Cross-national comparisons of socio-economic differences in health indicators

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2 Cavelaars AEJM, Kunst AE, Geurts JJM, Crialesi R, Grötvedt L, Helmert U, et al. Differences in self-reported morbidity by educational level: a comparison of 11 western European countries. J Epidemiol Community Health 1998; 52:219-27.

3 Cavelaars AEJM, Kunst AE, Geurts JJM, Helmert U, Lundberg O, Matheson J, et al. Morbidity differences by occupational class among men in seven European countries: an application of the Erikson-Goldthorpe social class scheme. Int J Epidemiol 1998; 27:222-30.

4 Cavelaars AEJM, Kunst AE, Geurts JJM, Helmert U, Lahelma E, Lundberg O, Matheson J, et al. Differences in self-reported morbidity by income level in six European countries. Submitted for publication.

5 Mielck A, Cavelaars AEJM, Helmert U, Martin K, Winkelhake O, Kunst, AE. Comparisons of health inequalities between East and West Germany. Submitted for publication.

6 Cavelaars AEJM, Kunst AE, Mackenbach JP. Socio-economic differences in risk factors for morbidity and mortality in the European Community: an international comparison. Journal of Health Psychology 1997;2:353-72.

7 Cavelaars AEJM, Kunst AE, Geurts JJM, Crialesi R, Grötvedt L, Helmert U, et al. Socio-economic differences in smoking in 12 European countries. Submitted for publication.

8 Cavelaars AEJM, Kunst AE, Geurts JJM, Crialesi R, Grötvedt L, Helmert U, et al. Persistent variations in average height between countries and between socio-economic groups: an overview of 10 European countries. Submitted for publication.

9 Mackenbach JP, Cavelaars AEJM, Kunst AE, Groenhof F, Geurts JJM, EU Working Group on Socio-economic Inequalities in Health. Socioeconomic inequalities in cardiovascular disease mortality: an international study. Submitted for publication.

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1 Introduction

1.1 Socio-economic differences in health

An international phenomenon

Differences in health between socio-economic groups are a major public health problem. In all European countries for which data are available and for some considerable time now, rates of mortality and morbidity have been found to be higher among groups with a lower income, a lower educational level or a lower occupational class[1-3]. Mortality and morbidity rates have been found to be one and a half to four times higher among the most disadvantaged, depending on the population studied and the exact methods used. Moreover, for some countries there is evidence that these differences have increased during the last decades[4].

Studying the causes of these health differences is highly valuable for understanding disease etiology. It may help to identify risk factors for diseases which will not easily be detected in other ways. Moreover, it is essential for designing strategies to reduce socio-economic differences in health. The latter is not only desirable from the point of view that these differences may, at least partly, be seen as unfair[5] but also because reducing socio-economic differences in health offers a good opportunity to improve overall health of societies at large[6].

Possible explanations of socio-economic health differences have been widely discussed[5,7,8]. One important explanation is that these differences are caused by differences between socio-economic groups in regard to material circumstances (e.g. housing and physical working conditions), behavioural factors (e.g. smoking and excessive alcohol consumption), psychosocial stress (e.g. work-related stress), and childhood living conditions (e.g. nutritional conditions) (i.e. causation mechanism). Another explanation is that health problems lead to downward social mobility or, in other words, health itself may affect socio-economic status (i.e. selection mechanism). During the last decade, more and more studies, notably in Great Britain[9], the Scandinavian countries[10-12] and the Netherlands[5,13-15], have tried to quantify the contribution of different factors in the explanation of socio-economic differences in health. These studies suggest that both material circumstances, behavioural factors, psychosocial stress and childhood living conditions can explain, to a certain extent, health differences between socio-economic groups. The contribution of health selection is generally judged to be small. However,

the complex mechanisms which bring about the persistent nature of socio-economic differences around the world as well as over time are not yet completely understood[16].

An international perspective

During the last decade, socio-economic differences in health have been increasingly studied within an international perspective[2,3]. Several studies have compared the size of socio-economic differences in morbidity and mortality of different countries. These studies showed that the size of these health differences varies between countries.

Different reasons can be distinguished for studying international variations[17,18]. First, international comparisons may provide a yardstick to judge the size of socio-economic differences in one's own country. If these differences are subsequently found to be larger, this can be drawn to the attention of researchers and policy makers who will hopefully give it high priority on their agendas. Another reason is that comparing societies which differ with respect to national features such as living standards, social policies, the size of income inequalities or cultural features may shed new light on the way in which those national characteristics might influence the pattern and magnitude of socio-economic differences in health. Evidence for these potential effects is difficult to obtain otherwise. One way in which national characteristics may influence socio-economic health differences is that they determine the skewness of social gradients in risk factors for morbidity and mortality. Another way is that they influence the extent to which health determines socio-economic status. Finally, international comparisons might be helpful to evaluate whether findings of studies with respect to the explanation of socio-economic health differences can be extrapolated from one country to another.

The study presented in this thesis aims to compare the magnitude of socio-economic differences in health indicators between western European countries. It builds upon previous studies which compared the size of socio-economic differences in morbidity between countries. Furthermore, it investigates whether there are international variations in social gradients of risk factors for morbidity and mortality, and whether this can help to explain international variations in the size of socio-economic health differences. The study is part of a larger project called "Socio-economic inequalities in morbidity and mortality: an international comparison". The mortality results of this project have already been reported by Kunst[18].

In section 1.2, an overview is presented of earlier studies on international variations in the size of socio-economic differences in morbidity and the size of socio-economic differences in risk factors. Subsequently, a short description of the present study (1.3) and the structure of this thesis are given (1.4).

1.2 Previous international comparisons

Socio-economic differences in morbidity

Before the start of this project, several researchers compared the size and/or the pattern of socio-economic differences in morbidity among adults in different countries[19-31]. For

these comparisons, data were used from nationally representative health surveys or other national surveys such as level of living surveys or multi-purpose surveys. The studies concerned self-reported morbidity and generally focused on relative differences in morbidity rates between socio-economic groups rather than on absolute differences. An overview of the studies and related publications is given in table 1.1.

Several studies compared socio-economic differences in morbidity between the Scandinavian countries. Karisto and colleagues studied differences in the prevalence of chronic illness by occupational class[19], educational level[19,20] and income[20] in Denmark, Finland, Norway and Sweden using data from the Scandinavian Welfare Study of 1972. Lahelma and colleagues studied differences in the prevalence of limiting long-standing illness by occupational class[21,22] and educational level[21,23] in Finland, Norway and Sweden using data from the Nordic Level of Living Survey of 1986/87. Both studies showed that the size of these socio-economic differences varied between the Scandinavian countries but that the position of the countries varied according to the study, socio-economic indicator, morbidity indicator, and sex. However, the variations between the Scandinavian countries were generally small and not statistically significant.

Other studies focused on the question whether socio-economic differences in morbidity are larger in Great Britain as compared to Scandinavian countries. Vågerö and Lundberg[24,25] and Wagstaff et al[26] studied differences in long-standing illness by occupational class in Great Britain and Sweden in 1981 using the British Registrar General.s scheme. The relative risk for class V versus class I was much smaller in Sweden than in Great Britain. However, the size of morbidity differences was slightly larger in Sweden than in Great Britain when the more robust manual versus non-manual ratio[24,25] or the more sophisticated concentration index[26] were used. Lahelma, Arber and others[27,28] investigated the pattern of limiting long-standing illness by occupational class in Great Britain, Sweden, Norway and Finland using 1986/87 data. They reported that for both men and women, differences in prevalence rates between high and low classes were somewhat larger in Sweden and the other Scandinavian countries than in Great Britain.

More comprehensive international comparisons were performed by Kunst et al, and Van Doorslaer et al. Kunst and colleagues[29] assessed the size of socio-economic differences in several indicators of morbidity for a broad range of countries, using survey data from the 1980s. Although income, occupational class and educational level were used as socio-economic indicators, only educational level was available for most countries and was judged to be highly comparable[30]. Differences in morbidity by educational level among men were relatively small in Great Britain and Sweden, intermediate in Spain, the Netherlands, Finland, Norway, Denmark and West Germany, and large in Italy and the United States. The same international pattern was observed for women, except that relatively small differences were also observed for Dutch women. Van Doorslaer et al[31] studied the size of income-related differences in perceived general health for men and women combined for nine countries, using national survey data of 1985-1992. Relatively large differences were reported for the United States and Great Britain, intermediate differences for the Netherlands, Finland, Spain, Switzerland and West Germany, and small differences for Sweden and East Germany.

Table 1.1 Overview of earlier studies on international variations in socio-economic differences in self-reported morbidity among adults.

Data source/study - publication	Included countries	Included SES-indicator[1]	Included morbidity indicator[2]
Comparisons between Scandinavian countries			
Scandinavian Welfare Study 1972	Norway, Finland, Sweden, Denmark		
- Karisto, 1978		Occ, Educ	CC
- Lahelma, 1990		Educ, Inc	CC
Nordic Survey on Living Conditions 1986/87	Finland, Norway, Sweden		
- Lahelma, 1993		Occ, Educ	Among others: LI, LLI, LD
- Rahkonen, 1993		Occ	LI
- Lahelma, 1994		Educ	LII
Comparisons between one or more Scandinavian countries and Great Britain			
Swedish Survey on Living Conditions 1981 General Household Survey 1981 (GB)	Sweden, Great Britain		
- Lundberg, 1986		Occ	LI
- Vågerö, 1989		Occ	LI
- Wagstaf, 1991		Occ	LI
Nordic Survey on Living Conditions 1986/87 General Household Survey 1985/1986 (GB)			
- Lahelma, 1994	Finland, Norway, Sweden, Great Britain	Occ	LLI
- Arber, 1993	Finland, Great Britain	Occ	LLI
More comprehensive comparisons			
National surveys of 1980-1992			
- Kunst, 1992	Norway, Finland, Sweden, Denmark, Great Britain, Netherlands, West Germany, Italy, Spain, United States, Canada, Japan	Occ, Educ, Inc	Among others: PGH, RDA, LI, LD, height
- Kunst, 1995	Sweden, Denmark, Great Britain, Netherlands, West Germany, Italy, United States, Canada	Educ	PGH, RDA, LI, LD, height
- Van Doorslaer, 1997	Finland, Sweden, Great Britain, Netherlands, West Germany, East Germany, Switzerland, Spain, United States	Inc	PGH

[1] Occ = occupational class, Educ = educational level, Inc = income.

[2] PGH = perceived general health, LI = any long-standing illness or health problem, LLI = limiting long-standing health problem, CC = chronic illness/diseases/conditions, LD = long-term disabilities, RDA = restrictions daily activities.

In conclusion, previous studies suggest that the size of socio-economic morbidity differences varies between countries. These studies, however, often suffered from serious limitations. First, most studies only included the Scandinavian countries and Great Britain[19,21-25,27,28]. A disadvantage of focusing on a small number of countries is that national characteristics that are consistently related to the size of health differences are more difficult to identify. Second, many studies included only one indicator of morbidity[19,22,24,25,27,28,31] and/or one indicator of socio-economic status[22,24,25,27,28,30,31]. The inclusion of several indicators for morbidity and socio-economic status is preferable because both concepts cannot easily be measured by a single indicator. Furthermore, the inclusion of more indicators of morbidity and socio-economic status prevents the results from being sensitive to comparability problems that are specific for one particular indicator. Third, in the few studies that were more comprehensive[29-31], the comparability of the morbidity indicators as well as the socio-economic indicators was not always optimal.

Socio-economic differences in risk factors for morbidity and mortality

Only very few studies compared countries with respect to socio-economic differences in risk factors for morbidity and mortality[30,32-36]. Most of these focused on behaviour-related risk factors. Pierce described differences in smoking prevalence by educational level in Great Britain, Finland, Sweden, Norway and France using survey data from around 1987[32,33]. In all countries, lower educated men and women smoked more than the higher educated. The largest relative differences in smoking rates between educational groups were observed for Great Britain and Norway. Sobal and Stunkard[34] provided an overview of the relationship between socio-economic status and obesity and compared developed and developing countries with respect to the direction of the association (negative or positive). In developing countries, higher prevalence rates of obesity were found consistently among the higher socio-economic groups. On the other hand, in developed countries, consistently higher prevalence rates of obesity among lower socio-economic groups were observed for women but not always for men. Helmert et al[35] studied socio-economic differences in both cigarette smoking, obesity, hypertension and hypercholesterinemia in East and West Germany, using data from the early eighties. For both parts of Germany, higher prevalence rates of risk factors were found among the lower socio-economic groups, except for hypertension among men in West Germany. For men, the odds of having two or more risk factors was about equally large in both parts of Germany. For women, the social gradient was somewhat steeper for East Germany. Hupkens et al[36] studied socio-economic differences in drinking patterns in the countries of the European Union using the Eurobarometer survey of 1988. They observed variations in socio-economic differences in wine and beer drinking behaviour between countries. In contrast to southern European countries, the higher educated in the northern countries consumed wine with meals more frequently and more often than the less educated. For beer consumption, their results showed a tendency for a reversed picture, i.e. in the northern countries, beer was consumed more frequently by less educated people.

Finally, one study focused on variations between countries with regard to socio-economic differences in height. Height has been shown to be a predictor of morbidity

and mortality[37] and is assumed to reflect childhood living conditions[38]. Kunst et al[30] studied the size of height differences by educational level among adults in 5 northern European countries. In all countries, higher socio-economic groups were on average taller than lower socio-economic groups. For both men and women, these differences were relatively large for Denmark and Germany, intermediate for Finland and the Netherlands, and small for Sweden.

The previous studies which compared countries with respect to socio-economic differences in risk factors for health often suffered from several problems. The studies which compared a broad range of countries suffered from comparability problems in the available data[32,37]. Some studies were aimed at comparing the direction of the association rather than the size of the differences[34] or focused on patterns of behaviour rather than on the risk taking behaviour[36]. Moreover, the studies for which the comparability was most optimal included only a small range of countries[30,35].

1.3 This study

Objective

As previously mentioned, the present study is part of a larger project called "Socio-economic inequalities in morbidity and mortality: an international comparison" which was conducted between 1993 and 1996 within the framework of an EU sponsored concerted action[17]. Research groups from 16 European countries participated in this project. The first objective of the concerted action was to give a comprehensive overview of variations between countries with respect to the size of socio-economic differences in morbidity and mortality. The second objective was to take a first step towards the explanation of international variations in the size of health differences by studying international variations in socio-economic differences in cause-specific mortality and in risk factors for morbidity and mortality. The results concerning socio-economic differences in total and cause-specific mortality are presented elsewhere[18]. This thesis focuses on morbidity and risk factors for morbidity and mortality.

The research questions addressed in this thesis are:

- How large are the socio-economic differences in self-reported morbidity in western European countries? Are these differences smaller in some countries than in others?
- How large are the socio-economic differences in the prevalence of risk factors for morbidity and mortality in western European countries? Are these differences smaller in some countries than in others?
- What clues do the latter results provide for the explanation of international variations in socio-economic differences in morbidity and mortality?

This study gives a more comprehensive overview of international variations in the size of socio-economic differences in morbidity than earlier studies. With respect to international variations in the size of socio-economic differences in risk factors for morbidity

and mortality, this study can be seen as the first comprehensive one. In comparison to most previous studies, more efforts are made to improve the comparability of the available data. Below, the comprehensiveness of the study and the methods used to improve the comparability of the data are briefly discussed.

Comprehensiveness of the study

The size of socio-economic differences in morbidity were estimated for 12 countries from the north, the west and the south of Europe. Data were obtained from national health surveys or similar surveys of 1985-1993 and related to men and women aged 20-74 years. Four different indicators of self-reported morbidity were included, namely perceived general health, long-term disabilities, chronic conditions and any long-standing health problem. Moreover, three different indicators of socio-economic status were used: educational level, occupational class and income. The availability of comparable data related to selected morbidity indicators and socio-economic indicators varied between the countries involved, as is shown in table 1.2.

Table 1.2 Overview of the availability of morbidity data by socio-economic status by country.

Country	Morbidity indicators				Socio-economic indicators		
	Perceived general health	Long-term disabilities	Chronic conditions	Any long-standing health problem	Education	Occupation	Income
Norway	X	X			X		
Finland	X	X		X	X		X
Sweden	X		X		X	X	X
Denmark	X	X		X	X	X	
Great Britain	X			X	X	X	X
Netherlands	X	X	X	X	X	X	X
West Germany	X	X	X		X	X	X
East Germany	X		X		X		X
Switzerland	X	X			X	X	
France	X				X	X	X
Italy	X		X		X		
Spain	X		X		X		

The selection of the socio-economic indicators and the morbidity indicators was based on an extensive inventory made of the availability and comparability of data in national health surveys or similar surveys of the 16 European countries which participated in the concerted action. No internationally comparable data on socio-economic differences in morbidity were identified for Ireland, Belgium, Portugal and Greece.

The size of socio-economic differences in regard to one or more risk factors for health was measured for all countries except for East Germany. For the measurement of socio-economic differences in risk factors, two types of data sources were used (table 1.3). First, data from national health surveys or similar surveys of 1986-1994 were used for 12 European countries. For most countries, these data originated from the same surveys

as the morbidity data and concerned men and women aged 20-74 years. Risk factors measured with national survey data were smoking and height. Educational level was used as a socio-economic indicator. Data on other important risk factors such as alcohol consumption, diet, physical activity, working conditions, and housing conditions were available in the national surveys of some countries. However, the availability of internationally comparable data was too limited to include these other risk factors[39]. As an alternative, data were also obtained from an international survey: the Eurobarometer surveys of 1987-1991. Risk factors which could be studied using these surveys were excessive alcohol consumption, infrequent consumption of fresh vegetables, overweight and smoking. Moreover, the use of the Eurobarometer surveys enabled the inclusion of data on risk factors for Belgium, Ireland and Greece. Educational level as well as occupational class were used as socio-economic indicators.

Table 1.3 Overview of the included data with respect to socio-economic differences in risk factors for morbidity and mortality.

	National surveys		Eurobarometer surveys			
Risk factors / Country	Smoking	Height	Smoking	Excessive alcohol consumption	Infrequent vegetable consumption	Overweight
Norway	X	X				
Finland	X	X				
Sweden	X	X				
Denmark	X	X	X	X	X	X
Great Britain	X		X	X	X	X
Ireland			X	X	X	X
Netherlands	X	X	X	X	X	X
Belgium			X	X	X	X
West Germany	X	X	X	X	X	X
East Germany						
Switzerland	X	X	X	X	X	X
France	X	X	X	X	X	X
Italy	X	X	X		X	X
Spain	X	X	X	X	X	X
Portugal	X		X	X	X	X
Greece			X	X	X	X

Enhancing the comparability

Several authors have pointed out that a number of comparability problems can strongly bias international comparisons with respect to the size of socio-economic health differences, especially those concerning morbidity[40-42]. In this study, complete comparability is not warranted, but the international comparability of the data was at least enhanced as far as was possible on the basis of the data which were available for the different countries.

This was achieved using different methods. First, the analyses were restricted to those countries for which the survey questions on different morbidity indicators and risk factors were judged to be highly comparable with respect to the structure and wording of these questions. More details on this selection will be given in the subsequent chapters of this thesis. Moreover, the comparability of the measurement of educational levels and occupational classes was enhanced by recoding individual-level data on education and occupation according to common classifications for all countries. Finally, the comparability of the results was enhanced by performing all data analyses at the co-ordinating centre at the Department of Public Health, Erasmus University Rotterdam, the Netherlands. Data were analysed for all countries using a standard protocol. The data sets were created by the country representatives according to highly detailed and standardised specifications.

Some remaining comparability problems could not be solved such as differences in general survey characteristics, and remaining differences in the measurement of morbidity indicators, risk factors for health and socio-economic indicators. Many sensitivity analyses have been performed to evaluate the possible effect of remaining comparability problems as will be outlined in the subsequent chapters of this thesis.

1.4 Structure of this thesis

Part I of this thesis deals with the first research question. It describes international variations in the size and pattern of socio-economic differences in self-reported morbidity among 12 western European countries. Three different indicators of socio-economic status are analysed separately. Educational level is used as a socio-economic indicator in chapter 2. Differences in morbidity by educational level are studied for adult men and women from 11 European countries. In chapter 3, differences in morbidity by occupational class are studied for seven countries. The Erikson-Goldthorpe social class scheme is applied to data from each of these countries. Results for women are not included since no international comparable data on occupational class were available for women. Chapter 4 gives an overview of morbidity differences by income level in six European countries. The independent impact of income on morbidity is studied by adjusting the inequality estimates for other socio-economic indicators. In the last chapter of part I, chapter 5, a comparison is made of health differences by educational level and income in East and West Germany detected after unification.

Part II focuses on the second research question of this thesis. It describes international variations in the size of socio-economic differences in risk factors for 16 different European countries. In this part of the thesis, only educational level is used as an indicator of socio-economic status. In chapter 6, socio-economic differences in smoking, overweight, excessive alcohol consumption and infrequent vegetable consumption are studied for 11 countries of the European Union using the international Eurobarometer surveys. International variations in socio-economic differences in smoking are studied in more detail in chapter 7. Differences between low and high educated groups regarding prevalence of smoking are studied for 12 countries using national survey data.

Chapter 8 describes variations in average height between 10 European countries, and between socio-economic groups within these countries using national survey data.

Part III focuses on international variations in social gradients in risk factors and their contribution to the size of socio-economic differences in health. In the discussion sections of the chapters of part II, this contribution is already evaluated to some extent but superficially and qualitatively. An in-depth quantitative evaluation is made in chapter 9. Correlations are calculated between international variations in (a) social gradients in risk factors and (b) socio-economic differences in cardiovascular disease mortality. This quantitative evaluation focused on cardiovascular disease mortality since most of the risk factors included in this study are risk factors for cardiovascular disease rather than for generic morbidity indicators or all-cause mortality.

In the final chapter, first the results are summarised. Second, the effect of remaining comparability problems is evaluated and explanations for our findings are given. Third, the implications of the results for future research and policies with respect to socio-economic health differences as well as suggestions for future comparative research are discussed.

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Part I

International variations in the size of socio-economic differences in self-reported morbidity

2 Differences in self-reported morbidity by educational level: a comparison of 11 western European countries

Objective
To assess whether there are variations between 11 western European countries with respect to the size of differences in self-reported morbidity between people with high and with low educational levels.

