DIFFERENCES IN PREVALENCE OF CARDIOVASCULAR DISEASES IN EUROPE

A CROSS-SECTIONAL STUDY

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Abstract

Europe is facing a major health problem, related to chronic diseases. Because of the transition towards man made degenerative diseases, the causes of death for European countries consist mostly of chronic diseases, especially cardiovascular diseases. In order to find new ways to tackle this problem, this study analyses the differences in cardiovascular disease prevalence between European countries participating in the SHARE project. The influence of the population composition, age and sex, on the cardiovascular diseases rate is shown. A model is proposed that takes macro risk factors into account. A countries GDP is found to be a significant predictor for the cardiovascular diseases (CVD) rates. Other macro risk factors are shown to be related to the CVD rates as well, including government expenditure on health, as well as the health personnel employed in hospitals. In order to improve cardiovascular disease prevention programs, more attention must be paid to the influence of the macro-economic factors and healthcare quality and access in general.

Keywords: Cardiovascular diseases, risk factors, Europe, GDP, population composition

Table of Contents

1 Introduction

When looking at the world and diseases in general, people often look at Africa as the continent with the most widespread and deadly diseases. However, Europe as a continent also has its own disease problems, which can be just as deadly. Although European death rates are declining and life expectancy is on the rise, health is still an issue. Degenerative disease mortality is declining, but the percentage of deaths caused by these diseases is still very high. According to the epidemiologic transition model, most European countries are currently in the fourth stage, which encompasses a rise in life expectancy to 80-85 years and a decrease in man-made and degenerative disease mortality and the emergence of new diseases, such as HIV and Lyme. The man-made diseases and degenerative disease are now the most important reason for mortality and include chronic diseases, like cardiovascular diseases and cancer (Omran, 1998). The epidemiologic transition model is a source of inspiration for this research, in which the main focus is on chronic diseases, more specific, cardiovascular diseases, in European countries. Europe has now moved towards “The age of declining CVD mortality, ageing, lifestyle modification, emerging and resurgent diseases”, according to Omran (1998, p. 2). In the future, as Omran states, “the age of aspired quality of life, with paradoxical longevity and (futuristic stage) persistent inequities” (1998, p. 3), is the next stage for the western nations. Ultimately, the question is, how do we get there? Even though the deaths from cardiovascular diseases are declining in most European countries, there are a lot of differences between these countries, when looking at the number of people with the diseases (European Society of Cardiology, 2015). But what could be the explanation for these differences, and how can they be reduced?

1.1 Background

Chronic diseases are diseases of long duration and generally slow progression (ECDA, 2015). A type of chronic disease, called cardiovascular disease (CVD), is a group of diseases that includes heart and blood vessel problems, such as stroke, high blood pressure, coronary artery disease or a heart disease (EC, 2015a). The CDC (2015a) states that seven of the top ten causes of death in 2010 worldwide were chronic diseases. These diseases have increased in prevalence compared to other illnesses, due to the fact that acute deaths from these illnesses have decreased and vaccination programs prevent the spread of these diseases. People live longer and are therefore more susceptible to other types of diseases related to old age. They are caused by a multitude of different lifestyle factors and not a single reason. The most deadly two disease groups were cardiovascular diseases and cancers, which caused almost 48% of all deaths all over the world. According to Busse et al. (2010) cardiovascular diseases are one of the main causes of death, together with cancer, chronic respiratory diseases and diabetes, they are good for 86% of all causes of death in Europe. Cardiovascular diseases are the largest factor, with 52%. What makes it so important to tackle this problem, is the fact that 80% of premature heart disease and stroke is preventable (WHO, 2015). Another important fact is that chronic diseases have a large impact on a person’s life expectancy and can cause all kinds of other diseases and disabilities. Even for society in general, it is important, because as the prevalence of chronic diseases increases, so does the social, economic and medical burden for society (EUObserver, 2015). According to Busse et al., chronic conditions “depress wages, earnings, workforce participation and labour productivity, as well as increasing early retirement, high job turnover and disability. [...] As expenditure on chronic care rises across Europe, it takes up increasingly greater proportions of public and private budgets“(2010, p.1).

The determinants of health include the social and economic environment, the physical environment and individual characteristics and the behaviour of a person (WHO, 2014). However, these conditions are not the same for the different European countries and within countries there will also be differences. As an indicator for public health, chronic diseases are often used, because, as stated above, they are one of the most common causes of death. The chances of developing chronic diseases increases as people age. So, in an ageing population, the percentage of chronic diseases will increase.

Because of the growing ageing population in a lot of European countries, the European Commission is very interested in this part of the population. The European Commission have therefore created a survey called SHARE (Survey of Health, Ageing and Retirement in Europe), which will give more insight, for example, in health and socio-economic status for a lot of European countries (Börsch-Supan et al., 2013). SHARE is mostly focused on personal determinants, for example on the known influences of lifestyle behaviour, like smoking, drinking or physical activity, but there are a lot of different factors that could influence the differences in cardiovascular diseases between European countries. For instance, social and environmental factors also play an important role in the development of cardiovascular diseases. Also, there is inequality in the burden of the conditions and in the access to prevention and control (EC, 2015b). In this paper there will be more focus on these and other macro-level determinants, like population composition, GDP, income levels, education levels and health services, because this has not been investigated that much yet. Even more, these macro-level determinants differ greatly for most of the European countries.

1.2 Objective

The objective for this research is to describe, or explore and explain, the differences in prevalence of cardiovascular diseases in the different European countries. By researching the differences in prevalence of cardiovascular diseases, there will be more knowledge available in the future about these differences and what causes them. Armed with this knowledge, the population, the government, municipalities and health facilities in the different countries, could play a role in preventing and resolving this problem of inequality, by influencing the controllable determinants that have a negative effect on the health of people. And possibly by working together with the other countries, the inequalities could be reduced.

1.3 Research Questions

What are the main differences in the prevalence of cardiovascular diseases between European countries?

- How are cardiovascular diseases spread across European countries?
- How does the age and sex composition influence the differences in cardiovascular diseases between countries?
- How could the remaining differences in cardiovascular diseases be explained by differences on the macro-level?

1.4 Structure of the Paper

In the following chapters these research questions will be tried to answer. In chapter two the theories that will help to answer these questions will be shown together with the literature already published about this topic. In the end, a conceptual model will be presented, which will show the objective of this research in a picture. Chapter three is all about the data and methods that are used in this paper. First of all the two data sources will be explained and examined on data quality. In the second part of this chapter, the methods that are used are set out. Then, chapter four will show the results that are obtained. And chapter five is about the conclusion discussion that is created by reflecting on the results. Also some recommendations for further research will be explained.

2 Theoretical framework

The theoretical framework contains the theories, literature and conceptual model that are relevant to this research. The theory by Whitehead and Dahlgren (1991) and their model will be discussed first. Next, literature that handles similar problems which are related to the three research sub-questions is discussed. The conceptual model captures all this information and maps it to this research.

2.1 Theory

The model that is used here to explain the relations between the different factors, has been created by Whitehead and Dahlgren (1991). This model is explained by Popay et al. (1998) and is shown in Figure 1. The model represents the factors that influence health and that create inequalities. This is important for this research in order to explain how the age and sex composition and how the macro-level factors can affect the differences in cardiovascular diseases.

First, the biological factors age, sex and the genetic characteristics provided by the biological parents are at the bottom of the model. These are the health determinants that cannot be influenced by the individual. The second set of factors are about alcohol and drug usage, as well as eating habits and physical activity. These factors can directly influence the physical characteristics of a person and can be directly changed by the individual. Those two layers in the model represent the personal characteristics and behaviour and are also called downstream factors.

The next step in the model includes the social and community influences, which describe the outside influences that an individual cannot control. The next step, living and working conditions describe the factors such as, education, housing and work environment, which can be partially influenced by the individual. The last one, the general socioeconomic, cultural and environmental conditions, can also partially be influenced by the individual, for example by choosing a place to live or to work (Popay et al., 1998). The top three layers represent broader factors, also called upstream factors.

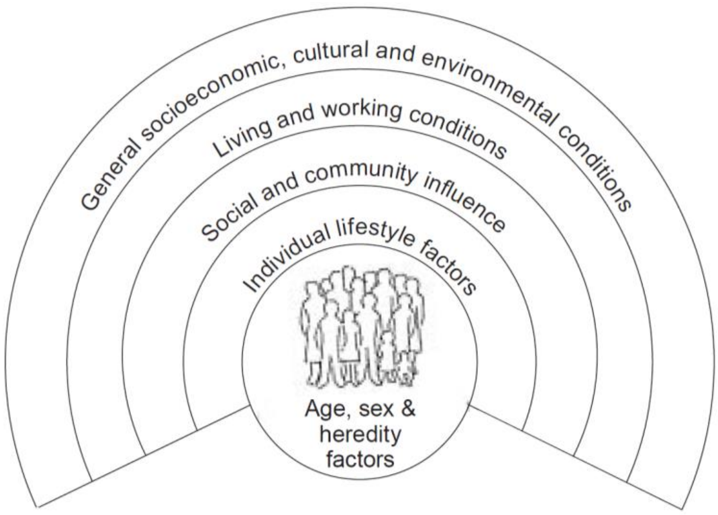

Figure 1: The Whitehead/Dahlgren model (source: Dahlgren and Whitehead, 1991)

What this model provides, is a way of abstracting the factors that are important for a person's health. The factors have been grouped and each layer can only directly influence the layer above and below. The bottom four layers include determinants that can directly influence a person's health. For instance, the older a person becomes, the larger the chances become for developing certain diseases. Also, smoking or alcohol abuse can adversely affect a person's health. A social or community influence can result in stress or depressions, which are proven bed for a person's health. The living and working conditions can have adverse health effects, with things like work related hazards or bad housing and limited sanitation.

