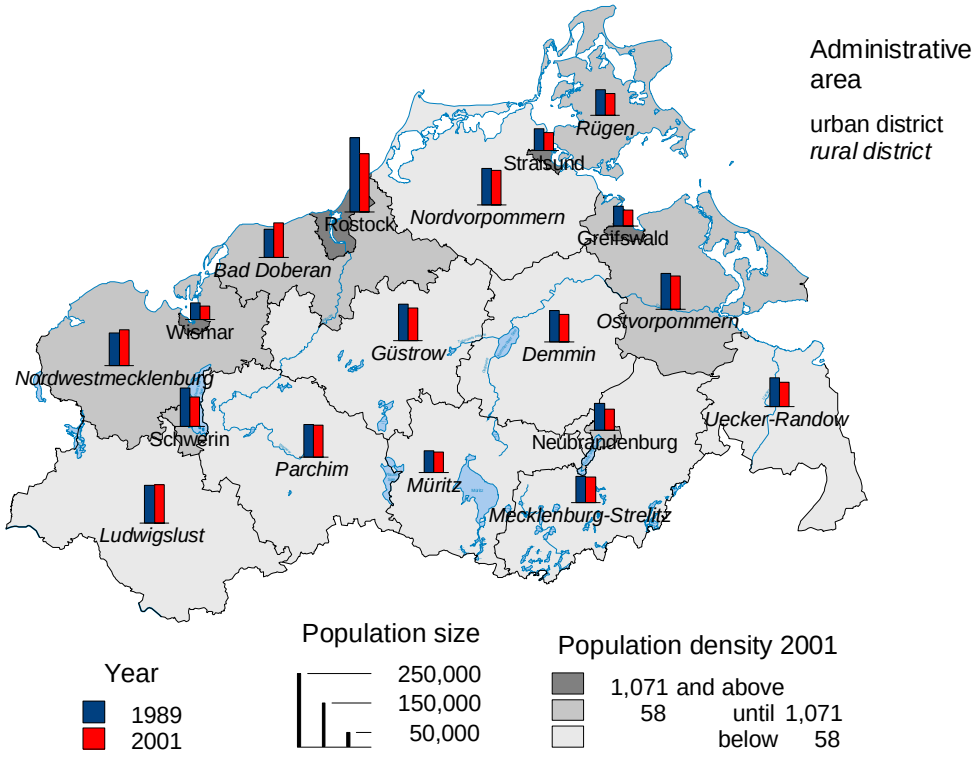
With regard to the shift to ICD 10 in 1998, the overall number of deaths due to external causes of death has not changed. Liver cirrhosis underwent a minor increase (Office of National Statistics UK 2002, pp. 78–79; Anderson et al. 2001, p. 16).

6 Results III – Mortality variation across districts within Mecklenburg-Vorpommern and its determinants

6.1 Mortality and life expectancy pattern across districts of Mecklenburg-Vorpommern

Before analyzing mortality in MV on the district level, a quick glance at population size will be drawn. The state's population size was around 1.8 million inhabitants in 2001 compared to nearly two million inhabitants in 1989 (Statistisches Jahrbuch MV 2002, p. 38). The distribution of population in the years 1989 and 2001 across districts and the population density in 2001 are shown in Figure 10. Population density is naturally the highest in cities and furthermore along the shoreline of the Baltic Sea. Until 1989, the last year of the German Democratic Republic, the population rose and then faced a high out of state migration. Rostock is the biggest district with around 200 000 inhabitants, but it has lost about one fifth of its population since 1989. Apart from

Figure 10: Population size in districts of Mecklenburg-Vorpommern in 1989 and 2001 and population density (persons per km²) of districts in Mecklenburg-Vorpommern in 2001



Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

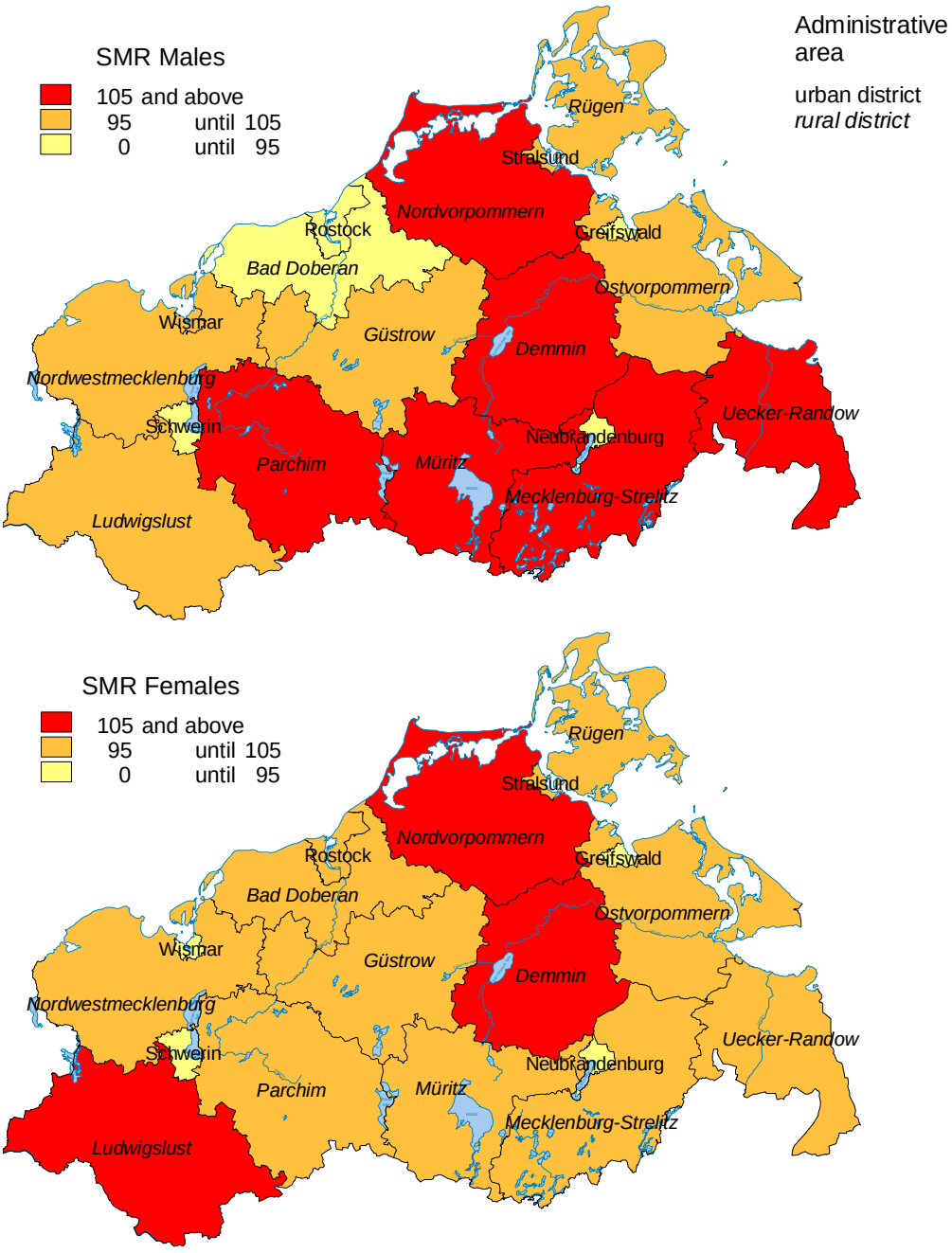
Bad Doberan, Nordwestmecklenburg and Ludwigslust, all remaining districts underwent population losses. Bad Doberan benefited from people who left Rostock and wanted to move to a suburban district without losing advantages such as work or shopping facilities of a major city. Similarly, Ludwigslust and Nordwestmecklenburg rather gained population due to in-migration from West Germany. The closely situated West German cities of Hamburg and Lübeck can be hold liable for this. Apart from the cities which all lost around 20% of their population after Unification, Rügen and Uecker-Randow are the other districts, which have experienced significant population losses.

A geographical visualisation of the regional mortality in 1997–2001 is given in Figure 11 by the standardised mortality ratios (SMR).

The regional pattern as illustrated in Figure 11 shows mortality classified by district according to three groups of high, middle and low mortality. The mortality groups are classified by standardised mortality ratios. Districts with SMR below 95 fall into the group with low mortality, districts with SMR between 95 and 105 fall into the middle mortality group and thus districts with SMR above 105 fall into the high mortality group. Standardised mortality ratio was chosen as an indicator for regional mortality variations by taking the MV average as reference mortality level. Most districts in women fall into the medium mortality class. Cities experience generally higher mortality although Rostock and Stralsund are in the middle category. Only three districts – Ludwigslust, Nordvorpommern and Demmin – are classified into the highest mortality class. On the other hand, the mortality pattern of men shows rather equal classification into the three classes. Again, urban districts exhibit lower mortality. The middle class comprises of districts in the west of MV and districts, which are situated along the shoreline. The districts in the heartland belong to the disadvantaged areas within MV. This geographical description can only give a very rough guidance on the regional distribution of mortality. Spatial variation of mortality somewhat goes along with population density.

Figure 12 shows the life expectancy in the periods 1982–86, 1987–91, 1992–96 and 1997–2001 and the extent of variation in life expectancy across time and districts. Horizontal lines in Figure 12 indicate the federal average length of life in MV. The advantage of urban compared to rural districts at all points in time is seen at the first glance. MV gained in the observed period from 1982–86 to1997–2001 in average 4.5 years in length of life in females and 3.7 years in men. The life expectancy gain is not the result of a steady improvement of the mortality situation. In the period

Figure 11: Standardised mortality ratios in districts of Mecklenburg-Vorpommern in 1997–2001 for males and females



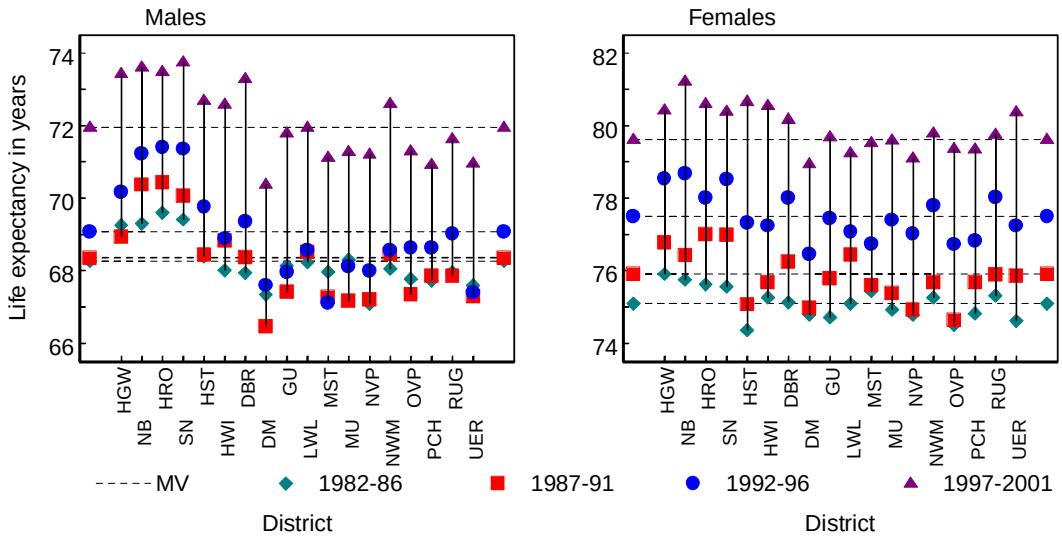
Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

between 1992–96 and 1997–2001 the major improvement has taken place whereas before only sparse improvements were recorded.

For women, the differences in life expectancy over time are more uniformly distributed than for men. As for variation, in all of the years the maximum and minimum values are closer in women. Women in all districts of MV exhibit increases in life expectancy from one period to the following one. Although the major improvement took place from 1992–96 to 1997–2001, there is an improvement in life expectancy to a considerable extent also from 1987–91 to 1992–96. Stralsund shows the most favourable trend in women as they gained 6.3 years in length of life throughout the whole period. Stralsund hence turned from the last rank in 1982–86 to one of the most advantaged districts now. A similar development can be seen for the district of Uecker-Randow. An inauspicious trend was experienced by Ludwigslust and Mecklenburg-Strelitz who had life expectancies above average in at least one of the periods and are now below the MV average.

