

PERSPECTIVES ON THE RISE AND FALL OF SWEDISH CARDIAC EPIDEMICS: The cases of Linköping and Norrköping

Björn Grip and Hans Nilsson

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Perspectives on the Rise and Fall of Swedish Cardiac Epidemics – the Cases of Linköping and Norrköping

Björn Grip, PhD student and Hans Nilsson, Associate Professor, Linköping University

Abstract

Morbidity and mortality in cardio-vascular diseases can be described as an ongoing epidemic, although a very protracted one, lasting more than 100 years. Cardiovascular diseases still top mortality rates in the world today, accounting for about 30% of all deaths around the globe. But it is in the industrialized world that cardio-vascular diseases dominate, although differences are great among various regions. Myocardial infarctions are significantly more common in Sweden than in southern Europe, but less common than in Eastern Europe. The overall question concerns the consequences for health in areas on the road to a post-industrial society. Over the years a clearer link has become visible between lifestyle and health. In Sweden infectious diseases diminished as result of rising living standards. At the same time cardiovascular diseases were beginning their upward phase, reaching a peak in the 1960s.

Deaths due to cardio-vascular disease bring to light significant discrepancies related to socio-economic and cultural factors. A comparison of the Swedish twin cities Linköping and Norrköping show considerable differences in death rates in favor of Linköping, amounting to about 30 % fewer in the 1920s with a tendency toward rising differences thereafter. A preliminary investigation of diagnoses has shown that links commonly made between health and socio-economic patterns need revision. The differences in cardio-vascular morbidity show another pattern than was expected. It is obvious that the neighborhood environments themselves have significance, and that the inequalities need additional research based on complementary explanatory models.

Introduction

Cardio-vascular diseases (CVD) top mortality rates in the world today.¹ This disease group accounts for about 30 per cent of all deaths worldwide.² But it is in the industrialized world that cardio-vascular diseases dominate.³ For example, about 60 per cent of all myocardial infarctions take place in industrialized countries. In Europe cardio-vascular diseases cause almost half of all deaths.⁴ However, the differences are great among various regions in Europe. Myocardial infarctions are significantly more common in Sweden than in Southern Europe but much less common than among the population in Eastern Europe, where especially men are affected. In the Nordic countries the situation is remarkably similar in Sweden, Norway and Denmark. Over time the mortality curves are parallel. However, Finland stands out with significantly higher levels in this comparison.⁵ Although declining, cardio-vascular diseases are still the most common cause of death in Sweden, accounting for about 38 per cent of all deaths in 2012.⁶ Morbidity and mortality in cardio-vascular diseases can be described as an on-going epidemic, although a very protracted one lasting more than one hundred years.

The query

The overall question in our research concerns what happens with public health on the road to a post-industrial society. This question includes many issues, but fundamental are the ways in which historical differences have survived, still have an effect, and may even do so tomorrow. The focus here is on cardio-vascular diseases, which have been the dominating causes of death in the OECD-countries since World War Two.

In what way did cardio-vascular mortality develop during the period? In the beginning of the last century infectious diseases were still declining, at the same time that the cardio-vascular epidemic became established.

What patterns are found within the two cities being used as models during the cardiac epidemic, and can plausible explanations for the patterns be found?

The specific aim is to compare differences in cardiac morbidity today between neighbourhoods in two close but different social environments in the twin cities, Linköping and Norrköping, in the county of Östergötland. The historical differences in diagnosis of cardio-vascular diseases in the twin cities are already known. The main question that has thus been formulated here is whether these differences can be adequately explained in terms of variations in the morbidity rates in CVD found in comparable socio-economic neighbourhoods in the two cities?⁷

The historical context

Looking back in the historical mirror in the 19th century infectious diseases were the worst threats to health.⁸ As welfare and living conditions improved, other causes of death became dominant. This long process of change in the role of infectious diseases is usually referred to as *the epidemiological transition*, a process that is still ongoing.⁹ This schematically describes the development from a society where diseases induced by poverty dominated to a society where lifestyle-related diseases have become common. Over the years a clearer link has become visible between lifestyle and health. This lifestyle-related health is, however, strongly limited by social, economic and cultural factors.¹⁰

Today in the developed countries there are five risk factors crucial for developing CVD: tobacco, alcohol, hypertension, high cholesterol and obesity. In a large international study researchers have calculated that about 90 per cent of myocardial infarctions are due to factors that can be influenced.¹¹ This is why myocardial infarction belongs to the category of death that can be termed *avoidable mortality*.¹² Poor education is one socio-economic explanation given for the doubled risk of developing cardio-vascular diseases. This is true for men as well as women.¹³ However, this needs to be explained further. Education gives more freedom to make independent decisions. More education often leads to higher income and, not least, to more freedom to decide one's own working hours. Education also gives increased opportunities for better planning.¹⁴ All these factors are crucial for better health.¹⁵

The epidemiological transition is connected with, and is a part of, the great historical change referred to as *the demographic transition*. This can be thoroughly studied in Sweden, as the demographic statistics have good quality and a long history.

The first phase of the demographic transition was characterized by very high death rates and, although the birth rates were also seemingly high, they could not outweigh the mortality. The consequence was that population growth was remarkably low. It can be said that life was fragile in all ages, but most so for children, especially the very young. Infant mortality was immensely high. In the latter part of the 18th and the early 19th century one out of every five infants died before the age of one year.¹⁶ Infectious diseases were a very large part of the mortality during this period. Poor as well as rich were severely affected by recurrent infections and epidemics. Towns were especially dangerous places in which to live, and the term “urban graveyards” was coined to describe the situation in the context of historical demography.¹⁷

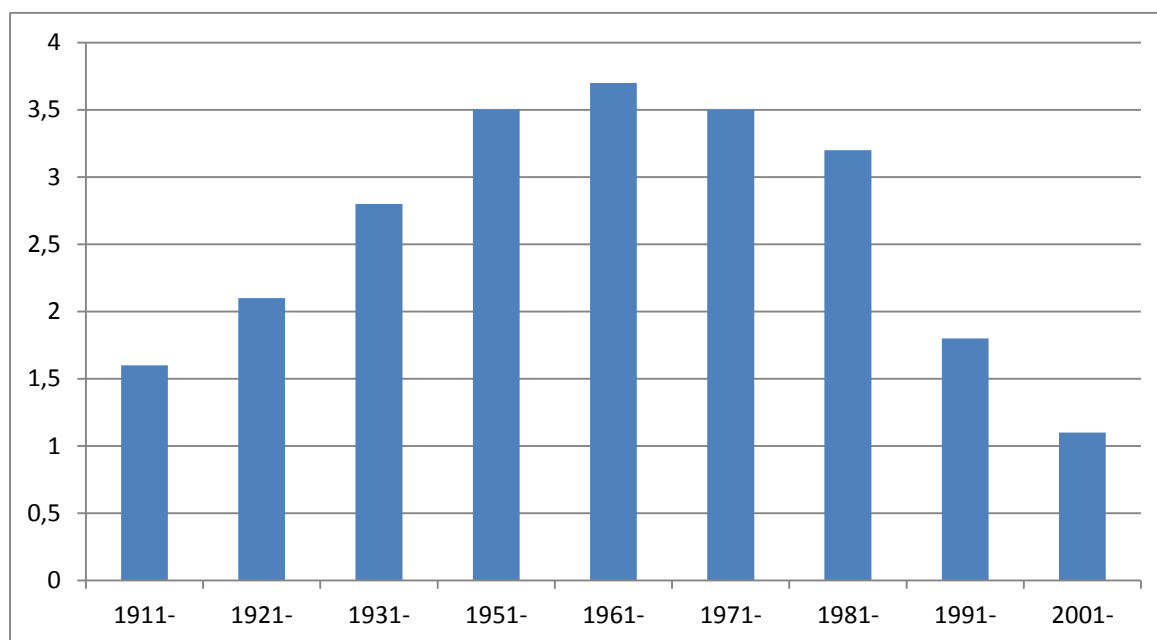
About 1820 the death rates began to decline in Sweden. It has been suggested that this was due to factors such as better diet, gradually improved sanitary devices and greater knowledge of hygiene.¹⁸ At the same time the birth rates continued at a high level. As a result, Sweden entered into the second phase of the transition. The population increased in size, and in the end of this phase of demographic history industrialization began in the country. It was during this period the comprehensive emigration to North America also started.