This model therefore describes in general the interactions between the layers and health and is used as a guideline for this study. Especially the influence of the macro-level variables is based on this model. GDP for instance, can only influence a person's living and working conditions. This can work its way down the model, and result in more adverse health effects.

2.2 Literature review

A lot of literature deals with disease causes, symptoms and effects. For this study, literature concerning the causes and risk factors is particularly interesting. Related studies have come up with a number of risk factors and even risk markers concerning health in general and cardiovascular diseases specifically. The WHO is one of the most important sources that produces studies on this subject. The CDC is another institution that generates a large amount of health related studies. Other researchers, such as Yusuf et al. (2001), provide overviews of existing literature concerning cardiovascular diseases. Other researchers have also worked on literature that is discussed in this section.

The WHO (2007) distinguishes the main determinants of health. Which, as they have stated, can be influenced by decisions on individual, commercial or political level. Several important health factors are divided into the following groups, positive health factors, protective health factors and risk factors Positive health factors are important in keeping a person healthy and consist mainly of food security, economic security and adequate housing and as well as social relationships and a form of control over one's life. Protective factors are behaviour or characteristics of an individual or his environment that can reduce or prevent adverse health effects. For example, the WHO (2007) states that external vaccination and immunization by the body itself are important factors in protecting the human body from diseases. Other factors, such as healthy food and purpose and direction in life are important as well, according to the WHO (2007).

2.2.1 The risk factors for cardiovascular diseases

The risk factors are the most important aspect of this study. These factors cause diseases and increase health problems and they are preventable. Risk factors can be very broad and can relate to the individuals environment, lifestyle or even social factors. If you look at the model by Whitehead and Dahlgren, some risk factors, like smoking, can be considered a type of individual lifestyle factors, while other factors fall under the category of living and working conditions. These are usually closely related, for example, someone's living conditions and education level could lead to misuse of alcohol or narcotics usage. Also, broader nationwide health risk factors, like pollution, are included in the top layer of the model. Other risk factors that are included in the top layer can act on two dimensions, on group level within a country and on country level. For instance, relative poverty could be limited to a certain group within a country, but could also be nationwide (WHO, 2007; CDC, 2015b).

The main risk factors for CVD that have been found, are provided by several epidemiologic studies and institutions, using all kinds of research methods. This includes cohort, case-control and ecological studies, which have analysed the causality using multiple criteria. There are two types of risk factors, the proven causal risk factors and the risk factors, also called risk markers, that have an association with CVD, but where causality has not been proven yet. The factors and markers can have a direct effect, but can also work through raising other proven risk factors. An example of this is low socioeconomic status. In general, CVD is mostly caused by a couple of behavioural risk factors, including tobacco use, alcohol abuse, unhealthy diets and physical inactivity (WHO, 2007; CDC, 2015b; Yusuf et al., 2001). Table 1 lists the downstream and upstream risk factors that have been found consistently among multiple studies and contribute to the prevalence of CVD in Europe.

Downstream risk factor	Upstream risk factors
Tobacco consumption* High blood pressure* High LDL-cholesterol* Overweight/Obesity* Unhealthy diet* Physical inactivity* Elevated glucose* Low HDL- cholesterol* Iron deficiency Alcohol abuse Drug abuse Psychological factors** Unemployment**	Income inequalities** Hazardous working conditions Breakdown of social structures** Trade policies Low socioeconomic status** Air pollution** Limited fitness facilities**
* Causally linked with CVD and proven by quantitative analysis ** Associated with CVD, not proven by quantitative analysis	

Table 1: Important contributors to the total burden of disease in the European region, 2015. Source: WHO, 2007; CDC, 2015b; Yusuf et al., 2001; Mobley et al., 2006; Brook et al., 2004.

It is important to note that the risk factors in Table 1 may not be all the risk factors that can have an effect on CVD. There are studies that suggest that these factors only explain half of the variance in CVD. This can be caused by an underestimation of the effect of each of the risk factors, or because some other risk factors have yet to be found (Chockalingam et al., 1999).

The several downstream risk factors are discussed in a lot of literature and are of less importance for this study. For instance, physical inactivity has been proven to be causally linked to CVD risk by several other studies (Katzmarzyk et al., 2009; Haapanen-Niemi, 2000). Also, obesity can be measured using weight and waist circumference. Both of which have been proven to be a causal risk factor for CVD (Dobbelsteyn et al., 2001; Hubert et al., 1984). A psychological factor that has been shown to be related to CVD risk is stress, which is often job related. This is confirmed by Kuper & Marmot (2002).

As can be seen from Table 1, the upstream risk factors are less clearly defined. This is because these are difficult to measure, macro factors. These macro level relations can be seen as aggregated population health indicators. People generally do not have a lot of influence on these factors, they are more or less given, depending on where you are born or live. So, when looking at the main determinants of health, it is also important to look at the macro risk factors, not just the micro factors. The next section will show results from other literature that have examined the relation between macro factors and CVD prevalence or mortality.

2.2.2 Macro or upstream risk factors for cardiovascular diseases

One of the important macro factors that can influence a person’s health is the wealth in developed and developing nations. The link between GDP and health indicators is universal, as is confirmed by existing literature. According to several sources, lower income results in poorer health, because affordable medication and balanced nutrition is affected. Also, housing and health services quality is lowered. The effect of lower income can differ between the European nations. In more developed nations, people with lower income are often supported by different social services. In less developed nations, these services are often not present. However, there is a striking consistency in the association between poverty and health. Poverty is the most important cause of preventable death, disease and disability. The difference between poor and non-poor vary enormously across countries and regions, but countries with lower mortality and morbidity rates have the greatest differences. An increase in per capita income leads to an increase in health inequality. The relation works in two ways, as poor health can also lead to lower economic status. Poor health is associated with progressively lower incomes. Indicators are the GDP, per capita income, scale of expenditure, consumption and production of goods and services. A low income leads to low health expenditures and a lower average life expectancy. Poverty reduction can help decrease the inequalities. (Beaglehole & Bonita, 2004; Filmer & Pritchet, 2001; Subramanian et al., 2002).

Also linked to wealth and health is employment status. Having a job means that you can pay your medical bills. This is confirmed by several studies. There is a strong positive relation between unemployment and several adverse health outcomes. This relation is visible through several risk factors that are more prevalent among unemployed people. This results in increased adverse health outcomes. The other way around also has a positive relation, but it is weaker. It is not conclusive that unemployment causes these outcomes directly, but a relation exists nonetheless. Likely there are many other factors that influence this outcome, which could be social, economic or clinical. The adverse health outcomes can include physical or mental illness and increased use of health care facilities. It is important to notice that the association between unemployment and adverse health outcomes disappears as the general unemployment rate of a nation increases. Even the threat of unemployment can cause an increase in cholesterol levels and blood pressure, this is especially the case with men who had more sleep disturbance. This effect can even be seen when the company explicitly states that suitable work alternatives will be sought and early retirements will be granted. Also, the effect was measured in a country with unemployment benefits (Jin et al., 1995; Mattiasson et al., 1990).

Education is important as a factor for wealth, employment and health. An extra year of education can increase a person's income by 8% and increases a person's life expectancy. Independently a person's income can also increase the life expectancy. This doubles the effect (Deaton, 2002).

Socioeconomic status is another factor that can be associated with cardiovascular risk factors. In the following study, adolescents aged 12-17 have been monitored and a negative relation was found between risk behaviours for chronic diseases and socio economic status. The lower the socio economic status, the higher the risk behaviours among adolescents. Risk behaviours included tobacco use, alcohol use, unhealthy diets and sedentary lifestyles. A possible improvement of this behaviour could be achieved by community or school programs focusing on preventing these risky behaviours (Lowry et al., 1996; Mackenbach et al., 1997; Mackenbach et al., 2008).

Also important are primary physician facilities and the availability of healthcare in general. Improvements in life saving technology should not be ruled out, as technological advancements can increase the chances of survival and early detection of diseases. Health insurance and health policies provide a way for people to afford more healthcare than without insurance (Deaton, 2002).

The living environment of an individual is also important according to several studies. For instance, different forms of air pollution are positively associated with cardiovascular risk factors. Multiple studies have confirmed this result, although studies differed in sample sizes, locations and atmospheric conditions. Short-term exposure to elevated air pollution levels gives significant contributions to acute cardiovascular mortality. Hospital admissions are also increased for different cardiovascular diseases when the pollution levels rise. Long-term exposure reduces the overall life expectancy with a few years (Brook et al., 2004). Other factors in the living environment can also be associated to cardiovascular disease risks. This includes the land use mix index, crime rates, fitness facilities, affluence and racial segregation. People living in rural areas have a greater CVD risk. Fitness facilities have a significant negative relation with CVD risk. Crime is positively related to CVD risk, more crime in the neighbourhood, means a higher CVD risk. (Mobley et al., 2006).

According to Deaton (2002), it is necessary to look at both health and wealth when developing policies. Health inequalities are closely related to income inequalities. Focusing only on health when developing policies to combat inequalities can have negative effects. For instance, in order to prevent smoking, taxes on cigarettes are often raised. This can have a negative effect, because people will not stop buying them because of their addiction. This will result in the often already low income individuals to have even more reduced spending power.

2.2.3 Spread of cardiovascular diseases

The spread of the cardiovascular diseases in Europe is very important, because it is the starting point of this research. For instance, which countries have more deaths related to these diseases and which countries have less deaths. The European Cardiovascular Disease Statistics Report 2012, contains much of this information. In this report it is stated that most deaths are caused by coronary heart disease (CHD) and stroke. As can be seen in Figure 2 and Figure 3, the death rates from stroke and CHD are much higher in Central and Eastern Europe than in Western, Southern and Central Europe (Nichols et al., 2012).