For men, there is hardly any improvement from 1982–86 to 1987–91, but a large improvement in the later periods. The marginal improvement in the first period is explained by gains in length of life in some districts, which coincides with a worsening in life expectancy in six of the 18 districts. Bad Doberan is the district with the most advantageous trend with an increase of more than five years in life expectancy from 1982–86 to 1997–2001. Nordwestmecklenburg has also caught up and turned

Figure 12: Life expectancy in districts of Mecklenburg-Vorpommern in 1982–86, 1987–91, 1992–96 and 1997–2001 compared to average life expectancy in Mecklenburg-Vorpommern for males and females



Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

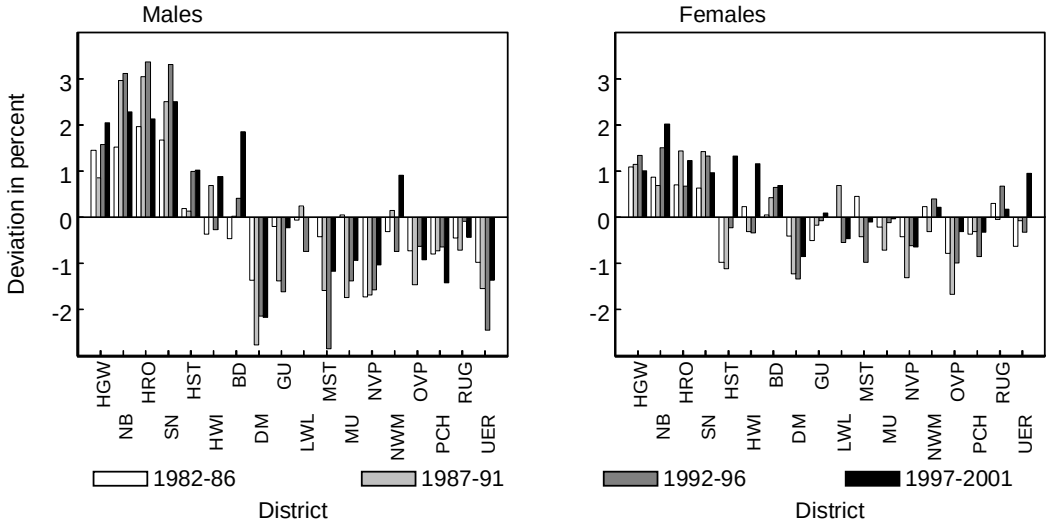
into a district with life expectancy above average. For males, none of the districts had such an unfavourable development that first life expectancy was above and then in 1997–2001 below the average as it was the case in women. Most of the districts being below MV average held this position throughout the considered period and vice versa.

6.2 Variation and resulting inequality in length of life

The variation of life expectancy within MV that was already described in chapter 6.1 will now be further analyzed. In Figure 13 deviations from the MV average are expressed as percentage of the average MV life expectancy in the respective period. Herewith the deviation is given irrespective of the height of life expectancy and the four periods can be compared with each other and among sexes. The advantage of this diagram is the direct comparison to the average of all districts and the comparison of the time periods 1982–86, 1987–91, 1992–96 and 1997–2001.

Deviations from the average life expectancy of Mecklenburg-Vorpommern are more pronounced in men than in women. Furthermore, the deviations in men are greater and point to a strong urban-rural difference. In general, the urban districts exhibit positive deviation from the average, which means that life expectancy in urban districts is above average. Hence, life expectancy in rural

Figure 13: Deviations from average life expectancy in Mecklenburg-Vorpommern as a percentage of life expectancy in 1982–86, 1987–91, 1992–96 and 1997–2001 for males and females



Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

districts is below average. The pattern for females is similar, but not as clear as seen for males.

The cities of Greifswald, Neubrandenburg, Rostock, and Schwerin exceed the MV average by far in all periods from 1982–86 to 1997–2001, both for males and females. The other two cities, HWI and HST, are above average in 1997–2001. (For a list of significant differences from life expectancy in the districts of MV to the MV average life expectancy, please see Table A 5 in the annex.) Life expectancy in rural districts is mostly below the MV average. An exception is Bad Doberan, the district surrounding Rostock. In Bad Doberan, life expectancy is above average from 1992–96 onwards for males and from 1987–91 onwards for females. Furthermore, life expectancy in NWM is higher than the MV average in 1997–2001 for males. Females exhibit more variance in rural districts. Life expectancy is partly below and partly above the average of MV in several districts and at several time points. Hence, the distinction between urban and rural districts is less clear.

Deviations from the life expectancy average differ strongly in the four periods under consideration. The tendency is towards increasing deviations from the average from 1982–86 to 1992–96. From 1992–96 to 1997–2001, the deviations are decreasing. The relationship between increasing and decreasing deviation is now further looked at with a summary indicator of inequality.

Average inter-district differences in life expectancy (AIDD) show the average deviation from one district of MV to another (Table 5). The percentage value refers to the percentage of the respective weighted life expectancy.

AIDD as percentage for males rose from 1982–86 to 1992–96 and decreased in the following period 1997–2001. Females exhibited lower dispersion than men do. AIDD increased from 1982–86 to 1987–91, but then decreased in the subsequent periods.

A jump of three years in average life expectancy in men is related to the decreasing AIDD. When relating this result to the life expectancy trend by districts of MV (Figure 12), it turns out that mostly rural districts account for the life expectancy increase in 1997–2001. Urban districts experienced this rise too, though their life expectancies already underwent a major increase from 1987–91 to 1992–96. The major catch-up effect in life expectancy of rural districts of MV hence enforced the life expectancy convergence.

For females, a big life expectancy increase started already in 1987–91. Decreasing dispersion in life expectancy cannot be so closely linked to the gain in females' life expectancy in the rural

Table 5: Average inter-district difference in life expectancy in Mecklenburg-Vorpommern 1982–86, 1987–91, 1992–96 and 1997–2001 for males and females

	Males				Females			
	1982–86	1987–91	1992–96	1997–2001	1982–86	1987–91	1992–96	1997–2001
AIDD (in years)	0.425	0.690	0.775	0.605	0.244	0.425	0.366	0.346
AIDD (in percent)	0.622	1.009	1.121	0.838	0.325	0.560	0.472	0.433
Life expectancy (life table)	68.27	68.36	69.08	71.95	75.10	75.92	77.50	79.62
Life expectancy (weighted average of population share and life expectancy in districts)	68.29	68.39	69.14	72.14	75.12	75.93	77.53	79.89

Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

districts. Nevertheless, it holds also good that the sharp life expectancy increase in cities started earlier than in the rural districts.

In fact, convergence of life expectancy prevails today thanks to a general life expectancy improvement and especially thanks to the good adaptation of rural districts in the latter period.

6.3 Distribution and variation of causes of death across districts of Mecklenburg-Vorpommern

Causes of death and the referring death rates were already dealt with in chapter 5. Now, the characteristic causes of death which force inequality in life expectancy are addressed. On the district level, not all causes of death were available so that there are some constraints in analysis. Nevertheless, many important groups are available and give a good overall impression of the cause-specific situation. First of all, a chi-square test for goodness of fit with k-1 degrees of freedom (with k = number of districts = 18) was applied to find out in which causes inner-state variation is statistically significant (Table 6). Both for men and for women, the variation for all-cause mortality is significant. Only in several causes of death variation in female mortality is significant. These are diabetes mellitus, the group of ischaemic heart diseases as well as the subgroup of myocardial infarction itself, cerebrovascular disorders and other causes of death ($p < 0.01$). Much more variations at significant level are observed in male cause-specific mortality. Only in the subgroups of cancer of stomach, cancer of intestine and rectum, and cancer of male genital organs

Table 6: Chi square values of variation by causes of death across districts of Mecklenburg-Vorpommern (with k-1 = 17 degrees of freedom) in 1994–97 for males and females

	Cause of death	Males	Females
1	All causes	310.5 **	102.3 **
2	Neoplasms	54.6 **	20.1
2.1	Cancer of stomach	6.4	26.2
2.2	Cancer of intestine and rectum	18.4	20.5
2.3	Cancer of male genital organs	17.3	na
2.4	Cancer of female genital organs	na	25.8
2.5	Cancer of trachea, bronchus and lung	58.1 **	21.3
2.6	Cancer of breast	na	20.9
3	Respiratory diseases	48.7 **	36.2 **
4	Diabetes mellitus	53.5 **	57.9 **
5	Ischaemic heart disease	131.4 **	113.4 **
5.1	Myocardial infarction	126.9 **	62.4 **
6	Cerebrovascular disorders	147.6 **	298.6 **
7	External causes of death	98.3 **	20.8
7.1	Motor-vehicle accidents	85.4 **	25.2
7.2	Suicide	51 **	12.5
8	Alcohol-related causes of death	86.7 **	32.3 *
9	Other causes of death	55.4 **	123.5 **

na not applicable
** significant at 0.01 level (critical value 33.4)
* significant at 0.05 level (critical value 27.6)

Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

there is no significant variation. Hence, all other causes and groups of causes of death exhibit variation ($p < 0.01$).

In order to give a complete picture on cause-specific mortality within MV, the SMR by single causes of death and groups of causes of death are analysed by districts (Table A 6 in the annex). The structure of causes of death by districts is the background of the cause-specific variation.

SMR significantly higher and lower than the average of MV (confidence intervals do not include 100) are very distinct. In the six cities of MV and Bad Doberan there is persistent lower mortality than the MV average, the only exception are women in Rostock. Rural districts exhibit the reverse picture by having generally higher mortality – with some exceptions. The description of the spatial pattern by the urban-rural divide is therefore very clear. It has to be kept in mind that some groups of causes of death are very much determined by single causes. Thus, the group of neoplasms is largely determined by lung cancer in men and breast cancer in women. Deaths from myocardial

infarction account for a big share in the group of ischaemic heart disease in the same manner as motor vehicle accidents make up a big part of external causes of death.

Let us first throw a glance at the male's mortality figures. As seen before in Table 6, all causes except cancer of stomach, intestine and rectum and of male genital organs exhibit significant variations across districts. Seventeen of the 18 districts have statistically significant deviations from the average in all-cause mortality. Given the clear divide between low SMR in cities and Bad Doberan and high SMR in the remaining rural districts, not all of the causes listed in Table A 6 (in the annex) are described. Neoplasms, respiratory and alcohol-related diseases and external causes of death follow this trend of the distinction between urban and rural districts. The pattern of heart diseases is interesting. Many districts exhibit SMR below 100 in myocardial infarction, but SMR above 100 in IHD mortality and vice versa. Same directions of IHD and myocardial infarction could be expected, because myocardial infarction is a subgroup of IHD. Much variation is found for cerebrovascular disorders with the lowest SMR of 56 in Wismar and Mecklenburg-Strelitz with the highest SMR of 152. Urban districts show lower SMR in cerebrovascular disorders than the MV average. Variation in other causes of death is low, pointing to the fact that the available causes are a good representation of the male mortality situation.

Considering the low variation in female cause-specific mortality from the MV average, this is reflected in low variation across single districts. Standardised mortality ratios for all causes are much closer to 100 than it is the case for men. Some urban districts have higher SMR in certain cancers than the average as well as some rural districts also experience lower mortality in certain cancers. This makes it difficult to find a clear-cut pattern. Significant variation within MV was found for ischaemic heart disease and myocardial infarction (Table 6). Although most districts have either higher SMR or lower SMR in both causes, not all of the differences are significant. Nordvorpommern even has a SMR of 90 in ischaemic heart disease and a SMR of 116 in myocardial infarction, both significantly different from 100. Mortality from cerebrovascular disorders among women was also found to have significant variation from the average of MV – 15 districts experience significant deviations from the average. Alcohol-related causes of death show SMR significantly lower than 100 not only in most cities, but also in many rural districts. This means that no clear pattern as in men can be found. Also external causes of death have variations, but show

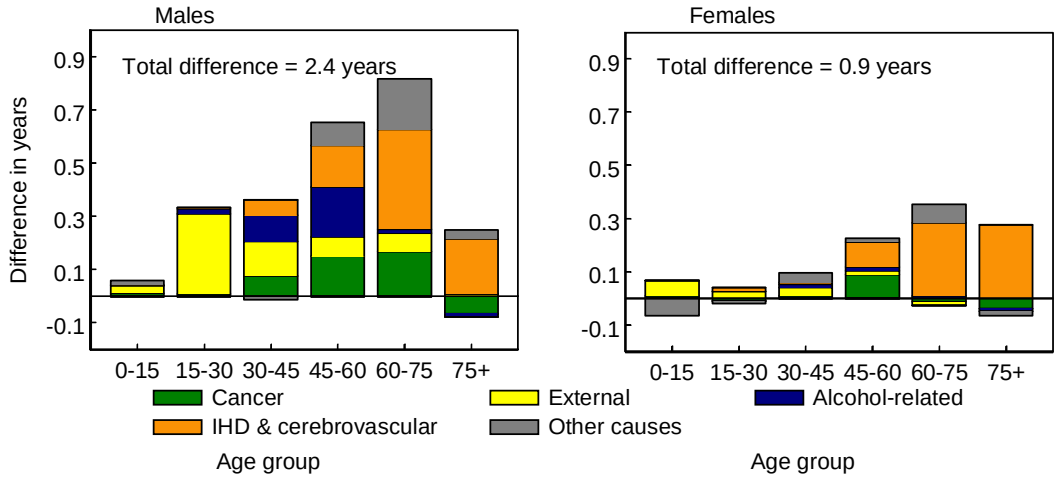
that the urban districts of Rostock and Neubrandenburg are advantaged concerning motor-vehicle accidents.

The urban-rural mortality discrepancy is now further highlighted. It has been detected already in chapter 6.1 by looking at spatial variations in the life expectancy and consequently by considering the SMR by causes. The structure of the urban-rural gap is analysed by decomposing the difference in life expectancy of urban and rural districts by age and causes of death. As mentioned above, the advantage of this method is that it does not only take into account the age- and cause-specific mortality rates, but it also weights a higher influence of younger ages on life expectancy. Results are displayed in Figure 14. The total difference between life expectancies constitutes 2.4 years for men and 0.9 years for women.

As an example how to understand the given result, external causes of death in men at age 15–29 are chosen. The value of 0.3 says that men in rural districts could live a third of a year longer if they have had the same mortality rate as that in the favoured urban districts. When summing up all causes of death over all age groups, this returns the given totals of 2.4 years for men and 0.9 years for women. The major contributions to the total urban-rural difference for men are made by age group 45–74. Apart from this maximum, men experience an additional peak at age 15–29. Women's age-specific contributions are concentrated at higher age groups. Three quarters of the urban-rural difference in length of life fall into the age group 45 and above. This follows the general pattern of later mortality among women. For them, differences between urban and rural districts increase up to age group 60–74 and then decline.