In the third phase of the demographic transition, mortality continued to decline but population growth stagnated as a consequence of diminishing birth rates. This is the period of the first half of the twentieth century, a developing industrial society characterized by smaller families and generally improved better living conditions.

During the fourth phase birth as well as death rates were low. Life had become safer, and more and more people reached old age. It was during the latter part of phase three and during phase four that lifestyle maladies and the epidemic of cardio-vascular diseases first emerged and then gradually diminished (Figure 1).

The cardio-vascular death rate in a historical perspective

Figure 1: Deaths per 1,000 inhabitants in Sweden, average in ten years periods. Circulatory diseases in the period 1911-1970, hereafter death rates in myocardial infarctions 1971-2006; Age group 50-74 years; Source: Statistics Sweden. Cause of Death Registry.



In Figure 1 the development of cardio-vascular diseases in Sweden during the last hundred years can be studied. The bars form a pattern which led us to compare the sequence of events with an epidemic of infectious disease, albeit a very protracted one. In the beginning few were affected, thereafter more and more, until it culminated in the 1960s. The upswing phase can probably be explained with a combination of various factors. Better living conditions in general, but at the same time more fast food and less physical activity resulted in a new death panorama - a decline in deaths from infectious diseases and an increase of life-style related diseases. During this period smoking also increased significantly.¹⁹

A partial explanation of the low death rate during the first part of the 1900s may be that a fraction of CV deaths is hidden in the group with “unknown cause of death”.²⁰

In the 1970s and thereafter a distinct decline in cardio-vascular diseases can be seen. The explanation of declining death rates in cardio-vascular mortality must be sought in several directions. The risk of developing illness had diminished, and the chance of surviving a heart infarction had increased. A factor which may have contributed is that the determinants of infarction diminished. Hypertension was treated, and smoking had decreased due to decisive work on public opinion and increased taxes, together with legislation and other restrictions concerning where smoking is allowed. Improved medical care, successful health work and potent medication also played a role.²¹

Although a clear trend can be seen, it is worth noting that the basis for the statistics published in Figure 1 has changed over time. Therefore it is difficult to make exact comparisons. In the period 1911-1970 the concept circulatory diseases was used in the cause of death registers. In the period 1971-2006 the diagnosis myocardial infarctions was used specifically. This was because myocardial infarctions had come to dominate within the cardio-vascular diagnosis, at the same time that other diagnoses in this category diminished as causes of death.

Delimitations

This study focuses on the period when the cardio-vascular epidemic was at its peak and the following decline in mortality from heart disease, namely from about 1950 to the present. Two different but neighbouring Swedish cities are the focus of the studies presented. Studying population in comparable cities allows us to isolate possible factors that can explain the change and the difference among various populations. The age group chosen for the study is between 50 and 74 years, consisting of persons still at work or newly retired. Before the age of 50, heart diseases are unusual, and after 74 they are too common, as life often finishes with some kind of heart disease.

Regional differences in illness

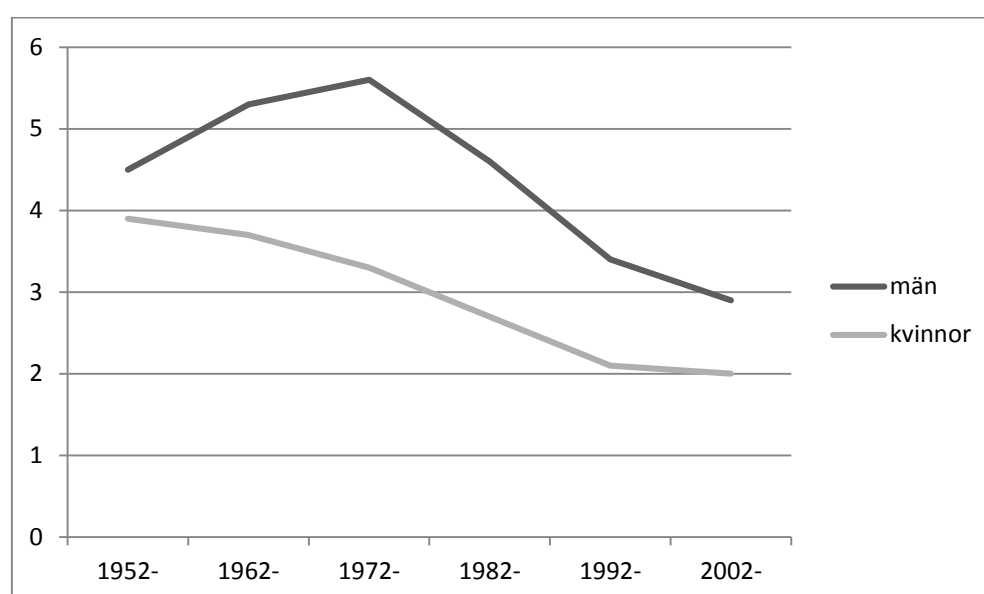
National change can be said to have its roots in or be the sum of changes on the regional level. This is also true in the region where the two cities are located. Thus it is necessary to move from the national to the regional level, the county of Östergötland. Regional differences in mortality have been discussed since the days of the 19th century demographic pioneers. Maps of different demographic areas were drawn, and patterns emerged that were difficult to explain. One such difference, however, is between cities and smaller municipalities. Today these differences are strikingly small, but, if you look back in history, they have been large in the past. There has thus been a change in the relationship between cities and countryside. Up to about 1930 it was more dangerous to live in towns than in the countryside. Then the mortality rates changed to the advantage of the towns, and the countryside became relatively more risky.²² As cardio-vascular morbidity is linked to lifestyle, studies have been made of possible regional differences in food culture that could be related to heart health in contemporary society. There is a correlation between areas where food was based on milk, meat and fat and higher rates of cardio-vascular morbidity. On the other hand, areas where the diet was based on rye, vegetables and fish had lower rates of cardio-vascular mortality.²³ Counties with high rates of cardio-vascular mortality during the period 2004-2006 were the counties of Värmland, Kalmar and Örebro. Particularly low figures were correspondingly found in the county of Uppsala. The curves regarding the closely related stroke mortality were not fully identical with infarctions, but have demonstrated large similarities when it comes to regional incidence.²⁴