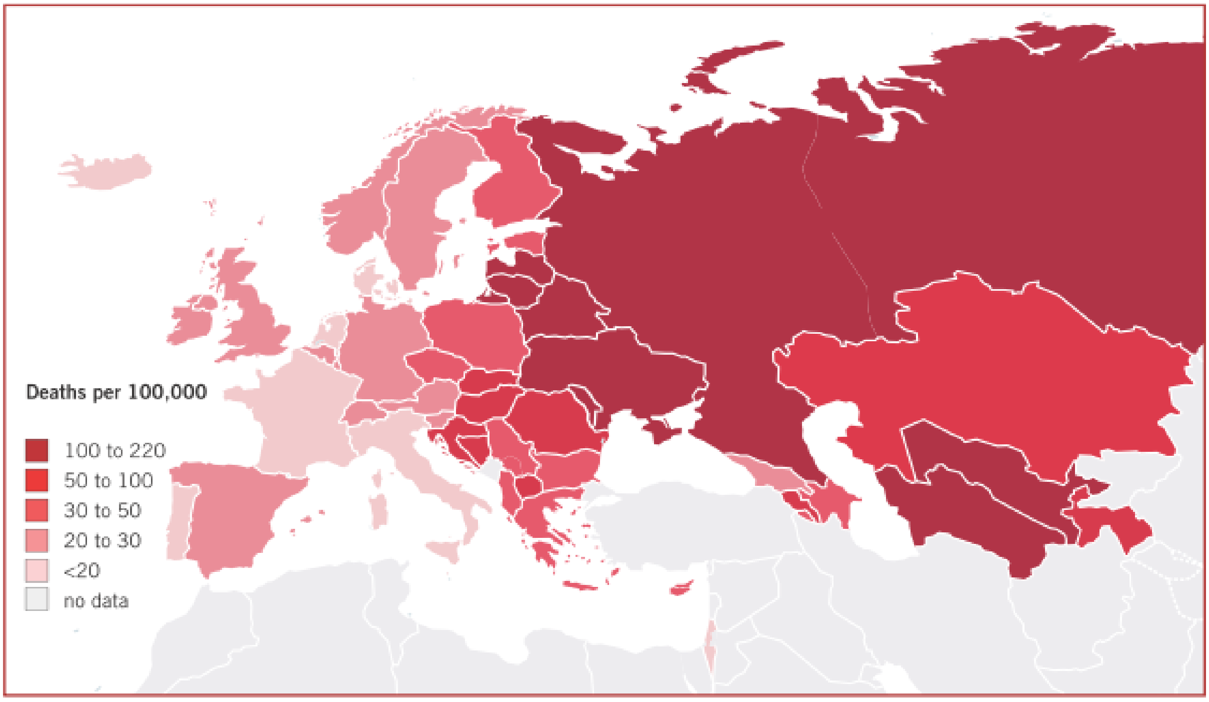

Figure 2: Age-standardized death rates from Coronary Heart Disease (CHD), men under 65, 2010

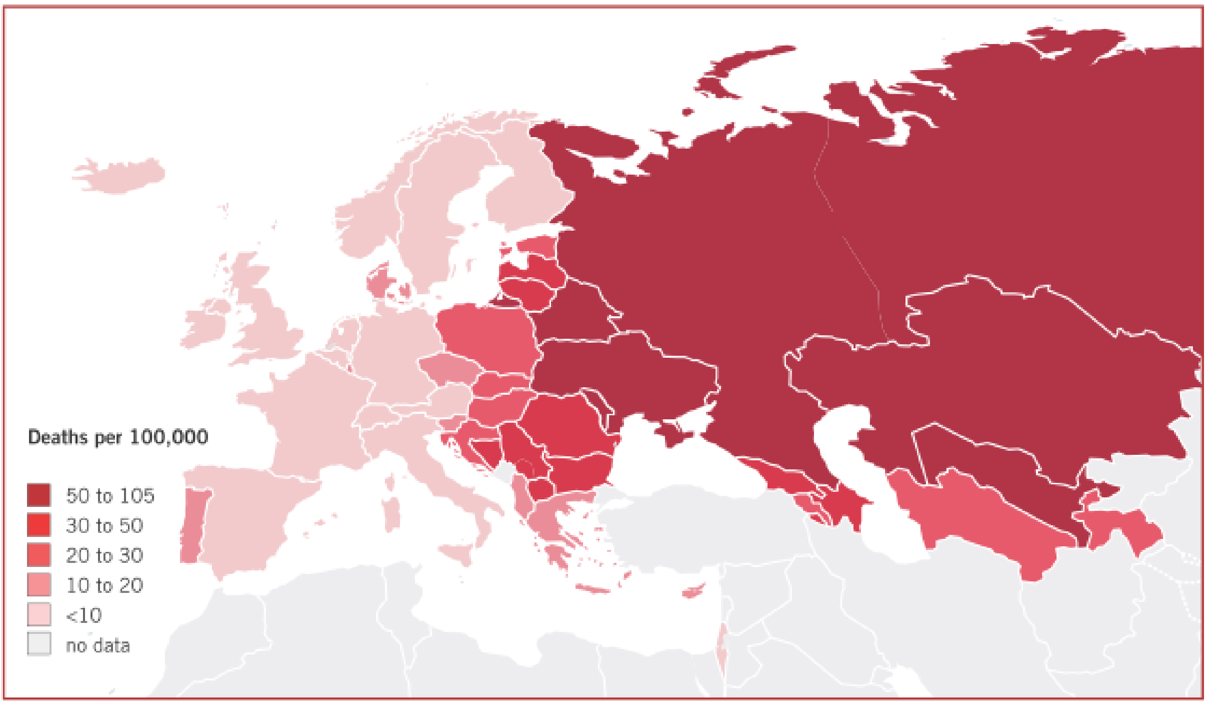

Figure 3: Age-standardized death rates from Stroke, men under 65, 2010

This is clearly a big difference and this indicates a high inequality in health between the different European countries. This is also confirmed by Levi et al. (2002), who stated that there were major geographical differences in CVD mortality trends. Especially some Eastern European countries had exceptionally high CVD mortality rates. These have been declining the last few decades in most European countries, but the Eastern European countries have experienced an increase in the 1990s. This has put these countries in the top 10 of the worldwide CVD mortality rates.

The research focusing on between country risk factors is limited. It is difficult to compare and find complete and consistent data sets on individual behavioural risks as well as macro risks. Wealth seems to be one of the most important factors that have been compared in studies. Wealth is studied in the form of socioeconomic status as well as education levels and income levels separately (Nichols, et al. 2013).

The country differences in CVD mortality are related to the socio-economic inequalities between different groups within and between countries. CVD mortality rates are higher for people with lower occupational class or educational level. To combat these inequalities, it is important to focus on lowering the behavioural risk factors that are present within these groups. In Western Europe there is a north-south division, where the inequalities within the northern countries are larger than in the southern countries (Mackenbach, et al., 2000).

2.3 Conceptual model

The conceptual model is shown in Figure 4. Two different types of factors are specified. Macro and population composition factors. The macro factors are national policy statistics, such as the healthcare and education budgets. But also national statistics that are not directly related to policies, including the (un)employment rates, healthcare facilities, education levels and the GDP. The population composition factors include the age and sex of the nation’s population.

The age and sex composition factors have a direct influence on the prevalence of CVD. Female prevalence rates are a lot lower than male rates. Age is also an important factor, the older people are, the higher the prevalence rates.

The macro factors do not have a direct influence on the prevalence rate, but they work through the various layers as described in Whitehead and Dahlgren's model (1991). The macro factors are present in the outer two layers, where they can influence an individual's social life and community and his lifestyle factors.