The cause-specific pattern of urban and rural districts obtained by decomposition reflects largely the general age-specific prevalence of causes of death. At young adult ages, external causes of death such as motor-vehicle accidents prevail. External causes of death are thus the main explanatory factor for contributions to the urban-rural life expectancy in life expectancy at age 15–29. Altogether, external causes account for about one fourth of the total urban-rural difference in life expectancy for men and only 13% for women. Alcohol-related mortality, more prevalent among men, is seen mostly in middle adult ages starting around age 30–59. It accounts for a considerable amount of life expectancy differences between urban and rural areas for men, but not for women. Neoplasms, which make the second highest contribution of causes of death, then have their biggest share around ages 45–74. They account for 15% of the urban-rural life expectancy gap for

Figure 14: Decomposition of differences in life expectancy by age and causes of death between urban and rural districts of Mecklenburg-Vorpommern 1994–97 for males and females



Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern
Please note: External causes of death exclude those that are alcohol-related (Accidental poisoning by alcohol)

men and 6% for women. The relatively small contribution of cancers to the urban-rural life expectancy difference is remarkable given their big share in deaths. Some cancers have lower mortality in urban, others have lower mortality in rural districts. Same applies to age groups. Finally, the group of ischaemic heart diseases and cerebrovascular disorders is the determining factor of the urban-rural difference in life expectancy due to older ages. The contribution of circulatory pathology to the total gap in women is 0.7 years, or 75%. For men, the difference due to this cause-of-death group is 0.8 years, or 34%.

In general, greater differences in cause-specific mortality is found for men. Causes of death responsible for greater variation are external and alcohol-related causes at young and middle adult ages. Whereas some cancers play an important role at mid-old ages, IHD and cerebrovascular diseases play a major role at old ages. Smaller differences are found for women. An overwhelming influence of circulatory pathology and old-age mortality exists.

6.4 Socio-economic factors of temporal change and regional variation

This subchapter aims at identifying causal relationships between life expectancy and related socio-economic indicators on district level as well as the changes of socio-economic indicators in order to determine why a district performs better than another one over time. Therefore, correlation

coefficients and regression models were applied for the time periods 1994–97 and 1998–2001 as well as for the change factors from 1994–97 to 1998–2001. Socio-economic indicators are the percentage of blue-collar workers, unemployment rate, physicians and private cars per 1 000 inhabitants, and GDP per capita. Another indicator included is the affiliation to urban or rural districts. The four most important socio-economic indicators as described in the literature review in chapter 2.4.3 – education, occupation, personal income, employment status – are thus included. The percentage of blue-collar workers is a proxy for education, occupation is measured by unemployment rate and the percentage of blue-collar workers. Personal income was not available on district level; GDP is therefore a proximate summary measure.

Correlation analysis between life expectancy in MV districts and socio-economic indicators show high interdependences. Cross-sectional data was analysed for the time points 1994–97 and 1998–2001. Furthermore, a correlation was conducted for the factors of absolute change for all variables were included in the correlation. Only the dichotomous variable of urban and rural districts (0 = urban, 1 = rural) remained unchanged. Table 7 shows the Pearson correlation coefficients.

The simplistic tendency is that life expectancy of a certain district is higher, the more physicians practise, the fewer blue-collar workers there are, the lower the unemployment rate and the number of private cars are in a district, and the higher the GDP per capita is. Urban position strengthens higher life expectancy. Though most of the correlations are highly significant, also the socio-economic factors highly correlate among each other.

Generally, the correlation coefficient for the correlation between life expectancy and the socio-economic factors is higher for males than for females. The socio-economic factors thus seem to be a better image of the males' living conditions, for example because of their higher involvement in the labour market.

The change in life expectancy from 1994–97 to 1998–2001 exhibits only few correlations on significant level with the referring change factors of the socio-economic indicators. No significant correlations exist for women. For men, there are significant correlations for the change factors in the number of private cars and in GDP per capita. Results show that a higher increase of life expectancy (all districts and both sexes experienced increases in life expectancy from 1994–97 to 1998–2001) goes along with an increase in the number of private cars and a low increase in GDP per capita. These are the formal relationships obtained from the correlation analysis.

Table 7: Pearson correlation coefficients of life expectancy and socio-economic indicators of MV districts 1994–97 and 1998–2001 and the of the change in life expectancy and socio-economic indicators of MV districts from 1994–97 to 1998–2001

a) Correlation coefficients of life expectancy and socio-economic indicators 1994–97

	LE Males	LE Females	Physicians	Blue-collar workers	Unemploy-ment rate	Private cars	GDP	Urban/rural district
LE Males	1	0.65 ***	0.66 ***	-0.83 ***	-0.71 ***	-0.40 *	0.83 ***	-0.79 ***
LE Females	0.65 ***	1	0.76 ***	-0.73 ***	-0.55 **	-0.30	0.67 ***	-0.67 ***
Physicians	0.66 ***	0.76 ***	1	-0.89 ***	-0.47 **	-0.58 ***	0.74 ***	-0.85 ***
Blue-collar workers	-0.83 ***	-0.73 ***	-0.89 ***	1	0.57 ***	0.63 ***	-0.93 ***	0.95 ***
Unemployment rate	-0.71 ***	-0.55 **	-0.47 **	0.57 ***	1	-0.05	-0.63 ***	0.53 **
Private cars	-0.40 *	-0.30	-0.58 ***	0.63 ***	-0.05	1	-0.42 *	0.69 ***
GDP	0.83 ***	0.67 ***	0.74 ***	-0.93 ***	-0.63 ***	-0.42 *	1	-0.87 ***
Urban/rural district	-0.79 ***	-0.67 ***	-0.85 ***	0.95 ***	0.53 **	0.69 ***	-0.87 ***	1

b) Correlation coefficients of life expectancy and socio-economic indicators 1998–2001

	LE Males	LE Females	Physicians	Blue-collar workers	Unemploy-ment rate	Private cars	GDP	Urban/rural district
LE Males	1	0.74 ***	0.64 ***	-0.78 ***	-0.67 ***	-0.45 *	0.77 ***	-0.73 ***
LE Females	0.74 ***	1	0.50 **	-0.73 ***	-0.23	-0.55 **	0.78 ***	-0.73 ***
Physicians	0.64 ***	0.50 **	1	-0.91 ***	-0.20	-0.72 ***	0.72 ***	-0.83 ***
Blue-collar workers	-0.78 ***	-0.73 ***	-0.91 ***	1	0.26	0.82 ***	-0.92 ***	0.93 ***
Unemployment rate	-0.67 ***	-0.23	-0.20	0.26	1	-0.05	-0.30	0.21
Private cars	-0.45 *	-0.55 **	-0.72 ***	0.82 ***	-0.05	1	-0.75 ***	0.86 ***
GDP	0.77 ***	0.78 ***	0.72 ***	-0.92 ***	-0.30	-0.75 ***	1	-0.90 ***
Urban/rural district	-0.73 ***	-0.73 ***	-0.83 ***	0.93 ***	0.21	0.86 ***	-0.90 ***	1

c) Correlation coefficients of the absolute change in life expectancy and the change in socio-economic indicators from 1994–97 to 1998–2001

		Absolute change in							
		LE Males	LE Females	Physicians	Blue-collar workers	Unemploy-ment rate	Private cars	GDP	Urban/rural district
Absolute change in	LE Males	1	-0.20	-0.23	-0.27	-0.11	0.56 **	-0.44 *	0.29
	LE Females	-0.20	1	-0.29	0.14	0.12	0.02	0.15	0.04
	Physicians	-0.23	-0.29	1	-0.46 **	0.40 *	-0.66 ***	0.50 **	-0.70 ***
	Blue-collar workers	-0.27	0.14	-0.46 **	1	0.23	-0.15	0.21	-0.11
	Unemployment rate	-0.11	0.12	0.40 *	0.23	1	-0.60 ***	0.49 **	-0.62 ***
	Private cars	0.56 **	0.02	-0.66 ***	-0.15	-0.60 ***	1	-0.86 ***	0.88 ***
	GDP	-0.44 *	0.15	0.50 **	0.21	0.49 **	-0.86 ***	1	-0.86 ***
	Urban/rural district	0.29	0.04	-0.70 ***	-0.11	-0.62 ***	0.88 ***	-0.86 ***	1

*** Correlation is significant at 0.01 level
** Correlation is significant at 0.05 level
* Correlation is significant at 0.10 level

Source: Own calculations with data on socio-economic factors from Statistical Yearbooks Mecklenburg-Vorpommern (1995–2004) and population data from the State Office of Statistics Mecklenburg-Vorpommern

Regression models show the influence of the chosen socio-economic factors on life expectancy as dependent variable. Table 8 shows the results of the regression analysis.

The highest goodness of fit (highest R square) is found for men with percentage of blue-collar workers and unemployment rate as included independent variables (each with Model 2). R square is 0.772 in 1994–97 and 0.843 in 1998–2001. It turns out – as seen in the correlation analysis – that life expectancy is lower in those districts with a high proportion of blue-collar workers and with high unemployment rate. Both indicators are positively correlated, but only significant in 1994–97 ($p < 0.01$; see Table 7). The explanatory power of the chosen socio-economic indicators is less pronounced for women. In 1994–97, the value of R square is 0.577 with the number of physicians as explanatory variable. In 1998-2001, GDP per capita is the most influential variable on female life expectancy. R square is 0.616 in this case. In all cases, the analysis of variance shows significant results ($p < 0.01$), indicating that the regression coefficients are significantly different from zero.

Temporal change is less explained by the socio-economic variables under consideration. For males the regression model returns a R square value of 0.484. The change in number of private cars and the affiliation to an urban or rural district are the independent variables with biggest influence in this model (Model 2). Formally, this means that an higher increase in the number of private cars from 1994–97 to 1998–2001 caused a higher increase in life expectancy and that the affiliation to a rural district caused a lower increase in the respective district. It was not possible to create a regression model for women with the factors of temporal change since the significance level of the partial correlation coefficient between change of socio-economic factors and change of life expectancy was not high enough. In conclusion this means that the independent factors are not strong enough to explain the life expectancy increase from 1994–97 to 1998–2001. Same was seen for the correlation coefficients that did not show significance ($p > 0.10$) with the female life expectancy change (Table 7).

Although relationships between life expectancy in MV districts and socio-economic indicators could be figured out, the interpretation of the results has to be done with caution. This is because data is on aggregate level of MV districts. For example, the increase of number of cars is highly correlated with the affiliation to an urban district. As mentioned before, the correlation analysis of change factors revealed that faster rising life expectancy goes together with a decrease or small increase of number of physicians, a small increase of GDP and an increase of the number of private cars. The

Table 8: Linear regression models (stepwise) of life expectancy and socio-economic factors on districts of Mecklenburg-Vorpommern 1994–97, 1998–2001 and the absolute changes in socio-economic factors from 1994–97 to 1998–2001 for males and females

a) Regression models for 1994–97

	Model summary	ANOVA	Unstandardised coefficients		
	R square	Significance	B	Standard error	Significance
Dependent variable: Life expectancy 1994–97, males					
Model 1	0.691	0.000			
Constant			76.342	1.114	0.000
Blue-collar workers			-0.126	0.021	0.000
Model 2	0.772	0.000			
Constant			77.635	1.135	0.000
Blue-collar workers			-0.095	0.023	0.001
Unemployment rate			-0.159	0.069	0.035
Dependent variable: Life expectancy 1994–97, females					
Model 1	0.577	0.000			
Constant			77.448	0.221	0.000
Physicians			0.273	0.059	0.000

b) Regression models for 1998–2001

	Model summary	ANOVA	Unstandardised coefficients		
	R square	Significance	B	Standard error	Significance
Dependent variable: Life expectancy 1998–2001, males					
Model 1	0.606	0.000			
Constant			77.572	1.049	0.000
Blue-collar workers			-0.103	0.021	0.000
Model 2	0.843	0.000			
Constant			80.555	0.929	0.000
Blue-collar workers			-0.086	0.014	0.000
Unemployment rate			-0.191	0.040	0.000
Dependent variable: Life expectancy 1998–2001, females					
Model 1	0.616	0.000			
Constant			78.435	0.344	0.000
GDP			0.000	0.000	0.000

c) Regression models for the absolute changes from 1994–97 to 1998–2001

	Model summary	ANOVA	Unstandardised coefficients		
	R square	Significance	B	Standard error	Significance
Dependent variable: Change in life expectancy from 1994–97 to 1998–2001, males					
Model 1	0.315	0.015			
Constant			2.017	0.274	0.000
Change in private cars			0.016	0.006	0.015
Model 2	0.484	0.007			
Constant			1.842	0.258	0.000
Change in private cars			0.036	0.011	0.004
Urban/rural district			-1.069	0.482	0.043
Dependent variable: Change in life expectancy from 1994–97 to 1998–2001, females					
Regression not possible since selection criterion is not met					

Criterion to enter: probability of F <= 0.050; criterion to remove: probability of F >= 0.100

Source: Own calculations with data on socio-economic factors from Statistical Yearbooks Mecklenburg-Vorpommern (1995–2004) and population data from the State Office of Statistics Mecklenburg-Vorpommern

great number and increase of private cars in rural districts follows a general pattern that the need for private cars is higher in rural areas due to a lack of public transport. Private cars are also an indicator of wealth, but they are negatively correlated with GDP.