Data and methods
National representative data on morbidity by educational level were obtained from health interview surveys, level of living surveys or other similar surveys carried out between 1985 and 1993. Four morbidity indicators were included and a considerable effort was made to maximise the comparability of these indicators. A standardised scheme of educational levels was applied to each survey. The study included men and women aged 25 to 69 years. The size of morbidity differences was measured by means of the regression based Relative Index of Inequality.

Results
The size of inequalities in health was found to vary between countries. In general, there was a tendency for inequalities to be relatively large in Sweden, Norway and Denmark and to be relatively small in Spain, Switzerland and West Germany. Intermediate positions were observed for Finland, Great Britain, France and Italy. The position of the Netherlands strongly varied according to sex: relatively large inequalities were found for men whereas relatively small inequalities were found for women. The relative position of some countries, e.g. West Germany, varied according to the morbidity indicator.

Conclusion
Because of a number of unresolved problems with the precision and the international comparability of the data, the margins of uncertainty for the inequality estimates are somewhat wide. However, these problems are unlikely to explain the overall pattern. It is remarkable that health inequalities are not necessarily smaller in countries with more egalitarian policies such as the Netherlands and the Scandinavian countries. Possible explanations are discussed.

2.1 Introduction

Many studies throughout Europe have reported a higher level of morbidity and mortality for people with a lower educational level, occupational status or income level[1-3]. An interesting question is whether the size of these health inequalities varies substantially between countries. One of the reasons for studying international variations in socio-economic inequalities is that international comparison enables judgements to be made on the size of inequalities in health in one's own country. In addition, comparative studies of health inequalities in societies that differ with respect to the size of income inequalities, national living standards and other potentially relevant aspects, may shed more light on the causes of socio-economic inequalities in health.

Several international comparisons have focused on socio-economic inequalities in self-reported morbidity. These studies suggested that the size of inequalities in health varies between countries[4-15]. Comparative research has, however, until now lacked comprehensiveness and often suffered from problems with comparability of data. More specifically, previous international studies mainly concerned a few countries, especially the Scandinavian countries and Great Britain, and most of them included only one indicator of morbidity. In the few more comprehensive studies[9,14,15], the comparability of the morbidity indicators as well as the socio-economic indicators was not always optimal.

In this study, a more comprehensive view of international variations in socio-economic inequalities in morbidity is given. As well as the four Scandinavian countries and Great Britain, we included the Netherlands, Germany, France, Switzerland, Italy and Spain. The inclusion of a broad range of countries is informative because comparison of more varied types of societies could provide new insight into the sensitivity of socio-economic inequalities within different societal contexts. Several different indicators of morbidity were included in order to cover various aspects of people's health. In addition, this study paid considerable attention to optimising the comparability of the data of the morbidity indicators and of the socio-economic indicator, educational level. Finally, for most countries more recent data from the early nineties were used.

2.2 Data and methods

Data sources and study population

Data were obtained from national health surveys, level of living surveys or similar national surveys. In this study, only surveys with more than 4000 respondents were included. Table 2.1 gives an overview of the 11 countries included, their surveys and the basic characteristics of each survey. Extensive evaluations were made of the extent to which differences in survey characteristics could have biased the international pattern observed in this study[16]. The results are summarised in the Discussion section.

Table 2.1 Surveys included in the study.

Country	Year	Name	Number of respondents	Excluded subpopulation	Non-response rate (%)	Proxy interviews
Denmark	1986/87	Danish Health and Morbidity Survey	4,753	F	20	no
Finland	1986	Survey on Living Conditions	12,057	I	13	no
France[1]	1991/92	Enquête sur la Santé et les Soins Medicaux	21,586	I	17	no[2]
West Germany	1984/86	Life and Health in Germany (NHS)	4,790	F	34	no
	1987/88	Life and Health in Germany (NHS)	5,335	F	29	no
	1990/91	Life and Health in Germany (NHS)	5,311	F	31	no
Great Britain	1991	General Household Survey	19,039	I	15	yes[3]
Italy	1990/91	Multiple Household Survey	132,264	I	11	yes
Netherlands	1991/92	Netherlands Health Interview Survey	11;126	I	43	yes
Norway	1985	Health Survey	10,600	I	21	no
Spain	1987	National Health Interview Survey	27,533	I	10	no
Sweden	1991	Swedish Level of Living Survey	5,306		21	yes[3]
Switzerland	1992/93	Swiss Health Survey	15,288	I	29	yes[4]

F = exclusion of foreigners

I = exclusion of institutionalised persons

[1] The question on the morbidity indicator included in this study was only asked to a subsample of the total number of respondents (n=8,235).

[2] Proxy interviews were used in this survey, but not for the measurement of the morbidity indicator included in this study.

[3] The percentage of proxy interviews for persons aged 25-69 was smaller than 5%.

The analyses were restricted to non-institutionalised men and women aged 25 to 69 years because this section of the population was included in all surveys. The institutionalised population could not be excluded in Germany. However, since the number of institutionalised persons in this age groups was very small (<1.5%) in all countries[16], the inclusion or exclusion of this subpopulation probably did not affect inter-country comparisons of inequality estimates.

Measurement of morbidity

In this study, four indicators of morbidity were included which together covered various aspects of a respondent's health. In table 2.2 the exact definitions of the indicators and the number of countries for which the indicators were available are given.

Table 2.2 Morbidity indicators included in the study and the number of countries for which the indicator was available in a comparable way.

Morbidity indicator	Number of countries	Measure of ill-health: % of respondents who ...
Perceived general health	11	consider their present state of health less than good.
Long-term disabilities	6	mention one or more long-term disabilities (6 items: climbing stairs, walking, carrying 5 kilos, reading newspaper, conversation with more than 2 persons, un-/dressing).
Chronic conditions	5	mention to have suffered from one or more chronic conditions in the last 12 months (9 conditions: cancer, diabetes mellitus, respiratory diseases, heart diseases, stroke, liver/gall diseases, kidney/urinary tract diseases, stomach/duodenum ulcer, muskulo-skeletal diseases).
Any long-standing health problem	4	reply positively to an open question similar to "Do you suffer from any long-standing illness, disease or disability".

Perceived general health was mostly measured by a question very similar to "How would you judge your present state of health in general?" with five possible response categories varying from very good to very poor. In Britain and Sweden, however, only three response categories were used. In addition, subtle differences were present in the phrasing of the question for different countries; for instance in Spain and Great Britain the question referred to the state of general health over the last 12 months. Because of these differences, "less-than-good" health might have referred to a more severe health state in one country than in another country. Since the observed size of health differences might be related to the severity of the measured health states, for some countries inequality estimates were also calculated for "less-than-fair" health or another cut-off point.

On the basis of an evaluation of the availability and the comparability of the questions on long-term disabilities, seven disability items were selected. The selected items, which referred to different aspects of physical functioning, were considered to be fairly comparable and available for at least four countries. One item (can you run 100 metre?) was excluded since it dominated the prevalence rates and because it referred to a clearly

less severe form of disability than the other items. We restricted the analysis to those countries for which at least four of the six remaining disabilities were available. Additional analyses showed that the estimates of socio-economic inequalities in the total group of disability items were not sensitive to the inclusion or exclusion of the disabilities which were missing in some of the countries[16].

On the basis of an evaluation of the availability and the comparability of the questions on chronic conditions, we decided to include only those surveys in the analyses which used a question in which the respondents have to indicate, for each condition separately, whether they have suffered from the condition during the last 12 months. From the sets of conditions for which data were available in the different countries, we selected nine chronic conditions which together covered a broad spectrum of conditions and which were available for most or all countries. The description of some of the selected chronic conditions was certainly not identical in each survey. However, it was found that the estimates of the magnitude of health differences by education for the total group of nine chronic conditions were not sensitive to the inclusion or exclusion of these specific conditions[16].

The indicator used to elicit any longstanding-health problem was based on one straightforward question (see table 2.2) which did not show substantial differences between countries.

Measurement of educational level

In all countries, educational level was measured as the highest level of education a person has achieved/completed. In all countries this highest level was based on information on general educational as well as on vocational training. The national educational levels were re-grouped into five standard hierarchic levels: (1) no education completed, (2) first level (primary school), (3) secondary level (first phase), (4) secondary level (second phase) and (5) third level, which included university and other forms of higher education[17].

Unfortunately, the available data did not permit us to distinguish the lowest three levels for each country. Therefore, three broad levels were distinguished: third level, secondary level: second phase, and all lower levels.

Figure 2.1 shows the distribution of the population over these three levels for men and women, respectively. The educational distribution of the Scandinavian countries, Denmark, the Netherlands and Great Britain are fairly similar with the exception of women from Norway who on average have a relatively low educational level. Although their relatively low education level seems to be an artifact of the available data, no explanation was found for this deviation. The educational distributions in France, Italy and Spain were more skewed than in other countries. The relatively low percentage of persons belonging to the two highest educational groups in France is caused by the restricted number of persons who complete their educational level with an examination. The deviant educational distribution for Switzerland reflects the particular structure of

the educational system in that country which is characterised by the considerable importance given to part-time vocational training. Since all persons who followed this type of training are assigned to secondary level (second phase), this level is much larger in Switzerland than in the other countries.

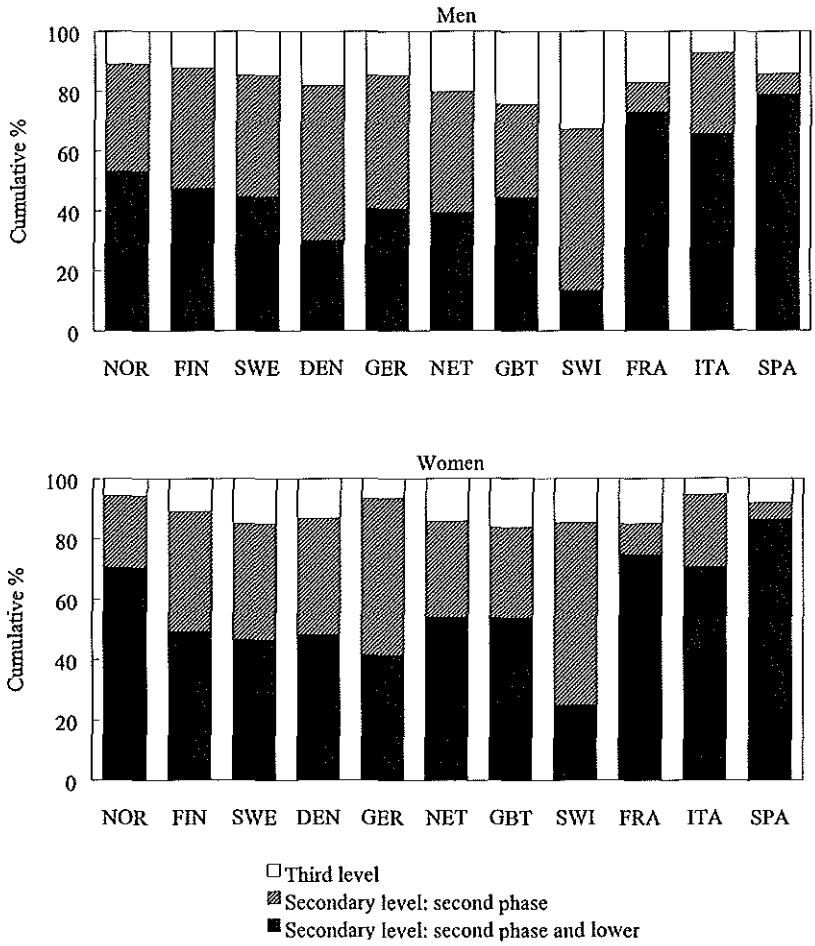

Fig. 2.1 Distribution of the survey population over three educational levels, for men and women aged 25-69 years.

Measurement of the size of inequality

The size of morbidity differences between educational groups was measured by means of a regression based index: the Relative Index of Inequality (RII). This index is used earlier to measure socio-economic health inequalities[14,18]. It does not only take into account differences in morbidity between educational groups but also the distribution of the population over the educational groups. Advantages of this index are that each edu-

cational group is taken into account separately and that only health differences are measured which are systematically related to education.

For the calculation of the RII, the socio-economic status (SES) of each educational group was quantified as the relative position of that group in the educational hierarchy. This continuous measure of SES was related to morbidity rates by means of regression analysis. Since the morbidity indicators were defined in a dichotomous way, logistic regression was applied. Adjustment for age was made by including a nominal variable representing 5-year age groups into the model. Exponentiation of the regression coefficients results in an odds ratio. The interpretation of this measure is the ratio of the odds for having the health problem for those at the bottom of the educational hierarchy as compared to those at the top. More details about this index can be found elsewhere[19,20].

Application of the RII requires the availability of a strictly hierarchical and reasonably detailed educational classification. All countries met the requirement of a hierarchic ordering of educational categories. The second requirement was not completely fulfilled since the lowest three educational groups were combined. This might have biased the results, especially when a large section of the population has attained only lower secondary school or less. This applied to France, Spain and Italy. Therefore, for these countries we evaluated whether the inequality estimates changed when a further distinction was made within this broad lower group. The results are reported in the next section.

The regression model assumes a linear relationship (after logistic transformation) between level of education and the prevalence of a health problem. This assumption was checked for all countries. Non-linearity was observed for Finland only. This non-linearity was characterised by lower than expected morbidity rates in the highest educational group. Because this highest group was relatively small, this deviation is of minor importance.

2.3 Results

Results will be discussed for men and women separately. Tables 2.3 and 2.4 give the prevalence rate and the size of morbidity inequalities for men and women respectively.

Men

The prevalence rate of less-than-good health for men from Denmark, France, Italy, the Netherlands, Norway and Sweden was approximately 20 percent (table 2.3). Relatively high prevalence rates were observed for Finland, Germany, Spain and Great Britain, and a low overall prevalence rate was observed for Switzerland. Differences in overall prevalence might be real or they may be artificial, e.g. due to subtle differences in survey questions on perceived general health. In the latter case, less-than-good health might refer to a more severe health state in one country than in the other. Since the size of inequality might be related to the severity of the health problem, the size of inequality

was also calculated for a neighbouring cut-off point for each of the above mentioned five countries with a deviant overall prevalence rate.

In table 2.3, the countries are ordered according to the observed size of inequality in perceived general health. The RII for less-than-good health was largest in Norway, Sweden, the Netherlands and Denmark while the smallest inequalities were found for Switzerland, Germany and Spain. The results concerning the neighbouring cut-off point for five of the countries showed that a more severe definition of perceived general health results in somewhat larger morbidity inequality estimates. The international position of the five countries was, however, not substantially changed by the choice of the alternative cut-off point. The RII for countries with a high international position was approximately twice as large as for the countries with a low position. The confidence intervals of the RII's were very large and only the intervals for the countries at the extreme positions did not overlap.

The percentage of men who mentioned one or more disabilities ranged from 7.8 to 17.9. A part of this difference was due to the fact that the number of included disabilities per country ranged from four to six. As is explained in the Data and methods section, the observed size of inequalities in health in a country is probably not largely influenced by the omission of one or two disability items. Inequality estimates were highest for Norway and the Netherlands, followed by Finland and Germany. Small inequalities were observed for Denmark and Switzerland. The international pattern that was observed for less-than-good health was somewhat different, notably for Germany and Denmark.

For the indicator chronic conditions, the prevalence roughly ranged from 20 to 30 percent. The inequality estimates were highest for men from Sweden, followed by Italy, while the smallest inequalities were found for the Netherlands, Germany and Spain. Some of the results for this indicator were not in line with the results for less-than-good health, notably the position of the Netherlands.

The prevalence rate of any long-standing health problem for men from Denmark, Great Britain and the Netherlands was about 30 percent or more. Again, a higher prevalence rate was found for Finland. The RII estimates for these countries were not clearly different from each other, and their confidence intervals largely overlapped. This contrasted with the results for perceived general health, for which smaller differences were found for Great Britain than for the Netherlands and the Scandinavian countries.

Women

The results for women (see table 2.4) corresponded fairly well to that of men: relatively small inequalities were found for Switzerland, Germany and Spain, and large inequalities for Norway and Sweden. The major differences were the relatively small inequalities among women in the Netherlands and the large inequalities among women in Denmark. The international patterns of inequality estimates for the different morbidity indicators were reasonably well in line with each other.

Table 2.3 The prevalence rate, the RII and the 95% confidence interval for perceived general health (less-than-good health, less-than-fair health or other cut-off point), long-term disabilities, chronic conditions and any long-standing health problems, per country. Men, aged 25-69 years.*

Country	Perceived general health		Long-term disabilities		Chronic conditions		Any long-standing health problem	
	Prevalence rate	RII	Prevalence rate	RII	Prevalence rate	RII	Prevalence rate	RII
Norway	21.2	6.98 (4.55-10.7)	9.6	5.40 (2.87-10.2)				
Netherlands	20.8	5.42 (4.03-7.29)	8.4	5.76 (3.67-9.00)	19.5	2.51 (1.87-3.36)	30.8	2.18 (1.71-2.78)
Sweden	22.0	4.84 (3.09-7.57)			32.1	3.87 (2.65-5.64)		
Denmark	19.8	4.60 (2.76-7.66)	7.8	2.92 (1.36-6.26)			31.2	2.39 (1.57-3.64)
Finland	40.9	4.45 (3.37-5.88)	17.9	3.48 (2.40-5.05)			42.1	2.28 (1.74-3.00)
	**7.4*	*4.70 (2.67-8.29)*						
Italy	20.0	4.36 (3.79-5.01)			24.7	3.27 (2.89-3.70)		
France	22.1	4.23 (2.55-7.03)						
Great Britain	31.6	4.06 (3.24-5.10)					34.0	2.09 (1.68-2.60)
	**10.1*	*4.36 (3.01-6.32)*						
Switzerland	13.2	3.09 (2.26-4.24)	10.9	1.92 (1.37-2.70)				
	**70.7*	*1.53 (1.22-1.92)*						
Spain	28.8	2.74 (2.11-3.55)			30.4	2.12 (1.64-2.74)		
	**7.2*	*3.33 (1.99-5.59)*						
West Germany[1]	54.1	2.25 (1.81-2.79)	13.6	3.34 (2.01-5.55)	27.9	2.39 (1.85-3.10)		
	**13.7*	*2.86 (2.08-3.93)*						

[1] Data on perceived general health and chronic conditions were obtained from the NHS of 1987/88 and 1990/91. Data on long-term disabilities were obtained from the NHS of 1984/86.

Table 2.4 The prevalence rate, the RII and the 95% confidence interval for perceived general health (less-than-good health, less-than-fair health or other cut-off point), long-term disabilities, chronic conditions and any long-standing health problems, per country. Women, aged 25-69 years.*

Country	Perceived general health		Long-term disabilities		Chronic conditions		Any long-standing health problem	
	Prevalence rate	RII	Prevalence rate	RII	Prevalence rate	RII	Prevalence rate	RII
Sweden	23.3	7.27 (4.55-11.6)			37.7	3.41 (2.35-4.95)		
Denmark	22.8	6.80 (3.95-11.7)	9.3	8.81 (3.61-21.5)			32.6	3.59 (2.29-5.61)
Norway	23.3	4.76 (2.92-7.73)	12.2	4.43 (2.23-8.79)				
France	30.0	4.18 (2.82-6.21)						
Great Britain	37.7	4.02 (3.24-4.98)					33.7	1.82 (1.46-2.26)
	**11.6*	*3.92 (2.76-5.56)*						
Finland	41.5	3.86 (2.93-5.09)	19.4	3.71 (2.57-5.36)			42.9	2.00 (1.53-2.61)
	**6.5*	*3.08 (1.72-5.53)*						
Netherlands	22.0	3.51 (2.59-4.75)	12.1	4.45 (2.91-6.80)	22.1	1.58 (1.17-2.13)	29.9	1.19 (0.92-1.53)
Spain	38.7	3.32 (2.47-4.46)			43.0	2.00 (1.51-2.64)		
	**9.6*	*4.90 (2.58-9.33)*						
Italy	25.6	3.14 (2.75-3.59)			27.1	2.42 (2.12-2.76)		
Switzerland	15.5	2.72 (2.03-3.64)	9.7	2.12 (1.49-3.03)				
	**73.5*	*2.81 (2.20-3.59)*						
West Germany[1]	55.7	2.51 (1.99-3.17)	19.4	4.08 (2.59-6.44)	30.3	1.56 (1.19-2.05)		
	**15.0*	*2.14 (1.56-2.94)*						

[1] Data on perceived general health and chronic conditions were obtained from the NHS of 1987/88 and 1990/91. Data on long-term disabilities were obtained from the NHS of 1984/86.

Additional analysis

Because the percentage of persons belonging to the lowest educational level was very large in France, Spain and Italy, we evaluated whether the RII estimates changed when the lowest educational group was divided into two hierarchical groups. The results are shown in table 2.5. For men and women, the changes in inequality estimates for Spain and Italy were negligible. The inequality estimates for men and women in France decreased when more educational categories were distinguished. However, France remained close to the international average.

Table 2.5 The RII and the 95% confidence interval for less-than-good perceived health and chronic conditions for France, Italy and Spain by sex, using 3 or 4 educational levels.

Country	# educational categories	Perceived general health		Chronic conditions	
Men					
France	3	4.23	(2.55-7.03)		
	4	3.53	(2.39-5.21)		
Italy	3	4.36	(3.79-5.01)	3.27	(2.89-3.70)
	4	4.30	(3.84-4.82)	3.15	(2.84-3.49)
Spain	3	2.74	(2.11-3.55)	2.12	(1.64-2.74)
	4	2.69	(2.17-3.35)	2.05	(1.66-2.55)
Women					
France	3	4.18	(2.82-6.21)		
	4	3.62	(2.66-4.93)		
Italy	3	3.14	(2.75-3.59)	2.42	(2.12-2.76)
	4	3.27	(2.93-3.65)	2.59	(2.32-2.89)
Spain	3	3.32	(2.47-4.46)	2.00	(1.51-2.64)
	4	3.53	(2.77-4.49)	1.69	(1.35-2.13)

2.4 Discussion

Summary of the findings

In this study, morbidity differences according to education were studied for 11 countries from the northern, the western and the southern parts of Europe. For almost all countries, two or more indicators of morbidity were included. Differences were measured using the RII.