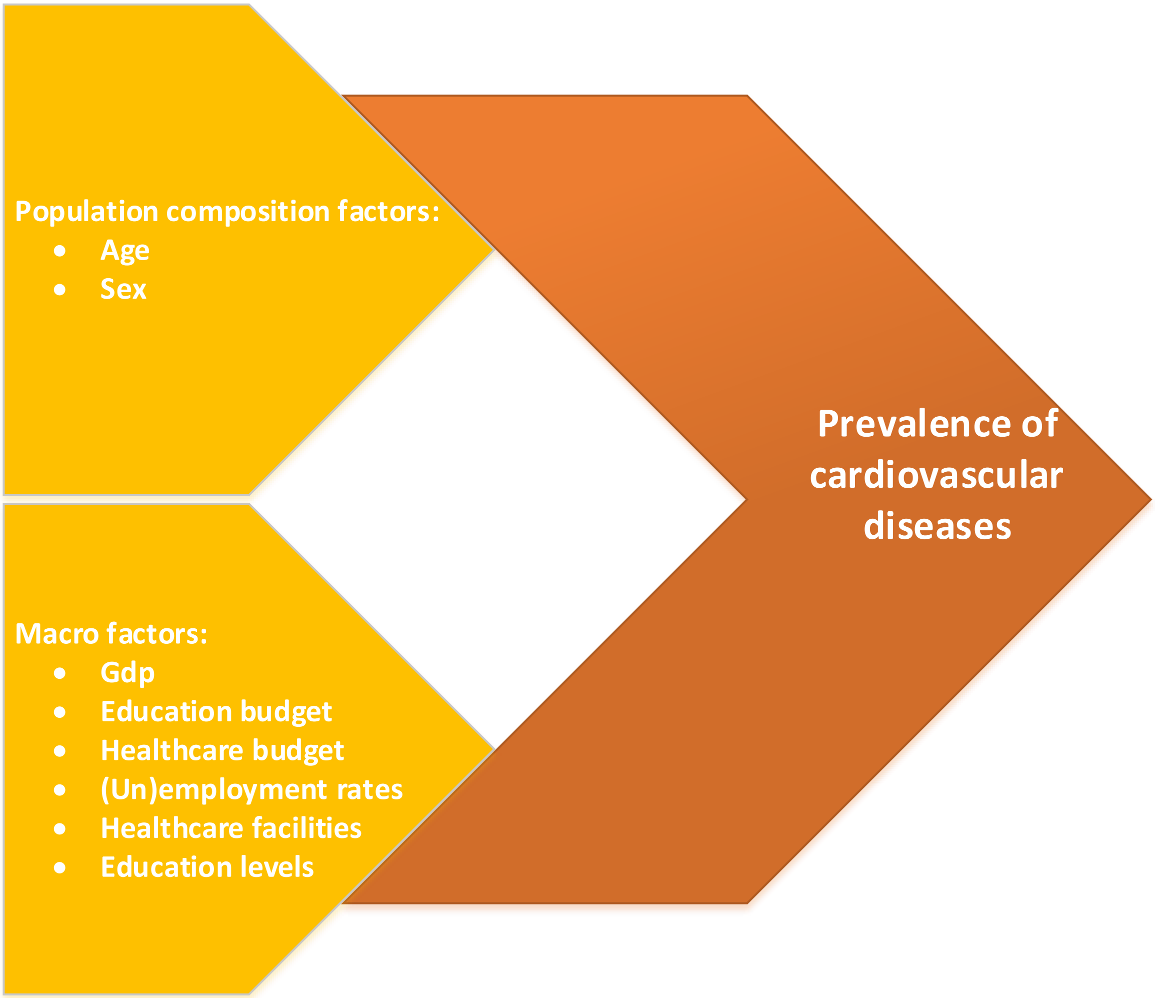

Figure 4: Conceptual model

3 Data & Methods

In this section the study design, the data used and the methods used to obtain the results are listed and explained.

3.1 Study design

This study is a descriptive research (O'Leary, 2010), trying to describe the possible relations between CVD and several macro factors. A cross-sectional study is done, collecting quantitative data from the year 2011 from two statistical data sources, the SHARE survey project and Eurostat. Therefore, all the data used in this research is secondary. This choice was made, because it is impossible to gather the same amount of quantitative data as the SHARE project within this thesis and an analysis of a small set of self-gathered data is not representative for the European region. Furthermore, the data from SHARE and Eurostat are comparable and matching dates can be used. Also, because of the size of the SHARE project and the Eurostat databases, there is no shortage of data on the topics discussed in this thesis.

3.2 The SHARE Project

The Survey of Health, Ageing and Retirement (SHARE) is performed in 20 European countries and has resulted in quantitative data. Data in the SHARE project has been gathered in waves spanning a year (2015a). Not all of the participating countries have joined every data collection wave of SHARE. Figure 5 shows which countries have been included in each wave.

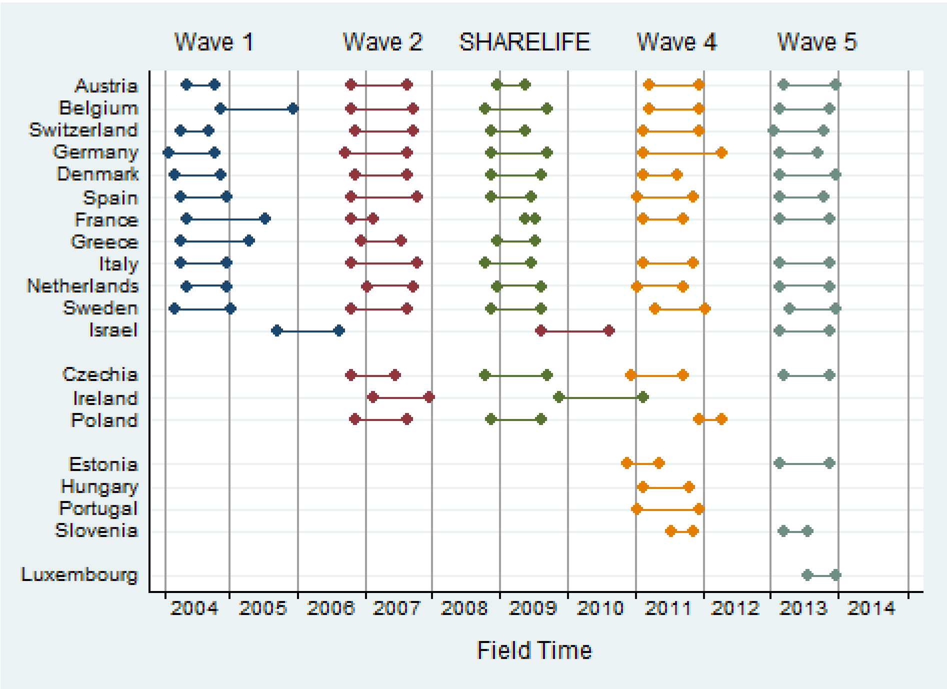

Figure 5: Country wave field time overview (SHARE, 2015b)

Based on Figure 5, the decision was made to use the fourth wave, which was gathered in 2011, for this research. In this wave the most interesting European countries are included. Even though the fifth wave is more recent, Poland, Hungary and Portugal are not participating in this wave, giving less results. Also, the fourth wave is only missing two newer questionnaire modules, which are not relevant for this research. So, the choice is made for the fourth wave, a little bit less recent, but more countries are included, in total 16 European countries.

The SHARE project uses a number of different questionnaires that can differ between the waves. The two questionnaire modules that are here are listed in Table 2 below.

Questionnaire Module	Data used
Demographics	Country of residency, year of birth (used to calculate respondent's age in 2011) and sex of the respondent
Physical Health	Current conditions of the respondent

Table 2: Overview of used CAPI modules from SHARE: Wave 4 (SHARE, 2015b)

The country of residency is used to combine the respondents into country specific groups. The year of birth is used to calculate the age of the respondent in 2011. The age and sex are used later on for the age and sex standardization. The current conditions of the respondent is used to check if the respondent currently has a cardiovascular disease.

The quality of the data from SHARE is high. For example, the SHARE project upholds several data quality standards, focusing on all the aspects of data generation (Börsch-Supan et al., 2013). Based on research analysis of the first three SHARE waves, the data has been strongly consistent between the waves, with less than 10% recall errors over all the events that have been measured. The amount of recall errors is largely determined by the respondents' age, gender and family status. (Garrouste et al., 2011)

SHARE hires survey agencies to perform the surveys. At the time of wave three of SHARE, there were 14 agencies that were performing the surveys. These agencies are required to uphold certain standards in order to maintain the quality of the survey data. The interviewers have to complete several training courses. Also, the agencies must have more than 50 interviewers that are participating in each wave. Every interviewer is not allowed to perform more than 50 interviews. At least eight attempts must be made to perform an interview, before the interview is cancelled. The retention rate should be at least 80 percent between waves. Lastly, at least 20 percent of each interviewer his completed interviews have to be verified. For each of the requirements a few agencies did not meet the specifications. (Alcser et al., 2011)

3.3 Macro data

Eurostat uses different types of data gathering techniques among all European countries, which results in quantitative data, which could also come from other sources than Eurostat. Eurostat is used here to gather macro data concerning the European countries.

From the data tables of Eurostat only data from 2011 is selected, in order to match the data with the SHARE data. The following data tables are used in this research.

GDP per capita in PPS: Gross domestic product (GDP) is defined as the value of all goods and services produced minus the value of any goods or services used in their creation. Purchasing Power Standards (PPS) is set at 100 for the average of all 28 European countries (Eurostat, 2015d).

Unemployment rate: of the total population, men and women, age group 15-74: This rate is calculated by the number of unemployed individuals divided by the total labour force, which is the number of unemployed individuals added to the number of employed individuals. Unemployed individuals are considered peopled aged 15 to 74 and currently without work and have been for at least four weeks (Eurostat, 2015g).

Employment rate: of the total population, men and women, age group 20-64: The employment rate of the total population is calculated by dividing the number of person aged 20 to 64 in employment by the total population of the same age group. The indicators are based on the EU Labour Force Survey (Eurostat, 2015h).

At least upper secondary or tertiary educational attainment, of the total population, men and women, age group 25-64: This is defined as the percentage of the population that has completed upper secondary education (ISCED 1997 level 3-6). The indicators are based on the EU Labour Force Survey (Eurostat, 2015k).

Tertiary educational attainment: of the total population, men and women, age group 55-74: This is defined as the percentage of the population that has completed tertiary education, like university, higher technical institution (ISCED 1997 level 3-6). The indicators are based on the EU Labour Force Survey (Eurostat, 2015j).

General government expenditure on health: percentage of GDP: Annual expenses on health, where health is specified as a COFOG (UNSD classification of functions of government) function (Eurostat, 2015e).

Expenditure on public and private educational institutions: percentage of GDP: Annual expenses on educational institutions, such as expenditure for personnel, other current and capital expenditure (Eurostat, 2015i).

Health personnel employed in hospital: head count per 100 thousand inhabitants. Health personnel includes the people that are employed in general and specialised hospitals as well as self-employed staff (Eurostat, 2015f).

Self-reported unmet needs for medical examination: percentage of the population aged 16 and over, men and women combined. For all reasons combined: too expensive, too far to travel or there is a waiting list. Self-reported unmet needs is defined by an individual's own assessment of whether he or she needs medical care or examination, but cannot get it due to it being too expensive, too far away to travel or because of waiting lists (Eurostat, 2015l).