The formal causal relationships of regression models do not necessarily mean that they really explain dependencies; it is rather a hint on where life expectancy differentials could come from. If there is no dependence between the change of life expectancy and the change of socio-economic factors, the increase in life expectancy is due to a general improvement of the socio-economic situation. MV experienced such an improvement. To exemplify this, GDP rose in all districts despite growing unemployment rates in 16 of the 18 districts.

7 Discussion

7.1 Summary of findings and comparison to hypotheses and literature

7.1.1 General mortality structure of Mecklenburg-Vorpommern

After a divergence in life expectancy of MV and East Germany from the West German average, a convergence set in after 1990. This convergence is the result of a strong mortality decline. Though MV is still on the bottom, it experienced the fastest rise in life expectancy compared to East and West Germany. The hypothesis of a mortality approach from Mecklenburg-Vorpommern to the German mortality level can be agreed upon. A further specification is that women came very close to the German average; the difference in life expectancy constitutes only one year to date. Men also approached the German average and the gap is two years in life expectancy. Nevertheless, men in MV exhibit the highest growth since 1990.

Almost all age groups were involved in this development. Before Unification, there was only little progress in reducing mortality but MV caught up very much during the 1990s. Men in middle adult ages lag behind the trend of fast mortality reductions. Women, on the other hand, underwent a more stable mortality reduction when regarding the trend across age groups. The same was found by Mai (2004, pp. 60–61) who calculated the gains and differences of East to West German age-specific mortality rates. Nevertheless, the high age groups (with peak around age 70) in women and the middle-old ages (with peak around age 50) in men cause the major part of differences in life expectancy between MV and Germany. This is a result of high numbers of deaths in the high age groups.

7.1.2 Cause-specific mortality structure of Mecklenburg-Vorpommern

The analysis of cause-of-death-specific mortality revealed those causes, which pushed the mortality decline of MV. Deaths in cardiovascular and respiratory diseases, for example, underwent a substantial decline. Since this decline was faster than in the German average, this is one reason for converging mortality rates. Even though a mortality decline in MV was seen before Unification, more improvements took place thereafter. Cancer mortality increased suddenly from 1989–90 though mortality rates before Unification were even lower than the German average. Dinkel observed this fact as well and concluded that cause-specific mortality data for the GDR is not

reliable due to differing coding practices in the two German States (Dinkel, unpublished document, p. 10; Dinkel 2001, pp. 26–27). In addition, the aetiology of cancer does not permit such sudden steep increases. After 1990, cancer mortality is falling again in men and stagnating in women. Increasing smoking prevalence some decades before among women and resulting lung cancer might be an explanation for this observation. Mortality in CVD explains the difference to Germany with regard to life expectancy in very high ages, however this group underwent a substantial decrease. Cancer contributes to the explanation in old ages. Respiratory diseases no longer explain mortality differences between MV and Germany. The share of this group is lowering and the mortality level almost equals the German average.

Avoidable causes of death show diverse patterns. After a stable trend during the 1980s, the whole group of avoidable causes shows a mortality increase after Unification, followed by a decline that took place faster than the average decline in Germany. The increase is reflected in causes amenable to health policy and in ischaemic heart disease, but not in causes amenable to health care and non-avoidable causes. Mortality of causes amenable to health care is very interesting: the common sex-specific pattern observed in other diseases does not exist. This group furthermore experienced a very strong decline throughout the whole observation period. The hypothesis, saying that avoidable mortality will experience a substantial decline after Unification is only partly correct. An increase around 1990 shifted avoidable mortality first to a higher overall level. Only a few years later, Mecklenburg-Vorpommern reached the level that existed before 1990. The decrease can largely be allocated to causes of death amenable to health care. The concept of avoidable mortality was invented as a measure of public health and health care supply. When efficient health care is available, then mortality from amenable causes should decline faster than overall mortality (Simonato et al. 1998, p. 624; Charlton & Velez 1986, p. 295). This cannot be agreed upon in the case of MV. In MV, there is a considerable decline in non-avoidable causes. Simonato and others (1998, pp. 626–629) found the greatest decline for causes amenable to treatment and better medical care. These causes are comparable to the group of causes amenable to health care chosen in this study. With regard to this group, MV does experience a mortality decline faster than overall mortality. During the 1990s, it was even faster than the German average decline. In fact, avoidable mortality turns out to be sensitive against the societal change introduced by Unification.

Critically commented has to be upon the age limit regardless of sex. Ischaemic heart diseases are for example a very common cause of death especially among very old women. Since the age limit includes only those deaths up to age 74, IHD mortality is therefore underestimated compared to men. The decline in IHD mortality is possibly the simple result of a postponement of deaths to higher age groups. The same effect potentially amounts for a certain proportion of the mortality decline in the other avoidable causes. The current selection of causes with fixed age limit is considered a compromise between medical state of affairs, data processing, and comparability. Lists with avoidable causes of death must therefore be subject to steady enhancements.

External and alcohol-related causes of death in MV underwent major changes throughout the whole period from the 1980s until 2002. External causes exhibit a higher level in Mecklenburg-Vorpommern than in Germany. The increase in external mortality in men right after Unification is almost fully explained by traffic accident mortality. The pattern is less clear for women. The hypothesis of excess traffic accident mortality is thus agreed upon, though this fact is more pronounced in men.

Dinkel presumed that the number of traffic accidents would continue to fall in the GDR just as West Germany experienced such a decrease in traffic accident mortality in the 1950s and 1960s. He presumed that the GDR would undergo this trend faster (Dinkel, unpublished document, p. 6). For Mecklenburg-Vorpommern, this assumption can be agreed upon since transport accident mortality has continuously decreased since 1991.

Suicide mortality in MV decreased since the beginning of the 1980s without any breaks. At present, suicide mortality in MV equals the German average. Suicide is thus either no indicator for the psychosocial stress during GDR or psychosocial stress was not as pronounced that it had any effect on mortality. The hypothesis of strongly declining suicide mortality after Unification has to be refuted.

The situation in MV with respect to alcohol-related mortality is less favourable. Whereas mortality was equal to the German average during the 1980s, it reached a peak in the years around 1992. Getting back to Baker and Rooney who emphasised that alcohol-related mortality reflects the consumption pattern of the preceding years, it can be assumed that the alcohol consumption increased around Unification (Baker & Rooney 2003, p. 8). This is the time were the most dramatic societal changes took place. Alcohol itself became much cheaper relative to other consumer goods

by then. Though alcohol-related mortality is declining since the mid-1990s, it is still considerably higher than the German average.

Nolte and others found for the GDR and Poland that the mortality rise after the political transition was largely attributable to road traffic accidents, digestive and circulatory diseases. The new mobility situation with faster cars, no speed limit, seat belt use and other factors (Nolte et al. 2000b, p. 904) explains raised traffic accident mortality. The same conclusion can be drawn for MV from the present study. Nevertheless, the higher traffic accident fatality in MV because of avenues lined with trees has to be taken into account. Dinkel mentions this fact as a cause for high traffic accident mortality in Mecklenburg-Vorpommern (Dinkel 2001, p. 29). External and alcohol-related causes of death constitute a big share of the life expectancy difference between MV and Germany (impact increased from 1993–97 onwards and explained approximately 60% in men and around 40% in women of the life expectancy difference in 1998–2002). External causes have the highest impact in young adult ages and for alcohol-related mortality the highest impact is in middle adult ages. (As mentioned before, circulatory diseases account for most of the life expectancy differences in the upper age groups.)

Other causes of death have only little impact on the life expectancy difference between MV and Germany.

7.1.3 Mortality structure across districts of Mecklenburg-Vorpommern

The analysis of mortality across the districts of Mecklenburg-Vorpommern showed that urban districts are favoured and that rural districts lag behind. For instance, the cities of Greifswald, Rostock, Schwerin and Neubrandenburg constantly lie above the average. Greater mortality differentials exist for men. Müller and Kück and the Ministry of Social Affairs MV found the same result in their studies conducted for the years 1991–95, respectively 1985–1996 (Müller & Kück 1998, pp. 20–25; Sozialministerium MV 1997, pp. 18–19). Largest mortality improvements were observed from 1992–96 to 1997–01 for both sexes in the present study.

Life expectancy varied across districts more significantly for men than for women. At the same time, men kept their mortality position mostly throughout the considered period whereas women underwent more changes. Inequality in life expectancy increased from 1982–86 to 1987–91 in women and from 1982–86 to 1992–96 in men. Afterwards, inequality decreased. The catch-up

effect from rural districts contributed to the falling inequality. Although there is a remarkable urban-rural mortality divide, the hypothesis with respect to increasing inequality as a consequence of this divide cannot be accepted. This must be related to greater mortality improvements in rural districts.

Mortality by causes of death across MV districts in the mid-1990s exhibits clear structures in men; in women, the pattern was less clear. All-cause mortality showed significant variation across districts, as well as many other causes – except several kinds of cancer – in men. Only few causes showed significant variation in women. Women's SMR by causes of death had values above and below the average level of 100, without a clear direction. In general, females' deviations from the average MV level were low. Men, on the other hand, had low SMR in cities and Bad Doberan, the rural district surrounding Rostock. This was the case for example for neoplasms (all neoplasms combined), respiratory, alcohol-related and external mortality. The study by the Ministry of Social Affairs MV pointed at the particularly low life expectancy for men in 1991–95 in the rural districts of Mecklenburg-Strelitz, Demmin, and Uecker-Randow and linked it to high external and alcohol-related mortality (Sozialministerium MV 1997, p. 18), other causes of death on district level were not mentioned. The present study can confirm this result of excess mortality only for alcohol-related mortality, but not totally for external mortality in 1994–97.

Several causes of death determined the discrepancy between urban and rural districts. Ischaemic heart disease and cerebrovascular disorders made up a big share of the difference, especially in women. External causes of death constituted the urban-rural difference in young adult ages. Alcohol-related causes explained much of the difference in middle adult ages in men. The study thus finds support to the hypothesis of higher external and alcohol-related mortality in rural districts. Detecting reasons is not possible by pure cause of death data analysis.

The ecological analysis of impact factors on life expectancy in MV districts revealed that a high number of physicians and high GDP in districts fortify high life expectancy. A low proportion of blue-collar workers, low unemployment rate and low number of private cars also go together with higher life expectancy. Negative correlation between life expectancy and cars across districts is an indirect effect of the urban-rural life expectancy divide since countryside people need cars more than their urban counterparts. For men, the most important factors that determined life expectancy in 1994–97 and 1998–2001 were the proportion of blue-collar workers and the unemployment rate. For women, the socio-economic indicators were not consistent over time. A higher life expectancy

increase of men from 1994–97 to 1998–2001 was determined by a higher increase in number of private cars. The conclusion is that rural districts, being more dependent on cars, experienced a faster life expectancy increase than the cities of MV. As far as the socio-economic indicators are comparable, von Gaudecker (2004) came to the same conclusion for the federal state of Baden-Württemberg. He pointed for example at income and high education, which both are factors for high life expectancy.

Socio-economic indicators in the present study were chosen with care; nevertheless, there were availability constraints so that for example personal income was not available. Those indicators returned by the regression models as the most influential ones had the highest statistical impact on life expectancy; however, one has to wonder if these are the ones that are the real driving force behind the improvements. High intercorrelations among almost all socio-economic factors have been observed. The interesting question on the change factors explaining changes in life expectancy over time could not be sufficiently solved. For women, the regression model could not even be built due to insignificant correlations. The given socio-economic indicators are thus not appropriate and point to a general improvement, which enforced a life expectancy increase. The change in the number of private cars and affiliation to either urban or rural district turned out to be the determining factors for the males' life expectancy increase from 1994–97 to 1998–2001 in MV districts. Private cars are an indicator of wealth, but implicate some problems. First, saturation level seems higher in rural districts, second, the quality of cars is not measured. Exchange of old and new cars could take place in cities and purchase of additional cars in rural districts could result in the observed higher increase in number of cars in rural districts. This indicator does not correctly assess wealth in this case.

7.2 Expectations for the future

Mecklenburg-Vorpommern faces many chances for its future development. Tourism, unpolluted environment, cheap land and workers are among them. When these opportunities to gain in the economic development will be taken, this could be reflected in higher life expectancy.

Current trends suggest, however, that Mecklenburg-Vorpommern will not reach the German average level in the medium term. Reason for that is the rural structure of the state with its implications. Economy is weak to date. Nevertheless, MV experienced a steep economic

improvement in absolute terms since 1989. To exemplify, telephone extensions and cars that were not self-evident in GDR, belong to almost every household now. After Unification, subventions came from the Federation and the European Union. These subventions will decrease and the new members of the European Union in Eastern Europe will benefit from them. Another disadvantage of MV is that rural populations usually face shortages in infrastructure and high emigration to the West German Länder, especially among young people. With regard to mortality, the shortages in health care are the small number of medical specialists and the long distances to hospital, which is notably relevant in the occurrence of myocardial infarctions and traffic accidents. The health care system in the GDR was not bad, though it lagged behind in medical technology. To date, the public health system faces altered conditions. Medical technology is on high standards all over Germany. Health problems that arose after Unification are alcohol-related diseases, stress, external causes of death and the prevention and treatment of circulatory diseases. In the special case of MV, there is also a lack of country doctors due to retiring physicians and the shortage of young people to replace them.