The size of morbidity differences was found to vary substantially between countries. There was a tendency for inequalities to be relatively large in Sweden, Norway and Denmark. Intermediate inequalities were observed for Finland, Great Britain, France and Italy, and relatively small inequalities were found in Spain, Switzerland and Germany. The international pattern of the size of health inequalities varied between

sexes and between morbidity indicators. For example, health inequalities in the Netherlands were found to be relatively large for men but relatively small for women. Another example was that relatively small inequalities were found for less-than-good health for men and for women from Germany whereas intermediate inequalities were found for long-term disabilities.

When the RII is used, a larger inequality estimate for one country than for another can be attributed to a larger effect of education level on morbidity and/or to larger inequalities in educational level in these countries[19,20]. To disentangle these two components, additional analyses were performed (results not shown). The results suggested that the international variations found in this study are due to variations between countries in the effect of education on morbidity and not to variations in the size of inequalities in education itself[16].

International comparability of the data

Much attention was paid to the international comparability of morbidity indicators. Cross-national comparisons were only made for morbidity indicators which were highly comparable as judged against the structure and the wording of the respective survey questions. However, some remaining comparability problems could not be avoided. Analyses in which the results were evaluated (e.g. evaluation of a different cut-off point for perceived general health) suggested that the international positions of countries that were observed in this study were robust[16].

The surveys included in this study differed in some general characteristics. In table 2.1 the major survey characteristics were mentioned. If inequality estimates are sensitive to these survey characteristics, the comparability of the inequality estimates for the different countries will be reduced. Non-response rates bias health inequality estimates if they are related to SES and, given SES, to health status. There are indications that response rates are lower among lower socio-economic groups and among less healthy people. This could imply that non-response might lead to an underestimation of health inequality estimates. The higher the percentage of non-response the larger this underestimation may be. The same applies to the exclusion of foreigners. Another survey characteristic which might bias the results is the use of proxy interviews. Sensitivity analyses using data from the Dutch survey showed that the use of proxy interviews was related to SES, and that their use might underestimate morbidity levels in persons with a low SES to a larger extent than morbidity levels in persons with a high SES[16]. A final aspect which could affect the results relates to differences in the year when the survey was carried out, which varied between 1985 and 1993. If there is a trend towards increasing inequalities in countries with relatively old surveys, the inequality estimates reported in this study will be smaller than the inequality estimates found if more recent data had been used. For Spain and Norway, which have relatively old surveys, some evidence is available suggesting that inequalities are increasing over time[16].

The question is whether these differences in survey characteristics might explain some of the international variation in the size of health inequalities, and more specifically the relatively small inequalities in Spain, Germany and Switzerland which were observed in this study. This indeed cannot completely be excluded. For instance, the size of health inequalities in Switzerland and Germany might have been underestimated because of the relatively high non-response rate and in case of Germany, also because of the exclusion of foreigners (approx. 8% of the German population). The size of health inequalities in Spain might have been larger if a more recent survey had been used. However, there are also surveys with similar general survey characteristics which show large socio-economic inequalities in morbidity, for example the Dutch and Norwegian surveys.

Taking into consideration the large confidence intervals around inequality estimates and the remaining problems with the comparability of the available data, the exact international position for most countries is uncertain. However, these problems are unlikely to explain the overall pattern, including the finding that egalitarian countries like the Scandinavian countries and the Netherlands do not have smaller inequalities in self-reported morbidity than other countries.

This is remarkable since it does not agree with the expectation that these inequalities are smaller in countries with more egalitarian socio-economic and other policies, such as the Scandinavian countries and the Netherlands. The 'Scandinavian welfare model'[21] resulted in, among others, a high share of state expenditures on social affairs and generous unemployment and disability benefits in the 1980's[22]. This has contributed to the fact that in the 1980's both the Netherlands and the Scandinavian countries have smaller income inequalities than any other country included in this study[23]. In addition, disadvantaged population groups in these countries have, as in Great Britain, virtually free access to high-quality medical care[9]. Sweden's egalitarian socio-economic policies date back to the 1930's, while those in Norway, Denmark, Finland and the Netherlands were developed in the post-war period[21].

Comparison with previous international studies

The results of previous international comparisons with respect to health inequalities according to educational level partly agree with our study. Lahelma et al[10,13] compared the size of inequalities in limiting long-standing illness for men and women from Sweden, Norway and Finland. Interestingly, their comparison was based on the same survey carried out in each of the three countries: the Nordic Level of Living Survey 1986-87 (the Finnish part of that survey is also used in the present study). Using these highly comparable data, Lahelma et al also observed somewhat larger (relative) inequalities for men from Norway and Sweden than for men from Finland. Inequalities among women were largest in Sweden. As in our study, the differences between the Scandinavian countries were small and not statistically significant.

Kunst et al[14] compared a broader range of countries using several indicators of morbidity, based for most countries, on national surveys carried out in 1986/87. They

observed for men and women approximately the same relative position for the Netherlands, Denmark and Great Britain as was observed in the present study. This is not surprising since the data for these three countries were elicited from the same surveys, albeit often from an earlier survey year. Other results of their study, however, were not completely in line with our results.

One of the discrepancies relates to the position of Italy and Germany, for which Kunst et al observed relatively large health inequalities according to education, rather than the intermediate and small inequalities observed in the present study. This discrepancy is probably related to the measurement of morbidity. Kunst et al included only one morbidity indicator for these countries. For Italy, a morbidity indicator was used which indicated whether persons were restricted in their daily activities, such as going to work during the last fourteen days. Socio-economic inequalities detected from this indicator can be strongly determined by (international variation in) exogenous factors such as the economic and social determinants of work absence. In the present study, two more general indicators of morbidity were used, i.e. perceived general health and the prevalence of chronic conditions. For Germany, Kunst et al used a measure of the prevalence of a few specific long-term disabilities. The problem with the use of this indicator was that it had a low prevalence rate which resulted in very wide confidence intervals around the inequality estimates. In the present study, more stable inequality estimates could be made for this indicator and, in addition, two other morbidity indicators.

Another discrepancy relates to Sweden, for which Kunst et al found somewhat smaller inequalities than our study showed. Inequalities in Sweden were found to be approximately as large as in Great Britain. In an extensive evaluation, we found that the discrepancy was related to the choice of the survey for Sweden: i.e. the Survey of Living Conditions from 1981 and 1988 used in the study of Kunst et al, and the Level of Living Survey of 1991, a panel study, used in the present study. After re-analysing the data from these two surveys with precisely the same statistical methods, health indicators and socio-economic indicators, we found somewhat larger inequality estimates with data from the Level of Living Survey.

In conclusion, the results of previous international comparisons on morbidity differences according to educational level agree only in part with the results of the present study. The discrepancies that are observed underline the need to include different morbidity indicators in comparisons between countries. They, in addition, emphasise that the use of a different survey might lead to somewhat different results for a specific country. For Sweden as compared to Great Britain, larger inequalities were observed in data from the survey used in this study as well as the surveys used by Lahelma et al, but equally large inequalities were observed in the survey used by Kunst et al. It is important to note, however, that despite this uncertainty about Sweden's international position, it cannot be considered low from a wider international perspective.

Some other international comparative studies have used occupational class and income level as indicators of socio-economic status. Since different socio-economic indicators

refer to different aspects of a person's socio-economic status and vary to the extent in which they are influenced by health, it could be questioned whether the same results would be obtained by using occupation or income as socio-economic indicators. Only three earlier comparisons focused on inequalities in morbidity according to occupational class. The results of these studies corresponded fairly well with this study on education[6,8,12]. For example, in a re-analysis of data presented by Vågerö and Lundberg[6], Wagstaff et al found slightly larger inequalities for Sweden as compared to Great Britain[8]. The international pattern for income seems to be different. Doorslaer et al[15] compared nine countries with respect to the size of differences between income groups in perceived general health for men and women combined, using data from national surveys from 1985 to 1992. For the Netherlands, Great Britain and Sweden, the same survey was used as in the present study, although often from an earlier survey year. Relatively large inequalities were reported for Great Britain, intermediate differences for the Netherlands, Finland, Spain, Switzerland and West Germany, and small differences for Sweden and East Germany.

One explanation for the inconsistencies between the international patterns found for the different socio-economic indicators might be that in countries where large morbidity inequalities according to income exist, material rather than behavioural factors play a larger role. It seems as if egalitarian socio-economic policies and other policies in the Nordic countries mainly influenced income-related health inequalities and were not equally effective in reducing health differences according to education.

Conclusion

In contrast to what was expected, health inequalities are not necessarily smaller in countries with more egalitarian policies, such as the Netherlands and the Scandinavian countries. There is even some evidence that educational inequalities in self-reported morbidity are somewhat larger in most Scandinavian countries and the Netherlands. This finding raises the question as to what the reasons might be for the perhaps larger inequalities in these countries.

A possible explanation which cannot yet be excluded, refers to the subjective nature of the morbidity data included in this study. Self-reported data are sensitive to the respondent's perception of 'objective' health problems, and his/her illness behaviour. Socio-economic inequalities in these factors might partly explain socio-economic differences in self-reported morbidity[24]. Countries might differ in the extent of inequalities in perceptions of health and illness behaviours, and this might explain our finding that inequalities in perceived general health are relatively large in most Scandinavian countries. This does not seem to be likely when taking into consideration our finding that inequalities in long-term disabilities, a more objective indicator of morbidity, were at least as large in the Scandinavian countries and the Netherlands as in other European countries. Nevertheless, the possibility of response bias cannot be excluded. Unfortunately, there is yet very little evidence of the contribution that health perceptions and other psycho-social factors make to inequalities in self-reported health in European countries.

Another possible explanation is that countries differ in the amount of social mobility which exists. In more 'open' countries, the educational level achieved is less dependent on the socio-economic status of a person's parents, and more on personal characteristics, including health (direct selection) and health related factors (indirect selection). In this way, a larger degree of social mobility can add to larger inequalities in health. Although the different international comparisons of social mobility did not yield consistent results[25,26], one study convincingly showed that mobility rates were somewhat higher in Sweden than in France, and England and Wales[27].

A final explanation relates to the possibility that countries with relatively large inequalities in morbidity have larger socio-economic gradients in risk factors for disease, e.g. behaviour related factors such as smoking and alcohol consumption. Perhaps, specific socio-cultural factors have contributed to steeper social gradients in these risk factors in the Netherlands or the Scandinavian countries or to small inequalities or even inverse gradients in Germany, Switzerland or Spain. A recent paper on international variations in the socio-economic gradients in risk factors observed a north-south pattern for smoking among women, and for heavy smoking among men, with small or even positive associations in France and the Mediterranean countries[28].

More research is clearly necessary to identify the determinants of the international pattern of health inequalities observed in this study.

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3 Morbidity differences by occupational class among men in seven European countries: an application of the Erikson-Goldthorpe social class scheme

Objective
This study describes morbidity differences according to occupational class among men from France, Switzerland, West Germany, Great Britain, the Netherlands, Denmark, and Sweden.

Data and methods
Data were obtained from national health interview surveys or similar surveys between 1986 and 1992. Four morbidity indicators were included. For each country, individual-level data on occupation were recoded according to one standard occupational class scheme: the Erikson-Goldthorpe social class scheme. To describe the pattern of morbidity by occupational class, odds ratios were calculated for each class using the average of the population as a reference. The size of morbidity differences was summarized by the odds ratio of two broad hierarchical classes. All odds ratios were age-adjusted.

Results
For all countries, a lower than average prevalence of morbidity was found for higher and lower administrators and professionals as well as for routine non-manual workers, whereas a higher than average prevalence was found for skilled and unskilled manual workers and agricultural workers. Self-employed men were in general healthier than the average population. The relative health of farmers differed between countries. The morbidity difference between manual workers and the class of administrators and professionals was approximately equally large in all countries. Consistently larger inequality estimates, with no or slightly overlapping confidence intervals, were only found for Sweden in comparison with West Germany.

Conclusion
Thanks to the use of a common social class scheme in each country, a high degree of comparability was achieved. The results suggest that the size of morbidity differences according to occupational class among men is highly similar between different European countries.

3.1 Introduction

International comparisons can make an important contribution to the study of socio-economic inequalities in health. Firstly, these comparisons enable researchers and policy makers to judge the size of inequalities in health in their own country. Secondly, these studies may shed more light on the causes of socio-economic inequalities when a comparison is made between societies which differ with respect to the size of income inequality, national living standards and other potential relevant aspects.

Until now, several international comparisons have been made with respect to socio-economic inequalities in self-reported morbidity. For these comparisons, education, income and occupation were used as indicators of socio-economic status[1-11]. The comparisons concerning education and income were most comprehensive with regard to the number and type of countries compared, and with regard to the number of morbidity indicators included[1,10]. Occupation is linked to education and income as well as to benefits which result from some occupations such as prestige, privilege and power[12]. Although occupation is probably the most comprehensive indicator, previous studies have been limited to the Scandinavian countries and Great Britain[2,3,6,7,9]. One of the reasons for this gap is presumably the considerable effort necessary to make occupational classifications comparable for different countries.

In this study, occupational inequalities for several indicators of self-reported morbidity were studied for men from France, Switzerland, West Germany, Great Britain, the Netherlands, Denmark and Sweden. Data were obtained from national health surveys or similar surveys. Comparability was optimised by recoding all subjects to one standard occupational classification: the Erikson-Goldthorpe social class scheme (EGP-scheme). This social class scheme was developed for comparative investigations on social mobility among the populations of modern industrial societies[13]. The EGP-scheme has until now only rarely been used for studying socio-economic inequalities in health[14]. Our first aim was to describe the pattern of self-reported morbidity by occupational class in the different European countries. The second aim was to assess whether differences in self-reported morbidity between high and low occupational classes were larger in some countries than in others.

3.2 Data and methods

Data were obtained from national health interview surveys, level of living surveys or multipurpose surveys (see table 3.1). Only those surveys were included for which sufficient information was available to assign economically active as well as (the majority of) inactive persons to the occupational classes. The analyses were restricted to non-institutionalised men aged 25-69 years, because this was the broadest group covered by

all surveys. No internationally comparable data were available for women. Data sets were created by the country representatives according to a standard protocol and sent to the co-ordinating centre for centralised analysis.

Table 3.1 Surveys included in the study.

Country	Year	Name	Number of respondents	% Non-response
Denmark	1986/87	Danish Health and Morbidity Survey	4753	20
France[1]	1991/92	Enquête sur la Santé et les Soins Medicaux	21586	17
West Germany[2]	1987/88	Life and Health in Germany (NHS)	5335	29
	1990/91	Life and Health in Germany (NHS)	5311	31
Great Britain	1991	General Household Survey	19039	15
Netherlands	1991/92	Netherlands Health Interview Survey	11126	43
Sweden	1991	Swedish Level of Living Survey	5306	21
Switzerland	1992/93	Swiss Health Survey	15288	29

[1] The question on the morbidity indicator included in this study was only asked to a subsample of the total number of respondents (n=8,235).

[2] The two surveys were pooled in order to obtain more stable estimates.

Four indicators of morbidity were included covering various aspects of a respondent's health. The exact definitions of the indicators are given in table 3.2. As a result of a strict selection procedure, cross-national comparisons were only made between countries for which the morbidity indicators were highly comparable as judged against the structure and the wording of the respective survey questions. However, some remaining comparability problems could not be avoided. These problems were evaluated as much as possible. In this study, one example of such an analysis is given. Perceived general health was mostly measured by a question very similar to "How would you judge your present state of health in general?" with five possible response categories: very good, good, fair, poor, very poor. In Britain and Sweden, however, only three response categories were used. In addition, subtle differences were present in the phrasing of some of

Table 3.2 Morbidity indicators included in the study.

Morbidity indicator	Measure of ill-health: % of respondents who ...
Perceived general health	consider their present state of health less than good.
Long-term disabilities	mention one or more long-term disabilities (climbing stairs, walking, carrying 5 kilogram, reading newspaper, conversation with more than 2 persons, (un-)dressing.
Chronic conditions	mention one or more chronic conditions (cancer, diabetes mellitus, respiratory diseases, heart diseases, stroke, liver/gall diseases, kidney/urinary tract diseases, stomach/duodenum ulcer, muskulo-skeletal diseases).
Any long-standing health problem	reply positively to an open question similar to "Do you suffer from any long-standing illness, disease or disability".

the answer categories for different countries. Because of these differences, "less-than-good" health might have referred to a more severe health state in one country than in another country. Since the observed size of health differences might be related to the severity of the measured health states, for some countries inequality estimates were also calculated for a lower cut-off point, mostly "less-than-fair" health[11,15].

The Erikson-Goldthorpe scheme (EGP-scheme) was used to classify men into occupational classes[16]. This scheme is coherently derived from a number of well-defined principles: being an employer versus employee, having an employment contract of a 'service' versus a 'labour' type, performing manual work versus non-manual work, and working in an agricultural or non-agricultural setting. Figure 3.1 presents a flow diagram which shows how these four dimensions are combined to form the EGP-classes.

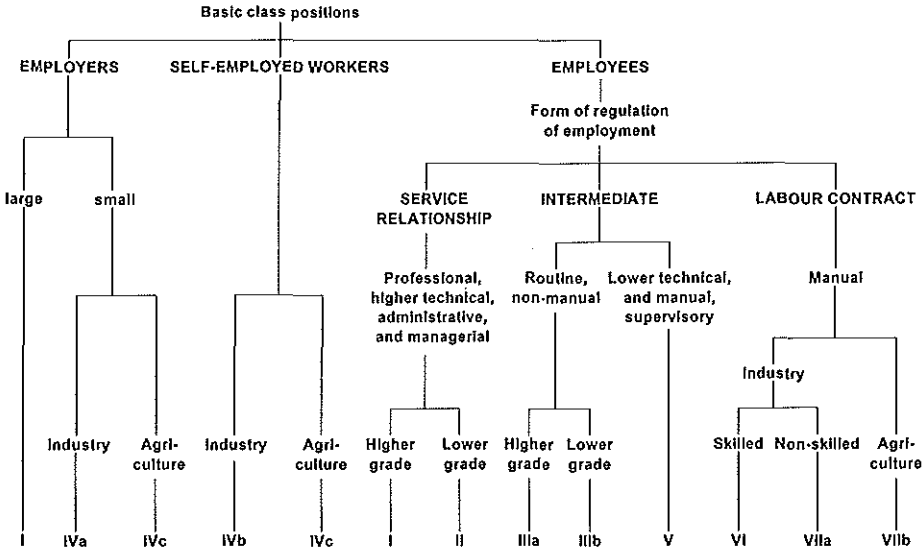

Fig. 3.1 The derivation of the EGP-class scheme (source: ref 16).

The country specific conversion algorithms that were developed by Erikson, Goldthorpe or colleagues to allocate persons to the EGP-classes were available for a few countries only. Therefore, we used an international applicable algorithm developed by Ganzeboom, Luijkx and Treiman[17]. This 'GLT-procedure' assigns a social class code to persons on the basis of their occupational title ('brick layer', 'accountant', etc.), employment status (self-employed or in employment) and supervisory status (the number of subordinates). Detailed information about the procedure used can be found elsewhere[15]. For all countries, 3-digit occupational codes, information on employment status and supervisory status were available for the total study population. An exception is Great Britain, for which information on the supervisory status of the employed was missing. The GLT-procedure could not be used for France. Therefore, we used a conversion algorithm that was developed for France by Erikson, Goldthorpe and colleagues. Eco-

nomically inactive men were assigned to occupational classes using information based on their last job. The percentage of men who could not be classified ranged from approximately 0.5% in Great Britain and France to approximately 4% in the Netherlands and Germany.

In this study, eight EGP-classes were distinguished. Figure 3.2 gives the percentage distribution of the survey populations over these classes. This distribution was fairly similar in all counties. Approximately 35% of the population belonged to the higher and lower administrator and professional classes, whereas the share of manual classes (skilled and unskilled manual workers) was approximately 40 % in each country. Compared to other countries, the number of skilled manual workers in France was large in proportion to the number of unskilled manual workers. This is probably due to a difference between the algorithm for France and the GLT-procedure in the criteria used to classify manual workers as skilled or unskilled. In Great Britain, the relatively small proportion of persons belonging to higher administrators and professionals was underestimated due to the absence of information on subordinates for the employed.

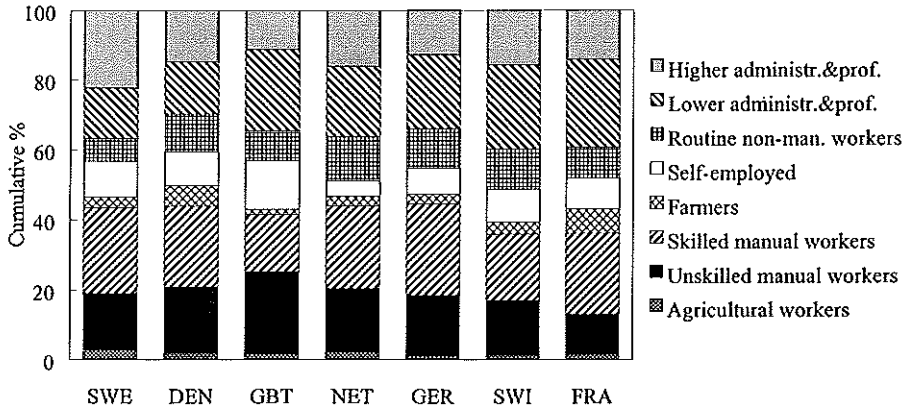

Fig. 3.2 The distribution of the population over eight EGP-classes, men aged 25-69.

For all analyses, logistic regression was applied. To describe the pattern of morbidity by EGP-class, the odds ratio for having the health problem in each separate occupational class, as compared to the average of the total population, was estimated. The size of health inequality in each country was summarised by the odds ratio of two broad groups: higher and lower administrators and professionals versus skilled and unskilled manual workers. These two groups comprise large sections of the population (approximately 75%) and are clearly hierarchical. A comparison between these groups is not sensitive to international differences in the distinction between skilled and unskilled manual workers (e.g. France) or lower and higher administrators and professionals (e.g. Great Britain). For all analyses, adjustment for age was made by including a nominal variable representing five year age groups into the logistic regression model.

Table 3.3 Inequality in less-than-good perceived health, and a lower cut-off point(*) for countries with a relatively high prevalence rate by occupational class for men aged 25-69.