The data quality of Eurostat is high as well. The quality of Eurostat is checked and maintained by its own Quality Assurance Framework, which is in compliance with the European Statistics Code of Practice. This includes 15 principles covering the institutional environment, statistical processes and statistical output stated by Eurostat (2015). Based on these principles that are proven in practice, using good practice indicators, the Eurostat data is considered to be of high quality (Eurostat, 2015).

3.4 Concepts

To analyse the prevalence of CVD in the different European countries in SHARE, an indicator must be used. The data from a question in the CAPI main questionnaire (SHARE, 2015c) is used as an indicator. The question that has been chosen is: "PH006_DocCond", which asks about the current conditions of the respondents. The full question is listed in Appendix A. For analysis of the occurrence of CVD in this pool of respondents, the answers to these doctor defined conditions are used. These are answers one, which is a heart attack or heart problem and four, which is a stroke or vascular disease. These answers will be used as an indicator for the prevalence of CVD. This indicator was chosen, because the question states that the person currently has the indicated disease. Answer two with hypertension and high blood pressure is not chosen, even though hypertension is included in CVD. But high blood pressure is not, and there are too many respondents that have chosen this answer, which would mess up the results.

The following macro factors that have been chosen are:

- GDP per capita in PPS
- Unemployment rate, men and women, age group 15-74
- Employment rate, men and women, age group 20-64
- Upper secondary or tertiary educational attainment, men and women, age group 25-64
- Tertiary educational attainment, men and women, age group 55-74

- Total government expenditure on health, percentage of GDP
- Total expenditure on public and private educational institutions, percentage of GDP
- Healthcare personnel employed in hospitals, head count per 100,000 inhabitants
- Percentage of self-reported unmet needs for medical examination, because it is too expensive too far to travel or there is a waiting list

The Employment and unemployment rates have been chosen, because of their relation with health in general, as stated in section 2. The same goes for the GDP, as wealth is an important factor in public health.

Educational attainment was chosen to verify the education levels within the countries. Education can have a big impact on income, socioeconomic status and the ability to pay medical bills as has been shown in several studies concerning health. It is also related to lifestyle behaviour, as smoking and drinking is more common among lower educated people. Two different age groups and education levels are used to try and see if there is a difference in the effect.

Related to the GDP is the expenditure on health by the government. Another useful factor is the total expenses on educational institutions, giving information on the educational system and its size. To try and remove some of the dependency between these factors and the GDP, a percentage of GDP is used.

The last two factors are the healthcare personnel and the percentage of unmet needs for medical examination. Both factors have been chosen as indicators for the quality of the healthcare system in each country.

3.5 Data handling

To analyse the data and to answer the research questions, three statistics tools are used. SPSS, Excel and ArcMap. The SHARE data is supplied in SPSS data format and SPSS is used to merge the different data sets from each of the SHARE questionnaire modules used in this thesis. SPSS is also used to perform statistical analysis. Excel is used to perform age standardization. ArcMap is used to generate thematic colour maps from the data.

To prepare the data for analysation, the following steps are used:

- There are 58,489 respondents included in the fourth wave of SHARE
- For this study, 291 respondents have been excluded, because they have not filled in their sex, year of birth or have not filled in the CAPI main questionnaire.
- One outlier with birth year 2011 has been excluded as well.

3.6 Methods

Cardiovascular disease prevalence is added as a variable, using the indicator specified in the previous section. The data is split into male and female groups, in order to analyse the differences in rates for each country between both sexes. For each country the rates are calculated by using the total amount of respondents of each country and the amount of respondents with CVD. The rates are calculated separately for each sex.

To analyse the effect of age on the CVD rate in each of the SHARE countries and improve the comparability of the rates, age standardization is used. The age standardisation procedure specified in Preston et al. (2001), where the average age distribution of the 16 countries is used with the age-specific CVD rate for each country to calculate the age standardised CVD rate. This technique of standardisation is useful here because the following conditions are met: A rate is compared between multiple populations, the rate has different values for each of the age groups and the effect of the population age has to be minimized for the comparison of the CVD rate. The age of the respondents is added as a variable, using the year of the fourth wave, 2011 and the birth year of the respondents. In order to complete the calculation, the respondents must then be divided into age groups. For this research the ages 20-104 are used with intervals of 5 years. Age groups of 5 years are chosen to limit the amount of groups, but to keep some distinction in the results. With the age groups, the age-specific CVD rate can be calculated. Also, the age distribution of each country can now be calculated. After this step, the average age distribution between the countries is calculated. Using the age-specific CVD rate of each country, the age standardized rate can be calculated.

To analyse how the remaining differences in cardiovascular diseases can be explained by differences on the macro-level, the respondents are no longer divided by sex. New rates are calculated for each country, using all respondents. This way, the effect of sex is averaged out and there is now one variable that can be analysed using regression. In the next step all the variables are standardized and then transformed with the natural logarithm to increase the normality and decrease the variance and possible outliers. After this transformation the new variables are checked for any remaining outliers. This is done by performing an exploratory data analysis in SPSS with each of the new variables as the dependent variable. Of each analysis a boxplot has been created, which shows outlying cases. These cases are labelled by country in order to identify them. The outliers are removed to give a better representation of the variable values. Because there is a limited number of cases, only 16, even one outlier can change the outcome of any analysis. Removing outliers could be dangerous with a limited amount of data points. In order to perform a regression, the variables are assumed to be normally distributed. The variables are therefore checked for normality using the Shapiro-Wilk test, because there are less than 50 cases for each variable. A significance higher than 0.05 means that the variable is normally distributed. The correlation is analysed after the normality check. This is done between all the variables and uses the Pearson Correlation coefficient. The correlation between the independent variables should be limited, otherwise they can influence the outcome of the regression analysis. Univariate regression analysis is performed with the CVD rate and each of the other variables separately, to see if there is a linear relation. All the variables which are found to have a linear relation in the univariate regression analysis, are added into the stepwise linear regression. This procedure removes the weakest correlated variable after each regression analysis. The variables that gives the best model are left. Finally, a curve estimation is performed with each of the variables and the CVD rate, to check for non-linear relationships.

4 Results

The results are discussed in the order of the research questions defined in the first section. Each question has a number of results shown in the form of figures, maps or tables. The results are explained here and will be discussed in the next chapter.

4.1 How are cardiovascular diseases spread across European countries?

After analysing the data for the different types of CVD that have been measured among all the SHARE respondents in Wave four, the following numbers are derived:

- 13.7% of all the respondents have had a heart problem or a heart attack
- 4.4% of all the respondents currently have stroke or cerebral vascular disease.
- Combined, 16.7% of all the respondents currently have one or more of the conditions listed above.

From these numbers the prevalence rates were calculated for both sexes separately. When comparing the CVD rates, there are clear differences visible between the 16 European countries. The rates for all male respondents are shown in Figure 6 below, the rates for female respondents are shown in Figure 7.

CVD rate per 1000 male individuals in SHARE countries, ages 20-104

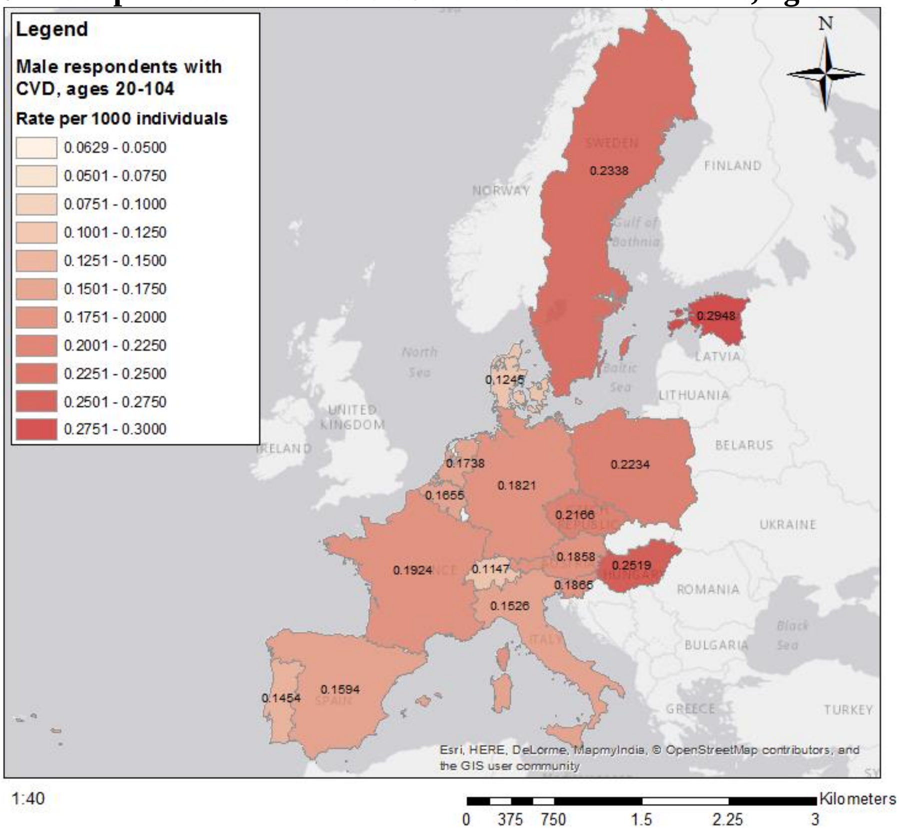

Figure 6: CVD rate per 1000 male individuals in each SHARE country (Data source: SHARE, 2011a, 2011b)