Circulatory diseases depend on prevention as well as on fast emergency admission to hospital. Since the latter fact is not given in MV, CVD mortality will probably not fall down to the German average level. The adjustment of the rural infrastructure towards faster emergency admissions to hospital on the countryside is not realistic because rural areas are likely to loose even more population to the centres. Respiratory mortality might remain on the German average level due to low environmental pollution. Cancer mortality should follow the German trend of falling death rates. This disease group is still far from the German average. Assuming that hospitals in MV have similar medical equipment as in the rest of Germany, reasons for differentials must be behaviour-based.

External mortality will remain high in MV. Traffic accidents will continue to determine external mortality. Since the fatality of car accidents is almost twofold the German average (Dinkel 2001, p. 29), this leads to the conclusion that traffic accident mortality will remain high unless action is taken. A reduction of alcohol-related mortality is theoretically possible by effective prevention programmes. Alcoholism and its relationship to political and societal changes introduced by the opening of the Berlin Wall in 1989 are often subject to discussion. This is also the relationship between alcoholism and unemployment. People are thought to start drinking because they lost their job and want to escape from reality. Because of alcohol problems, they reduce the possibility of

getting a new job. Policy guidelines such as education on alcohol abuse are in demand to fight this vicious circle. Strengthened traffic checks with field sobriety test, reducing the legal alcohol limit and reductions of speed limit at dangerous spots can decrease the number of fatal accidents. Raised taxes on alcohol as in Scandinavian countries could possibly decrease alcohol consumption in the long term. However, in Germany these kinds of changes can only be done at federal level and are not very likely.

Avoidable mortality is likely to reduce further since the health care system steadily develops. However, the group of causes amenable to health policy will remain on a fairly higher level than the German average (for reasons of composition of this group with traffic accident mortality and liver cirrhosis).

With respect to the urban-rural mortality divide, the trend is difficult to assess. As mentioned before, subventions from the European Union that supported particularly disadvantaged rural areas will substantially decrease. Will the rural districts use its potentials of tourism, cheap land, workers and great nature, then the convergence to the cities will probably continue.

Further growing life expectancy in Mecklenburg-Vorpommern is very likely. If MV will equal the German average level depends on its socio-economic development and can only be reached in the long term.

8 Summary

Objective of this study was to give an impression of the standing of Mecklenburg-Vorpommern within the German context in respect of life expectancy and cause-specific mortality from the early 1980s until now. Länder level as well as district level of MV was focused on. Inequality and socio-economic factors were addressed, too.

Cause of death-specific mortality data and population data at Länder level covers the years 1980–2002. The period from 1982–2001 was observed at MV district level, cause-specific analysis was performed for the period from 1994–97. Demographic and statistical methods such as standardised death rates (SDR), standardised mortality ratios (SMR), decomposition of life expectancy, average inter-district difference of life expectancy, regression analysis and other methods were applied.

Mecklenburg-Vorpommern is the winner when regarding the absolute life expectancy gain in years in the observed period. Women underwent a more favourable trend then men in general. Especially favourable trends are observed for respiratory diseases, suicide mortality, and mortality amenable to health care. Circulatory diseases made the largest contribution to the life expectancy increase. Remaining excess mortality can be allocated to many causes of death, but some are particularly worth mentioning: female cancer mortality, external and alcohol-related causes, and the group of causes amenable to health policy. Increased mortality in CVD, external and alcohol-related causes explain much of the life expectancy difference between MV and Germany.

MV exhibits a strong urban-rural mortality divide with urban population having much higher life expectancy than the rural population. Apart from circulatory diseases, external and alcohol-related causes account for a big proportion of the urban-rural difference, just as it is the case for the difference between MV and the German average life expectancy. Life expectancy inequality across districts is higher for men than for women and decreases currently. The rural districts experienced much mortality improvement in the second half of the 1990s and approached the mortality level of urban districts in MV. Socio-economic indicators show significant relationships with life expectancy. Lower proportions of blue-collar workers and low unemployment rate in a certain district are mostly associated with high life expectancy in men. For women, this is a high number of physicians and a high GDP per capita.

Action has to be taken to fight the large amount of excess mortality of MV in external and alcohol-related causes in young and middle adult ages. The problem of health behaviours should be addressed by adequate health policies. Further analyses should be devoted to the relationship between mortality and socio-economic factors on individual level.

Annex

Table A 1: ICD codes of causes of death within Mecklenburg-Vorpommern as provided by the State Office of Statistics Mecklenburg-Vorpommern

	Cause of death	ICD 9 code
0	All causes	000-E999
1	Infectious and parasitic diseases	001-139
2	Neoplasms	140-239
3	Circulatory diseases	280-289
4	Respiratory diseases	460-519
5	Digestive diseases	520-529
6	External causes of death	E800-E999
7	Other diseases	other than 1-6
9	Tuberculosis	010-018
10	Cancer of lips, oral cavity and pharynx	140-149
11	Cancer of stomach	151
12	Cancer of intestine and rectum	152-154
13	Cancer of male genital organs	175, 185-187
14	Cancer of female genital organs	174, 179-184
15	Cancer of trachea, bronchus and lung	160-165
16	Cancer of breast	174, 175
17	Diabetes mellitus	250
18	Hypertonic disease	401-405
19	Ischaemic heart disease	410-414
20	Myocardial infarction	410, 411
21	Cerebrovascular disorders	430-438
22	Acute respiratory diseases	460-466
24	Liver cirrhosis	571
25	Motor vehicle accidents	E810-E819
26	Poisoning by alcohol	E860
27	Chronic alcohol disease and alcohol dependence syndrome	291, 303
28	Suicide	E950-E959
29	Homicides	E960-E969
30	Accidental drowning	E910

Source: State Office of Statistics Mecklenburg-Vorpommern

Table A 2: Selection of causes of death and referring ICD 9 and ICD 10 codes

ICD 10 chapter	Cause of death	ICD 10 code	ICD 9 code
I	Infectious and parasitic diseases	A00-B99	001-139
II	Neoplasms	C00-D48	140-239
	Malignant neoplasms	C00-C97	140-208
	Malignant neoplasms of lip, oral cavity and pharynx	C00-C14	140-149
	Malignant neoplasms of oesophagus	C15	150
	Malignant neoplasms of stomach	C16	151
	Malignant neoplasms of colon	C18	153
	Malignant neoplasms of rectum and anus	C19-C21	154
	Malignant neoplasms of pancreas	C25	157
	Malignant neoplasms of larynx and trachea/bronchus/lung	C32-C34	161-162
	Malignant neoplasms of breast	C50	174-175
	Malignant neoplasms of cervix uteri	C53	180
	Malignant neoplasms of other parts of uterus	C54-C55	179, 182
	Malignant neoplasms of ovary	C56	183
	Malignant neoplasms of prostate	C61	185
	Malignant neoplasms of kidney	C64	189
	Malignant neoplasms of bladder	C67	188
	Malignant neoplasms of lymph./haematopoietic tissue	C81-C96	200-208
	Other Neoplasms	Rest (C00-D48)	Rest (140-239)
IV	Endocrine, nutritional and metabolic diseases	E00-E90	240-278
	Diabetes mellitus	E10-E14	250
V	Mental and behavioural disorders	F00-F99	290-319
	Alcohol abuse (including alcoholic psychosis)	F10	291, 303
	Other Mental and behavioural disorders	Rest (F00-F99)	Rest (290-319)
VI	Diseases of the nervous system and the sense organs	G00-H95	320-389
IX	Diseases of the circulatory system	I00-I99	390-459
	Ischaemic heart diseases	I20-I25	410-414
	Acute myocardial infarction	I21-I22	410, 411
	Other Ischaemic heart diseases	Rest (I20-I25)	Rest (410-414)
	Other Heart diseases	I30-I33, I39-I52	420-423, 425-429
	Cerebrovascular diseases	I60-I69	430-438
	Other Diseases of the circulatory system	Rest (I00-I99)	Rest (390-459)
X	Diseases of the respiratory system	J00-J99	460-519
	Pneumonia	J12-J18	480-486
	Chronic lower respiratory diseases	J40-J47	490-494, 496
	Other Diseases of the respiratory system	Rest (J00-J99)	Rest (460-519)
XI	Diseases of the digestive system	K00-K93	520-579
	Chronic liver disease	K70, K73-K74	571.0-571.9
	Other Diseases of the digestive system	Rest (K00-K93)	Rest (520-579)
XIV	Diseases of the genitourinary system	N00-N99	580-629
XVIII	Symptoms, signs, abnormal findings, ill-defined causes	R00-R99	780-799
XX	External causes of injury and poisoning	V01-Y89	E800-E999
	Accidents	V01-X59	E800-E929
	Transport accidents	V01-V99, Y85.0-Y85.9	E800-E848, E929.0-E929.1
	Accidental poisoning by alcohol	X45	E860
	Other Accidents	Rest (V01-X59)	Rest (E800-E999)
	Suicide and intentional self-harm	X60-X84	E950-E959)
	Homicide, assault	X85-Y09	E960-E969
	Other External causes of injury and poisoning	Rest (V01-Y89)	Rest (E800-E999)
XXI	Other diseases or external causes of death	Rest (A00-Y99)	Rest (001-E999)

Source: European shortlist on causes of death (European Commission 2002, pp. 116–117)

Table A 3: SDR by causes of death per 100 000 in Mecklenburg-Vorpommern, East and West Germany in 1985–89, 1992–96 and 1998–2002 for males and females

a) 1985–89

ICD 10 chapter	Cause of death	Males MV	Males East	Males West	Males GER	Females MV	Females East	Females West	Females GER
I–XX	All causes	1477.1	1359.7	1110.8	1158.3	890.9	871.2	654.9	697.5
II	Neoplasms	272.3	249.5	286.5	279.5	157.0	153.3	173.0	169.3
	Malignant neoplasms	234.0	209.8	232.8	228.5	122.9	119.8	132.1	129.8
	Malignant neoplasms of stomach	29.4	27.4	25.1	25.5	14.2	13.5	13.2	13.3
	Malignant neoplasms of colon	12.8	13.2	22.8	21.0	11.1	11.8	18.3	17.1
	Malignant neoplasms of pancreas	11.1	10.2	12.6	12.2	6.6	6.4	8.3	8.0
	Malignant neoplasms of larynx and trachea/bronchus/lung	87.1	77.1	77.3	77.2	9.8	8.8	11.2	10.7
	Malignant neoplasms of breast	na	na	na	na	24.7	24.4	32.8	31.1
	Malignant neoplasms of ovary	na	na	na	na	10.6	11.2	11.3	11.3
	Malignant neoplasms of prostate	19.6	17.6	29.0	26.8	na	na	na	na
	Malignant neoplasms of lymph./haematopoietic tissue	18.8	15.9	18.1	17.7	10.8	10.1	11.1	10.9
IV	Endocrine, nutritional and metabolic diseases	33.9	29.9	15.1	17.8	36.5	33.2	15.2	18.8
	Diabetes mellitus	28.3	26.2	12.6	15.1	30.9	28.9	12.8	16.0
V	Mental and behavioural disorders	28.2	15.7	11.6	12.4	10.0	7.2	4.8	5.3
VI	Diseases of the nervous system and the sense organs	13.2	11.2	16.3	15.4	9.3	8.7	11.2	10.8
IX	Diseases of the circulatory system	756.3	721.5	513.4	552.7	506.4	506.7	315.9	352.9
	Ischaemic heart diseases	219.5	227.7	238.4	236.4	106.8	112.9	107.4	108.4
	Acute myocardial infarction	80.5	87.6	154.4	141.9	29.0	29.8	58.6	53.0
	Cerebrovascular diseases	106.8	105.8	110.0	109.2	80.5	87.2	86.7	86.8
X	Diseases of the respiratory system	120.3	103.4	81.8	85.9	44.8	38.3	30.6	32.2
	Pneumonia	28.3	25.0	22.6	23.1	16.5	15.2	12.7	13.3
	Chronic lower respiratory diseases	76.2	62.1	51.1	53.1	16.4	14.3	13.9	14.0
XI	Diseases of the digestive system	69.3	64.7	55.8	57.6	38.6	35.5	29.9	31.0
	Chronic liver disease	27.3	26.6	30.3	29.6	9.3	9.4	12.0	11.5
XIV	Diseases of the genitourinary system	26.8	24.9	13.1	15.3	13.3	12.5	7.9	8.8
XVIII	Symptoms, signs, abnormal findings, ill-defined causes	15.4	13.3	30.0	26.6	10.2	9.1	19.5	17.4
XX	External causes of injury and poisoning	113.3	98.6	65.3	71.9	40.5	44.2	29.9	32.8
	Accidents	61.1	51.4	36.9	39.8	23.8	25.3	18.2	19.6
	Transport accidents	24.7	20.5	18.8	19.1	7.9	6.7	6.6	6.6
	Suicide and intentional self-harm	43.2	40.6	24.7	27.8	12.7	15.3	9.6	10.7