	Sweden	Denmark	Great Britain	Netherlands	Germany	Switzerland	France
Prevalence (%)							
Total population	22.0	19.8	31.6	20.8	54.1	13.2	22.1
			**10.1*		**13.7*		
Pattern (Odds ratio and 95% Confidences Interval (CI))							
Total population	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Higher administrators and professionals (I)	0.48 (0.36-0.63)	0.57 (0.38-0.85)	0.50 (0.41-0.61)	0.52 (0.41-0.65)	0.73 (0.62-0.86)	0.55 (0.43-0.71)	0.50 (0.37-0.69)
Lower administrators and professionals (II)	0.65 (0.47-0.90)	0.55 (0.37-0.84)	0.69 (0.61-0.78)	0.68 (0.56-0.82)	0.78 (0.68-0.87)	0.74 (0.62-0.89)	0.79 (0.64-0.98)
Routine non-manual workers (III)	0.70 (0.44-1.13)	0.86 (0.56-1.32)	1.03 (0.86-1.25)	0.76 (0.60-0.96)	0.93 (0.79-1.11)	1.10 (0.88-1.38)	0.94 (0.67-1.34)
Skilled manual workers (V+VI)	1.37 (1.11-1.69)	1.33 (1.04-1.71)	1.34 (1.17-1.53)	1.31 (1.14-1.52)	1.20 (1.07-1.34)	1.50 (1.28-1.77)	1.48 (1.23-1.80)
Unskilled manual workers (VIIa)	1.74 (1.35-2.23)	1.13 (0.84-1.50)	1.55 (1.39-1.72)	1.61 (1.37-1.88)	1.32 (1.14-1.52)	1.30 (1.08-1.57)	1.57 (1.21-2.05)
Self-employed (IVa/b)	0.73 (0.50-1.06)	1.02 (0.68-1.53)	0.83 (0.71-0.98)	0.82 (0.57-1.19)	0.88 (0.71-1.09)	0.80 (0.60-1.06)	0.61 (0.43-0.88)
Farmers (IVc)	1.62 (0.93-2.79)	1.75 (1.13-2.72)	0.80 (0.51-1.25)	1.13 (0.79-1.61)	1.04 (0.73-1.49)	1.29 (0.87-1.92)	1.14 (0.81-1.61)
Agricultural labourers (VIIb)	2.24 (1.28-3.92)	1.38 (0.61-3.12)	1.61 (1.07-2.43)	1.27 (0.79-2.05)	1.32 (1.14-1.52)	0.32 (0.11-0.97)	2.08 (1.02-4.26)
Summary measure of inequality (Odds Ratio and 95% CI)							
OR V+VI+VIIa / I+II	2.79 (2.13-3.65)	2.19 (1.56-3.08)	2.32 (2.03-2.65)	2.40 (2.00-2.88)	1.63 (1.43-1.87)	2.12 (1.75-2.57)	2.24 (1.77-2.83)
			**2.54 (2.05-3.14)*		**1.76 (1.44-2.16)*		

3.3 Results

In table 3.3, the pattern of less-than-good perceived general health by EGP-class is given. The results for the different countries largely correspond. In all countries, a significantly lower prevalence compared to the average of the population (1.0) was found for higher and lower administrators and professionals. The odds ratios of these classes varied between 0.48 and 0.73. Also routine non-manual workers in most countries had an odds ratio lower than 1.0, however, none of these ratios were significantly different from 1.0. A significantly higher prevalence compared to the population average was found for skilled and unskilled manual workers. In all countries, with the exception of Denmark and Switzerland, unskilled manual workers more often reported less-than-good health than skilled manual workers. Self-employed men had a relatively low prevalence, with the exception of those in Denmark. The position of farmers varied between countries, with a clearly higher than average prevalence in Sweden, Denmark, Switzerland and a smaller than average prevalence in Great Britain. The odds ratios for agricultural workers were, with the exception of Switzerland, larger than 1.0.

Table 3.4 Inequality in long-term disabilities by occupational class, men aged 25-69.

	Denmark		Netherlands		Switzerland	
Prevalence (%)						
Total population	7.8		8.5		10.9	
Pattern (Odds ratio and 95% CI)						
Total population	1.00		1.00		1.00	
Higher administrators and professionals (I)	0.75	(0.41-1.35)	0.44	(0.30-0.64)	0.77	(0.61-1.00)
Lower administrators and professionals (II)	0.49	(0.23-1.02)	0.50	(0.36-0.71)	0.91	(0.75-1.11)
Routine non-manual workers (III)	0.57	(0.26-1.27)	0.97	(0.70-1.35)	1.04	(0.81-1.35)
Skilled manual workers (V+VI)	1.23	(0.81-1.86)	1.53	(1.25-1.87)	1.26	(1.04-1.53)
Unskilled manual workers (VIIa)	1.35	(0.88-2.09)	1.45	(1.15-1.82)	1.11	(0.89-1.38)
Self-employed (IVa/b)	0.97	(0.51-1.84)	0.57	(0.31-1.06)	0.81	(0.59-1.10)
Farmers (IVc)	0.81	(0.40-1.62)	1.07	(0.65-1.77)	1.15	(0.74-1.80)
Agricultural labourers (VIIb)	1.26	(0.41-3.87)	1.71	(0.94-3.11)	0.95	(0.43-2.10)
Summary measure of inequality (Odds Ratio and 95% CI)						
OR V+VI+VIIa / I+II	2.04	(1.22-3.42)	3.16	(2.37-4.22)	1.38	(1.12-1.70)

The results for long-term disabilities, chronic conditions and any long-standing health problem (tables 3.4 to 3.6) were in general, in line with those for less-than-good perceived general health. One exception was that no consistent differences were found between skilled and unskilled manual workers. In addition, for farmers from Denmark and Great Britain, the odds ratio was not consistently smaller or larger than 1.0 for each morbidity indicator.

The ratio of the prevalence odds of skilled and unskilled manual workers versus higher and lower administrators and professionals is given in the last row of tables 3.3 to 3.6 and is also shown in figure 3.3. For countries with a high overall prevalence of less-than-good health, this summary measure is also given for a lower cut-off point: less-than-fair health.

For perceived general health, the difference between low and high occupational classes was relatively large for Sweden and small for Germany, whereas the other countries formed one large intermediate group. The confidence intervals of Sweden however, overlapped with all countries except Germany. Countries with a relatively high overall prevalence of less-than-good health, Great Britain and Germany, showed approximately the same international position for a lower cut-off point of perceived general health.

Table 3.5 Inequality in chronic conditions by occupational class, men aged 25-69.

	Sweden		Netherlands		Germany	
Prevalence (%)						
Total population	32.1		19.5		27.9	
Pattern (Odds ratio and 95% CI)						
Total population	1.00		1.00		1.00	
Higher administrators and professionals (I)	0.50	(0.40-0.63)	0.73	(0.59-0.90)	0.56	(0.45-0.69)
Lower administrators and professionals (II)	0.78	(0.60-1.01)	0.82	(0.68-0.99)	0.79	(0.67-0.93)
Routine non-manual workers (III)	0.72	(0.48-1.07)	0.85	(0.68-1.07)	1.00	(0.82-1.23)
Skilled manual workers (V+VI)	1.55	(1.29-1.86)	1.24	(1.07-1.45)	1.31	(1.15-1.50)
Unskilled manual workers (VIIa)	1.48	(1.18-1.85)	1.29	(1.09-1.53)	1.22	(1.04-1.44)
Self-employed (IVa/b)	0.81	(0.59-1.10)	0.88	(0.61-1.27)	0.85	(0.66-1.10)
Farmers (IVc)	1.33	(0.80-2.22)	0.94	(0.64-1.37)	1.06	(0.72-1.55)
Agricultural labourers (VIIb)	1.54	(0.90-2.63)	1.33	(0.82-2.15)	1.05	(0.57-1.93)
Summary measure of inequality (Odds Ratio and 95% CI)						
OR V+VI+VIIa / I+II	2.51	(2.00-3.14)	1.63	(1.36-1.95)	1.84	(1.56-2.16)

Inequalities in long-term disabilities were largest in the Netherlands and smallest in Switzerland, with Denmark in an intermediate position. The confidence intervals for the Netherlands and Switzerland did not overlap. For chronic conditions, inequalities were larger in Sweden than in the Netherlands and Germany. The confidence intervals for Sweden and the Netherlands did not overlap whereas the confidence intervals for Sweden and Germany overlapped marginally. For any long-standing health problems, slightly larger inequalities were found for Denmark than for the Netherlands and Great Britain. However, all confidence intervals overlapped.

Table 3.6 Inequality in any long-standing health problem by occupational class, men aged 25-69.

	Denmark		Great Britain		Netherlands	
Prevalence (%)						
Total population	31.3		34.0		30.8	
Pattern (Odds ratio and 95% CI)						
Total population	1.00		1.00		1.00	
Higher administrators and professionals (I)	0.54	(0.39-0.75)	0.70	(0.59-0.83)	0.82	(0.70-0.98)
Lower administrators and professionals (II)	0.79	(0.58-1.07)	0.89	(0.79-0.99)	0.92	(0.79-1.07)
Routine non-manual workers (III)	0.86	(0.61-1.21)	0.95	(0.79-1.14)	0.93	(0.77-1.12)
Skilled manual workers (V+VI)	1.30	(1.05-1.61)	1.17	(1.03-1.33)	1.17	(1.02-1.33)
Unskilled manual workers (VIIa)	1.18	(0.92-1.50)	1.23	(1.10-1.36)	1.18	(1.02-1.37)
Self-employed (IVa/b)	0.99	(0.70-1.41)	0.84	(0.72-0.97)	0.79	(0..57-1.09)
Farmers (IVc)	1.33	(0.88-2.03)	1.35	(0.90-2.04)	0.91	(0.65-1.27)
Agricultural labourers (VIIb)	1.04	(0.49-2.22)	1.12	(0.74-1.69)	1.05	(0.68-1.63)
Summary measure of inequality (Odds Ratio and 95% CI)						
OR V+VI+VIIa / I+II	1.87	(1.43-2.46)	1.46	(1.29-1.65)	1.34	(1.15-1.56)

3.4 Discussion

Summary of the findings

This is the first comprehensive comparison of western European countries with respect to occupational differences in self-reported morbidity. For all countries, the same occupational class scheme was applied: the EGP-scheme[13,16,17].

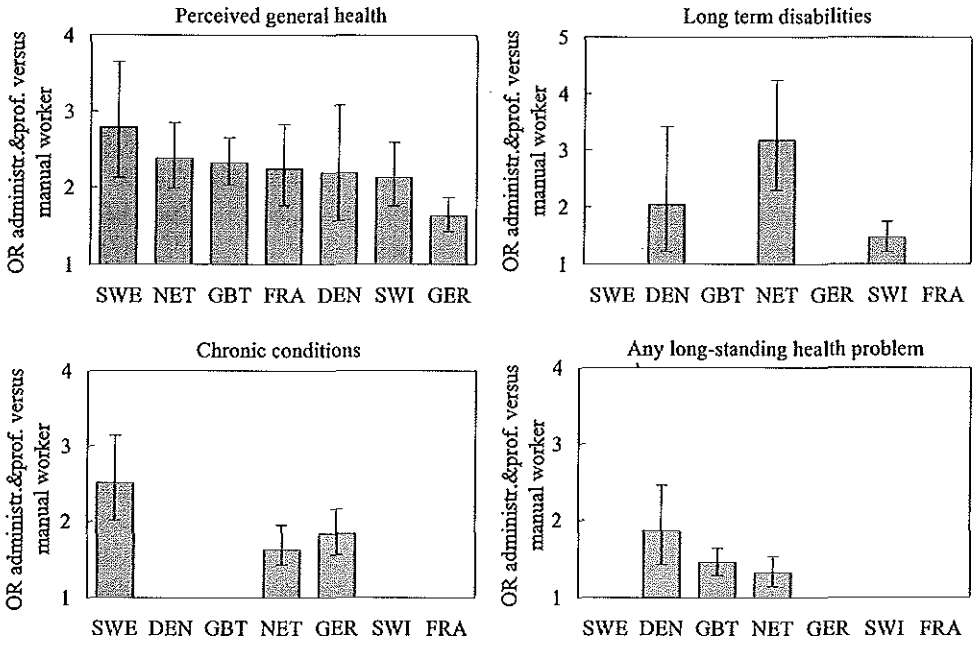

Fig. 3.3 Summary measure of inequality (Odds Ratio and 95% CI; administr.&prof. versus skilled and unskilled manual workers).

The EGP-scheme showed substantial variations in morbidity. The pattern over the various classes was similar for all countries: a smaller than average prevalence was found for higher and lower administrators and professionals and a larger than average prevalence was found for skilled and unskilled manual workers, and agricultural workers. The prevalence of less-than-good perceived health was, in general, higher among unskilled manual workers than among skilled manual workers. For the other morbidity indicators, no consistent differences were found between these classes. Routine non-manual workers and self-employed were generally healthier than the average population. The relative health of farmers differed between countries.

The size of morbidity differences was summarised by comparing skilled and unskilled manual workers to higher and lower administrators and professionals. The summary measures were approximately equally large in all countries. Consistently larger inequality estimates, with no or slightly overlapping confidence intervals, were only found for Sweden in comparison with Germany.

International comparability of the data

Much attention was paid to the international comparability of morbidity indicators yet some remaining comparability problems could not be avoided. However, analyses in which the results were evaluated (e.g. evaluation of a different cut-off point for perceived general health) suggested that the international positions of countries with

respect to the size of relative socio-economic difference in morbidity that were observed in this study were robust.[15]

There are indications in the general literature that response rates are lower in lower socio-economic groups and in less healthy people. As a result, non-response might lead to an underestimation of health inequality estimates. The higher the percentage of non-response the larger this underestimation may be. The question is therefore if differences in non-response rates between the surveys we used might have biased our results. Of particular concern are the Netherlands, Germany and Switzerland, countries with relatively large non-response rates. Non-response research concerning the surveys we used for these countries did not find a clear relation between non-response rates and socio-economic status (results not published). Although bias cannot completely be ruled out on the basis of these non-response studies, they do suggest that the effects on our inequality estimates are modest.

Another question which must be addressed before discussing the substantive interpretation of these finding is whether the application of the EGP-scheme in this study has indeed resulted in internationally comparable occupational class schemes for the different countries. If these class schemes are found to differ on some points, the next question is whether these differences might have biased the results of this study.

Comparability problems might have been introduced by differences in the basic information to which the GLT-conversion was applied. Essential to this algorithm is that the occupational title of men is known at a 3-digit occupational code level. This was the case for all countries, but the classification of these codes was more detailed and therefore perhaps more homogeneous in some countries than in others. The number of 3-digit codes ranged from 280 to 375. This number was not clearly associated with the observed morbidity differences in the countries; the Swedish survey which had the lowest number of codes, showed the largest morbidity inequalities. As a further check, we estimated the extent to which the 3-digit codes combined occupations which belonged to different broad occupational classes (class I/II, V/VI or III/ IV/ VII). This was checked for Sweden, Great Britain and Germany. In all three countries, less than 5% of the men belonged to a heterogeneous occupation code, implying that at most 5% of all men could have been misclassified.

For Great Britain, no information was available on the supervisory status of employees. The potential effect of this lack of information was estimated by additional analyses using data from other countries. These analyses showed that the main effect was that approximately 6% of the men who actually belonged to the higher and lower administrators and professionals (i.e. 2% of the total population) had been wrongly classified as routine non-manual workers. Since it is likely that the morbidity level of the misclassified group was somewhat higher than of other administrators and professionals, the morbidity level of this class is probably underestimated. As a result, the morbidity differences between skilled and unskilled manual workers and the higher and lower administrators and professionals might have been slightly overestimated for Great Britain.

A more fundamental problem with the GLT-algorithm is that it does not take into account the situations in specific countries. Application of the GLT-algorithm implies that men with the same job are assigned to the same occupational class in each country. But the social position of a specific job may differ between countries. To evaluate whether the size of inequality changes when the algorithm to allocate persons to EGP-classes is adapted to a specific country, additional analyses were performed using the Swedish data. For Sweden, we compared the inequality estimates based on the GLT-algorithm with the inequality estimates based on the conversion algorithm that Erikson developed specifically for Sweden. The results, which are given in table 3.7, showed that inequality estimates for the GLT-algorithm were slightly larger but that both algorithms resulted in the same international position for Sweden. The GLT-algorithm was used for all countries except France. We cannot exclude that somewhat different inequality estimates would have been obtained for France if the GLT-algorithm had been used. However, we do not think that this would have substantially changed the position of France.

Table 3.7 Summary measure of inequality (Odds Ratio and 95% CI; V+VI+VIIa / I + II) for Sweden, using the GLT algorithm and the original EGP-scheme.

	GLT algorithm		Original EGP-scheme	
Less-than-good health	2.79	(2.13-3.65)	2.51	(1.89-3.34)
Chronic conditions	2.51	(2.00-3.14)	2.46	(1.94-3.13)

In conclusion, we were able to use one standard occupational class scheme for all countries. Some remaining comparability problems could not be avoided with the data which were available from the different European countries. However, these remaining problems probably did not have a large effect on the results of our study.

Comparison with other studies on inequalities by occupational class

The pattern of morbidity by EGP-class found in this study was fairly comparable to the patterns found in studies which used a national occupational class scheme: a low prevalence was in general found for higher and intermediate non-manual workers and high prevalences were found for manual workers. A consistent and clearly higher prevalence for unskilled than for skilled manual workers has been observed in some studies[18,19], but not in others[3,6,9,20-22]. In contrast to our study, a consistently lower prevalence among routine non-manual workers as compared to skilled manual workers was not always found[3,9,18]. An explanation for this difference might be that the EGP-scheme, in contrast to most other class schemes, allocates men with lower level jobs in the service sector such as mail carriers and housing caretakers, who probably have morbidity levels comparable to unskilled manual workers, to the class of unskilled manual workers in stead of to the class of routine non-manual workers. The relatively good health of self-employed men that we found for all countries except Denmark was also found in some other studies[18,19], but not in all[22]. Especially for some countries not included in this study, such as Finland and Norway, a larger than average prevalence

was found[3,9]. Those studies which distinguished farmers, reported a prevalence close to the national average or a relatively high prevalence[3,9,18,19].

Our results also corresponded fairly well with the two earlier studies which compared health inequalities by occupational class between countries. Vågerö and Lundberg[6,7] studied the size of inequalities in long-standing illness in Great Britain and Sweden for adult men and women combined, using data of the Swedish Survey on Living Conditions and General Household Survey of 1981. Occupational class was measured using the British Registrar General's scheme for both countries[23]. The relative risk for class V versus class I was smaller for Sweden than for Great Britain, whereas the size of morbidity differences was approximately the same when the more robust manual versus non-manual ratio was used. Lahelma et al.[3] studied the pattern of limiting long-standing illness by occupational class for adult men from Sweden, Finland, Norway and Great Britain, using the Nordic Level of Living Survey of 1987 and the General Household Survey of 1987. The difference in prevalence between high and low classes was slightly larger in the Scandinavian countries than in Great Britain.

Conclusion

This study suggests that inequalities in self-reported morbidity according to occupational class are highly similar between countries. These inequalities are not smaller in countries such as Sweden and the Netherlands, despite their more egalitarian socio-economic policies. This is supported by international comparisons on morbidity inequalities according to education which showed that inequalities in the Scandinavian countries and the Netherlands are not smaller, and perhaps even somewhat larger, than in other European countries[11]. Income related inequalities in morbidity do, however, seem to be smaller in egalitarian countries[10].

The approximate similarity observed in this study does not necessarily imply that morbidity differences by occupational class have the same background in all countries. This is suggested by the different international patterns observed for education as compared to income. Dissimilarities between countries with regard to underlying causes are also indicated by mortality studies. For mortality also about equally large inequalities are found in most western European countries but there are large variations in the contribution that different causes of death make to these inequalities[15]. These cross-national differences emphasise the need to compare countries also with respect to social gradients in specific risk factors for disease.

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4 Differences in self-reported morbidity by income level in six European countries

Objective
This study gives an overview of the pattern and magnitude of income-related inequalities in self-reported morbidity in six European countries using data from national health interview or similar surveys of 1986-1992.

Data and methods
One to four morbidity indicators were studied per country. Income was measured as net household income and adjusted for household size. Respondents were regrouped into decile groups on the basis of their adjusted income. The size of income-related inequalities in morbidity was measured by two (logistic) regression-based indices: the Relative Index of Inequality (RII) and the Effect Measure (EM). For the RII, age adjusted prevalence rates of income decile group were related to their relative position on the income distribution. For the EM, it was quantified as the median yearly income of each income decile group, expressed in US dollars. In additional analyses, the independent impact of income on health was studied by simultaneous controlling for other socio-economic indicators.

Results
Morbidity rates generally decreased with increasing disposable yearly income. This decrease was steeper among lower income levels than among higher income levels. The RII for perceived general health was relatively large in Great Britain and small in Sweden, Finland and Germany (range: 2.84-4.53) whereas the EM was about equally large for most countries. Somewhat different international patterns were observed for other indicators of morbidity. The size of income-related inequalities in health decreased substantially when control was made for educational level, occupational class and employment status. The independent impact of income on perceived general health was about equally large for most countries.

Conclusion
The results of this study provide some support to the expectation that income-related inequalities in health are smaller in countries with smaller income inequalities.

4.1 Introduction

International comparisons can make an important contribution to the study of socio-economic inequalities in health. Comparing societies, which differ with respect to national living standards, social policies, the size of income inequalities etc. may shed new light on the way in which national characteristics determine the pattern and magnitude of socio-economic inequalities in health[1].

Recent international comparisons of health differences with educational level and occupational class as indicators of socio-economic status showed that health inequalities are not necessarily smaller in countries such as Sweden, Norway and the Netherlands than elsewhere in Europe[2,3]. These results did not support the expectation that health inequalities are smaller in countries with a tradition of egalitarian socio-economic policies. One of the studies which supported this expectation was the only comprehensive international comparison on socio-economic inequalities in morbidity, using income as indicator of socio-economic status. Van Doorslaer et al[4] compared nine countries with respect to the size of income-related inequalities in perceived general health for men and women combined, using data from national surveys held between 1985 and 1992. Relatively large inequalities were reported for the United States and Great Britain, intermediate inequalities for the Netherlands, Finland, Spain, Switzerland and West Germany, and small inequalities for Sweden and East Germany. This pattern of inequalities in morbidity by income was strongly correlated with the size of income inequalities in each country. This suggests that egalitarian social-economic policies can influence the size of health inequalities.