Regional statistics in the county of Östergötland provide opportunities to compare cardio-vascular mortality between men and women (Figure 2). If you study data for the different counties of Sweden, it appears that men as well as women in Östergötland in the beginning of the period studied had somewhat greater mortality than the average for Sweden. From 1989 onward Östergötland remains near the average in Sweden.²⁵ The curves, for men as well as women, are similar to the national picture. The county of Östergötland can therefore be said to be representative of Sweden. For women the figure shows a steady decline since the early measurements in the 1950s, a decline that began at least twenty years earlier than for men. The gender differences in cardio-vascular morbidity are well documented but are still an interesting study object. These differences between the sexes were largest when mortality was at its peak and were to the disadvantage of men. The decline was not as rapid in the late part

of the investigated period, and, when it comes to women, their improvement stagnated. Research shows that women have adopted some negative aspects of male lifestyles, for example, the large group of female smokers with poor education.²⁶

The period studied contains several extensive changes. Urbanization meant that the cities of Linköping and Norrköping became an increasing part of the county of Östergötland, growing from about one third of the population in the beginning of the 1950s up to two thirds in 2006. About 1970 the employment rate of women increased considerably; the ideal of housewives was no longer important and had had its day. At the same time the public sector's proportion of the GNP increased, and shortly thereafter, the transition of Sweden from industry to a more service oriented economy began.²⁷

Figure 2: Death rate per 1,000 persons in myocardial infarction, the county of Östergötland 1952-2006, men and women, age group 50-74 years. Source: Socialstyrelsen, Dödsorsaksregistret.



The twin cities - Linköping and Norrköping

Today the Östergötland cities of Linköping and Norrköping, comparable in size, are commercial- and service-cities and both are seats of higher education. While numerically similar, their populations are vastly different socially and culturally, which has led to inequity in health matters. The life expectancy for men is more than two years shorter in Norrköping than in Linköping, whereas for women the difference is more than one and a half years.²⁸

Explained in another way, this mortality difference amounts to about the same figures as the number dying each year in Swedish traffic accidents, about 300 persons.²⁹ In a public health perspective this difference in mortality represents many lives lost in a population. This loss means the loss of human capital with all the associated suffering. This can also be expressed in terms of economic value which represents a cost to society. Data from the Swedish Institute of Public Health has shown that health problems also have negative effects on local economic growth, a cost that Norrköping to a greater extent has been forced to bear.³⁰

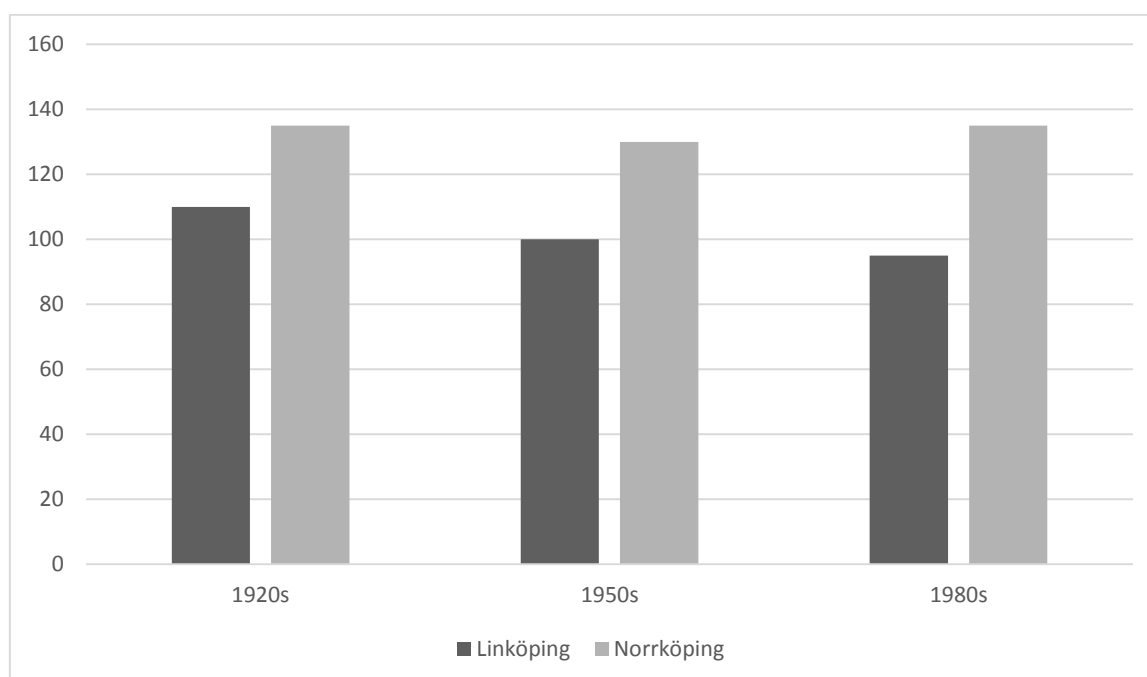
In a historical perspective Norrköping was industrialized early. In the 17th and 18th centuries there were industry-like environments, and during the 19th century industrialization took off in earnest. Linköping was a quiet agrarian market town with a lyceum and elements of ecclesiastical, provincial and later county council government. It was not until in the first part of the 20th century that Linköping became industrialized, and by World War Two the development had progressed so far that both cities were characterized by industrially oriented production.³¹

There was an important difference between the industrial structures in the two cities. Industry in Linköping consisted largely of the traditionally male dominated metal industry, while Norrköping was characterized by the textile industry, where low paid female workers made up the majority of the work force. Norrköping underwent a fundamental restructuring during the period 1960-1980, a time of turbulence when much of the industrial production disappeared.³²

Linköping also went through a similar process but managed the changes better because of a higher level of technology and engineering in the economic life of the city. During the same period the city became home to a technical college that later developed into a university. Linköping's old profile as an ecclesiastical center and center for learning played an important role for these establishments. Another significant factor was the establishment of the high tech aircraft manufacturer, Saab, in the 1940s. The later rapid growth in Linköping from 1970 onward was due to the expansion of the public service sector and, not least, the emergence and development of a growing regional hospital center that eventually became a university hospital in the late 1980s. The structural change in Norrköping, which is still going on, took longer than in neighboring Linköping, because in the first phase the textile industry was replaced by other low technologic industries.³³