CVD rate per 1000 female individuals in SHARE countries, ages 20-104

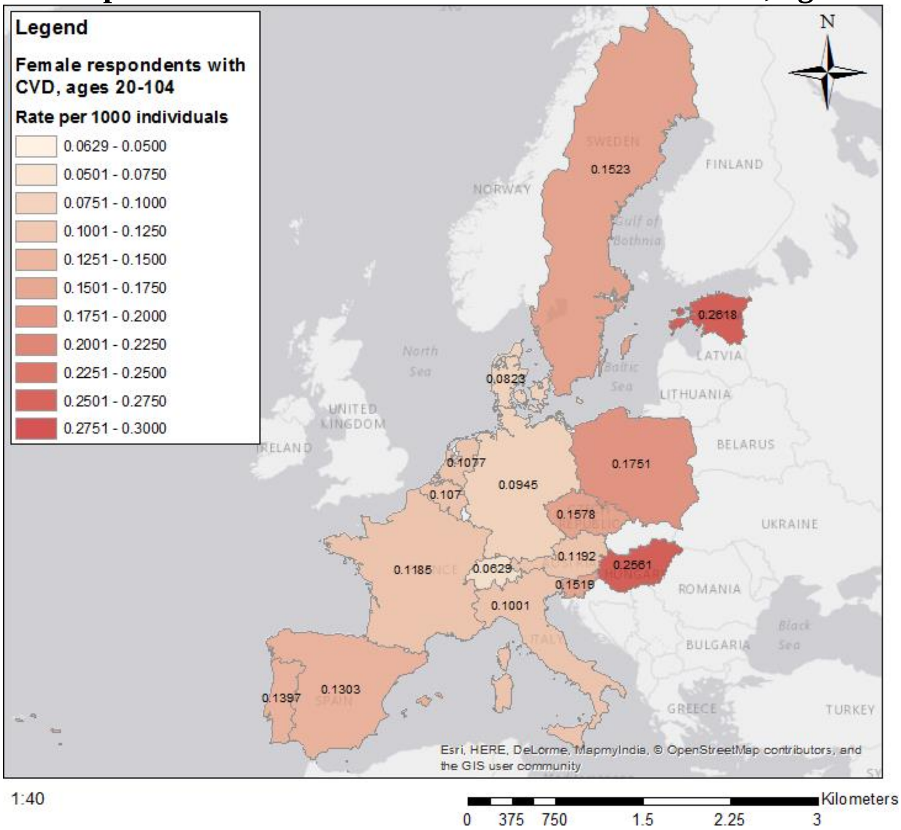

Figure 7: CVD rate per 1000 female individuals in each SHARE country (Data source: SHARE, 2011a, 2011b)

When comparing both figures, it is clear that overall the male CVD rates are much higher than the female CVD rates. There is also less variance between the male CVD rates among the countries. The female CVD rates are spread over a wider spectrum. In general the CVD rates are a lot higher in Hungary and Estonia, compared to the other European countries. The average CVD rate among all countries is 0.1602. Other countries who are above average are Poland, Sweden and Czechia. Switzerland, on the other hand, has by far the lowest CVD rate, followed by Denmark. Western and Central European countries clearly have lower CVD rates than Eastern European countries. Sweden is an exception to this rule, but the high percentages of CVD in Sweden could be caused by a high average age of the respondents. In the next section, the age standardisation is performed, which should reduce the effect of the age of the respondents on the CVD rates. This will improve the comparability of the CVD rates between the countries.

4.2 How does the age and sex composition influence the differences in cardiovascular diseases between countries?

New rates have been calculated, using the age standardisation technique described in Chapter 3.6. The new rates for males are shown in Figure 8, the new rates for females are shown in Figure 9.

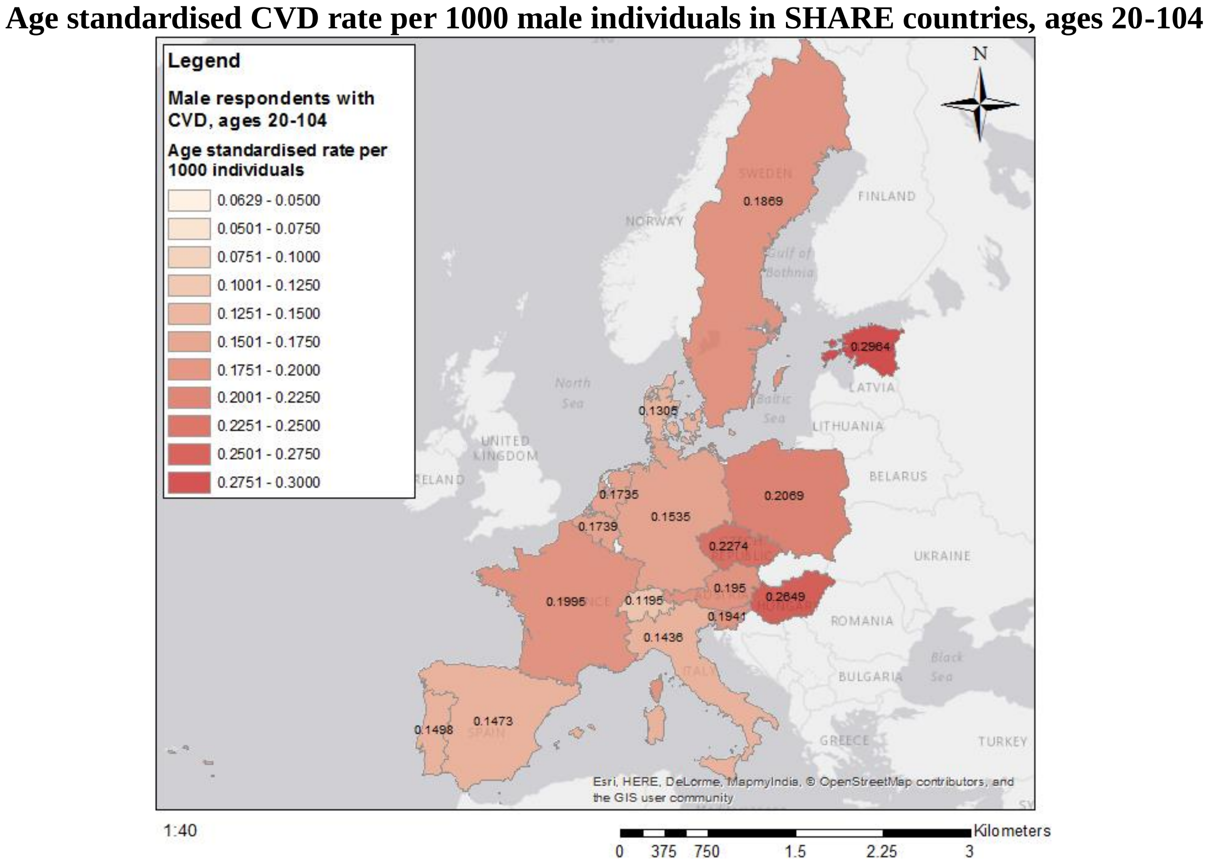

Figure 8: CVD rate per 1000 male individuals, age standardised, in each SHARE country (Data source: SHARE, 2011a, 2011b)

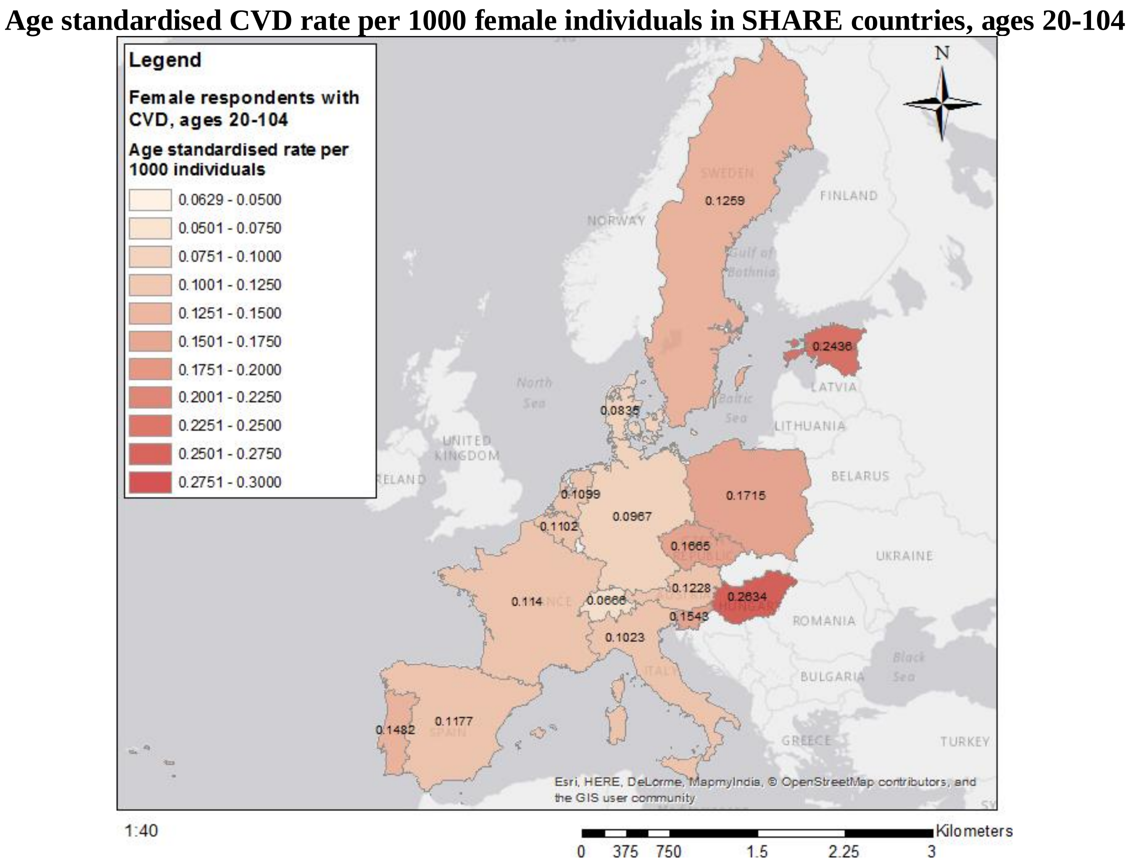

Figure 9: CVD rate per 1000 female individuals, age standardised, in each SHARE country (Data source: SHARE, 2011a, 2011b)

The age standardization has changed the rates for some countries, giving a better view of the differences in CVD rates. The same countries still have a high CVD rate, even when standardized, Estonia, Hungary and Poland. The exception is Sweden, where both male and female rates are much lower relatively. Clearly, most Swedish respondents are located in different age groups than the respondents from other countries. Switzerland and Denmark still have the lowest CVD rates. The male German rate is also relatively lower. According to the age standardised CVD rates, the Eastern European countries have a higher rate in general, compared to the Western and Central European countries. Table 9 in Appendix B shows a detailed listing of the results of the CVD rates and age standardized CVD rates for both sexes for each of the SHARE countries.