na not applicable

Table A 3 continued

b) 1992–96

ICD 10 chapter	Cause of death	Males				Females			
		MV	East	West	GER	MV	East	West	GER
I–XX	All causes	1315.4	1206.0	991.2	1029.7	723.7	690.2	590.3	608.9
II	Neoplasms	301.5	279.3	271.0	272.7	167.7	161.3	163.5	163.2
	Malignant neoplasms	252.8	234.0	221.5	223.9	128.7	125.6	128.5	128.0
	Malignant neoplasms of stomach	26.2	25.2	19.1	20.1	12.9	12.8	10.1	10.6
	Malignant neoplasms of colon	19.5	18.9	22.9	22.2	14.7	14.4	17.2	16.7
	Malignant neoplasms of pancreas	11.8	12.2	12.5	12.5	7.7	8.0	8.5	8.4
	Malignant neoplasms of larynx and trachea/bronchus/lung	90.5	80.1	71.6	73.1	13.8	10.9	14.0	13.4
	Malignant neoplasms of breast	na	na	na	na	26.8	26.8	32.9	31.7
	Malignant neoplasms of ovary	na	na	na	na	10.5	10.5	10.4	10.4
	Malignant neoplasms of prostate	25.8	25.6	30.2	29.5	na	na	na	na
	Malignant neoplasms of lymph./haematopoietic tissue	17.8	17.0	18.3	18.1	11.5	10.9	11.7	11.5
IV	Endocrine, nutritional and metabolic diseases	27.9	26.4	20.8	21.8	30.3	27.1	19.1	20.6
	Diabetes mellitus	25.7	24.4	17.9	19.0	27.6	24.9	16.5	18.1
V	Mental and behavioural disorders	44.3	20.7	15.9	16.8	10.9	5.8	6.3	6.2
VI	Diseases of the nervous system and the sense organs	17.5	12.2	20.5	19.1	10.2	7.9	13.7	12.6
IX	Diseases of the circulatory system	579.1	575.8	432.8	457.3	359.3	362.3	270.2	287.0
	Ischaemic heart diseases	325.1	308.8	201.3	219.8	170.7	162.4	97.0	108.9
	Acute myocardial infarction	158.4	163.8	114.7	123.4	61.1	61.1	46.2	49.0
	Cerebrovascular diseases	133.0	130.2	86.3	93.7	104.8	102.1	67.7	73.9
X	Diseases of the respiratory system	86.1	76.0	72.4	73.0	29.3	26.5	29.4	28.9
	Pneumonia	15.6	17.9	19.5	19.2	8.4	9.4	11.0	10.7
	Chronic lower respiratory diseases	62.3	48.5	45.4	46.0	15.4	12.5	14.5	14.2
XI	Diseases of the digestive system	96.0	78.7	48.0	53.8	42.9	35.7	27.3	29.0
	Chronic liver disease	61.6	50.5	26.3	31.0	19.1	17.0	11.5	12.6
XIV	Diseases of the genitourinary system	13.4	11.7	10.4	10.7	7.4	6.7	6.6	6.6
XVIII	Symptoms, signs, abnormal findings, ill-defined causes	15.2	17.9	28.1	26.3	6.3	9.8	17.5	16.1
XX	External causes of injury and poisoning	115.9	92.2	55.6	62.4	42.1	34.6	23.5	25.6
	Accidents	75.1	55.9	31.3	35.9	31.6	23.1	14.6	16.2
	Transport accidents	38.3	29.3	15.5	18.2	12.2	9.1	5.3	6.0
	Suicide and intentional self-harm	28.0	28.2	20.2	21.6	6.6	8.5	6.9	7.2

na not applicable

Table A 3 continued

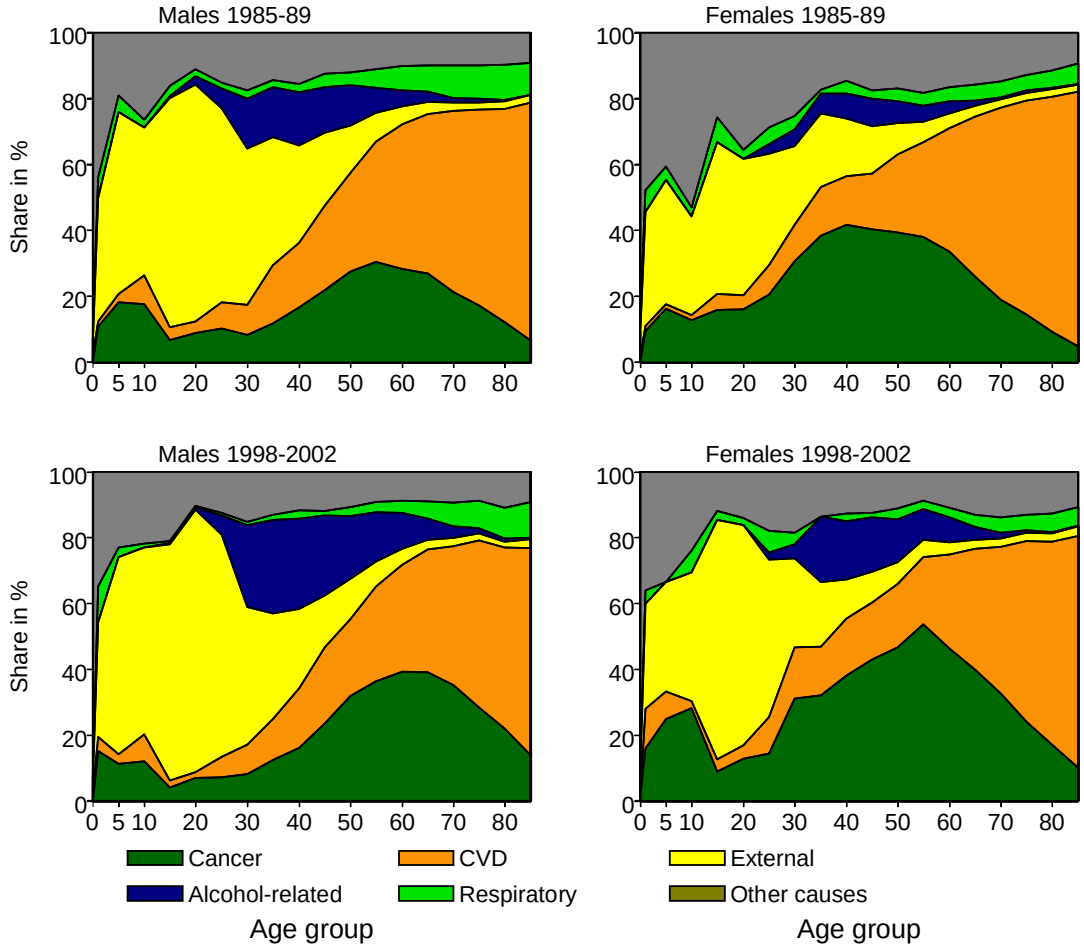
b) 1998–2002

ICD 10 chapter	Cause of death	Males MV	Males East	Males West	Males GER	Females MV	Females East	Females West	Females GER
I–XX	All causes	1036.9	960.1	855.6	876.9	577.3	559.1	527.4	534.2
II	Neoplasms	278.1	212.8	251.2	243.6	149.1	117.5	156.6	148.2
	Malignant neoplasms	227.8	175.5	200.4	195.4	114.4	91.0	123.2	116.2
	Malignant neoplasms of stomach	22.2	16.2	14.6	14.9	9.9	7.9	8.1	8.0
	Malignant neoplasms of colon	19.4	15.9	21.0	20.0	12.6	10.5	15.0	14.0
	Malignant neoplasms of pancreas	13.2	10.7	13.0	12.5	9.3	7.2	9.1	8.7
	Malignant neoplasms of larynx and trachea/bronchus/lung	82.7	58.9	66.0	64.5	14.5	9.5	17.6	15.8
	Malignant neoplasms of breast	na	na	na	na	23.6	19.0	30.7	28.1
	Malignant neoplasms of ovary	na	na	na	na	8.7	7.3	9.4	9.0
	Malignant neoplasms of prostate	23.5	19.7	26.6	25.3	na	na	na	na
	Malignant neoplasms of lymph./haematopoietic tissue	18.6	15.0	18.5	17.8	11.3	9.3	12.1	11.5
IV	Endocrine, nutritional and metabolic diseases	24.4	19.0	19.9	19.7	21.2	17.1	17.2	17.2
	Diabetes mellitus	21.4	17.3	17.4	17.4	18.8	15.4	14.9	15.0
V	Mental and behavioural disorders	24.2	10.2	13.4	12.8	4.5	2.4	4.9	4.4
VI	Diseases of the nervous system and the sense organs	16.8	12.0	18.3	17.1	9.3	7.4	12.2	11.2
IX	Diseases of the circulatory system	436.0	358.1	373.6	370.4	282.6	227.9	247.3	243.2
	Ischaemic heart diseases	243.8	196.3	175.2	179.1	135.9	105.9	91.1	94.2
	Acute myocardial infarction	102.1	95.5	88.8	90.2	43.6	38..5	38.3	38.4
	Cerebrovascular diseases	84.3	77.5	66.4	68.4	67.1	60.7	52.3	54.1
X	Diseases of the respiratory system	68.2	45.7	63.4	60.0	25.8	16.8	29.4	26.7
	Pneumonia	25.6	15.0	19.0	18.3	12.4	7.7	11.1	10.4
	Chronic lower respiratory diseases	37.7	25.9	35.4	33.5	11.2	7.4	13.7	12.3
XI	Diseases of the digestive system	74.5	51.8	44.6	46.3	32.1	23.2	27.0	26.2
	Chronic liver disease	47.9	32.8	23.2	25.3	15.1	10.7	10.2	10.4
XIV	Diseases of the genitourinary system	10.5	7.7	11.5	10.8	7.0	4.7	7.6	7.0
XVIII	Symptoms, signs, abnormal findings, ill-defined causes	10.5	10.7	28.4	24.9	4.4	4.8	17.6	14.9
XX	External causes of injury and poisoning	76.1	54.4	49.9	50.9	27.0	19.5	20.2	20.1
	Accidents	45.1	31.0	26.0	27.1	18.5	12.6	11.4	11.7
	Transport accidents	25.3	15.6	12.9	13.6	8.8	5.2	4.5	4.7
	Suicide and intentional self-harm	17.5	18.4	18.9	18.8	4.7	4.7	6.0	5.7

na not applicable

Source: Own calculations with data from the Human Mortality Database (www.mortality.org 2005) and State Offices of Statistics Germany; selection of causes based on "European shortlist on causes of death" (European Commission 2002, pp. 116–117)

Figure A 1: Distribution of causes of death across age groups in Mecklenburg-Vorpommern in 1985–89 and 1998–2002 for males and females



Source: Own calculations with data from State Office of Statistics Mecklenburg-Vorpommern

Table A 4: Classification of avoidable deaths with age limit and referring ICD 9 and ICD 10 codes

	Cause of death	Age group	ICD 9 code	ICD 10 code
Causes amenable to health care				
1	Intestinal infections	0-14	001-009	A00-A09
2	Tuberculosis	0-74	010-018, 137	A15-A19, B90
3	Other infectious diseases (Diphtheria, Tetanus, Poliomyelitis)	0-74	032, 037, 045	A36, A35, A80
4	Whooping cough	0-14	33	A37
5	Sepicaemia	0-74	38	A40, A41
6	Measles	1-14	55	B05
7	Malignant neoplasm of colon and rectum	0-74	153, 154	C18-C21
8	Malignant neoplasm of skin	0-74	173	C44
9	Malignant neoplasm of breast	0-74	174	C50
10	Malignant neoplasm of cervix uteri	0-74	180	C53
11	Malignant neoplasm of cervix uteri and body of the uterus	0-44	179, 182	C54, C55
12	Malignant neoplasm of the testis	0-74	186	C62
13	Hodgkin's disease	0-74	201	C81
14	Leukaemia	0-44	204-208	C91-C95
15	Diseases of the thyroid	0-74	240-246	E00-E07
16	Diabetes mellitus	0-49	250	E10-E14
17	Epilepsy	0-74	345	G40, G41
18	Chronic rheumatic heart disease	0-74	393-398	I05-I09
19	Hypertensive disease	0-74	401-405	I10-I13, I15
20	Ischaemic heart disease	0-74	410-414	I20-I25
21	Cerebrovascular disease	0-74	430-438	I60-I69
22	All respiratory diseases (excluding influenza and pneumonia)	1-14	460-479, 488-519	J00-J09, J20-J99
23	Influenza	0-74	487	J10-J11
24	Pneumonia	0-74	480-486	J12-J18
25	Peptic ulcer	0-74	531-533	K25-K27
26	Appendicitis	0-74	540-543	K35-K27
27	Abdominal hernia	0-74	550-553	K40-K46
28	Cholelithiasis and cholecystitis	0-74	574-575.1	K80-K81
29	Nephritis and nephrosis	0-74	580-589	N00-N07, N17-N19, N25-N27
30	Benign prostatic hyperplasia	0-74	600	N40
31	Maternal deaths	All	630-676	O00-O99
32	Congenital cardiovascular anomalies	0-74	745-747	Q20-Q28
33	Perinatal deaths, all causes excluding stillbirths	All	760-779	P00-P96, A33, A34
34	Misadventures to patients during surgical and medical care	All	E870-E876, E878-E879	Y60-Y69, Y83-Y84
Causes responsive to health policy				
35	Malignant neoplasm of trachea, bronchus, and lung	0-74	162	C33, C34
36	Cirrhosis of liver	0-74	571	K70, K73-K74
37	Motor vehicle accidents	All	E810-E825	V02-V04, V09, V12-V14, V19-V78, V80-V87, V89

Source: Nolte and McKee 2004, p. 66 (causes of death considered amenable to health care) and Nolte et al. 2002, p.1907 (causes responsive to health policy)

Table A 5: Significant differences from life expectancy in districts of Mecklenburg-Vorpommern to the average of Mecklenburg-Vorpommern in 1982–86, 1987–91, 1992–96 and 1997–2001