In this study, we give an overview of income-related inequalities in self-reported morbidity in six European countries, which vary in the size of income inequalities[5]: Great Britain, France, the Netherlands, Germany, Sweden and Finland. This study extends the earlier analysis of Van Doorslaer et al. on three points. Firstly, we studied not only the magnitude but also the *pattern* of health variations by income level. To know whether the shape of the relationship between income and health is linear or not might clarify which factors determine income-related inequalities in health. Secondly, this study investigated income-related inequalities not only for the morbidity indicator *perceived general health* but, included for most countries one or two other morbidity indicators. This is important since studies that used education level or occupational class as indicators of socio-economic status have shown that the position of a country might vary according to the morbidity indicator that is considered[2,3]. Thirdly, we estimated to what extent income-related inequalities in morbidity in each country reflect an independent association of income with morbidity, i.e. an association that cannot be attributed to other socio-economic indicators. This enables us to evaluate to what extent the health of persons is directly influenced by their financial situation.

For this purpose, the impact of income on health is studied by simultaneous controlling for educational level, occupational class and employment status (being gainfully employed or not). Controlling for other socio-economic indicators will eliminate those health differences between income groups which are due to differences between income groups in their educational level, occupational class and employment status, and which reflect a direct effect of these characteristics on health instead of a direct effect of income itself. Moreover, adjustment for employment status can also be expected to remove a large part of the reverse causality effect, i.e. the effect of ill-health on income. A main way by which ill-health affects income is by exclusion from the labour market of work-disabled persons, with a subsequent fall in income[6,7]. A graphical representation of the association between income, the other socio-economic indicators, and health is given in figure 4.1.

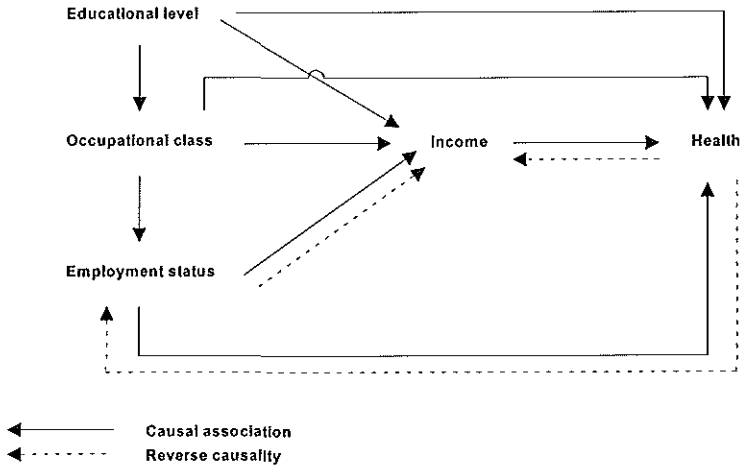

Fig. 4.1 A simple graphical presentation of the association between income, other socio-economic indicators and health.

4.2 Data and methods

Data were obtained from national health interview surveys or similar surveys. Table 4.1 shows the included surveys and their basic characteristics. The analyses were restricted to non-institutionalised men and women aged 25 to 69 years, because this subpopulation was included in all surveys.

The indicators of morbidity included in this study cover various aspects of a respondent's health. The exact definitions of the indicators are given in table 4.2. The indicators were included only for those countries for which they were highly comparable as judged against the structure and the wording of the respective survey questions[8].

Table 4.1 Countries and surveys included in the study.

Country	Year	Name	Number of respondents	Non-response rate
Finland	1986	Survey on Living Conditions	12,057	13
France[1]	1991/92	Enquête sur la Santé, et les Soins Medicaux	21,586	17
West Germany[2]	1987/88	Life and Health in Germany (NHS)	5,335	29
	1990/91	Life and Health in Germany (NHS)	5,311	31
Great Britain	1991	General Household Survey	19,039	16
Netherlands	1991/92	Netherlands Health Interview Survey	11,126	43
Sweden	1991	Swedish Level of Living Survey	5,306	21

[1] The question on the morbidity indicator included in this study was only asked to a subsample of the total number of respondents (n=8,235).

[2] The surveys only concerned the western part of Germany (the former FRG); two surveys were pooled in order to obtain more stable estimates.

Table 4.2 Morbidity indicators included in the study and the number of countries for which the indicator was available in a comparable way.

Morbidity indicator	Number of countries	Measure of ill-health: % of respondents who ...
Perceived general health	6	consider their present state of health less than good.
	3	consider their present state of health less than fair.
Long-term disabilities	2	mention one or more long-term disabilities (6 items: climbing stairs, walking, carrying 5 kilos, reading newspaper, conversation with more than 2 persons, un-/dressing).
Chronic conditions	3	mention to have suffered from one or more chronic conditions in the last 12 months (9 conditions: cancer, diabetes mellitus, respiratory diseases, heart diseases, stroke, liver/gall diseases, kidney/urinary tract diseases, stomach/duodenum ulcer, muskulo-skeletal diseases).
Any long-standing health problem	3	reply positively to an open question similar to "Do you suffer from any long-standing illness, disease or disability".

In all countries, income level was measured as net household income. For two countries, this information was obtained by linkage of survey data with the tax registry. For all other countries, information on net household income was based on one or more survey questions and income was given in at least 10 income classes. For the latter group of countries, the household income of each individual was calculated as the midpoint of their income class. For the lowest and highest income class, however, income was calculated as 2/3 times the upper limit, and 4/3 times the lower limit of the income class, respectively. Sensitivity analyses showed that the inequality estimates reported in this study were not highly sensitive to the exact values used to estimate the income of the lowest and highest income class. Net household income was in all countries corrected

for the number of persons in the household by using a simple formula[9]: household equivalent = total net household income / household size$^{0.36}$. Respondents were regrouped into decile groups on the basis of their equivalent household income.

From now on in this study, we will use the term "income" to refer to equivalent household income. The percentage of the population for which information on income was missing was smaller than 1% in Sweden and Finland, approximately 7% in Germany and France, 23% in the Netherlands and 28% in Great Britain.

To study the pattern and size of income-related differences in morbidity, the income level of the decile groups was quantified by two different variables. Firstly, it was measured as the relative position of each decile group in the income distribution, i.e. as the percentage of persons with a lower income level. E.g. the relative position of the lowest decile group, which comprises 10 percent of the population, is on average 0.05, for the lowest but one income group it is 0.15, and so on. This numeric variable was related to prevalence rates by means of regression analysis. Nominal variables were included into the model to adjust for sex and age (5-year age groups). Since the morbidity indicators were defined in a dichotomous way, logistic regression was applied. Exponentiation of the regression coefficient ($e^{-\beta}$) resulted in an odds ratio. This odds ratio can be interpreted as the (odds of the) prevalence rate expected for those at the bottom of the income distribution (0) compared with that expected for those at the top (1), taking into account all intermediate groups. More details about this index, which is a version of the Relative Index of Inequality and is mathematically related to the concentration index used by Van Doorslaer et al.[4,10], can be found elsewhere[11,12]. Secondly, we quantified the income level of each decile group as its median yearly (household equivalent) income. For this purpose national currencies were transformed into US dollars (1991), taking into account differences between countries in purchasing power and national inflation rates. Again logistic regression models were used in order to assess the association between this income variable and morbidity. Adjustments were made for age and sex. Exponentiation of the regression coefficient ($e^{-\beta}$) resulted in the odds ratio associated with a reduction of the yearly (household equivalent) income by $10.000. This latter odds ratio, we called the Effect Measure (EM).

The regression models used to estimate the RII and the EM assume that there is a linear relationship between the income variables and the prevalence of morbidity (after logistic transformation of the prevalence rate). This assumption was checked by (1) visual inspection of the relationship between income variables and prevalence rates, (2) testing whether the residual variation of our model was significantly larger than that of a model in which the income variables were entered into the model as a nominal variable and (3) testing whether inclusion of a quadratic term or log-transformation of the income variables improved the fit of the model.

Additional analyses were performed to test whether the RII and EM differed between countries, and between men and women within each country. To this end, each time two regression models were compared: a model with the income variable, age and, respec-

tively, country and sex as independent variables, and the same model including an interaction term for, respectively, country and the income variable, and sex and the income variable. The X^2-test was used to test whether the inclusion of an interaction term improved the model significantly. To investigate whether the size of income-related inequalities in morbidity is related to the size of income inequalities, we estimated the size of income inequality in each country in a way analogously to the calculation of the RII. The relative position of each income group on the income distribution was related to the median yearly disposable income of each decile group (USD in 1991) using ordinary least squares regression analysis. The regression coefficient can be interpreted as the difference in yearly (household equivalent) income expected for those at the top and the income expected for those at the bottom of the income distribution, taking into account all intermediate income groups. Additional analyses showed that the international rank order of the countries with respect to the size of income inequality was similar for other measures of income inequality, such as the difference in income between the richest 50% of the population as compared to the poorest 50% of the population.

To estimate the independent association between income and morbidity, the RII and the EM were calculated in an additional series of regression analyses in which control was made for educational level, occupational class and employment status. To this end, nominal variables representing internationally comparable measures of educational level (three levels) and occupational class (eight classes), and employment status (economically active versus inactive) were subsequently included in the logistic regression model. Details on the measurement of educational level and occupational class can be found elsewhere[2,3,8]. Being economically active was defined as .having a job at this moment/have worked during the past week..(Finland, Great Britain) or .having a job at this moment/have worked during the past week, for more than 12 hours. (Netherlands, Germany, Sweden). Since the meaning of economically inactivity is different for men aged 60 to 69, analyses were also performed for a narrower age range (25-59). Because the results for both age groups were similar, those for the entire age group are presented below. Since no internationally comparable information on occupational class was available for women, analyses were restricted to men aged 25-69 years. No analyses could be performed for France since the format of the available data set was not suitable for the simultaneous analyses of several socio-economic variables.

4.3 Results

Income-related inequalities in morbidity

Figure 4.2 illustrates the pattern of health variations by income decile group for perceived general health. For all countries, except Sweden, the prevalence of less-than-good health decreased about linearly with an increasing position on the income distribution. The same patterns were found for the other morbidity indicators (results not shown). Formal tests on linearity (see Data and method section) showed that in all

countries, except in Sweden, the prevalence of less-than-good perceived general health and other morbidity indicators was linearly related to the relative position of each income group (after logistic transformation of the dependent variable).

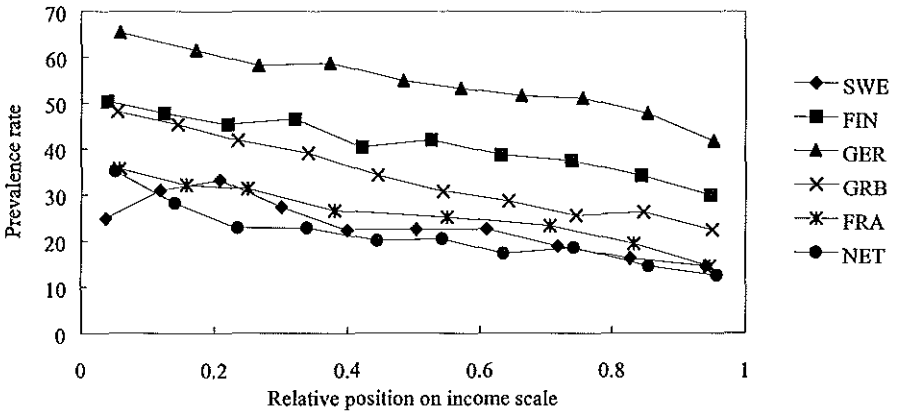

Fig. 4.2 Prevalence rate of less-than-good perceived general health by income decile group when the income level of each decile group is quantified as its relative position on the income distribution. Men and women aged 25-69 years.

The RII, which quantifies the relation illustrated above, is given in table 4.3 for all indicators of morbidity. In the table, the countries are ordered according to the RII value for less-than-good health for men and women combined. For men and women combined, largest RII estimates for less-than-good perceived health were found for Great Britain, and smallest estimates were observed for Sweden, Finland, and Germany. For countries with a high overall prevalence of less-than-good health, the results are also given for a lower cut-off point (mostly less-than-fair health) since the higher prevalence rates might be artificial, e.g. due to subtle differences in survey questions on perceived general health[8]. The results for the lower cut-off point of perceived general health showed a substantially larger RII for Great Britain and a slightly larger estimate for Germany. For Finland a slightly smaller RII was observed.

The international patterns found for the other morbidity indicators were not consistent with the results for perceived general health. The relatively high position for Great Britain for perceived general health was much less marked for the only other morbidity indicator available for Great Britain. Similarly, relatively low positions of Sweden, Finland and Germany were not observed for most other morbidity indicators.

The position of some countries varied by sex. Health inequalities in the Netherlands were found to be relatively large for men but relatively small for women. Health inequalities in Great Britain were consistently larger than in other countries for women but not for men.

Table 4.3 The Prevalence rate (%) and the Relative Index of Inequality (RII), with 95%-conficence interval, for perceived general health (less-than-good health and less-than-fair health or another cut-off point), long-term disabilities, chronic conditions and any long-standing health problem. Men and women aged 25-69 years.*

	Perceived general health			Long-term disabilities			Chronic conditions			Any long-standing health problem		
Country	%	RII		%	RII		%	RII		%	RII	
Men & Women												
Great Britain	31.6	4.53	3.86-5.31							33.8	2.56	2.19-3.00
	**10.9*	*6.50*	*5.08-8.33*									
Netherlands	21.4	3.80	3.10-4.66†	10.4	3.72	2.81-4.93†	20.8	1.84	1.51-2.26	30.3	1.56	1.31-1.85†
France	26.6	3.74	2.96-4.72									
Sweden	22.6	3.42	2.59-4.51				34.8	2.39	1.88-3.03			
Finland	41.2	3.37	2.82-4.03	18.7	2.99	2.41-3.71†				42.5	2.35	1.98-2.79
	**6.9*	*3.14*	*2.29-4.31*†									
West Germany	54.9	2.84	2.45-3.30				29.1	1.98	1.67-2.35†			
	**14.4*	*3.34*	*2.71-4.11*									
Test interaction country • income		p=0.001			p=0.797			p=0.011			p<0.001	
Men												
Great Britain	31.6	4.62	3.65-5.84							34.0	2.35	1.88-2.94
	**10.1*	*7.19*	*4.96-10.4*									
Netherlands	20.8	5.42	4.00-7.35	8.5	6.05	3.89-9.42	19.5	2.06	1.54-2.77	30.8	2.06	1.61-2.64
France	22.1	3.92	2.70-5.68									
Sweden	22.0	3.21	2.16-4.78				32.1	2.33	1.66-3.27			
Finland	40.9	3.74	2.90-4.81	17.9	4.10	3.00-5.59				40.1	2.46	1.93-3.14
	**7.4*	*4.45*	*2.86-6.92*									
West Germany	54.1	2.72	2.21-3.34				27.9	2.40	1.89-3.06			
	**13.7*	*4.02*	*2.98-5.44*									
Women												
Great Britain	37.7	4.39	3.53-5.44							33.7	2.75	2.21-3.43
	**11.6*	*6.45*	*4.63-9.00*									
Netherlands	22.0	3.07	2.32-4.07	12.1	2.68	1.86-3.88	22.1	1.70	1.29-2.25	29.9	1.23	0.96-1.57
France	30.0	3.66	2.70-4.95									
Sweden	23.3	3.82	2.57-5.66				37.7	2.38	1.71-3.33			
Finland	41.5	3.11	2.43-4.00	19.4	2.33	1.72-3.14				42.9	2.30	1.81-3.29
	**6.5*	*2.28*	*1.44-3.59*									
West Germany	55.7	2.92	2.36-3.61				30.3	1.62	1.27-2.07			
	**15.0*	*2.70*	*2.02-3.58*									

† Significant difference (p<0.05) in the RII between men and women.

Figure 4.3 illustrates the pattern of health variations by income when the income level of each decile group is quantified as its median disposable yearly income, in US dollar in 1991. For all countries, except for Sweden, the prevalence of less-than-good health decreased continuously with increasing income. The magnitude of this decrease diminished, however, with increasing income. The same patterns were found for the other morbidity indicators (results not shown). Formal tests confirmed that the prevalence of less-than-good perceived general health as well as those of other morbidity indicators was generally not linear related to the relative position of each income group (after logistic transformation of the dependent variable). Log-transformation of the income variable improved the fit of the regression models for all countries, except for Sweden. This implies that in most countries the associations between the median disposable income and health are steeper among lower income levels than among higher income levels.

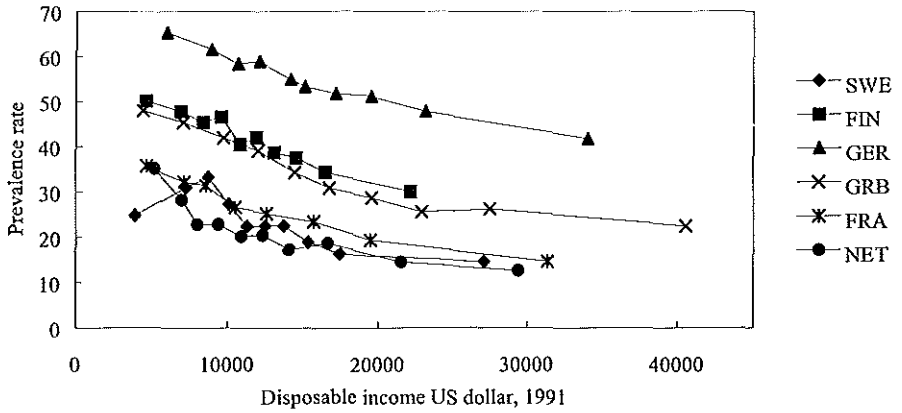

Fig. 4.3 Prevalence rate of less-than-good perceived general health by income decile group when the income level of each decile group is quantified as its median disposable income (yearly equivalent household income), measured in US dollars. Men and women aged 25-69 years.

The EM, which summarises the associations illustrated above, is given in table 4.4. Countries are ordered as in table 4.3. For men and women combined, the EM for less-than-good perceived health was about equally large for most countries. However, the EM for Finland was slightly larger and for Germany was slightly smaller than for other countries. The international pattern found for the other morbidity indicators was not entirely consistent with the results for perceived general health. For example, a clearly lower position for Germany was not observed for chronic conditions. As for the RII, the position of some countries varied by sex. In the Netherlands and Germany, the effect of income on health was relatively small for women but not for men.

Since the associations between the median yearly income and morbidity were generally not linear, we also estimated the EM using log-transformed income as independent variable. Generally, log-transformation did not affect the international position of countries with respect to the size of the EM.

Table 4.4 The Effect Measure (EM), with 95%-confidence interval, for perceived general health (less-than-good health and less-than-fair health or another cut-off point), long-term disabilities, chronic conditions and any long-standing health problem. Men and women aged 25-69 years.*

	Perceived general health	Long-term disabilities	Chronic conditions	Any long-standing health problem
Country	EM	EM	EM	EM
Men & Women				
Great Britain	1.61 1.51-1.72			1.32 1.26-1.40
	**1.92 1.72-2.15*			
Netherlands	1.82 1.64-2.02†	1.80 1.55-2.09†	1.32 1.20-1.45	1.19 1.10-1.28†
France	1.78 1.59-1.99			
Sweden	1.80 1.55-2.12		1.53 1.34-1.74	
Finland	2.18 1.93-2.46	2.10 1.81-2.44†		1.73 1.55-1.93
	**2.13 1.70-2.67†*			
West Germany	1.53 1.43-1.63		1.27 1.18-1.36†	
	**1.67 1.51-1.86*			
Test interaction country*income	p=0.018	p=0.554	p=0.070	p<0.001
Men				
Netherlands	2.13 1.82-2.51	2.27 1.78-2.91	1.35 1.18-1.54	1.35 1.21-1.51
Great Britain	1.68 1.53-1.86			1.29 1.19-1.40
	**2.10 1.76-2.53*			
France	1.81 1.52-2.18			
Finland	2.35 1.98-2.81	2.54 2.03-3.19		1.83 1.55-2.16
	**2.78 2.02-3.87*			
Sweden	1.67 1.37-2.06		1.45 1.22-1.72	
West Germany	1.51 1.36-1.66		1.40 1.25-1.57	
	**1.74 1.49-2.05*			
Women				
Great Britain	1.57 1.44-1.69			1.34 1.24-1.44
	**1.85 1.61-2.15*			
Sweden	2.04 1.61-2.62		1.61 1.33-1.95	
France	1.77 1.52-2.06			
Finland	2.06 1.74-2.44	1.83 1.50-2.26		1.65 1.41-1.93
	**1.71 1.26-2.35*			
Netherlands	1.65 1.43-1.91	1.54 1.28-1.87	1.29 1.13-1.47	1.06 0.95-1.17
West Germany	1.53 1.39-1.69		1.21 1.10-1.34	
	**1.57 1.43-1.81*			

† Significant difference (p<0.05) in the EM between men and women.

For the Netherlands, however, the new EM for perceived general health and long-term disabilities was about as large as for Finland (results not shown).

Figure 4.4 shows the association between the size of income inequalities and the RII for perceived general health. The size of income inequalities was largest for Great Britain and smallest for Sweden and Finland. This is in agreement with results from other studies[5]. The RII.s for less-than-good and less-than-fair perceived health were averaged for Germany, Great Britain and Finland. The correlation between the RII's for perceived general health and the size of income inequalities was high, r=0.84 (p=0.04), although it was largely dependent on the position of Great Britain. For the other morbidity indicators, no correlation was calculated since the number of countries was too limited. However, the variations between countries in the RII for the other morbidity indicators do not consistently support the association observed for perceived general health.

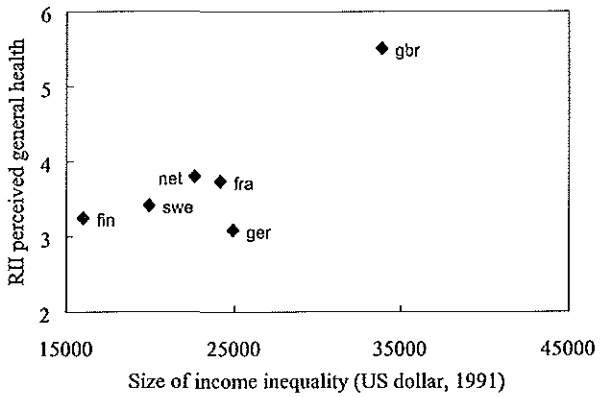

Fig. 4.4 The RII for perceived general health plotted against the size of income inequality.