4.3 How could the remaining differences in cardiovascular diseases be explained by differences on the macro-level?

To answer this question, the macro variables from Eurostat will be used in combination with the age and sex standardized CVD rate. To analyse the macro level differences, the variables have been checked and prepared. The results are shown below in Table 3.

Variable	**Outliers**
Unemployment rate	3.06
Upper secondary or tertiary educational attainment percentage, age group 25-64	3.54; 3.99; 4.03
Percentage of self-reported unmet needs for medical examination	-2.30
Total general government expenditure on Health as percentage of GDP	0.69; 1.55; 1.61

Table 3: Outliers found for each independent variable

Fortunately there were only a few outliers, nine in total. The outliers are limited to four different variables, where the government expenditure on health and the upper secondary or tertiary educational attainment both have three outliers. This could influence the normality of these variables and could also have an effect on the regression analysis. The other variables are not affected.

Variable	**Nr. of cases**	**Significance**
Age and sex standardized CVD rate (CVD)	16	0.515
Unemployment rate (U)	14	0.915
Upper secondary or tertiary educational attainment percentage, age group 25-64 (STEA)	13	0.219
Percentage of self-reported unmet needs for medical examination, because it is too expensive too far to travel or there is a waiting list (UHN)	15	0.377
GDP per capita in PPS (GDP)	16	0.263
Annual expenditure on public and private educational institutions as percentage of GDP, for all levels of education combined (GEE)	16	0.726
Employment rate of the total population, men and women, age group 20-64 (E)	16	0.665
Total general government expenditure on Health as percentage of GDP (GEH)	13	0.139
Tertiary educational attainment percentage, age group 55-74 (TEA)	16	0.824
Health personnel employed in hospitals in head count per hundred thousand inhabitants (HP)	14	0.387

Table 4: Shapiro-Wilk test significance for every standardized variable

As can be seen from Table 4 all variables are normally distributed, because the significance is higher than 0.05. This means that they are suitable to be used for a regression analysis. The normality of the variables that have only 13 cases is the lowest, which seems logical. A limited amount of cases can decrease the normality of a variable.

To obtain a first glance at the interactions between the different variables, a correlation is performed for all variables. First, the correlations between the CVD rate and the other variables are analysed, Table 5 shows the results.

	U	STEA	UHN	GDP	GEE	E	GEH	TEA	HP
Pearson Correlation	0.491	0.340	0.479	-0.816	-0.438	-0.430	-0.655	-0.258	-0.534
Significance	0.075	0.256	0.071	0.000	0.090	0.096	0.015	0.334	0.049
		= significant at 0.01				**= significant at 0.05**			

Table 5: Pearson correlation coefficients and significance for every independent standardized variable with the CVD rate

The table shows the correlation coefficient and the significance of the relation. Two variables have a Pearson correlation coefficient above 0.5 and significant correlation at the 0.05 significance level. These are the government expenditure on health and the health personnel employed in hospitals. One variable is significant at the 0.01 significance level and has a high Pearson Correlation coefficient. This is the GDP per capita. Clearly this variable is closely related to the CVD rate. The STEA and TEA variables have the least correlation and do not seem to be related to the CVD at all. The Pearson Correlation coefficient is also important to check if the variables that will be used as independent variables in the regression are truly independent. The results are shown below.

	U	STEA	UHN	GDP	GEE	E	GEH	TEA	HP
Unemployment rate (U)	1	.210	.718	-.760	-.263	-.543	-.518	.234	-.313
Upper secondary or tertiary educational attainment percentage(STEA)		1	.361	-.464	-.588	-.007	-.379	-.921	-.439
Percentage of self-reported unmet needs for medical examination (UHN)			1	-.651	-.413	-.482	-.359	-.114	-.279
GDP per capita in PPS (GDP)				1	.506	.691	.716	.026	.720
Government expenditure on Education as percentage of GDP (GEE)					1	.520	.701	.078	.642
Employment rate (E)						1	.562	-.467	.704
Government expenditure on Health as percentage of GDP (GEH)							1	-.074	.711
Tertiary educational attainment percentage (TEA)								1	-.246
Hospital personnel as head count per hundred thousand inhabitants (HP)									1
		= significant at 0.01				**= significant at 0.05**			

Table 6: Pearson correlations coefficients between the independent standardized variables

Most of the variables seem to be correlated with the GDP, with six significantly correlated variables at significance level 0.05:

- Unemployment rate (U)
- Percentage of self-reported unmet needs for medical examination (UHN)
- Government expenditure on Education as percentage of GDP (GEE)
- Employment rate (E)
- Government expenditure on Health as percentage of GDP (GEH)
- Hospital personnel as head count per hundred thousand inhabitants (HP)

Two variables have correlations with five other variables, the government expenditure on education and the employment rate. The least correlated variables are the educational attainment variables, which only have a very high correlation between themselves. When performing regression analysis it must be considered that some of the variables are connected in a way that could influence their overall impact in the regression and could compromise the independence of the variables. However, the coefficient for GDP and CVD, as seen in Table 5 is higher than almost all correlations between the other variables. This could negate the effect of the correlations between the independent variables.

For further information on the relation between the variables and the CVD rate, a Univariate regression analysis is performed for each variable with CVD as the dependent variable. The results are shown in Table 7.

Covariate variable	**Adj. R^2**	**p**	**Const.**	**B**
U	0.177	0.075	-2.717	0.426
STEA	0.035	0.256	-7.235	1.223
UHN	0.170	0.071	-1.956	0.150
GDP	0.642	0.000	1.951	-0.832
GEE	0.134	0.090	-0.344	-0.891
E	0.127	0.096	3.822	-1.342
GEH	0.377	0.015	0.469	-1.206
TEA	0.000	0.334	-1.340	-0.152
HP	0.225	0.049	2.499	-0.605

Table 7: Univariate regression analysis results with the CVD rate as dependent variable

Here, all the variables are shown with the corresponding general linear models. The significance is the same for all variables compared to the Pearson Correlations in Table 5. GDP, GEH and HP have a significant linear relation to CVD at the 0.05 significance level. The model fit for GDP is pretty high, the adjusted R^2 gives a 64.2% explanation of the variability of the CVD rate. The GEH gives a model fit of 37.7%, which means that it cannot explain a lot of the variance of the CVD rate, even though it is significantly related. The Beta values of thee GDP and GEH show a large influence in the regression model, when comparing with the constant value. The other variables are not significantly related and could possibly have a more non-linear relation, or no relation at all.

Further analysis includes a stepwise linear regression model using the significant variables from Table 7 as independent variables and CVD as the dependent variable. The results from this linear regression are shown in Table 8.

Variables entered	Adj. R^2	p	Const.	B
GDP	0.632	0.001	1.951	-0.816

Table 8: Model derived from linear regression with GDP, UHN, GEH, GEE as independent variables and CVD as dependent

The model shows only the GDP as predicting variable. The other variables do not give a significant improvement to the model, with significances above 0.6. The adjusted R^2 is not as high as seen in Table 7, and the p is a bit higher. The GDP has a large influence on the CVD, as is shown by the Beta coefficient in relation to the constant value. The scatterplot with the standardized predicted values and the CVD rate is shown in Figure 10.

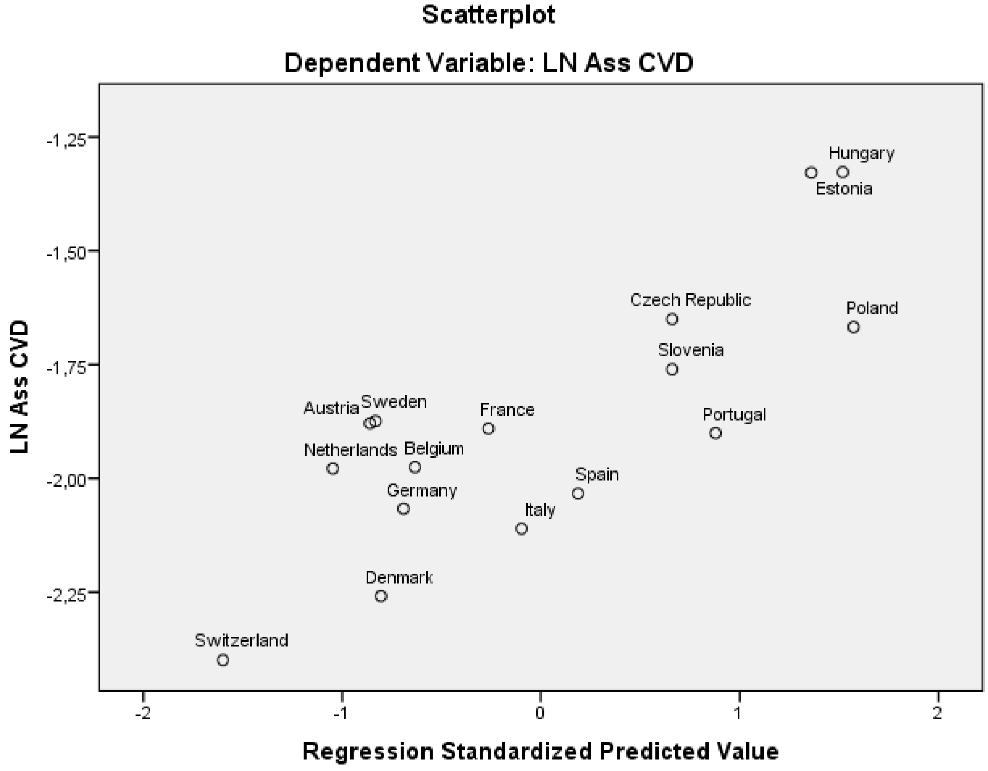

Figure 10: Standardized predicted value and CVD rate of a linear regression model

A linear relation is visible in this graph. There are some errors, but in general the model is a good fit. The model can predict the differences in CVD rate among the European countries of SHARE, using the GDP of these countries. What has been shown in the results is that the main differences in CVD among European countries can be explained by the GDP differences. Other macro factors do play a role as well, but are also closely related to the nations GDP.