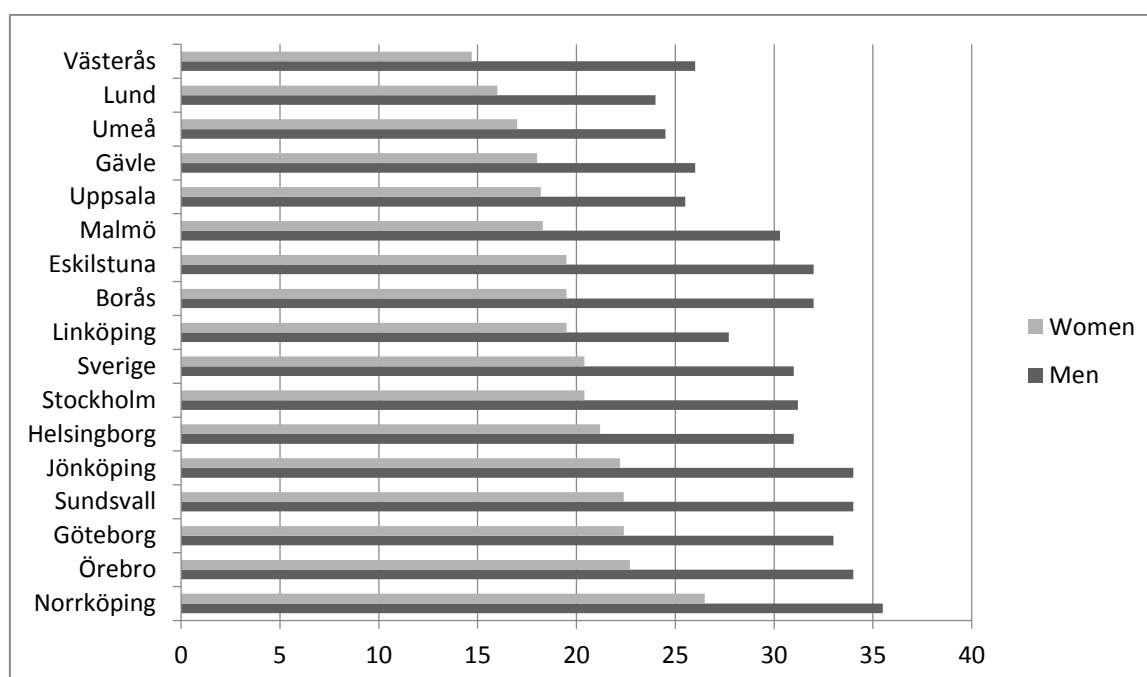
If the mortality patterns are analyzed historically it is not surprising that the industrial town Norrköping exhibited greater mortality than Linköping which was characterized by civil and ecclesiastical administration and the agricultural production of the surrounding area. The higher mortality rates in Norrköping were largely caused by infectious diseases, which, in turn, depended on poorer conditions. However, the differences between the cities remain large even today when morbidity and mortality are studied. Most striking was the variation when it comes to cardio-vascular mortality, the most common cause of death. Mortality in this type of disease has been greater in Norrköping (about 30 per cent more) throughout the period during which statistics have been collected on this diagnosis (See Figure 3).

Figure 3: Deaths in circulatory diseases in Linköping and Norrköping (deaths per 1,000), index Sweden=100. Sources: Statistic Yearbook of Linköping and Norrköping, SVAR: Excerpts from the death and burial books



Norrköping is distinguished by its high cardio-vascular mortality even when we make comparisons with other Swedish towns of the same size, that is, urban areas with a population of more than 100 000 inhabitants for 2002 to 2006. The pattern is the same for both men and women, even though the level of deaths is considerably higher among men. When women in Norrköping and Linköping are compared, the difference is actually larger, as well as in comparison with the average in Sweden (see Figure 4).

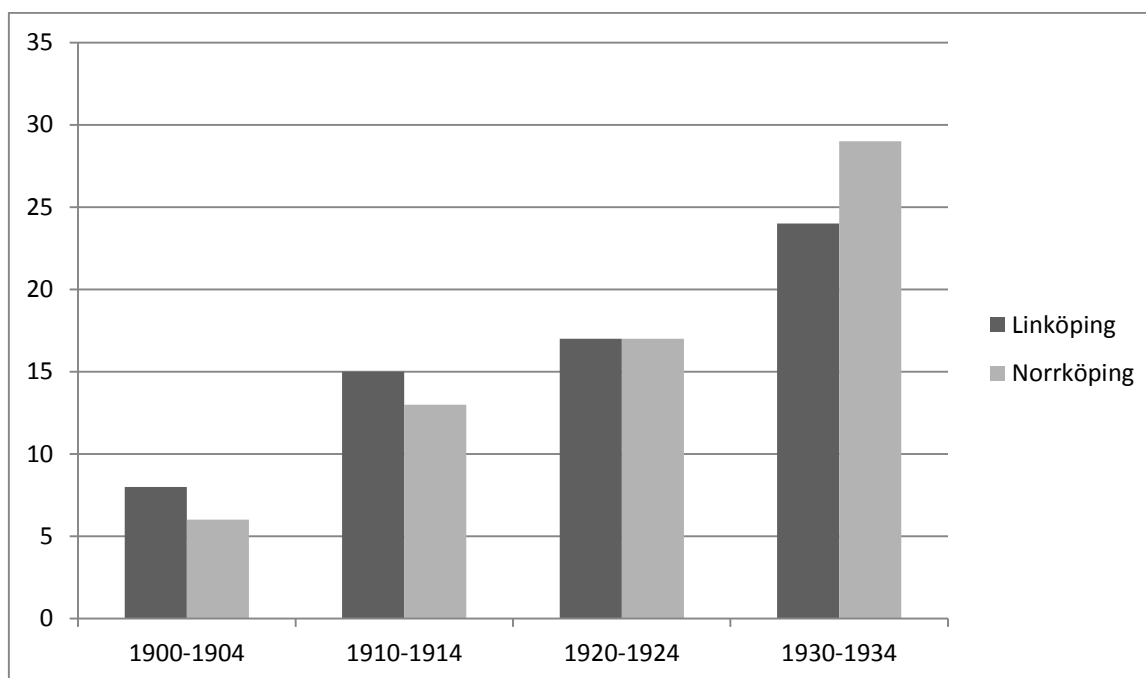
Figure 4: Age-adjusted mortality in heart and circulatory diseases per 100 000 inhabitants for women and men in Sweden's 15 largest cities 2002-2006. Source: Statistics Sweden.



On the other hand, the rate in Linköping is quite near the average for the country, which also can be observed in the overview (Figure 4).³⁴

One question is in what way cardio-vascular mortality in Linköping and Norrköping developed during the period when infectious diseases were declining and the cardio-vascular epidemic became established in the beginning of last century (Figure 5)?

Figure 5: Mortality (per cent) in cardio-vascular diseases, of total diagnoses in Linköping (Cathedral parish) and in Norrköping (Saint Olai parish). Average five year periods per 1,000 inhabitants. Source: Parish registers from Linköping and Norrköping.



This part of the study is based on a systematic examination of the death and burial registers of the city parishes of Linköping and Norrköping.³⁵ The causes of death from a number of five year periods have been registered: 1900-04, 1910-14, 1920-24 and 1930-34. All ages are included. The registered causes of death related to cardio-vascular diagnoses have subsequently been put in relation to the total mortality in each period. The results substantiate the pattern that is generally recognized, which is that the rise in heart infarctions in its first stage runs parallel to improvements in welfare and the general decline in death rates. This development, in turn, is a consequence of the decline in infectious diseases.³⁶ In the first two periods small, rural Linköping had a somewhat higher level of cardio-vascular diseases, while infectious diseases hit the blue collar city, Norrköping, harder. In the beginning of the 1920s the cities were on an equal level, but in the 1930s the trend started that is shown in Figure 3.