Effect of controlling for other socio-economic variables

Figure 4.5 shows the effect of controlling for educational level, occupational class and employment status on the RII for men. Without correction, the RII for perceived general health (less-than-good health and less-than-fair health) was relatively large for the Netherlands and Great Britain, and small for Finland, Sweden and Germany. Controlling for educational level resulted in a moderate decrease of the RII in all countries. The effect of subsequent adjustment for occupational class was generally very small. Controlling for educational level and occupational class did not change the relative position of countries. Subsequent controlling for employment status resulted in a substantial decrease of the RII in Finland, Great Britain and the Netherlands. For all countries, however, income-related inequalities in perceived general health remained statistically significant. After controlling for the three socio-economic indicators, the RII estimates for perceived general health were about equally large in all countries.

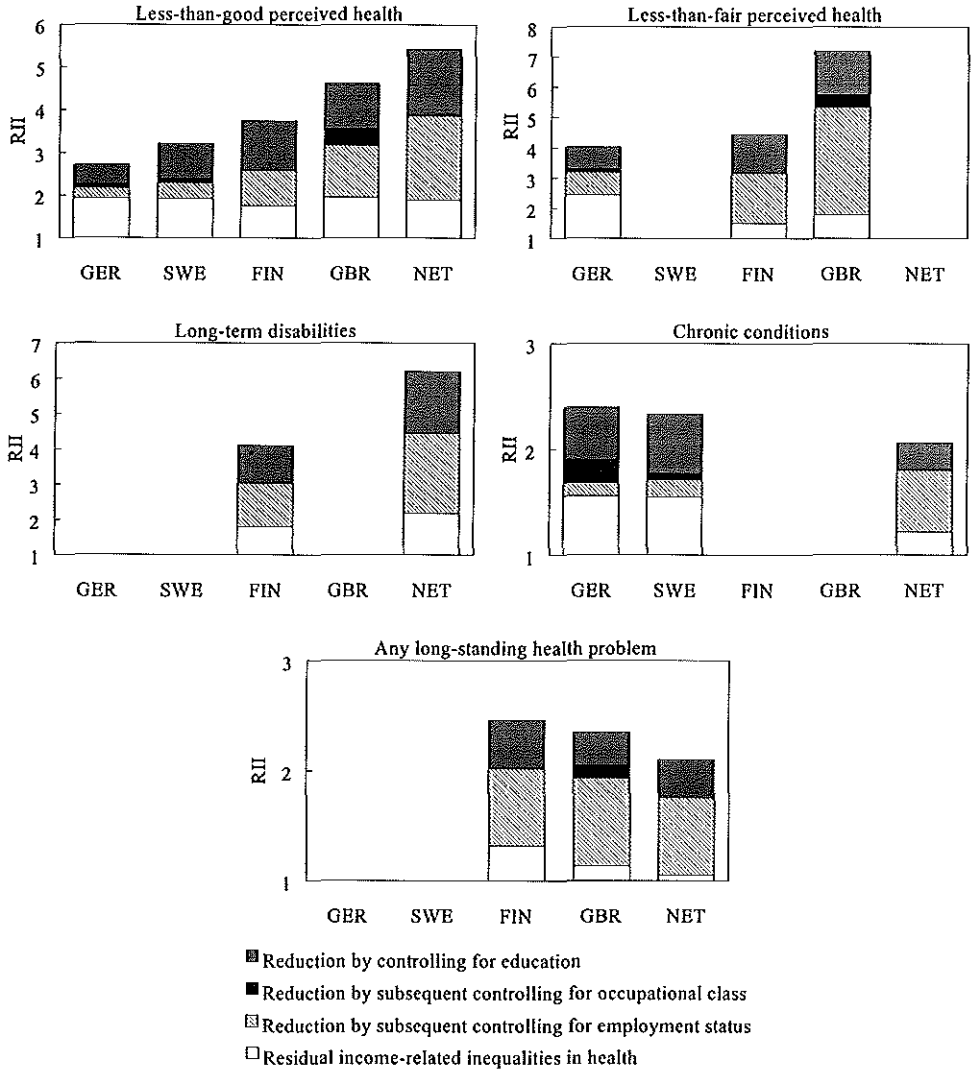

Fig. 4.5 Reduction of the size of income-related inequalities in morbidity (RII) by subsequent controlling for other socio-economic indicators. Men aged 25-69 years.

Also for the other morbidity indicators, controlling for educational level and especially employment status resulted in a substantial decrease of the RII, whereas controlling for occupational class generally had a very small effect. After control for the three socio-economic indicators, the RII estimates remained statistically significant, except for inequalities in any long-standing health problem in the Netherlands and Great Britain. Controlling did not change the international position of countries with respect to chronic conditions and any long-standing health problem. For long-term disabilities, however, controlling for other socio-economic indicators also resulted in equally large inequali-

ties for the two countries included. The effect of controlling for the three socio-economic indicators on the EM resembled closely the effect they had on the RII (results not shown).

4.4 Discussion

Evaluation of data problems

In this study, net household income was adjusted for the household size using an equivalence scale (household size$^{0.36}$) proposed by Buhman et al in the context of the Luxembourg Income Study[9]. Many other studies have, however, used a weight between 0.6 and 0.8 instead of 0.36. An important question therefore is whether the results of this study are sensitive to the choice of the equivalence scale. Additional analyses, in which we used 0.72 as a weight, showed somewhat smaller inequality estimates in all countries, but the relative order of countries was not affected. An exception was the position of Sweden, which was more favourable when a higher weight was used.

The comparability of income data was optimised by including only countries for which net income data were given for all household members, income levels were distinguished in the form of at least ten income categories, and income data were missing for less than 30% of the respondents (for this reason data from Denmark, Norway, Spain and Switzerland were excluded). However, some remaining differences were present in the measurement of income. In Germany, France and the Netherlands, information on the total amount of net household income was obtained with one simple question with 10 to 12 income classes as answer possibilities, while for Great Britain income data were obtained by an extensive battery of questions. In Finland and Sweden, on the other hand, information was obtained by linkage of the survey data with the tax registry. Because of this, the income level might have been measured less precisely in Germany, France and the Netherlands than in the other countries (e.g. possibly subjects forget some sources of income when income is measured with a simple surveys question). This might have resulted in more misclassification and thereby in a larger underestimation of the inequality estimates than in the other countries.

Another problem which might have affected the comparability of our inequality estimates are differences between countries in survey non-response rates and in non-response rates to income questions (partial non-response). Non-response rates can bias the inequality estimates if they are related to income and, per income level, to health status. Several studies have shown that response rates are lower among those who are less healthy. In addition, there are indications in the general literature that response rates are lower among the poor, and to a lesser extent, among the rich as compared to the rest of the population[13]. Non-response might therefore lead to an underestimation of the size of income inequalities and perhaps of income-related inequalities in health. The higher the percentage of non-response the larger this underestimation may be. Countries with

relatively large survey non-response rates are the Netherlands and Germany. Partial non-response rates were large in the Netherlands and Great Britain. For the surveys of these countries, specific non-response research has been carried out. However, only for the Dutch survey non-response was studied in relation to income level. This study, which compared the income distribution of respondents with that of a sample of non-respondents observed that response rates were not lower among the lowest or highest income class (internal report, Statistics Netherlands). For the British survey, non-response was studied using a proxy for income, car ownership. It was found that the non-response rate among non-car-owners was only slightly higher than among car owners (internal report, Office for National Statistics). However, bias cannot completely be ruled out on the basis of these non-response studies.

Although the shape of the relationship between income and morbidity indicators is probably not largely biased by the above mentioned data problems, these problems do make it difficult to determine the exact magnitude of income-related inequalities in health and international variations in this magnitude. It is possible that the position of Finland and, especially Sweden, is overestimated as compared to other countries. This means that the international position of Finland and Sweden may be more favourable than was observed in this study.

Comparison with other studies

In this study, we found that the shape of the relation between morbidity rates and the disposable median income of income groups was generally not linear. In most countries, the association was steeper among lower income levels than among higher income levels. This is in agreement with the few other studies from the UK and the US, which investigated the shape of the relationship between income and mortality[14,15], and between income and poor health[16]. Studies, which investigated the shape of the relation between morbidity rates and the relative position of income groups on the income distribution, are rare. Lundberg and Fritzell[17] studied the association between morbidity and relative income position among adults in Sweden using the same data as included in this study but a different age-range and income measure (individual income before tax without correction for household size). Their results for physical illness support our finding that the pattern of morbidity by income in Sweden, in contrast to other countries, is characterised by a relatively low morbidity level among the lower income groups. Additional analyses in which we excluded subgroups of the population like self-employed, farmers and economically inactive persons showed that the relatively low morbidity level among lower income groups we observed for Sweden is not related to these specific groups. So, it is yet uncertain what causes the deviant pattern observed for Sweden.

Doorslaer et al[4] studied inequalities in perceived general health by income for men and women combined in nine countries using survey data of 1982-1992. The size of inequalities was measured with the concentration index, which is mathematically similar to the Relative Index of Inequality used in this study. Perceived general health was

operationalised as a continuous latent variable, which combines information on different cut-off points, including less-than-fair and less-than-good health. The international pattern of income-related inequalities reported in that study are in agreement with the pattern we found for perceived general health among men and women combined. Both studies observed for men and women combined largest inequalities in Great Britain, intermediate inequalities in the Netherlands and smallest inequalities in Sweden, Germany and Finland ($r=0.91$, $p=0.03$, $n=5$). Besides, both studies showed a high positive correlation between the size of health inequalities and the size of income inequalities. Although the results for perceived general health of both studies are consistent with each other, the results of this study also showed that this pattern is not clearly found for the other morbidity indicators. The absence of a clear relationship between the size of income inequalities and the magnitude of inequalities in morbidity has recently also been reported by a Spanish study which investigated the association between the size of income inequalities and the size of income-related inequalities in long-term disabilities among 17 regions[18].

Recent international comparisons in which we used educational level or occupational class as indicators of socio-economic status instead of income level, do not confirm the finding of this study that health inequalities are possibly somewhat smaller in more egalitarian countries such as Finland and Sweden[2,3,19]. Health inequalities by educational level in the Nordic countries even seemed to be relatively large from an international perspective. This suggests that egalitarian socio-economic and other policies in the Nordic countries may have reduced income-related health inequalities but were not equally effective in reducing health differences according to educational level.

In this study, we observed that the magnitude of income-related inequalities in morbidity is substantially reduced when adjustments are made for other socio-economic indicators, especially employment status. This is in agreement with other studies which estimated the effect of income on mortality[14] and morbidity[20,21], independently of other socio-economic indicators.

Explanations of the results

The existence of an association between income and morbidity among higher income levels as well as lower income levels suggests that the impact of income cannot only be explained by the relatively poor financial situation of those at the bottom of the income distribution. The large differences in health among higher income levels underline the potential importance of relative income (instead of disposable), which may affect health via, among others, psychosocial stress[22]. Our finding that the strength of the association between income and health did not diminish with increasing position on the income distribution, while it did diminish with increasing disposable income, supports the idea that especially relative income is of interest.

However, the size of income-related inequalities in health reduced substantially when control was made for educational level, occupational class and employment status. This indicates that a large part of the income-related inequalities in health is due to dif-

ferences between income groups in these other socio-economic characteristics and their independent effect on health. Moreover, the large reduction observed when controlling for employment status might reflect reverse causality, i.e. an effect of ill-health on income. A main way by which ill-health affects income is by exclusion from the labour market of work-disabled persons, with a subsequent fall in income[6,7]. We should warn, however, that the residual effect of income estimated in this study provides only an approximate estimate of the direct causal effect of one's financial position on health. This causal effect might have been overestimated because there might be other confounding socio-economic factors for which we could not control, such as marital status. In addition, we have not been able to control for reverse causality completely since some of the effect of ill-health on income is not linked to the exclusion from the labour market. Controlling for employment status might, on the other hand, have led to an underestimation of the causal effect of income on health since the control procedure removes the independent effect that the financial situation might have on health via employment or in interaction with employment status.

The high correlation between the size of income inequalities, and the RII for perceived general health observed in this study and in the study of Van Doorslaer et al, is in agreement with the expectation that health inequalities are smaller in countries with egalitarian social and health policies and small income inequalities. This finding is not completely surprising since the RII not only takes into account the magnitude of the association between disposable income and health, but also the magnitude of inequalities in income itself[11,12]. The correlation between the size of income inequality and the size of income-related inequalities in morbidity found in this study should to some extent be interpreted reservedly, among others, because the correlation largely depends on the position of Great Britain.

Analyses in which we simultaneously controlled for other socio-economic indicators showed that the relatively large RII's for perceived general health for men in the Netherlands and Great Britain approached those of other countries after controlling for other socio-economic indicators. This means that variations between countries in the RII for perceived general health can be attributed to differences between countries in the association between income and other socio-economic indicators and/or to differences in the strength of the association between these other socio-economic indicators and health. The relatively large inequalities in Great Britain and the Netherlands reduced especially when control was made for employment status. As outlined above, controlling for employment status removes the effect of being unemployed on health and the effect of health on income that is related to exclusion from the labour market of work-disabled persons (reverse causality). This suggests that the relatively large income-related inequalities in perceived general health among men in Great Britain and the Netherlands might be due to a relatively large impact of ill-health on income. Different mechanisms might be at work in different countries. In Great Britain, this large impact might be due to a large decrease in disposable income when people leave the labour market because of ill-health. For the Netherlands, on the other hand, this large effect is

more likely to be due to the fact that the proportion of persons who leave the labour market because of ill-health is relatively large, perhaps because of the relatively generous sickness benefits in that country.

Conclusion

For all countries, higher morbidity rates were observed among the lower income groups. The shape of the relationship between income and morbidity was in general linear or log-linear, depending on the way the socio-economic status of income groups was measured. The independent impact of income was fairly small in all countries, which suggests that income-related health inequalities reflect to only a modest extent a direct causal effect of a person's financial situation on health.

The size of income-related health inequalities varied between countries. In spite of some data problems that make it difficult to determine the exact international position of countries, the results of this study do provide some support for the view that income-related inequalities in health are smaller in countries with smaller income inequalities. Additional analyses indicated that these variations might be related to differences between countries in the extent to which ill-health affects income. This latter implies that social policies which aim to improve the income position of ill and disabled people, especially by enhancing the opportunities to stay in the labour market, are an important tool to diminish income-related health inequalities in societies, or at least to avoid a widening of these inequalities.

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5 Comparison of health inequalities between East and West Germany

Objective
The aim of this study is to assess whether the extent of health inequalities varies between East and West Germany at a point in time shortly after the reunification.

Data and methods
Data were obtained from two cross-sectional studies conducted in 1990/92 in East (1,146 men, 1,268 women; response rate of 70%) and West Germany (2,623 men and 2,688 women; response 69%) with nearly identical study protocols. Socio-economic status (SES) was assessed by household equivalent income and by educational level. Morbidity was assessed by perceived general health and by the number of chronic conditions. Absolute differences as well as relative differences (odds ratios) in morbidity rates between low SES groups and high SES groups were calculated, and both measures were standardised for age. Analyses were performed for men and women aged 25-69 years.

Results
Income inequalities were considerably larger in West Germany as compared to East Germany, but there were only minor differences between East and West Germany concerning educational inequalities and overall morbidity rates. Most measures of health inequalities indicated that health inequalities favouring the upper socio-economic groups exist in East Germany as well as in West Germany, and that there were no major differences in the extent of health inequalities between both parts of Germany.

Conclusion
Using two data sets that have been raised with nearly identical study protocols, it seems that health inequalities are relatively stable, as they do not differ substantially between East and West Germany despite the fact that both parts of Germany have experienced different social systems during the past 45 years.

5.1 Introduction

There is a growing interest in comparing health inequalities between different European countries. The most recent empirical studies have mainly been published by two large international research teams, one headed by Doorslaer and Wagstaff[1] and one headed by Mackenbach and his team[2-9]. The rational for these comparisons is that they can help us to understand the causes for health inequalities and the potential for reducing them. The major challenge these comparisons are facing is that it is usually very difficult to compare data that have been raised in different countries.

It is especially interesting to compare health inequalities between East and West Germany, as both parts of Germany shared a long period of common history and culture, have then experienced very different socio-economic and health care systems for about 45 years, and are now merging into one system again, accompanied by severe social problems mainly in the eastern part. Thus it can be assumed that health inequalities differ between East and West Germany. We hypothesised that health inequalities are larger in West Germany, as in East Germany the society was more egalitarian.

Health inequalities favouring the higher socio-economic groups have been reported in a number of studies from West Germany[10-12] as well as from East Germany[13-15]. Studies comparing the extent of health inequalities in the eastern and western part of Germany are rare, though, and those that are available provide information that is difficult to interpret. The first study was based on data from 1987[16]. It indicated that health inequalities by educational level were somewhat *larger* in East Germany than in West Germany; but the data were hardly comparable, as a representative sample from West Germany was compared with a sample from a single town in East Germany (i.e. Görlitz). The second study was based on a random survey of adults in East and West Germany conducted in 1992[17,18]. It indicated that health inequalities by educational level, occupational status and income were somewhat *smaller* in East Germany than in West Germany. The statistical analyses failed to adequately express the magnitude of health inequalities, though, as the regression coefficients presented in that study were very difficult to interpret. The third study was based on a different survey conducted in 1992 in East and West Germany[19]. Using an approach developed in economics that is rarely used in epidemiological studies (i.e. concentration of income and of poor health), it indicated that poor health was slightly concentrated in lower income participants, and that this concentration is about the same in East Germany as in West Germany.

The best answer concerning the question if the extent of health inequalities differs between East and West Germany can be provided by analysing data from two population surveys that have been conducted in 1990/92. These data represent the largest representative sample available from East and West Germany. The study protocol of the surveys was nearly identical in both parts of Germany. Based on these data, we addressed three questions:

- Are there differences in social inequalities between East and West Germany?
- Are there differences in morbidity rates between East and West Germany?
- Are there differences in the size of health inequalities between East and West Germany?

The analyses primarily focused on the third question, but the other two were included as well as they could help to explain the extent of health inequalities. Concerning the first question, it is yet quite clear that the standard of living is still lower in East Germany than in West Germany. The available studies comparing the extent of social inequalities showed that income inequalities were larger in West Germany than in East Germany[20]. Concerning the second question, no clear answer has been provided yet. In West Germany, some health problems seemed to be more prevalent (e.g. myocardial infarction), some less prevalent (e.g. hypertension) and others (e.g. general health complaints) about as prevalent as in East Germany[20,21]. This confusing picture was somewhat surprising, as all-cause mortality was clearly higher in East Germany than in West Germany[22,23].

5.2 Data and methods

Data were derived from two studies in East and West Germany carried out with nearly identical methodologies and protocols. In West Germany, a representative sample of 8,000 persons was chosen from 100 sample points. The survey was conducted in 1990/91 in the framework of the German Cardiovascular Prevention Study[24] and included 25-69 year old German residents. The study design has been described in more detail elsewhere[25]. Data were available from 5,311 respondents (2,623 men and 2,688 women), yielding a response rate of 69% among those who could be contacted (i.e. excluding those who had moved, whose addresses were incorrect or who were deceased prior to the start of the survey).

In East Germany, a representative sample of 4,000 persons was chosen from 50 sample points. The survey was conducted in 1991/92 and focused on 18-79 year old German residents[26]. Data were available from 2,509 respondents, yielding a response rate of 70% among those who could be contacted. As the West German survey was confined to the age range 25-69 years, we excluded the age ranges 18-24 and 70-79 from the East German survey. Thus, in the present analysis 2,414 persons (1,146 men, 1,268 women) could be included from East Germany.

Two indicators of socio-economic status (SES) were used. The first indicator was based on the net monthly household income (total gross household income minus taxes and social insurance premiums). The "net household equivalent income" was calculated by the following formula in order to adjust the net household income to the household size: (net household income) / (number of persons in the household$^{0.36}$). This formula was proposed by Buhmann et al.[27] as a simple tool for taking into account the economy of scales induced by an increasing number of household members.

The respondents were asked to mark an income class in the questionnaire. The questionnaire in West Germany included 12 income classes ranging from "below 1,000 DM" to "7,000 DM and more"; the questionnaire in East Germany included 12 income classes as well, but these were ranging from "below 500 DM" up to "5,000 DM and more", reflecting the fact that income is lower in the eastern than in the western part of Germany. As the formula shown above requires an exact income figure, it was assumed that the net household income was equal to the mean of the upper and lower bound of the marked income class. For the lowest income class, it was assumed that the average income level equaled 2/3 of the upper bound, and for the highest income class, it was assumed that the mean income level equaled 4/3 of the lower bound. The household equivalent income was divided into deciles. Concerning the comparison of the median equivalent income per income decile between East and West Germany (see figure 5.1), identical income classes were used for both parts of Germany, ranging from "below 1,000 DM" to "5,000 DM and more".

The second indicator of socio-economic status was the highest educational level achieved by the respondent. Three educational levels were distinguished, i.e. low (primary education), medium and high (university degree)[1]. The educational system in West Germany differed from the one established in East Germany, but these three levels provided a good matching of the two systems.

Morbidity was assessed by two indicators, *perceived general health* on the one hand and *number of chronic conditions* on the other. The indicator *perceived general health* was based on exactly the same question in both surveys: "How would you describe your present state of health: very good, good, satisfactory, less than good, or poor?" In a first step, we focused the analyses on those respondents who classified their health status as "less than good or poor", and in a second step, we combined these respondents with those who classified their health status as "satisfactory".

The question concerning the second indicator was posed slightly differently in both surveys: "Do you suffer or have you suffered from one of the following diseases?" in West Germany, and "Did you suffer from one of the following diseases in the past 12 months?" in East Germany. In West Germany, the respondent was given a list of 34 specific chronic conditions, and in East Germany a list of 37 specific chronic conditions was applied. We selected those 10 conditions that were listed identically in both surveys (diabetes mellitus, myocardial infarction, other heart disease or angina pectoris, cerebrovascular disease or stroke, hypertension, stomach or duodenum ulcer, liver or gall disease, kidney or urinary tract disease, muskulo-skeletal diseases). Then, we calculated the total number of chronic conditions per respondent. In a first step, we calculated the percentage of respondents reporting two or more of these chronic conditions, and in a

[1] Low educational level: 'keine abgeschlossene Schulbildung, Volks- oder Hauptschulabschluß, Mittlere Reife oder Realschulabschluß, Abschluß 10. Klasse (POS)'. Medium educational level: 'Fachhochschulreife, Abitur, Meister- oder Technikerschule'. High educational level: 'Fachhochschul-, Hochschul- oder Universitätsabschluß'.

second step, the percentage of respondents reporting at least one chronic condition was calculated as well.