	Males				Females			
	1982–86	1987–91	1992–96	1997–2001	1982–86	1987–91	1992–96	1997–2001
Greifswald	–	–	*	**	–	–	*	–
Neubrandenburg	*	**	**	**	–	–	*	**
Rostock	**	**	**	**	–	**	–	**
Schwerin	**	**	**	**	–	**	*	–
Stralsund	–	–	–	–	–	–	–	**
Wismar	–	–	–	–	–	–	–	–
Bad Doberan	–	–	–	**	–	–	–	–
Demmin	*	**	**	**	–	*	*	–
Güstrow	–	*	*	–	–	–	–	–
Ludwigslust	–	–	–	–	–	–	–	–
Mecklenburg-Strelitz	–	**	**	–	–	–	–	–
Müritz	–	**	*	–	–	–	–	–
Nordvorpommern	**	**	*	–	–	**	–	–
Nordwestmecklenburg	–	–	–	–	–	–	–	–
Ostvorpommern	–	*	–	–	–	**	–	–
Parchim	–	–	–	*	–	–	–	–
Rügen	–	–	–	–	–	–	–	–
Uecker-Randow	–	**	**	–	–	–	–	–

– not significant
* significant at 0.05 level
** significant at 0.01 level

Source: Own calculations with data from State Office of Statistics Mecklenburg-Vorpommern

Table A 6: SMR and 95% confidence intervals by causes of death in districts of Mecklenburg-Vorpommern in 1994–97 for males and females

Males	Greifswald	Rostock	Stralsund	Wismar	Neubrandenburg	Schwerin
All causes	94.46	84.92	95.08	96.42	85.61	85.62
	(91.12; 97.81)	(83.33; 86.50)	(92.12; 98.04)	(93.18; 99.66)	(82.67; 88.55)	(83.35; 87.99)
Neoplasms	104.39	87.10	108.45	101.19	86.78	92.14
	(100.08; 108.70)	(85.21; 88.99)	(104.72; 112.18)	(97.33; 105.06)	(83.44; 90.13)	(89.34; 94.94)
Cancer of stomach	87.84	106.19	87.33	113.40	83.79	112.15
	(83.39; 92.28)	(103.91; 108.48)	(83.33; 91.34)	(108.77; 118.02)	(79.93; 87.65)	(108.74; 115.57)
Cancer of intestine and rectum	106.80	88.32	141.40	104.87	122.97	88.49
	(101.60; 112.01)	(86.26; 90.38)	(136.49; 146.32)	(100.83; 108.91)	(118.89; 127.06)	(85.95; 91.02)
Cancer of male genital organs	114.28	100.91	117.39	135.29	77.08	108.17
	(108.63; 119.93)	(98.17; 103.65)	(112.33; 122.45)	(129.22; 141.37)	(73.31; 80.85)	(104.14; 112.20)
Cancer of trachea, bronchus and lung	92.83	79.06	90.58	90.46	79.33	89.68
	(89.15; 96.51)	(77.41; 80.70)	(87.42; 93.75)	(87.05; 93.87)	(76.20; 82.47)	(87.04; 92.33)
Respiratory diseases	85.12	84.35	95.82	98.23	68.08	92.00
	(80.57; 89.68)	(81.93; 86.76)	(91.20; 100.44)	(93.32; 103.13)	(64.05; 72.12)	(88.64; 95.36)
Diabetes mellitus	62.26	102.84	88.96	99.61	71.14	96.29
	(57.11; 67.41)	(100.24; 105.43)	(84.39; 93.54)	(95.16; 104.06)	(68.06; 74.22)	(92.65; 99.93)
Ischaemic heart disease	99.31	85.74	78.75	105.20	93.02	73.54
	(94.75; 103.87)	(83.58; 87.90)	(75.20; 82.30)	(100.74; 109.65)	(88.82; 97.21)	(70.72; 76.36)
Myocardial infarction	107.87	73.74	89.45	87.00	92.96	69.56
	(103.34; 112.40)	(71.84; 75.64)	(85.89; 93.02)	(83.10; 90.90)	(89.01; 96.91)	(67.03; 72.09)
Cerebrovascular disorders	74.03	83.72	78.33	56.37	66.86	77.61
	(69.55; 78.50)	(81.26; 86.18)	(74.15; 82.51)	(52.67; 60.06)	(62.96; 70.76)	(74.20; 81.01)
Alcohol-related diseases	77.65	81.45	103.81	90.04	79.05	92.32
	(75.30; 80.01)	(80.29; 82.60)	(101.47; 106.14)	(87.51; 92.57)	(77.13; 80.98)	(90.54; 94.09)
External causes of death	101.01	66.86	88.42	81.13	109.40	80.18
	(98.44; 103.59)	(65.49; 68.22)	(86.04; 90.79)	(78.56; 83.70)	(106.75; 112.06)	(78.03; 82.33)
Motor vehicle accidents	87.05	52.70	58.57	78.06	119.38	66.85
	(85.06; 89.04)	(51.67; 53.73)	(57.02; 60.12)	(76.02; 80.11)	(117.28; 121.49)	(65.39; 68.32)
Suicide	95.25	52.28	67.43	93.99	88.96	96.10
	(92.56; 97.93)	(51.23; 53.32)	(65.12; 69.73)	(91.54; 96.44)	(87.23; 90.69)	(93.67; 98.53)
Other causes	95.57	93.05	105.27	108.38	76.39	93.87
	(91.04; 100.10)	(90.89; 95.21)	(100.89; 109.27)	(104.10; 108.38)	(72.77; 80.02)	(90.77; 96.96)

Table A 6 continued

Males	Bad Doberan	Demmin	Güstrow	Ludwigslust	Mecklenburg-Strelitz	Müritz
All causes	94.85	111.91	105.98	102.01	111.09	104.76
	(92.37; 97.32)	(109.39; 114.43)	(103.67; 108.30)	(99.84; 104.17)	(108.35; 113.82)	(101.79; 107.73)
Neoplasms	94.66	103.76	108.27	95.09	108.33	100.34
	(91.69; 97.63)	(101.01; 106.52)	(105.54; 111.00)	(92.53; 97.65)	(105.25; 111.42)	(97.01; 103.67)
Cancer of stomach	97.84	113.78	98.49	105.88	94.95	108.08
	(94.56; 101.12)	(110.58; 116.98)	(95.47; 101.52)	(102.87; 108.90)	(91.39; 98.50)	(104.28; 111.87)
Cancer of intestine and rectum	94.41	101.75	114.94	83.03	105.47	107.08
	(90.65; 98.16)	(98.79; 104.71)	(112.02; 117.86)	(79.98; 86.09)	(102.00; 108.94)	(103.40; 110.75)
Cancer of male genital organs	88.99	80.46	104.84	109.55	74.55	93.19
	(85.15; 92.84)	(77.12; 83.81)	(100.94; 108.75)	(106.12; 112.98)	(71.28; 77.82)	(89.08; 97.30)
Cancer of trachea, bronchus and lung	94.03	101.26	107.44	92.29	117.84	87.48
	(91.24; 96.82)	(98.62; 103.90)	(104.82; 110.06)	(89.88; 94.70)	(114.64; 121.04)	(84.25; 90.71)
Respiratory diseases	95.08	123.61	85.93	98.37	105.82	118.11
	(91.05; 99.10)	(119.43; 127.80)	(82.61; 89.25)	(95.08; 101.66)	(101.73; 109.91)	(113.36; 122.86)
Diabetes mellitus	67.08	81.49	53.43	121.73	97.94	167.66
	(64.38; 69.79)	(78.63; 84.35)	(51.07; 55.79)	(118.40; 125.06)	(94.34; 101.54)	(161.93; 173.39)
Ischaemic heart disease	102.08	118.46	117.57	107.80	106.49	95.06
	(98.62; 105.53)	(115.00; 121.93)	(114.35; 120.79)	(104.92; 110.69)	(102.98; 109.99)	(91.27; 98.85)
Myocardial infarction	84.96	124.54	98.75	110.00	117.59	113.16
	(81.93; 87.99)	(121.27; 127.81)	(96.02; 101.47)	(107.21; 112.78)	(114.13; 121.05)	(109.40; 116.93)
Cerebrovascular disorders	93.12	134.26	112.82	105.56	152.51	105.10
	(89.38; 96.87)	(129.81; 138.71)	(108.97; 116.68)	(102.14; 108.98)	(147.59; 157.42)	(100.38; 109.82)
Alcohol-related diseases	88.27	127.05	103.29	90.55	128.57	113.21
	(86.45; 90.09)	(124.85; 129.26)	(101.53; 105.04)	(88.81; 92.29)	(126.32; 130.82)	(110.61; 115.82)
External causes of death	103.07	107.70	105.70	103.82	96.63	119.42
	(100.95; 105.20)	(105.27; 110.12)	(103.55; 107.86)	(101.83; 105.81)	(94.36; 98.90)	(116.48; 122.36)
Motor vehicle accidents	125.75	114.18	105.01	112.65	85.19	107.34
	(123.89; 127.61)	(112.34; 116.02)	(103.28; 106.74)	(111.03; 114.27)	(83.49; 86.88)	(105.13; 109.55)
Suicide	108.74	117.14	104.67	138.17	92.40	116.03
	(106.64; 110.84)	(114.36; 119.91)	(102.44; 106.90)	(135.75; 140.60)	(90.36; 94.43)	(112.38; 119.68)
Other causes	86.60	95.58	103.29	106.05	102.98	99.07
	(83.46; 89.73)	(92.44; 98.73)	(93.89; 99.72)	(103.00; 109.10)	(99.46; 106.50)	(95.14; 102.99)

Table A 6 continued

Males	Nordvorpommern	Nordwest-Mecklenburg	Ostvorpommern	Parchim	Rügen	Uecker-Randow
All causes	108.31	103.57	103.91	107.19	103.47	109.53
	(106.02; 110.61)	(101.24; 105.89)	(101.64; 106.17)	(104.76; 109.63)	(100.60; 106.34)	(106.86; 112.20)
Neoplasms	112.13	101.29	102.36	105.46	98.82	104.56
	(109.39; 114.86)	(98.51; 104.08)	(99.78; 104.93)	(102.65; 108.27)	(95.61; 102.03)	(101.56; 107.56)
Cancer of stomach	96.93	94.01	103.66	83.04	106.71	89.60
	(94.12; 99.75)	(91.01; 97.02)	(100.69; 106.62)	(79.96; 86.13)	(102.69; 110.73)	(86.54; 92.65)
Cancer of intestine and rectum	103.91	92.55	101.30	87.21	92.27	108.15
	(100.97; 106.85)	(89.59; 95.52)	(98.59; 104.02)	(84.23; 90.19)	(88.87; 95.67)	(104.95; 111.34)
Cancer of male genital organs	99.07	115.99	96.27	120.81	73.92	84.07
	(95.96; 102.17)	(111.86; 120.13)	(93.31; 99.22)	(116.71; 124.92)	(70.00; 77.84)	(80.52; 87.62)
Cancer of trachea, bronchus and lung	124.25	118.18	109.00	109.64	106.72	113.15
	(121.42; 127.08)	(115.35; 121.00)	(106.53; 111.47)	(106.80; 112.48)	(103.62; 109.82)	(110.19; 116.12)
Respiratory diseases	105.92	120.78	123.08	82.41	105.07	111.32
	(102.31; 109.53)	(117.16; 124.39)	(119.37; 126.79)	(79.02; 85.80)	(100.32; 109.83)	(106.99; 115.65)
Diabetes mellitus	140.73	78.86	121.93	141.41	82.70	89.54
	(137.28; 144.18)	(76.11; 81.62)	(118.52; 125.35)	(137.64; 145.17)	(79.49; 85.91)	(86.29; 92.80)
Ischaemic heart disease	106.52	105.72	93.34	107.68	98.46	109.70
	(103.51; 109.54)	(102.50; 108.94)	(90.44; 96.23)	(104.36; 110.99)	(94.60; 102.31)	(106.20; 113.19)
Myocardial infarction	129.36	103.69	97.38	118.18	99.62	105.38
	(126.21; 132.51)	(100.56; 106.82)	(94.55; 100.20)	(114.93; 121.43)	(96.19; 103.06)	(102.28; 108.48)
Cerebrovascular disorders	98.51	121.32	83.62	108.87	111.44	113.30
	(95.06; 101.95)	(117.34; 125.30)	(80.47; 86.77)	(105.13; 112.62)	(106.93; 115.95)	(109.23; 117.37)
Alcohol-related diseases	117.29	88.03	106.72	104.91	103.10	121.90
	(115.42; 119.17)	(86.41; 89.64)	(105.00; 108.45)	(103.05; 106.78)	(101.07; 105.13)	(119.72; 124.07)
External causes of death	116.39	116.06	111.56	104.69	114.10	108.55
	(114.24; 118.54)	(113.80; 118.33)	(109.61; 113.51)	(102.44; 106.93)	(111.60; 116.59)	(106.36; 110.74)
Motor vehicle accidents	118.95	127.79	101.25	120.30	127.86	124.78
	(117.15; 120.76)	(125.92; 129.66)	(99.73; 102.77)	(118.44; 122.17)	(125.78; 129.94)	(122.76; 126.80)
Suicide	103.75	117.43	110.04	129.77	107.70	93.04
	(101.72; 105.78)	(115.17; 119.68)	(108.31; 111.77)	(127.05; 132.48)	(105.30; 110.11)	(91.15; 94.93)
Other causes	97.23	92.93	117.02	116.12	110.53	109.50
	(94.37; 100.09)	(90.03; 95.83)	(113.83; 120.21)	(112.76; 119.48)	(106.76; 114.31)	(105.87; 113.13)