The general mortality figures for Linköping and Norrköping are presented in Table 1. Until the 1930s the differences between the towns were small. Both were comparably poor despite their dissimilar structures. Thereafter the social conditions in Linköping improved with decreasing mortality figures as one of the results. More in-migration, a higher birth rate and thus a younger population affects the general figures to Linköping's advantage. A positive developmental spiral was taking place.³⁷

Table 1: Comparison of crude death rates (CDR) in Norrköping and Linköping, ratio N/L.
Source: Statistics Sweden.

	<u>Nkpg</u>	<u>Lkpg</u>	<u>Ratio for Nkpg/Lkpg</u>
1900-	15.4	14.1	1.09
1910-	14.6	13.9	1.05

1920-	12.1	11.2	1.08
1930-	11.8	10.9	1.08
1940-	11.0	8.7	1.26
1950-	10.3	7.9	1.30
1960-	11.3	8.4	1.36
1970-	11.5	9.3	1.24
1980-	11.8	9.4	1.26
1990-	11.7	8.7	1.34
2000-	9.7	8.2	1.18

Differences in cardio-vascular diseases after 1952

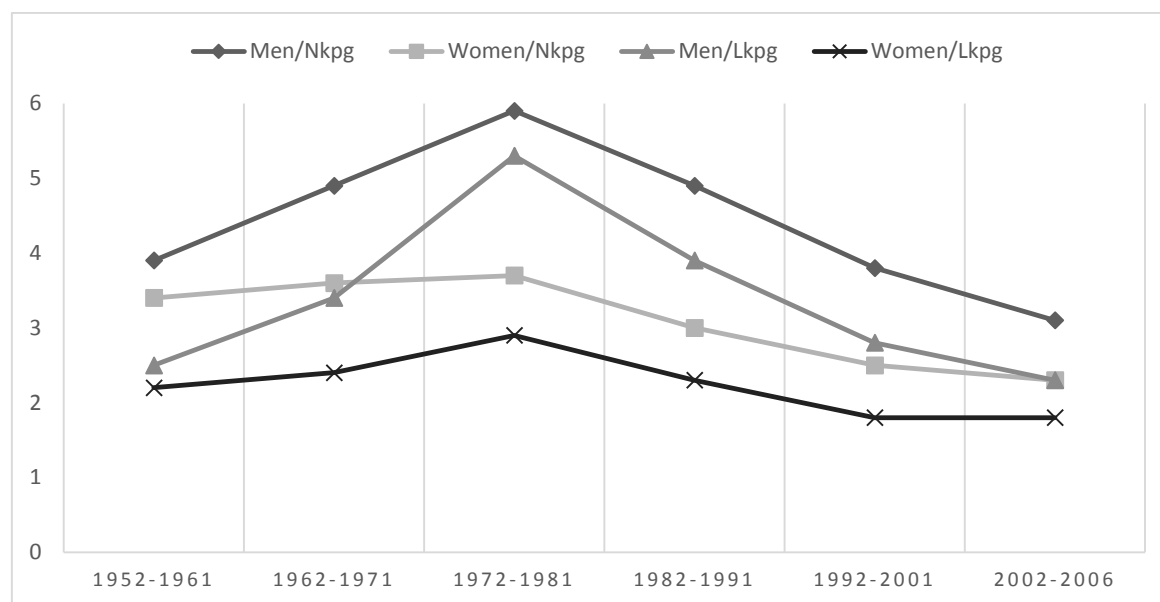
In the further analysis (Figure 6) the rise and fall of epidemics of heart infarction have been followed from 1952 onward. In Sweden the decades since the end of World War Two are generally characterized as having significantly better living conditions with higher wages, better housing, a reduction in working hours and the legal right to vacation. This progressive welfare development began stagnating in the end of the 1970s. However, Norrköping went through a dramatic restructuring during the late 1960s when the textile industry was hit by a serious crisis. Linköping experienced a similar situation about 1970 when its industrial structure had reached the limit of its expansion. Linköping suffered to a lesser extent than its neighboring city, perhaps due to a more diverse industry with a higher level of technology. During the 1990s Sweden, as well as the two investigated cities in Östergötland, went through a substantial economic decline with high unemployment as a consequence. This may have been the reason for the bubble on the sloping curve of mortality in myocardial infarction in this decade (Figure 6).³⁸

Urbanization has continued during the 20th century and has not stopped. Over time both Linköping and Norrköping have experienced a considerable increase in population. Part of this is a result of immigration, especially in Norrköping. Up to the 1990s Norrköping had a significantly greater proportion of immigrants than Linköping.³⁹

Studies have shown that Swedish *in-migrants* to the cities, migrants within Sweden, today as well as historically (at least from the 1950s), have better health than those who were natives of the city. This is mainly a consequence of the higher level of education of the in-migrants. When it comes to international immigration, the effect depends upon their origins.⁴⁰ The internal Swedish in-migration to the cities accordingly has positive effects on the statistics, in this case in favor of Linköping. A comparison between the cities in a cohort study concerning the degree of loyalty of the city natives shows that the inhabitants of Norrköping even in the beginning of the 21st century were more reluctant to migrate than the inhabitants in the neighboring city and the men to a higher degree than women. More of Linköping's in-

migrants remained in the city than was the case in Norrköping. Thus Linköping has grown faster and exceeds Norrköping in population.⁴¹

Figure 6: Death rate per 1,000 inhabitants in myocardial infarction in Linköping and Norrköping 1952-2006, women and men, age group 50-74 years. Source: SCB, Cause of Death Registry.



The most important result shown in Figure 6 is the large decline in cardio-vascular mortality which started in the 1980s. Unlike the figures showing results for Sweden and Östergötland in the graph for the cities, a clear peak can be seen for men as well as women. This is an urban phenomenon, and the peak becomes less clear when persons from rural areas and smaller municipalities are also included in the statistics. The peak may be explained by “the smoking generation” and the consequences of the habit, but also by less stringent alcohol restrictions. The peak is probably most striking for subgroups among men with weak positions in working life – unmarried men, divorced men and widowers.⁴²

The figure also shows that the difference between Linköping and Norrköping endures, even in a long perspective, and this is also true when comparisons between men and women are made. The long-term tendency is a levelling of the differences between the cities as well as between men and women. Mortality in heart infarction for a man in Linköping in 2006 corresponded to the same risk for a woman in Norrköping.