Absolute as well as relative health differences between low and high SES groups were calculated. The absolute rate difference was calculated as the morbidity rate in the low SES group minus the morbidity rate in the high SES group, controlling for age by indirect standardisation. The relative difference was calculated with logistic regression analyses using the high SES group as a reference. A nominal variable representing 5 years age groups was included in the regression model in order to correct for age. The regression coefficients and their standard errors were used to calculate odds ratios and their 95% confidence intervals. Income inequalities were mainly assessed by the Gini concentration index, a standard tool in income economics. The Gini index can range from 0 (equal income distribution) to 1 (maximum income concentration). A non-parametric bootstrap resampling method was used to calculate 95% confidence intervals with 1,000 resamplings.

5.3 Results

The median equivalent income (in Deutsche Mark) per income decile for East and for West Germany is shown in figure 5.1. The figure indicates that for both men and women income inequality was considerably larger in West Germany as compared to East Germany. This result was confirmed by the Gini indices. The calculations yielded a Gini index of 0.218 for East Germany and of 0.269 for West Germany. The 95% confidence intervals were 0.205 - 0.220 for East Germany and 0.262 – 0.273 for West Germany, indicating that income inequalities were significantly higher in West Germany

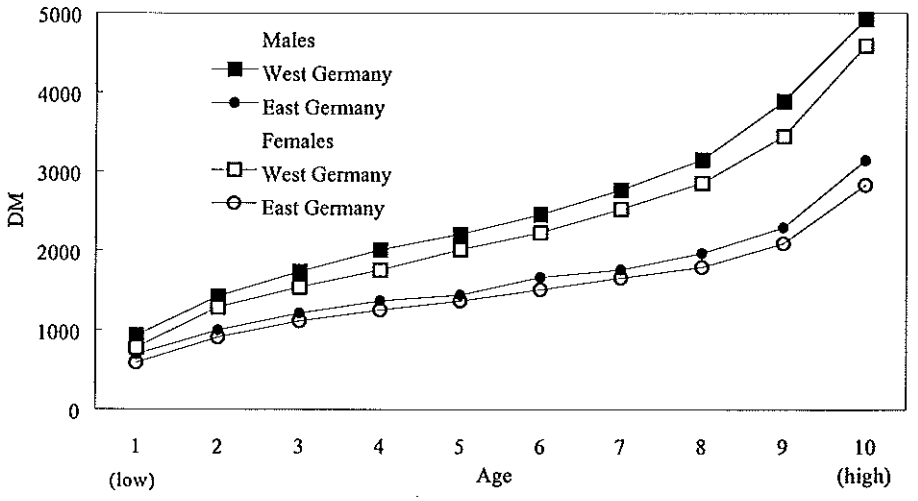

Fig. 5.1 The median equivalent income (in Deutsche Mark) per income decile.

than in East Germany. Concerning the distribution of the population over different educational levels, socio-economic differences in East and West Germany were remarkably similar (data not shown).

As expected, the prevalence rates for the morbidity indicators *less than good or poor health* on the one hand and *2 or more chronic conditions* on the other hand increased with age for men and women in both parts of Germany (figure 5.2). It is also important to note that with increasing age the indicator *2 or more chronic conditions* increased much more than the indicator *less than good or poor health*, but the most interesting point here was that there did not seem to be important differences in morbidity between East Germany and West Germany.

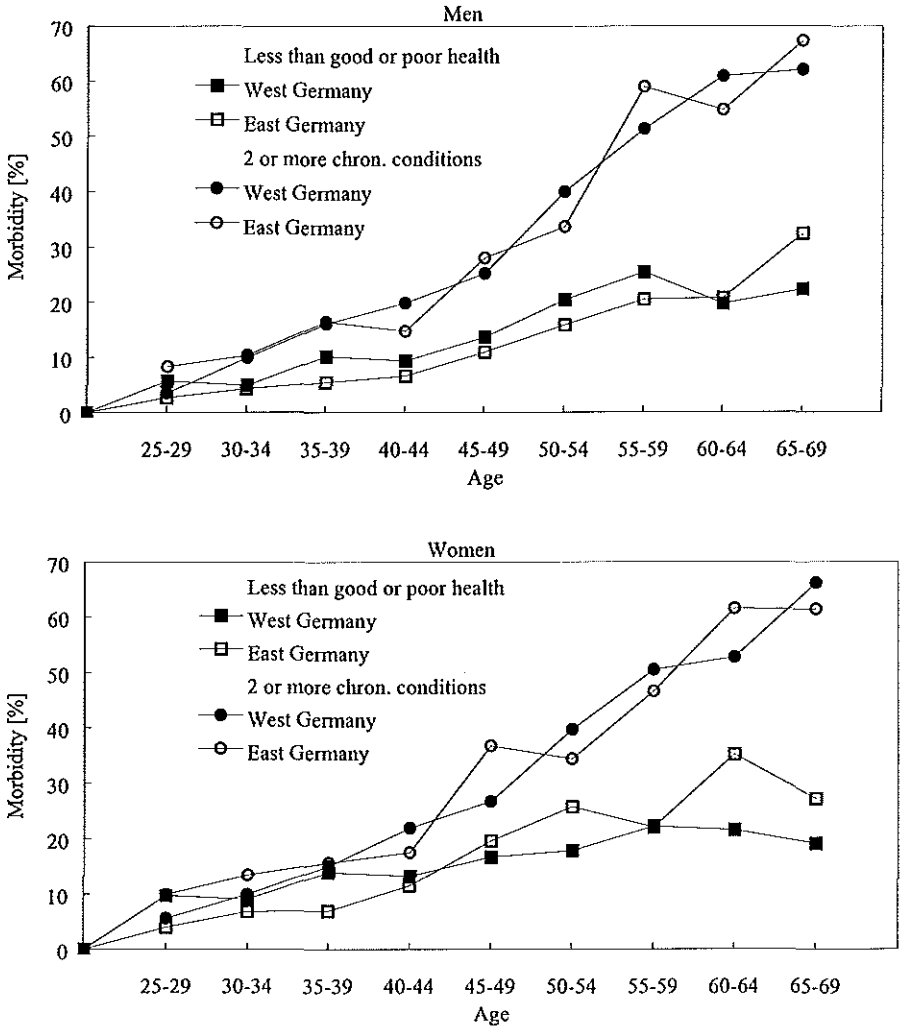

Fig. 5.2 Morbidity rates by age for men and women.

For both sexes and in both parts of Germany, morbidity rates increased with decreasing equivalent income (data not shown). In some cases there was no steady trend of increasing morbidity, but the pattern was still rather clear. This held for the morbidity indicator *less than good or poor health* as well as for the *indicator 2 or more chronic conditions*, although health inequalities by income were somewhat larger for the first morbidity indicator than for the second.

The rate differences and odds ratios comparing the income deciles 9+10 vs. 1+2 on the one hand and 6-10 vs. 1-5 on the other are presented in table 5.1. For both morbidity indicators, in both parts of Germany and for men as well as for women, the odds ratios indicated health inequalities favouring the higher income groups. All odds ratios for the indicator *less than good or poor health* reached statistical significance, and for West Germany three out of four odds ratios for the indicator *2 or more chronic conditions* reached statistical significance as well (statistical significance was narrowly missed for the fourth odds ratio). Concerning rate differences, in 15 out of 16 comparisons morbidity rates were higher in the lower income groups as compared to the higher income groups. Odds ratios and rate differences suggested that there were no important health inequalities by income in East Germany when the *indicator 2 or more chronic conditions* was used.

Table 5.1 Rate differences and odds ratios ratios including 95% conf. intervals comparing income deciles 9+10 vs. income deciles 1+2 and income deciles 6-10 vs. income deciles 1-5.

	West Germany		East Germany	
	Less than good or poor health	2 or more chron. cond.	Less than good or poor health	2 or more chron. cond.
Men				
9+10 / 1+2				
Rate difference (%)	+ 13.5	+ 7.0	+ 11.8	+ 3.2
Odds Ratio	3.28 (2.28 - 4.73)	1.54 (1.14 - 2.07)	4.05 (1.91 - 8.62)	1.43 (0.86 - 2.38)
6-10 / 1-5				
Rate difference (%)	+ 6.9	+ 4.2	+ 3.5	- 0.7
Odds Ratio	1.92 (1.51 - 2.44)	1.30 (1.07 - 1.59)	1.51 (1.01 - 2.27)	1.03 (0.75 - 1.42)
Women				
9+10 / 1+2				
Rate difference (%)	+ 9.1	+ 5.2	+ 7.5	+ 0.6
Odds Ratio	2.08 (1.49 - 2.90)	1.41 (1.05 - 1.89)	1.93 (1.06 - 3.50)	1.08 (0.67 - 1.74)
6-10 / 1-5				
Rate difference (%)	+ 4.0	+ 2.4	+ 8.2	+ 1.3
Odds Ratio	1.38 (1.10 - 1.72)	1.17 (0.96 - 1.42)	1.99 (1.39 - 2.85)	1.11 (0.82 - 1.50)

A mixed picture emerged when the extent of health inequalities was compared between East and West Germany. Rate differences and odds ratios suggested that for the indicator *2 or more chronic conditions* health inequalities were larger in West Germany than

in East Germany, but the confidence intervals widely overlapped, indicating that no statistically significant differences existed. For the *indicator less than good or poor health* there did not seem to be a clear East-West pattern.

Concerning educational differences, the prevalence of *less than good or poor health* increased with decreasing educational level in both parts of Germany, for men as well as for women (data not shown). The same association was shown for the indicator *2 or more chronic conditions*, the only exception being women in East Germany. This result was supported by the rate differences and the odds ratios (table 5.2). They indicated health inequalities favouring the higher educational level. The only exception was the indicator *2 or more chronic conditions* for women in East Germany.

Table 5.2 Rate differences and odds ratios including 95% confidence intervals comparing those with lower educational level and medium plus higher educational level.

	West Germany		East Germany	
	Less than good or poor health	2 or more chron. cond.	Less than good or poor health	2 or more chron. cond.
Men				
Rate difference (%)	+ 4.6	+ 3.3	+ 4.1	+ 6.3
Odds Ratio	1.51 (1.19 - 1.90)	1.23 (1.01 - 1.50)	1.63 (1.07 - 2.49)	1.29 (0.91 - 1.81)
Women				
Rate difference (%)	+ 5.6	+ 1.3	+ 2.2	- 0.9
Odds Ratio	1.64 (1.30 - 2.05)	1.09 (0.89 - 1.33)	1.24 (0.85 - 1.82)	0.94 (0.66 - 1.32)

Again, a mixed picture emerged when the extent of health inequalities was compared between East and West Germany. The rate differences and the odds ratios for the indicator *less than good or poor health* suggested that for women health inequalities were somewhat larger in West Germany than in East Germany. The indicator *2 or more chronic conditions* suggested that health inequalities were somewhat larger for men in East Germany than for men in West Germany. The most striking impression was, though, that health inequalities seemed to be very similar in both parts of Germany.

In another step, we calculated two more morbidity indicators, i.e. *satisfactory, less than good or poor health* and *1 or more chronic conditions*. Of course, these additional morbidity indicators (results not shown) provided higher prevalences and narrower confidence intervals than the results based on a more restricted definition of morbidity. Concerning the comparison of health inequalities between East and West Germany, these additional morbidity indicators supported the impression that there were no significant differences in health inequalities between East and West Germany. Looking at health inequalities by income, inequalities assessed by the indicator *satisfactory, less than good* or *poor health* were somewhat larger in West than in East Germany, and inequalities assessed by the indicator *1 or more chronic conditions* were somewhat larger in East Germany than in West Germany, but the differences between East and

West Germany never reached statistical significance. Looking at health inequalities by educational level, health inequalities seemed to be larger in East Germany in one case (men: satisfactory, less than good or poor health) and larger in West Germany in another (women: 1 or more chronic conditions).

5.4 Discussion

The three questions asked above can be answered in the following way. There were substantial differences in social inequalities between East and West Germany when income was considered. Figure 5.1 and the Gini concentration indices indicated that income inequality was significantly larger in West Germany than in East Germany. The Ginis reported above and their differences between East and West Germany were similar to previously published Ginis based on comparable data and equalisation schemes[28]. There were minor differences, however, when educational status was used as an indicator for social status. Concerning the second question on differences in morbidity between East and West Germany, figure 5.2 indicated that there were no major differences.

The third question on differences in health inequalities between East and West Germany was more difficult to answer. The analyses presented above can be interpreted in two ways. On the one hand, it could be stressed that some differences have been found, and that most differences pointed towards larger health inequalities in West Germany than in East Germany, especially when health inequalities by income were considered. On the other hand, it could be stressed that the differences in health inequalities were neither consistent for both indicators of morbidity nor were statistically significant. Contrary to our hypothesis that health inequalities are larger in West than in East Germany, the results presented here suggested, that there were no consistent or significant differences in health inequalities between both parts of Germany. This seemed also true for health inequalities by income, despite the fact that income inequality was considerably larger in West Germany than in East Germany. We put some trust in our conclusion, as the comparison was based on two rather large representative samples and as the study protocol was nearly identical in both surveys. Also, there is little reason to believe that potential selection or recall biases differed between East and West Germany.

The present study focused on the period shortly *after* the unification of Germany. The interpretation of the results was complicated by the fact that effects of the political and economic system *before* the unification were mixed with effects of the unification itself (i.e. economic disturbances and social stress in East Germany, selective migration to the West etc.). Social systems and health inequalities probably do not change rapidly, and as the data were based on surveys conducted only two years after the unification, they probably to a large extent still expressed differences between a socialist and a capitalist society. An obvious expression of this difference was that income inequalities in 1990/92 were still considerably smaller in East Germany than in West Germany.

Large studies that compared many different western European countries have observed that the extent of health inequalities seems to be rather unrelated to the size of income inequalities, or more generally, to the type of socio-economic policies[9,29]. The comparison between East and West Germany brought important additional evidence supporting this observation because it compared two countries that are highly similar in many other aspects, thus avoiding some problems of confounding that may have strongly affected other international comparisons, and also because the data were more comparable than in any other international comparison.

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Part II

International variations in the size of socio-economic differences in risk factors for morbidity and mortality

6 Socio-economic differences in risk factors for morbidity and mortality in the European Community: an international comparison

Objective
To assess whether there are variations between EU countries with respect to the size of socio-economic differences in risk factors of morbidity and mortality.

Data and methods
Data on risk factors were obtained from the Eurobarometer surveys of 1987-1991. The risk factors studied were smoking, excessive alcohol consumption, infrequent vegetable consumption and overweight. Educational level was used as an indicator of socio-economic status. Relative differences (odds ratios) and absolute differences in the prevalence of risk factors were calculated for men and women aged 20 to 74 years.

Results
International variations were found for most risk factors. Most remarkable was the north-south pattern found for smoking among women, and for smoking and infrequent vegetable consumption among men, with small or even positive associations in France and the Mediterranean countries.

Conclusion
The results provide indications about circumstances that can influence socio-economic differences in risk factor prevalence and suggest that these differences are relevant for understanding the size of socio-economic health differences in different European countries.

6.1 Introduction

In all western European countries, higher rates of mortality and morbidity have been found among lower socio-economic groups as compared to higher socio-economic groups[1-3]. One of the determinants likely to contribute to these inequalities are behavioural factors such as smoking and alcohol consumption[4,5]. For many countries, studies have shown that persons with a lower socio-economic status, in general, have a less favourable risk profile with respect to behavioural factors e.g.[6-11].

Whether the social gradients of these risk factors have the same magnitude in all western European countries has not yet been systematically examined. This type of information is highly valuable since it may help to identify causes of social gradients in risk factors. Furthermore, it may help to explain differences between countries in the size of health inequalities. The most recent and comprehensive international comparison of the size of health inequalities showed that inequalities in the Scandinavian countries and the Netherlands were not smaller than inequalities in the southern part of Europe, Germany and Switzerland[12]. This pattern was unexpected since it has often been suggested that health inequalities are smaller in more egalitarian countries[13]. Studying variations in the size of inequalities in risk factors might help clarify these unexpected findings.

Until now, only a few studies have compared the size of socio-economic inequalities in behavioural risk factors between countries. Pierce[14] compared trends in cigarette smoking by educational level in the US, Australia, Canada, Norway and Sweden. Helmert et al[15] compared the size of social inequalities in cardiovascular disease risk factors in East and West Germany. Sobal and Stunkard[16] provided an overview of the relationship between socio-economic status and obesity, and compared countries with respect to the direction of the association (negative or positive). The absence of comprehensive overviews of international variations in the magnitude of socio-economic inequalities in risk factors is probably related to the fact that it is very difficult to make comparisons between countries on the basis of published data. Many studies are not nationally representative and those which are often differ too much in their data and the methods used to make a valid comparison. Moreover, for some western European countries no data have been published on inequalities in risk factors such as unhealthy dietary habits.

In this study, social gradients in behavioural risk factors are studied for 11 European countries using the Eurobarometer. The Eurobarometer consists of a series of interview surveys conducted twice a year since 1970 in all countries of the European Union (EU) using identical questionnaires. It was designed to gather information on attitudes towards the EU and its policies but additional questions regarding behavioural risk factors for disease were appended in the surveys carried out between 1987 and 1991. The risk factors which were available for a sufficient number of respondents were smoking, alcohol and vegetable consumption, and overweight (although not a behavioural factor as such, it is related to behavioural factors such as physical activity and food intake).

Information on several socio-economic variables was collected by a standard interview schedule. In this study, education is used as an indicator of socio-economic status.

The questions we focused on were (1) how large are the differences between low and high educational groups in each country with regard to smoking behaviour, alcohol consumption, vegetable consumption and overweight, and (2) are there variations in the size of these differences between countries?

6.2 Data and methods

Data sources

The data were obtained from seven Eurobarometer surveys (No. 27, 29, 30, 31, 32, 34 and 36) which were held between 1987 and 1991 in all EU member countries: Denmark, West Germany, the Netherlands, Belgium, Luxemburg, Great Britain, Northern Ireland, Ireland, France, Greece, Italy, Spain and Portugal. East Germany was only included after 1990.

The Eurobarometer surveys cover the national population aged 15 and over in all EU member countries. For all surveys, a multi-stage sampling method was used. In the first stage, a number of sampling points (ca. 200) were systematically drawn in each country from all administrative regional units. The method used for the other stages differed between surveys 27 to 31 and surveys 32 to 36. For surveys 27 to 31, individuals or households were subsequently selected at each point by random sampling from a population or electoral list (3 countries), quota sampling by sex, age and occupation on the basis of census data (5 countries), or by a method combining these two procedures, i.e. "the standard random route procedure" (4 countries). For surveys 32 to 36, a starting address was selected at random in all countries at each sampling point and addresses were further selected by standard random route procedures. In each household, the respondent was selected according to a random procedure. Up to two attempts were made in order to obtain an interview. The average percentage of persons who were willing to take part in the surveys and who completed the whole questionnaire ranged from ± 40% in the Netherlands to ± 70% in Germany, Ireland, France, and Portugal.

Approximately 1000 persons per survey were interviewed in their homes by professional interviewers in all countries, except in Luxemburg and Northern Ireland where only 300 persons were interviewed. Survey 32 comprised twice as many persons per country as the other surveys. The responses were reweighed by sex, age, region and degree of urbanisation on the basis of national population data. This was undertaken to improve the representativity of the national populations of the survey samples. All interviews were carried out face-to-face in the respective national languages.

The analyses in this study were restricted to men and women aged 20-74. Luxemburg, Northern Ireland and the former East Germany were excluded since data for these coun-

tries were only available for 300 persons per survey or were only included in two of the seven Eurobarometer surveys.

Measurement of risk factors

Table 6.1 gives a detailed description of the risk factors and the approximate number of respondents in the surveys with this information. Smoking behaviour was measured using one question in which the respondents had to state whether they were current cigarette smokers, were current pipe or cigar smokers, had smoked once but had stopped, or had never smoked. Alcohol consumption was measured using two questions in which the respondents had to indicate how many units of alcohol they drank on average on a week day and on a weekend day, respectively. For these questions, it was stated that one glass of beer or wine was equal to one unit of alcohol, whereas one glass of spirits such as whisky or cognac was equal to two units of alcohol. The weighted average of the two questions (number of units/week day·5 + number of units/weekend day·2)/7 was used to estimate the average units of alcohol consumed per day. Vegetable consumption was measured using one question in which the respondents were asked how often they ate fresh vegetables, with five possible answer categories ranging from every day to never. Being overweight was defined as a Body Mass Index ≥ 25. Height and weight were reported by the respondents in centimetres and kilograms, respectively.

Table 6.1 Definition of the risk factors included in this study and the approximate number of respondents aged 20 to 74 years per country.

	Definition	Number of respondents
Smoking	smoking cigarettes, cigars or pipe	ca. 7000
Excessive alcohol consumption	the consumption of more than 4 units of alcohol per day for men and more than 3 units of alcohol per day for women	ca. 2600
Infrequent vegetable consumption	the consumption of fresh vegetables less than 3-4 days a week	ca. 1800
Overweight	a Body Mass Index (weight/height^2) ≥ 25	ca. 1800

To check the validity of our data, we compared the overall prevalence of the risk factors with those reported in other national studies. The prevalence of smokers among men and women found in this study corresponded fairly well with other studies which referred to approximately the same population and period[17-21]; the differences found between this study and others were generally less than 5%. However, for Italian women and for men and women in France and Portugal, we found a prevalence which was 7 to 9% higher. For body mass index, observed prevalence rates corresponded fairly well with other studies[17]; the maximum difference was about 5% for all countries, except for men in the Netherlands for which we found an 8% lower prevalence. Comparisons for excessive alcohol consumption and infrequent vegetable consumption were not possible since questions and definitions used to measure alcohol consumption and vegetable consumption often differed substantially or were missing.