A non-linear curve estimation regression, with checks for inverse, cubic and quadratic functions, has also been performed for each of the variables and the CVD rate. With the exception of the UHN variable, none of the other variables have a more significant non-linear relation with the CVD rate. The UHN variable has an inverse relation with a significance level of 0.056, which is higher than the 0.071 significance level found in the linear regression. However, this relation is still not significant and cannot be used as a predictor in a model.

Summarizing, cardiovascular diseases are spread unevenly across the European countries participating in SHARE. Eastern European countries have much higher rates in general, compared to Western and Central European countries. Also influencing this spread is the age and sex composition. Males have a much higher CVD prevalence than females in all the countries. Age is also an important factor, as was shown by the case of Sweden. Swedish rates were much higher compared to the other Western

European countries before age standardisation. Finally, multiple macro variables seem to correlate with the CVD prevalence rates. This includes the country's GDP per capita in PPS, the total annual government expenditure on health in percentage of the GDP and the hospital personnel as head count per hundred thousand inhabitants. Separately, each of these variables have a significant linear relationship with the CVD rate. When combined in a linear regression model, the GDP is the only variable that is included in the model. The other two variables do not result in a significantly better model. Therefore, the GDP of a European country can be used to predict the variations between the countries in CVD prevalence.

5 Conclusion and discussion

So, how are cardiovascular diseases spread across European countries? It can be concluded that the Eastern European countries experience higher CVD prevalence among the SHARE respondents, compared to the Western European countries. This result also largely corresponds with the European Cardiovascular Disease Statistics Report 2012, which states that the Eastern European countries experience more deaths from stroke and heart attacks. Switzerland and Denmark are the countries with the lowest prevalence of CVD, while Estonia and Hungary have the highest prevalence. Sweden has a higher prevalence of CVD than other wealthy Western nations, but as can be seen from the results of the second research question, this is caused by the age structure of the respondents. Clearly there must be a difference between the Western and Eastern European countries, with respect to CVD risk factors. Wealth seems to be an important factor here.

But first, how does the age and sex composition influence the differences in cardiovascular diseases between countries? The male CVD prevalence is much higher than the female CVD prevalence across all European countries. The spectrum of female CVD prevalence is wider than that of male CVD prevalence. This results in more inequality for female CVD prevalence between Western and Eastern European countries, than for male CVD prevalence. It could be the case that females are more affected by socio-economic inequalities. The age is a factor as well, but not that important for the differences between countries. With age standardisation, the gap between the Western and Eastern European countries is still clearly visible, which means that this difference cannot be explained by the age differences of the respondents within the countries. In the case of Sweden, this country is more in line with the other developed Western countries after age standardisation.

But, how could the remaining differences in cardiovascular diseases be explained by differences on the macro-level? The correlations and the univariate regression analysis between the CVD rate and the macro variables have shown that GDP per capita in PPS is the most important factor, followed by government expenditure on health and health personnel in hospitals. A stepwise regression model has selected GDP as the most important and only predictor. Clearly GDP is significantly related to CVD. GEH could be related, but does not improve the model with GDP significantly. Wealth is therefore clearly related to cardiovascular diseases. Countries with less income seem to have significantly more people with CVD. The government expenses on health are also important, not significant. This also makes sense as healthcare is an important factor for prevention and treatment of CVD, according to the literature by Deaton. Looking at Whitehead and Dahlgren’s model, the GDP, GEH and HP are considered outer layer factors. These factors cannot directly influence the CVD risk of an individual, but they work mostly through other factors, such as socio-economic status, and the living conditions. Which in turn influence an individual’s behaviour. From the bottom layer up there are the age and sex of an individual which also influences the education, income and socio-economic status.

GDP has also been found to correlate with a lot of the other variables, such as the government expenditure on health and education, the health personnel in hospitals, the employment and unemployment rates and the unmet health needs. Indeed these relations make sense and confirm what literature has stated, wealth is related to health and other factors. It is interesting to notice that although the government expenditure on health and education are provided in percentage of GDP, they are still significantly and highly correlated with the GDP itself. In other words, a lower GDP results in an even lower percentage of the GDP spent on health and education. This can have an effect on the health personnel and the unmet health needs as well.

Programs and policies for prevention of CVD should also focus on improving the GDP within the countries. Also, an increase in health budgets, or at least more funding to prevention of CVD, is important to decrease waiting lists and give people more access to medical facilities. This corresponds with results stated by Deaton, who said that wealth and health must both be considered when developing policies for improving health. The policies must also consider the influence of sex and age on the CVD rate. A country with a higher percentage of males has a higher CVD rate and an ageing population also has a higher CVD rate.

Because both Eurostat and SHARE only publish data that has been verified and checked according to several data quality standards and collected by respectable survey teams, the data quality is not considered a problem. However, the data may not be completely representable, because the research is limited by the SHARE data availability. Not all European countries are included in the SHARE project. Especially the Eastern European countries are somewhat underrepresented. Another limitation is the age of the respondents. Even though SHARE states it is a survey for people aged 50 and over, other persons living in the same house as a respondent are included in the research as well, adding younger people to the respondents. These people have been included in this study, but one could state that the representability of respondents younger than 50 years is questionable. Eurostat is not a problem for representability, because it has data on all European countries, for all ages. The outliers that have been removed are still of interest to this research, because they seem to be found mostly in the Eastern European countries. A solution to these outliers could be adding more Eastern European countries that have similar data sets, or that the regression analysis is split into a separate analysis for Eastern and Western European countries.

A few things could have been done differently in this study, because it does not look at all the factors that have an influence on the CVD rate. These are individual factors for example. These factors could give a different result. Other macro factors might be of interest as well. A shortcoming is the amount of cases available for each variable, because no more information was available from SHARE. A more detailed study could look at the same analysis, but for other SHARE waves.

Future research should look more at other non-linear relations and interactions between macro variables and the CVD rate. Also, more data from other European countries is needed to improve regression analysis and possible model outcomes. Personal determinants, such as smoking and alcohol usage have not been included in this study. They can however be a good measure for pre-CVD conditions. Linking these behaviours to other macro factors is another step forward.

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7 Appendix

7.1 Appendix A

Question "PH006_DocCond" from the CAPI main questionnaire (SHARE, 2015c):

"[Has a doctor ever told you that you had/Do you currently have] any of the conditions on this card? [With this we mean that a doctor has told you that you have this condition, and that you are either currently being treated for or bothered by this condition.] Please tell me the number or numbers of the conditions"

The possible answers are:

1. A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure
2. High blood pressure or hypertension
3. High blood cholesterol
4. A stroke or cerebral vascular disease
5. Diabetes or high blood sugar
6. Chronic lung disease such as chronic bronchitis or emphysema
7. ---
8. Arthritis, including osteoarthritis, or rheumatism
9. ---
10. Cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers
11. Stomach or duodenal ulcer, peptic ulcer
12. Parkinson disease
13. Cataracts
14. Hip fracture or femoral fracture
15. Other fractures
16. Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment

96. None

97. Other conditions, not yet mentioned

7.2 Appendix B

	CVD rate per 1000 respondents, ages 20-104		Age standardised CVD rate per 1000 respondents, ages 20-104	
Country	**Male**	**Female**	**Male**	**Female**
Austria	0.1858	0.1192	0.1950	0.1228
Germany	0.1821	0.0945	0.1535	0.0967
Sweden	0.2338	0.1523	0.1869	0.1259
Netherlands	0.1738	0.1077	0.1735	0.1099
Spain	0.1594	0.1303	0.1473	0.1177
Italy	0.1526	0.1001	0.1436	0.1023
France	0.1924	0.1185	0.1995	0.1140
Denmark	0.1245	0.0823	0.1305	0.0835
Switzerland	0.1147	0.0629	0.1195	0.0666
Belgium	0.1655	0.1070	0.1739	0.1102
Czechia	0.2166	0.1578	0.2274	0.1665
Poland	0.2234	0.1751	0.2069	0.1715
Hungary	0.2519	0.2561	0.2649	0.2634
Portugal	0.1454	0.1397	0.1498	0.1482
Slovenia	0.1865	0.1519	0.1941	0.1543
Estonia	0.2948	0.2618	0.2964	0.2436

Table 9: CVD rate and age standardized CVD rate for both sexes in each SHARE country (Data source: SHARE, 2011a, 2011b)