Geographical differences within the cities

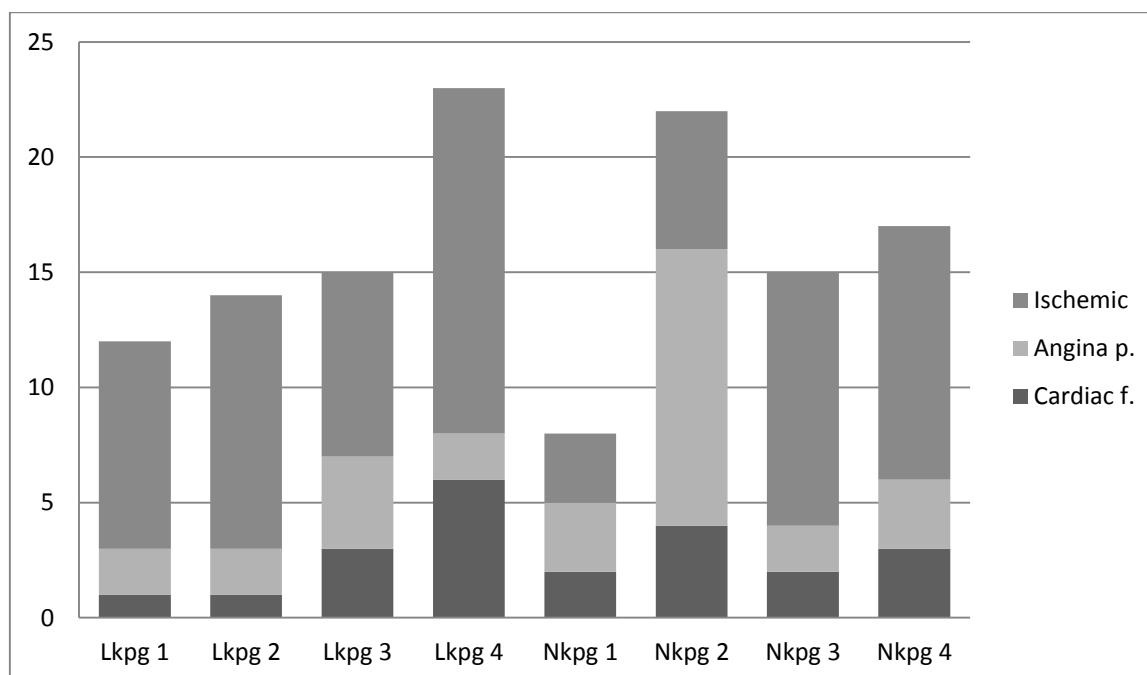
There are clear differences in health between different residential areas in larger cities today, a pattern that is well-known. Social segregation has increased significantly during the last twenty years in a world perspective as well as in Sweden.⁴³ Our knowledge is limited considering the geographical differences in cardio-vascular diseases. Mortality is nonetheless so low that chance may play a role when death in different cardio-vascular diagnoses is

analyzed from a geographical perspective. This is the reason why this article focuses on the reported morbidity in actual diagnoses.

A classical dilemma for health researchers is the relationship between the concepts morbidity and mortality. Mortality is definitive, even if the diagnoses in death certificates may be problematic. Morbidity, on the other hand, may suffer from such components as underreporting or even the opposite. Morbidity figures may also be affected by access to medical care. The present part of the study compares morbidity as reported at the health centers with which the research team collaborates.⁴⁴ Since 1999 the county council in Östergötland has had a special computerized register, the Care-Services Database (*Vårddatalagret*) that includes all visits in primary and hospital care within the county council region. This makes it possible to study information about diagnoses, care visits and prescribed drugs. The time period 2005-2009 was chosen because the validity of data was satisfactory during those years. A five-year period was chosen to eliminate the risk of chance. Most of the weaknesses of the Care-Service Database were resolved in the year 2005. It was necessary to have 2009 as the final year because after this year it is not possible to make comparisons between the health centers in the same way as before. Free choice of care dissolved the geographical relationship between the health center and a specific hinterland. The purpose here is not to paint a comprehensive picture but rather to investigate how morbidity in cardiovascular diseases is distributed in society.

Cardio-vascular diagnoses

Figure 7: Cardio-vascular diagnoses in the period 2005-2009 per 1,000 inhabitants of the average population in the age group 50-74 years listed at selected health centers in Linköping and Norrköping. Source: County Council in Östergötland, Care-Services Database.



Those cardio-vascular diseases that occur in the Care-Services Database have been assembled in bars so that the dominant diagnoses are shown together. Consequently comparisons can be made between different health centers without having to take into consideration the way in which the diagnoses were made. The diagnoses that have been registered are ischemic heart disease, angina pectoris and cardiac failure; the age group studied was, as before, 50-74 years. The diagnoses may be considered as a preliminary stage, or an important risk factor, in the mortality in cardio-vascular diseases that we analyzed before. Here it is no longer differences between the cities that emerge; instead it is the span within the cities that is being studied. The lowest figures in Norrköping are below the lowest in Linköping, and the highest figures overall are in Linköping. The risk presented thus depends on what neighborhood you live in to the same extent as who you are. Another observation is that diagnostics seem to differ between the health centers, that is, what diagnoses the doctors preferred to use.

As pointed out before, cardio-vascular diseases seem to be linked with poor social conditions; education level has been pointed out as especially important. The medical center areas that are included in this study (Figure 7) can to varying degrees be described in socio-economic terms. Lkpg 1 and Nkpg 1 are stable inner city areas with inhabitants that have proportionately high average income. Lkpg 2 and Nkpg 2 have mixed settlements and are a bit outside the city center in areas that were incorporated about 1970. Lkpg 3 and Nkpg 3 are areas near the city but outside the city centers with stable residents and mixed housing. Lkpg 4 and Nkpg 4 are classical housing project areas built outside the cities in the 1960s and early 1970s with a large proportion of immigrants.

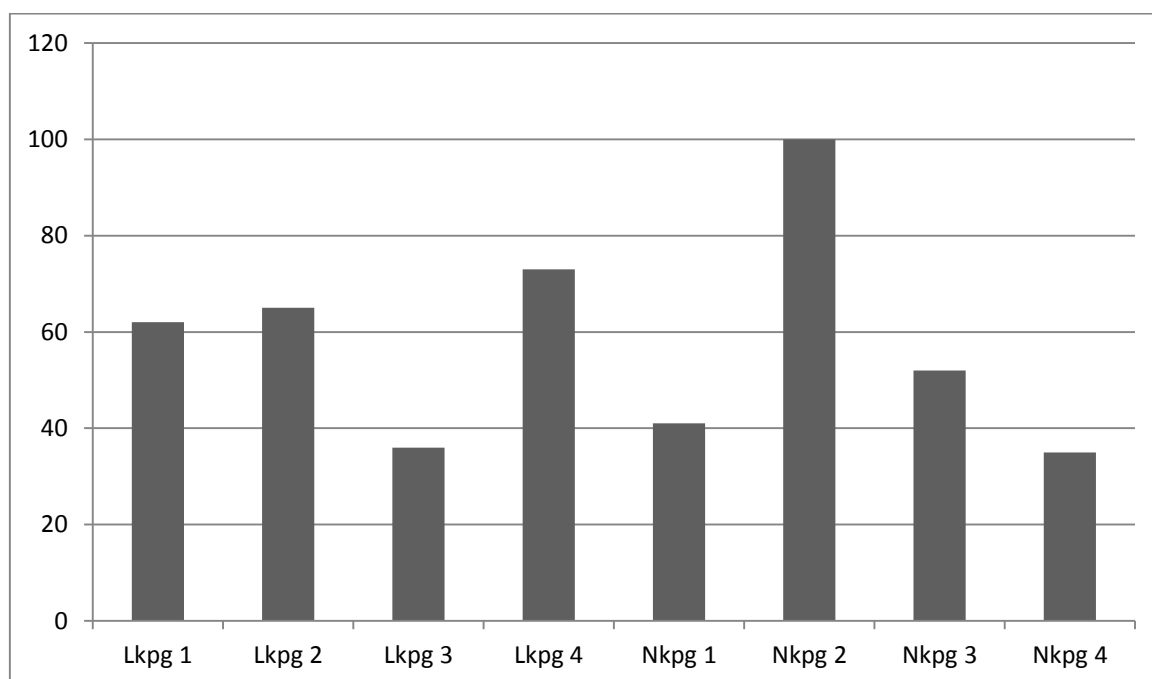
What can be seen in Figure 7 are large differences in morbidity among different medical centers in the cities. The patterns vary in the two cities. In Linköping there is a manifest connection between the rough social variable that is used here and the risk of being diagnosed with a cardio-vascular disease. It can also be noted that the diagnoses vary significantly within the cities. Norrköping and Linköping show different results in regard to the social factors. An area with a relatively stable residence pattern seems to be the worst place in Norrköping when it comes to myocardial diseases. However, it should be noted that it is Linköping that, although it has a smaller total mortality in cardio-vascular diseases, still harbors the most unhealthy places. On the other hand, Norrköping, while exhibiting a higher general mortality rate, has the best area, that is, the one with the lowest rates of cardio-vascular diseases (Figure 7).