Table A 6 continued

Females	Greifswald	Rostock	Stralsund	Wismar	Neubrandenburg	Schwerin
All causes	88.92	100.44	95.79	94.82	89.70	89.95
	(86.31; 91.53)	(99.04; 101.84)	(93.38; 98.20)	(92.17; 97.46)	(87.02; 92.39)	(88.09; 91.81)
Neoplasms	90.15	107.39	99.11	101.57	102.02	92.41
	(87.15; 93.15)	(105.79; 108.99)	(96.45; 101.76)	(98.47; 104.68)	(99.01; 105.02)	(90.34; 94.49)
Cancer of stomach	76.55	120.05	119.68	139.11	82.24	72.22
	(74.08; 79.03)	(118.30; 121.80)	(116.33; 123.02)	(135.25; 142.97)	(79.52; 84.95)	(70.24; 74.21)
Cancer of intestine and rectum	106.08	110.67	107.02	100.96	111.58	111.86
	(102.37; 109.80)	(108.89; 112.45)	(104.00; 110.04)	(97.76; 104.17)	(108.02; 115.13)	(109.36; 114.37)
Cancer of female genital organs	89.56	108.95	95.57	93.16	105.27	87.78
	(86.62; 92.51)	(107.35; 110.56)	(93.12; 98.02)	(90.21; 96.12)	(102.26; 108.27)	(85.85; 89.71)
Cancer of trachea, bronchus and lung	112.10	126.16	109.70	135.34	91.86	101.42
	(109.02; 115.18)	(124.46; 127.86)	(107.02; 112.38)	(131.82; 138.87)	(88.95; 94.77)	(99.29; 103.54)
Cancer of breast	101.25	122.04	113.57	83.75	108.44	89.32
	(98.22; 104.29)	(120.34; 123.75)	(110.85; 116.30)	(81.08; 86.41)	(105.52; 111.37)	(87.46; 91.19)
Respiratory diseases	106.42	117.22	120.95	87.25	77.46	96.16
	(102.74; 110.09)	(115.24; 119.19)	(117.61; 124.30)	(83.85; 90.64)	(74.37; 80.55)	(93.86; 98.47)
Diabetes mellitus	81.04	100.31	127.27	116.78	98.94	71.34
	(77.81; 84.27)	(98.49; 102.12)	(123.74; 130.80)	(112.79; 120.77)	(95.34; 102.54)	(69.49; 73.19)
Ischaemic heart disease	91.46	101.47	71.99	110.10	92.71	86.35
	(88.30; 94.62)	(99.76; 103.18)	(69.45; 74.53)	(106.74; 113.46)	(89.41; 96.01)	(84.18; 88.52)
Myocardial infarction	98.53	86.34	84.22	87.57	91.76	95.31
	(95.08; 101.98)	(84.71; 87.97)	(81.40; 87.04)	(84.49; 90.66)	(88.47; 95.05)	(92.88; 97.73)
Cerebrovascular disorders	63.93	97.15	69.11	67.97	63.97	75.67
	(61.22; 66.65)	(95.41; 98.89)	(66.51; 71.71)	(65.19; 70.75)	(60.94; 67.01)	(73.52; 77.81)
Alcohol-related diseases	82.43	105.91	132.70	73.63	69.49	99.35
	(80.18; 84.69)	(104.60; 107.22)	(129.94; 135.46)	(71.55; 75.71)	(67.44; 71.54)	(97.70; 101.00)
External causes of death	89.47	91.26	110.33	103.82	87.34	105.96
	(86.88; 92.06)	(89.67; 92.86)	(107.39; 113.26)	(100.79; 106.86)	(84.80; 89.87)	(103.73; 108.20)
Motor vehicle accidents	93.11	60.27	95.03	95.75	53.31	78.52
	(90.73; 95.49)	(59.22; 61.31)	(92.55; 97.50)	(93.21; 98.29)	(51.66; 54.97)	(76.94; 80.11)
Suicide	80.56	85.47	76.58	125.83	87.21	119.71
	(78.56; 82.56)	(83.99; 86.96)	(74.67; 78.48)	(122.73; 128.93)	(85.06; 89.37)	(117.82; 121.60)
Other causes	101.91	91.68	125.42	85.66	94.54	100.76
	(98.54; 105.28)	(90.00; 93.36)	(122.09; 128.76)	(82.70; 88.63)	(91.11; 97.97)	(98.38; 103.13)

Table A 6 continued

Females	Bad Doberan	Demmin	Güstrow	Ludwigslust	Mecklenburg-Strelitz	Müritz
All causes	94.04	108.08	103.00	103.61	104.55	103.08
	(92.01; 96.08)	(106.03; 110.13)	(101.10; 104.90)	(101.83; 105.38)	(102.35; 106.75)	(100.59; 105.57)
Neoplasms	94.20	98.15	106.35	99.41	97.91	94.73
	(91.95; 96.45)	(95.96; 100.35)	(104.20; 108.51)	(97.43; 101.38)	(95.48; 100.34)	(92.14; 97.33)
Cancer of stomach	84.05	103.98	86.17	84.58	128.85	76.88
	(81.72; 86.38)	(101.46; 106.50)	(84.23; 88.12)	(82.62; 86.54)	(126.00; 131.69)	(74.49; 79.27)
Cancer of intestine and rectum	84.94	102.31	110.62	93.55	69.02	98.97
	(82.47; 87.41)	(99.84; 104.77)	(108.38; 112.87)	(91.65; 95.46)	(66.83; 71.21)	(96.14; 101.81)
Cancer of female genital organs	91.38	107.78	109.26	95.66	97.28	103.37
	(89.16; 93.60)	(105.63; 109.94)	(107.10; 111.42)	(93.70; 97.61)	(94.85; 99.71)	(100.58; 106.16)
Cancer of trachea, bronchus and lung	86.76	74.03	106.76	73.52	94.29	79.88
	(84.70; 88.81)	(72.08; 75.98)	(104.65; 108.86)	(71.78; 75.27)	(92.00; 96.58)	(77.81; 81.94)
Cancer of breast	90.24	110.09	100.36	86.49	83.39	97.91
	(88.09; 92.39)	(108.00; 112.17)	(98.35; 102.37)	(84.60; 88.38)	(81.18; 85.61)	(95.12; 100.71)
Respiratory diseases	95.44	100.42	72.39	96.62	85.08	120.98
	(93.01; 97.87)	(98.08; 102.75)	(70.38; 74.40)	(94.48; 98.76)	(82.57; 87.59)	(117.65; 124.31)
Diabetes mellitus	87.48	90.89	61.28	120.20	100.46	121.85
	(85.01; 89.95)	(88.49; 93.29)	(59.46; 63.11)	(117.79; 122.61)	(97.70; 103.21)	(118.30; 125.39)
Ischaemic heart disease	105.19	109.87	119.89	97.67	100.70	93.77
	(102.668; 107.70)	(107.40; 112.34)	(117.47; 122.32)	(95.58; 99.75)	(98.14; 103.25)	(90.92; 96.63)
Myocardial infarction	93.45	115.84	93.03	88.04	108.30	134.80
	(91.05; 95.84)	(113.34; 118.34)	(90.75; 95.31)	(86.07; 90.01)	(105.58; 111.02)	(131.36; 138.24)
Cerebrovascular disorders	89.33	136.78	118.15	115.87	147.00	119.11
	(86.82; 91.84)	(133.90; 139.66)	(115.62; 120.68)	(113.52; 118.21)	(143.77; 150.23)	(115.75; 122.48)
Alcohol-related diseases	72.23	117.66	105.67	97.06	115.21	73.01
	(70.55; 73.91)	(115.68; 119.63)	(104.00; 107.34)	(95.32; 98.79)	(113.07; 117.34)	(71.11; 74.92)
External causes of death	97.86	115.95	77.39	91.45	125.62	104.44
	(95.64; 100.09)	(113.40; 118.51)	(75.66; 79.13)	(89.58; 93.32)	(122.73; 128.51)	(101.53; 107.35)
Motor vehicle accidents	127.52	118.27	100.84	119.98	118.33	97.05
	(125.54; 129.50)	(116.02; 120.51)	(99.18; 102.50)	(118.26; 121.71)	(116.26; 120.39)	(94.98; 99.12)
Suicide	113.76	76.47	94.05	109.75	169.22	77.22
	(111.66; 115.86)	(74.70; 78.24)	(92.35; 95.74)	(107.84; 111.65)	(165.86; 172.58)	(74.86; 79.58)
Other causes	85.35	96.36	84.59	108.25	83.40	109.33
	(83.01; 87.68)	(93.98; 98.74)	(82.45; 86.73)	(106.00; 110.49)	(80.92; 85.89)	(106.12; 112.55)

Table A 6 continued

Females	Nordvorpommern	Nordwest-Mecklenburg	Ostvorpommern	Parchim	Rügen	Uecker-Randow
All causes	100.80	104.23	103.50	103.20	97.41	99.78
	(98.95; 102.65)	(102.28; 106.18)	(101.60; 105.39)	(101.17; 105.22)	(95.09; 99.73)	(97.66; 101.90)
Neoplasms	104.28	101.03	102.63	98.27	92.19	101.31
	(102.21; 106.35)	(98.85; 103.20)	(100.55; 104.72)	(96.05; 100.49)	(89.66; 94.73)	(98.91; 103.71)
Cancer of stomach	106.79	89.10	86.94	127.85	84.10	116.92
	(104.55; 109.02)	(86.87; 91.33)	(84.84; 89.04)	(125.17; 130.53)	(81.44; 86.76)	(114.26; 119.57)
Cancer of intestine and rectum	105.90	117.16	100.25	74.20	90.72	91.68
	(103.58; 108.23)	(114.62; 119.69)	(97.95; 102.55)	(72.10; 76.30)	(88.01; 93.42)	(89.09; 94.28)
Cancer of female genital organs	104.26	94.34	124.40	83.70	83.89	100.37
	(102.24; 106.27)	(92.29; 96.38)	(122.16; 126.65)	(81.79; 85.61)	(81.53; 86.26)	(98.11; 102.62)
Cancer of trachea, bronchus and lung	104.87	95.94	96.38	84.78	121.42	100.86
	(102.97; 106.77)	(93.96; 97.92)	(94.43; 98.33)	(82.60; 86.96)	(118.78; 124.07)	(98.54; 103.18)
Cancer of breast	106.08	102.92	105.39	86.34	73.11	106.57
	(104.01; 108.14)	(100.80; 105.03)	(103.31; 107.46)	(84.46; 88.22)	(70.90; 75.32)	(104.29; 108.85)
Respiratory diseases	111.66	74.03	107.37	112.62	103.33	99.13
	(109.12; 114.20)	(71.92; 76.15)	(105.05; 109.69)	(109.96; 115.28)	(100.28; 106.38)	(96.48; 101.77)
Diabetes mellitus	118.41	100.45	130.50	111.55	91.59	70.70
	(115.93; 120.88)	(97.89; 103.01)	(127.74; 133.27)	(108.94; 114.16)	(88.63; 94.55)	(68.41; 73.00)
Ischaemic heart disease	90.01	114.01	93.90	104.26	102.09	100.67
	(87.90; 92.11)	(111.57; 116.45)	(91.71; 96.09)	(101.83; 106.70)	(99.26; 104.93)	(98.12; 103.21)
Myocardial infarction	115.83	112.44	91.29	120.30	90.28	102.92
	(113.40; 118.25)	(109.98; 114.91)	(89.16; 93.43)	(117.60; 123.00)	(87.45; 93.10)	(100.23; 105.61)
Cerebrovascular disorders	100.47	120.43	77.38	99.13	87.99	99.48
	(98.19; 102.75)	(117.80; 123.06)	(75.26; 79.51)	(96.69; 101.57)	(85.24; 90.74)	(96.85; 102.11)
Alcohol-related diseases	125.39	101.65	116.27	101.21	94.59	72.27
	(123.47; 127.31)	(99.82; 103.49)	(114.33; 118.21)	(99.34; 103.08)	(92.57; 96.60)	(70.58; 73.97)
External causes of death	104.64	98.28	108.51	95.64	107.66	100.44
	(102.45; 106.83)	(96.00; 100.56)	(106.17; 110.86)	(93.46; 97.81)	(104.78; 110.55)	(98.04; 102.84)
Motor vehicle accidents	107.06	116.92	110.53	110.18	68.83	158.53
	(105.31; 108.80)	(115.21; 118.63)	(108.83; 112.23)	(108.33; 112.03)	(66.99; 70.66)	(155.90; 161.15)
Suicide	110.07	127.23	72.65	87.96	110.15	87.17
	(107.99; 112.16)	(125.01; 129.45)	(71.09; 74.20)	(86.13; 89.79)	(107.68; 112.61)	(85.30; 89.04)
Other causes	102.36	90.79	128.47	108.57	101.76	105.80
	(100.09; 104.64)	(88.58; 93.01)	(125.96; 130.98)	(106.01; 111.13)	(98.98; 104.54)	(103.18; 108.42)

Source: Own calculations with data from the State Office of Statistics Mecklenburg-Vorpommern

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Eidesstattliche Versicherung (Statutory declaration)

Ich versichere eidesstattlich durch eigenhändige Unterschrift, dass ich die Arbeit selbständig und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Alle Stellen, die wörtlich oder sinngemäß aus Veröffentlichungen entnommen sind, habe ich als solche kenntlich gemacht. Ich weiß, dass bei Abgabe einer falschen Versicherung die Prüfung als nicht bestanden zu gelten hat.

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