Hypertension

Hypertension is one of the most important risk factors relating to the probability of suffering heart infarction. Thus it is also interesting to study this diagnosis in different medical center areas. A general comparison between the cities of Linköping and Norrköping shows a remarkably large difference with Norrköping exhibiting the worst results. About 2,000 more individuals in Norrköping have received the diagnosis hypertension than in the neighboring city, Linköping.⁴⁵ Figure 8 shows the number of individuals (per 1,000 inhabitants) in the age group 50-74 years reported with the diagnosis hypertension in the health centers studied for cardio-vascular diseases.

A comparison of hypertension and cardio-vascular diseases reveals similar patterns in regard to the different health areas. These differences are difficult to explain. The social classification does not seem to matter either in Linköping or in Norrköping. On the contrary it is the same medical centers showing both appallingly large numbers of hypertension diagnoses and the highest rate of cardio-vascular morbidity. It is, however, probably more complicated than that. Among other things, the way primary health care functions in different areas should be considered.

Figure 8: Hypertension diagnosis period 2005-2009 per 1,000 inhabitants of average population in the age group 50-74 years listed at selected health centers in Linköping and Norrköping. Source: County Council in Östergötland, Care-Services Database.



Discussion

The first finding is that there was a rising trend in cardiac diseases and deaths during the first half of the 20th century, at the same time that it became possible for infectious diseases to be dealt with. This was the era when vaccination programs expanded, sanitary conditions were improved, health information was spread and child care was developed. Death in infectious diseases thus gradually diminished in the interwar period. Cardiac diagnoses rose to become the dominant cause of death in the postwar period, partly as a result of a change in working life without a corresponding change in eating habits and a rising number of smokers, a trend that endured up to the 1990s.⁴⁶

Regional differences in cardiac death rates in Sweden have long been known. A better situation has existed in the southwest and the counties of Halland and Kronoberg, as well as in the county of Uppland, while the situation was worse in the counties of Värmland, Örebro and

Kalmar and the entire northern part of Sweden. Prior to the 1930s a clear difference existed between the towns and the countryside in favor of the latter. From the 1930s and thereafter the situation has been the opposite: cities became healthier than the countryside. The better figures for rural life before the 1930s may have been partly caused by unhealthy lifestyle, especially among in-migrants to cities who often were young and middle-aged unmarried men. The regional discrepancies may have been due to differences in food habits. Regional differences in unemployment have also been argued to cause regional differences in cardio-vascular diseases. The causes of the regional differences, however, need further investigation.⁴⁷

When the death rates in cardiac diagnoses in the two neighboring big cities in Östergötland are analyzed it can be seen that the situation in the early twentieth century was worse in Linköping than in Norrköping. This may be due to the fact that infectious diseases and death rates in tuberculosis declined earlier in Linköping. However, the picture began to change during the 1920s and thereafter. Cardiac deaths became more common among the poor textile workers in Norrköping.

The differences in cardio-vascular mortality in the two cities during the postwar period (Figure 6) may be summarized as follows:

- The mortality figures were higher in Norrköping during the whole period than in Linköping;
- A reduction seemed to occur;
- The differences between sexes seemed to decline as well.

When the morbidity figures in cardio-vascular diseases and hypertension are analyzed for the period 2005-09, it seems that there was a somewhat higher number of diagnoses in Linköping, the more prosperous city. This is surprising, given the mortality figures in the same diagnoses. Is it possible that there was a better chance for early discovery of cardio-vascular diseases and hypertension in Linköping because of more resources? Or was there a better chance to cure and thus survive heart diseases in this city, with its university hospital? In a ranking made by the head of the cause of death register in Sweden and the medical directors of some of the university hospitals in Sweden, the Linköping University Hospital was found to have the second best results during these years among all emergency hospitals in Sweden when it came to survival of heart infarctions. In the same ranking the emergency hospital in Norrköping had a position among the poorest five. The authors of the report were, however, cautious about drawing far-reaching conclusions, and they stressed that there are differences not included in the ranking when it comes to medical and socio-economic status of the patients at the various emergency hospitals.⁴⁸

When morbidity in cardio-vascular diseases and hypertension were deconstructed and analyzed in different neighbourhoods of the cities, there were even more surprises. The expected socio-economic pattern was not found. A diagnosis of cardio-vascular diseases or hypertension as a risk factor in the ages 50-74 shows that the differences were not the kind anticipated.

First and foremost, it is surprising that the seemingly prosperous area Nkpg 2 had the largest figures of all eight investigated health center areas when it came to hypertension. Other cardio-vascular disease diagnoses in Nkpg 2 also have seemingly high figures that are on the same level as Lkpg 4, the housing project area built in the 1960s and 1970s. The latter is an area that has had problems with integration, low level of education and high unemployment rates from the 1990s until today. The high morbidity figures in Nkpg 2 were not expected given the usual connection between socio-economic variables, morbidity and mortality. But there are differences between these “high-risk areas”. The foremost diagnosis in Lkpg 4 was ischemic heart diseases, while in Nkpg 2 it was angina pectoris that dominated.

However, if morbidity in cardio-vascular diseases in Nkpg 2 is compared with the corresponding suburb in Linköping, Lkpg 2, there are considerable differences to the disadvantage of Nkpg 2 (Figures 7 and 8). Thus there is reason to deepen the analysis of these neighbourhoods. What happens if the disease pattern is broken down on the basis of gender? And what patterns can be seen if class and ethnicity are taken into consideration in the comparison of Lkpg 2 with Nkpg 2? During the 1960s and 1970s there was considerable immigration of Finnish labour to Norrköping and not least to the suburb outside Norrköping, Nkpg 2. It is well-known that cardio-vascular diseases have been an even more significant cause of death among the Finns than among Swedes.⁴⁹ This was particularly true of individuals from the northeastern part of Finland and from Karelia, areas from which many were recruited to enterprises in Norrköping via Haparanda/Torneå during the latter part of the 1960s and the beginning of the 1970s.⁵⁰ This may be an explanation. There could, however, also be a bias when it comes to diagnoses made at the different health centers. Medical interest, cultural diagnostic traditions among doctors and more time to follow up the sick could all be explanations for the high figures of cardiac diagnoses at the health center in Nkpg 2. These factors could also account for the fact that the morbidity figures are different than expected when compared to mortality figures.

Another observation worth noticing is that Norrköping’s inner city, that is Nkpg 1, had the lowest morbidity in cardio-vascular diseases (8/1000 inhabitants), a level considerably lower than the corresponding area in Linköping, Lkpg 1 (13/1,000): that part of Norrköping also had the fewest hypertension patients of all eight investigated health centers. How representative are these residential areas of populations of the respective inner cities? What has migration and social change been like in these areas over time? Are the favorable differences in morbidity in cardio-vascular diseases in the inner city of Norrköping an indication of a wealthier population here than in the corresponding area of neighboring Linköping? There are numerous questions that need more detailed analyses of statistics from different databases (Cause of Death Registry, National Board of Health, Care-Services Database of the County Council of Östergötland and various databases in SCB, Statistics Sweden).

A third comparison worth noting is the development over time in cardio-vascular diseases in housing areas of the twin cities, Lkpg 4, and Nkpg 4, built during the 1960s and 1970s. The diagram shows that cardio-vascular diseases as well as hypertension especially, had a higher rate of diagnosis in Lkpg 4 than in Nkpg 4. The assumption has been made that there was change over time. Immigration to Norrköping started significantly earlier than in Linköping.

This was valid for the early migration flows from Chile and Iran in the 1970s and 1980s, but also of the refugees from the Balkan War during the first half of the 1990s. It is only with the invasion of Iraq in the beginning of the twenty-first century, that Linköping began to receive the same amount of refugees as Norrköping. The districts where immigrants and especially refugees were in the first place assigned housing were in the areas with large housing projects built in the 1960s and 1970s that is Nkpg 4 and Lkpg 4. These were the locations with empty available apartments, and today about one half the residents in these buildings have their origins from non-European countries. But what is the explanation of the relatively large differences in cardio-vascular diseases and hypertension between the two cities and the unfavorable results for Lkpg 4? One explanation may be that Norrköping earlier met the challenges of non-European immigration and thus learned how to successively build up expertise in the field of health promotion in neighborhoods with a high density of immigrants.⁵¹

Another explanation may be that the immigrants coming later were under more pressure, and the living conditions from which they fled had been even worse for the later refugees coming in the new millennium. Thus the situation may have been more difficult for the new immigrants in Linköping than in Norrköping. In Linköping the groups of immigrants were dominated by refugees coming in the aftermath of the Iraqi wars and the disintegration of Somalia. The earlier immigration to Norrköping consisted first of laborers from Finland, Greece and the former Yugoslavia. The first wave of refugees came from Chile and Iran in the 1970s. In the 1990s the flow was from the Balkans, especially Bosnia. Apart from better conditions and growth in Sweden during the 1970s, there were also better working opportunities in these decades. Bosnians also had better education than later arrivals, refugees from Iraq and Somalia.⁵²

A third explanation is very simple: a diagnosis is not the same as morbidity. A diagnosis is a professional estimation of a patient's disease status, but still just an estimation. There are also indications that these misdiagnoses have increased with new political governance and systems of remuneration. This point is clear in a newly published report from the National Auditing Office.⁵³

Conclusion(s)

The preliminary investigation of diagnoses in the Care-Services Database from the County Council in Östergötland has shown that the links between health and socio-economic information need revision as does the assumption that a higher social class position leads to better health. It is obvious that the inequalities in cardio-vascular diseases need additional research based on complementary explanatory models and that the neighborhood environments themselves have significance.

One starting point for an investigation could be to study the working conditions at different health centers and what the implications are for morbidity in cardio-vascular diseases. It is obvious that the conditions are not equal. For example, what are the consequences for morbidity when it was difficult to recruit doctors? And what are the consequences of different management theories and incitements given for the health care? Do the diagnoses for heart

diseases give a correct picture of morbidity in different surroundings when the health centers worked under different conditions? These are questions that need answers before any firm conclusions may be drawn.

¹The most common heart diseases are myocardial infarction and congestive heart failure. Diseases of the arteries are dominated by calcification in the aorta and stroke. Until 1970 the classification of these diseases was gathered under the same heading – “circulatory diseases”.

² World Health Organization, Cardiovascular diseases, Fact Sheet No 317, 2007.

³ World Health Organization, Atlas of Heart Disease and Stroke – Deaths from Coronary Heart Disease, Global Burden of Coronary Heart Disease, 2005.

⁴ European Heart Network and the British Heart foundation; European Cardiovascular Disease Statistics, 2005.

⁵ Mirzaei, M., Truswell, A. S. and Leeder, S. R. Coronary heart disease epidemics: not all the same. *Heart* 2009, 95(9): p 740-746

⁶ The dominant cause of death, CVD-mortality, shows a considerable decline from the late 1970s in Sweden. From 1988 until 2012 the decline amounted to 1-2% each year. Mortality declined first among the younger (20-49 years). Step by step mortality also diminished among the groups that included the middle-aged and those in early old age (50-74 years) with a clear downward trend around 1990. There was also a distinguishable age gradient, that is, the diminishing figures appear earlier in the younger age group. Even in the oldest group (75+), death was gradually postponed. When it comes to gender there was a clear tendency for mortality to be considerably higher among men, but the differences also seemed to be diminishing, especially in the ages that form the focus here, 50-74 years. People with poor education, especially women, were at a much higher risk of death in heart infarction. Socialstyrelsen, Sveriges officiella statistik, Hälso- och sjukvård. Dödsorsaker 2008, 2012 and 2013; Rostilla M, Toivanen S (eds), *Den orättvisa hälsan*, Stockholm 2012.

⁷ “Local mortality differences in heart diseases are documented” in Grip B, *Samhällsförändring och det ömtåliga hjärtat*, licentiate thesis, Linköpings universitet 2012; Nilsson, H. and Faresjö, T. *Stor skillnad – om ojämlik hälsa i Linköping och Norrköping*, CKS Rapport 2012:3, Linköping 2013; Wennerholm, C., Grip, B., Johansson, A-K., Honkasalo, M-L., Nilsson, H., Faresjö, T. “Cardiovascular disease occurrence in two close but different social environment”, *International Journal of Health Geographics* 2011, 10:5.

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¹¹ Vågerö, D. “Ökade skillnader i hälsa i världen - ojämlikheten globaliseras”, in Rostilla, M. and Toivanen, S. (eds), *Den orättvisa hälsan: Om socioekonomiska skillnader i hälsa och livslängd*, Stockholm 2012.

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¹⁴ Fritzell, J. “Socio-ekonomiska skillnader i hälsa” in Rostilla, M. and Toivanen, S. (eds), *Den orättvisa hälsan*, 2012, Stockholm

¹⁵ Ibid

¹⁶ SCB, Historisk statistik för Sverige 1715-1967, del 1 Befolkning, tabell 115 Spädbarnsdödlighet.

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¹⁹ Grip, B. *Samhällsförändring och det ömtåliga hjärtat* (licentiate thesis) chapter 6, Linköping University 2012.

²⁰ Sundin, J. and Willner, S. *Social change and health in Sweden. 250 years of politics and practice*, chapter 4 and 5, Stockholm, 2007.

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