For each of the risk factors included in the study, one cut-off point was chosen (e.g. 4 units of alcohol or more a day) to distinguish those at risk from those not at risk. Since the choice of the cut-off point had to be somewhat arbitrary, we evaluated whether the same international pattern was found when a more stringent definition of the risk factor was used. The alternative cut-off points defined were: 1) smoking ≥ 10 cigarettes a day (the number of cigarettes smoked a day was elicited by asking those who had admitted to smoking, 2) drinking ≥ 6 units of alcohol a day and 3) having a BMI ≥ 30 and 4) eating fresh vegetables < 1-2 times a week. Since the prevalence of drinking ≥ 6 units of alcohol a day among women was very low, no stable inequality estimates could be made, and therefore are not presented in this study. The same applies to the prevalence of eating fresh vegetables < 1-2 times a week among men and women.

The Eurobarometer data showed an extraordinarily high alcohol consumption level for Italy as compared to other countries. This deviation is probably due to a coding mistake in the Italian data. Accordingly, we excluded alcohol consumption data for Italy.

Measurement of educational level

Educational level was measured by the question: "How old were you when you left school: ≤ 14 ,15 , .., .., 22 years or older?". On the basis of the answer, we calculated the number of years of education that the respondents had completed by subtracting the age when compulsory education begins in each of the respective countries[22]. Two broad educational groups were defined for the calculation of educational inequalities in risk factors: zero to 11 years of education and 12 years of education or more. The percentage of men with a low education level ranged from about 25% in the Netherlands and Denmark to 75% in Portugal. For women these percentages ranged from 40% in Denmark, the Netherlands and Belgium to 80% in Portugal.

Measurement of inequalities

Two measures were used to describe differences in prevalence rates of risk factors between lower and higher educated persons: relative and absolute differences. Relative differences in prevalence rates between the two educational groups were calculated for each country separately by logistic regression analyses using the higher educational group as the reference group. Correction for differences in age structure between the educational groups was made by including nominal variables representing 5-year age groups in the regression model. The regression coefficients and their standard errors were used to calculate odds ratios and 95%-confidence intervals. For risk factors with low prevalence rates (< 10%) odds ratios are a good approximation of the relative risk and can be interpreted as the prevalence of the low educational group as a ratio of the prevalence of the high educational group. For risk factors with higher prevalence rates, odds ratios are larger than relative risks. To test whether the odds ratios differed significantly between countries, regression analyses were carried out for all countries combined. Two models were compared: a model with education, age and country as independent variables and the same model including an interaction term for country and education. The X^2-test was used to test whether the two models differed significantly.

Absolute rate differences were added to the odds ratio because they take into account differences between countries in the overall prevalence of a risk factor. This is relevant to the explanation of health inequalities, because the contribution that a risk factor can make to that explanation may also depend on its absolute prevalence. Absolute differences were calculated by subtracting the prevalence rate of the higher educational group from that of the lower educational group. Indirect standardisation was used to correct these rates for differences in age structure between the educational groups.

6.3 Results

Smoking

Table 6.2 presents the prevalence rates and odds ratios for smoking. Among men, the percentage of smokers varied from about 40% in Great Britain, Ireland and Italy to about 60% in Greece. In general, lower educated men smoked more often than those with a higher education; the odds ratios were larger than 1 in all countries. The size of inequality varied significantly between countries. Largest inequalities were found in the Netherlands, Ireland, Great Britain and Germany and smallest inequalities were found in Denmark, France and Portugal. The absolute differences (range: 1 to 10%) showed the same international pattern as the odds ratios, see figure 6.1.

Table 6.2 The percentage of current smokers (%) and the size of educational inequality in smoking measured by the Odds Ratio (OR) for 11 EU countries. Men and women, aged 20-74 years.

	Men			Women		
	%	OR	(95%-CI)	%	OR	(95%-CI)
Great Britain	39.1	1.59	(1.37-1.85)	33.4	1.94	(1.67-2.26)
Ireland	40.7	1.59	(1.37-1.86)	33.7	1.94	(1.65-2.28)
Denmark	48.6	1.20	(1.02-1.40)	47.2	1.55	(1.34-1.79)
Germany	46.4	1.57	(1.35-1.82)	29.0	1.27	(1.07-1.51)
Netherlands	49.0	1.59	(1.35-1.88)	37.8	1.35	(1.16-1.58)
Belgium	44.7	1.37	(1.18-1.59)	29.3	1.27	(1.08-1.50)
France	49.0	1.16	(1.00-1.35)	30.2	0.82	(0.70-0.96)
Spain	56.3	1.56	(1.33-1.83)	28.5	0.63	(0.52-0.76)
Portugal	46.8	1.04	(0.87-1.24)	11.1	0.32	(0.25-0.40)
Italy	41.2	1.46	(1.26-1.70)	28.7	0.93	(0.78-1.09)
Greece	62.2	1.52	(1.30-1.78)	28.8	0.51	(0.43-0.60)
Overall test interaction education•country		$p < 0.001$			$p < 0.001$	

The percentage of smokers among women ranged from about 11% in Portugal to about 47% in Denmark. Significant differences in the size of inequality were found between countries. In the more northern countries, women with a low educational level smoked more than women with a high educational level, with largest odds ratios for Ireland and

Great Britain. In the more southern countries, higher educated women smoked more than those with a lower education, with especially small odds ratios in Greece, Portugal and Spain. The same pattern was also found for the absolute differences (range: -10% to 13%), see figure 6.1.

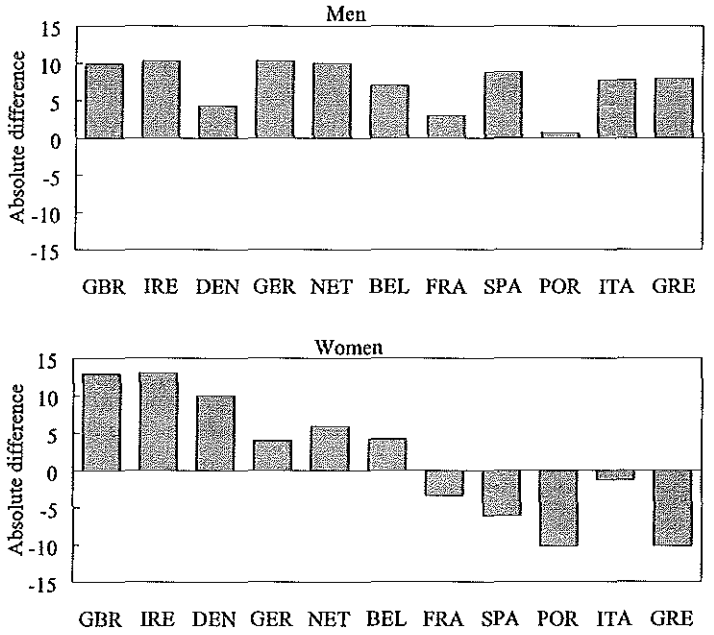

Fig. 6.1 The difference in the percentage (%) of current smokers between two broad educational groups for 11 EU countries. Men and women, aged 20-74 years.

Excessive alcohol consumption

Table 6.3 shows the prevalence rates and odds ratios for excessive drinking. The percentage of men drinking ≥ 4 units of alcohol a day varied from approximately 6% in Denmark to approximately 30% in France. The size of inequality varied between countries. In all countries except Belgium, excessive alcohol consumption occurred more often among lower educated men. Odds ratios were relatively large for Greece, Ireland and Portugal, and small for Spain and Denmark. The absolute differences (range: -2% to 9%) showed the same pattern (figure 6.2).

The percentage of women drinking ≥ 3 units of alcohol a day ranged from approximately 2% in Portugal and Denmark to approximately 9% in France. For some countries, e.g. Spain and Belgium, odds ratios were clearly smaller than 1 and for some other countries larger than 1. None of the odds ratios was significantly different from 1. The countries did not show significant differences in the magnitude of inequality. The absolute differences within these countries varied only from –1% to 2% (figure 6.2).

Table 6.3 The percentage (%) of excessive drinkers (men: ≥ 4 units/day, women: ≥ 3 units/day) and the size of educational inequalities in alcohol consumption for 10 EU countries. Men and women, aged 20-74 years.

	Men			Women		
	%	OR	(95%-CI)	%	OR	(95%-CI)
Great Britain	19.4	1.30	(0.98-1.72)	7.6	1.11	(0.74-1.66)
Ireland	23.7	1.64	(1.22-2.21)	6.6	0.87	(0.53-1.41)
Denmark	6.1	1.07	(0.57-2.00)	1.8	0.83	(0.31-2.20)
Germany	8.7	1.43	(0.92-2.22)	2.5	1.64	(0.71-3.79)
Netherlands	13.1	1.29	(0.87-1.91)	3.8	1.38	(0.68-2.78)
Belgium	15.8	0.84	(0.60-1.19)	6.1	0.63	(0.38-1.07)
France	31.5	1.13	(0.88-1.47)	9.0	0.98	(0.64-1.50)
Spain	17.6	1.02	(0.73-1.41)	2.8	0.53	(0.24-1.12)
Portugal	23.9	1.64	(1.13-2.38)	1.9	1.52	(0.44-5.22)
Italy[1]	-	-		-	-	
Greece	27.0	1.72	(1.29-2.28)	5.0	0.77	(0.44-1.31)
Overall test interaction education*country			$p < 0.05$			$p > 0.05$

[1] The frequency distribution of the Italian population over the answer categories of the questions concerning alcohol consumption were unrealistic possibly because of a coding mistake.

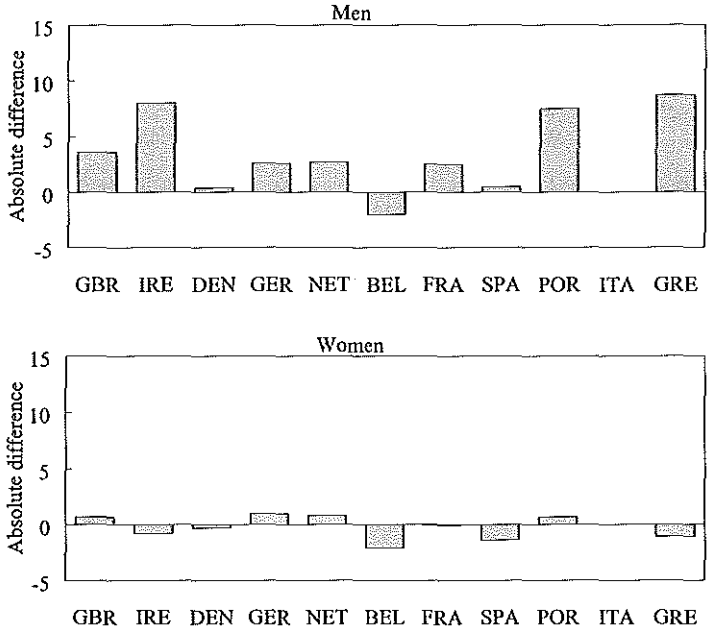

Fig. 6.2 The difference in the percentage (%) of excessive drinkers (men: ≥ 4 units/day, women: ≥ 3 units/day) between two broad educational groups for 10 EU countries. Men and women, aged 20-74 years.

Infrequent vegetable consumption

The percentage of men eating fresh vegetables less than 3-4 days a week varied from approximately 8% in the Netherlands and Ireland to approximately 40% in Germany (table 6.4). The size of inequality differed between countries. Inequalities were large in the more northern countries and small or even in the reverse direction in the southern countries. The absolute differences (range: -2% to 13%) showed a somewhat more favourable position for the Netherlands, Great Britain and Ireland than the odds ratio because of the relatively low overall prevalence in these countries (figure 6.3).

The prevalence for women ranged from 4% in the Netherlands to approximately 30% in Germany. The size of inequality varied between countries. For all countries except the Netherlands and Greece, a lower consumption of fresh vegetables was found among lower educated women. Inequalities were largest in Denmark and Great Britain. The absolute differences (range: -1% to 11%) showed a similar pattern as the odds ratio with the exception of the more favourable position of Great Britain (figure 6.3).

Table 6.4 The percentage (%) of persons who infrequently consume fresh vegetables (< 3-4 times/week) and the size of educational inequalities in those who infrequently consume fresh vegetables for 11 EU countries. Men and women, aged 20-74 years.

	Men			Women		
	%	OR	(95%-CI)	%	OR	(95%-CI)
Great Britain	13.1	1.88	(1.19-2.98)	9.4	2.67	(1.52-4.67)
Ireland	7.6	1.93	(0.99-3.78)	5.8	1.49	(0.76-2.93)
Denmark	29.8	1.89	(1.38-2.59)	23.9	2.08	(1.49-2.91)
Germany	39.7	1.83	(1.33-2.50)	31.6	1.27	(0.89-1.81)
Netherlands	8.4	2.15	(1.21-3.82)	4.0	0.90	(0.41-1.94)
Belgium	14.5	1.04	(0.69-1.58)	9.7	1.43	(0.86-2.38)
France	21.2	1.01	(0.70-1.46)	18.2	1.21	(0.84-1.74)
Spain	24.5	0.87	(0.61-1.74)	22.9	1.45	(0.95-2.20)
Portugal	20.7	1.17	(0.74-1.85)	15.5	1.17	(0.66-2.32)
Italy	23.7	1.05	(0.73-1.51)	15.4	1.39	(0.87-2.22)
Greece	21.8	1.25	(0.87-1.80)	15.9	0.92	(0.61-1.40)
Overall test interaction education•country		$p < 0.01$			$p < 0.05$	

Overweight

Table 6.5 gives the prevalence rates and odds ratios for overweight. The percentage of men with a BMI ≥ 25 varied from approximately 20% in Portugal to approximately 50% in Germany. The association between overweight and education varied between countries. For all countries except Ireland, odds ratios were larger than 1. The largest inequalities were found in France and Germany, and the smallest inequalities were found in Spain, Greece and Portugal. The absolute difference (range: -3% to 12%) showed the same pattern (figure 6.4).

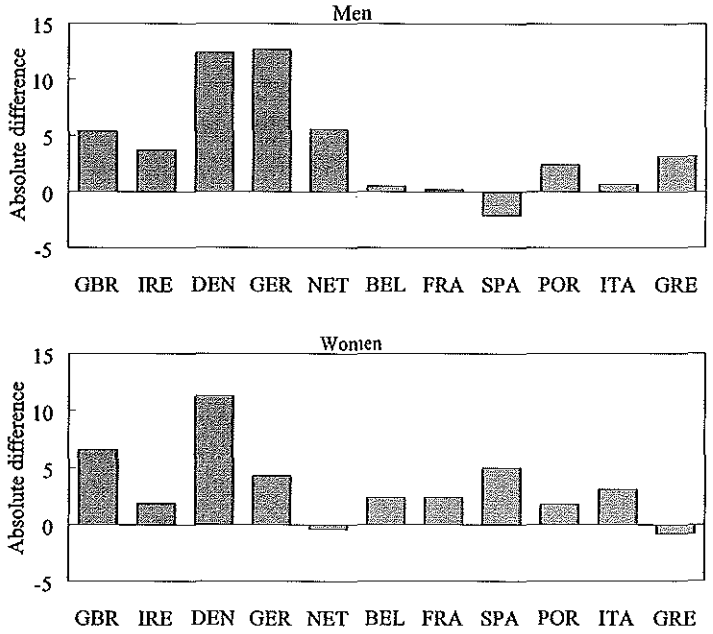

Fig. 6.3 The difference in the percentage (%) of persons who infrequently consume fresh vegetables (< 3-4 times/week) between two broad educational groups for 11 EU countries. Men and women, aged 20-74 years.

Table 6.5 The percentage (%) of persons who were overweight (BMI ≥ 25) and the size of educational inequalities in those who were overweight for 11 EU countries. Men and women, aged 20-74 years.

	Men			Women		
	%	OR	(95%-CI)	%	OR	(95%-CI)
Great Britain	34.5	1.47	(1.09-1.98)	29.3	2.05	(1.47-2.85)
Ireland	43.9	0.87	(0.64-1.20)	25.8	1.54	(1.06-2.24)
Denmark	37.1	1.34	(0.93-1.92)	22.1	1.88	(1.33-2.67)
Germany	49.4	1.71	(1.25-2.33)	28.4	1.85	(1.26-2.70)
Netherlands	33.5	1.38	(0.97-1.96)	30.3	2.36	(1.68-3.31)
Belgium	39.2	1.57	(1.16-2.15)	28.3	2.28	(1.64-3.16)
France	35.2	2.00	(1.44-2.79)	19.1	2.70	(1.77-4.11)
Spain	45.7	1.04	(0.74-1.45)	36.6	2.09	(1.32-3.33)
Portugal	20.7	1.19	(0.74-1.85)	36.0	1.83	(1.12-3.01)
Italy	43.0	1.50	(1.10-2.04)	25.0	1.59	(1.04-2.42)
Greece	53.5	1.07	(0.78-1.47)	42.2	2.05	(1.49-2.82)
Overall test interaction education•country		$p < 0.01$			$p > 0.05$	

Among women, the prevalence rates ranged from 19% in France to approximately 36% in Portugal and Spain. In all countries, overweight was more often present among the less educated women. The odds ratios did not vary significantly between countries. The pattern for the absolute difference (range: 7% to 13%) was approximately the same (figure 6.4).

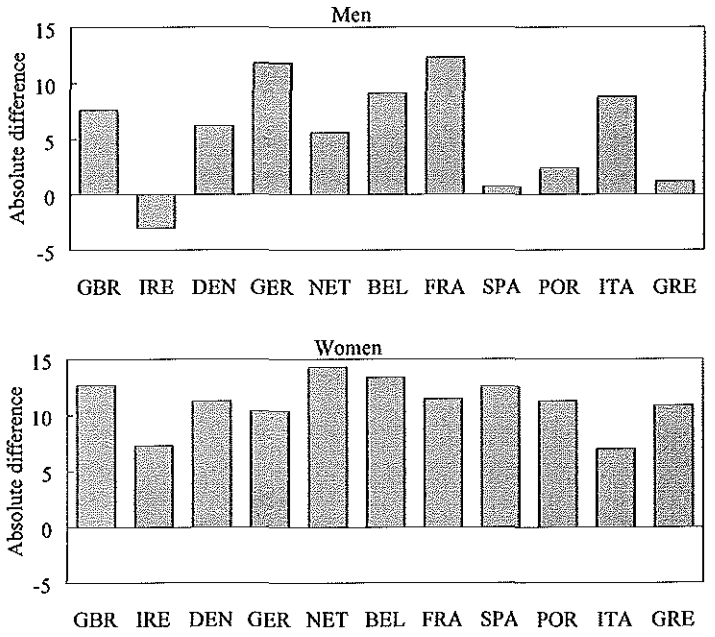

Fig. 6.4 The difference in the percentage (%) of persons who were overweight (BMI ≥ 25) between two broad educational groups for 11 EU countries. Men and women, aged 20-74 years.

Alternative definitions of risk factors

Smoking ≥ 10 cigarettes a day among men showed a different international pattern than merely smoking. Relatively large inequalities were found in the northern countries and small inequalities in the southern countries (figure 6.5 shows absolute differences). For women the same north-south pattern was found as in figure 6.1.

Drinking ≥ 6 units of alcohol a day among men showed a different international pattern than drinking ≥ 4 units alcohol a day. For the more stringent definition, large relative and absolute inequalities were found in Greece, Portugal and France, followed by Spain, Great Britain and Ireland. Small differences were found in Denmark, the Netherlands, Germany, and Belgium (figure 6.6 shows absolute differences).

Minor differences were found among men for BMI ≥ 30 in comparison to BMI ≥ 25. A relatively low position was again found for Ireland, Spain and Portugal but now also for Germany and Belgium (figure 6.7 shows absolute differences). For women, BMI ≥ 30

just as BMI ≥ 25 consistently showed a higher prevalence among the less educated and no international variations in the size of inequality.

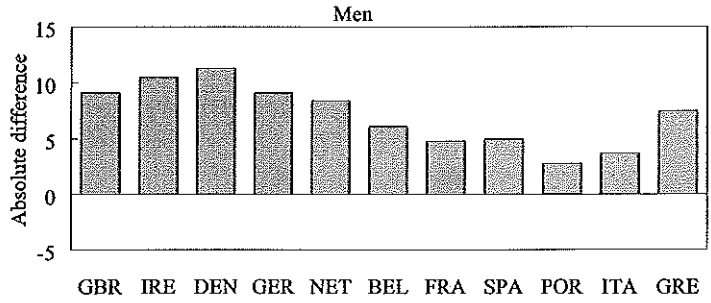

Fig. 6.5 The difference in the percentage (%) of smokers, smoking 10 or more cigarettes a day between two broad educational groups for 11 EU countries. Men aged 20-74 years.

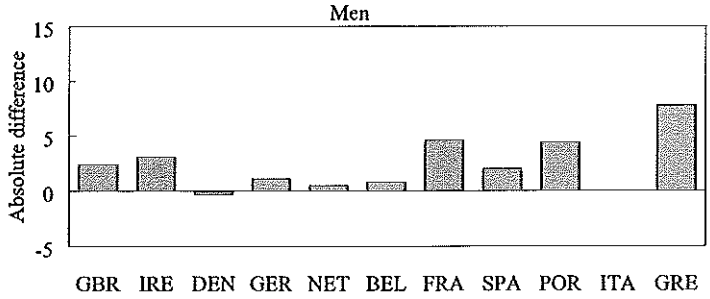

Fig. 6.6 The difference in the percentage (%) of very excessive drinkers (≥ 6 units/day) between two broad educational groups for 10 EU countries. Men aged 20-74 years.

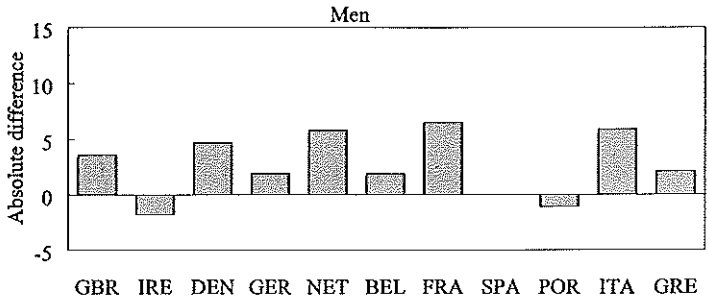

Fig. 6.7 The difference in the percentage (%) persons severely overweight (BMI ≥ 30) between two broad educational groups for 11 EU countries. Men aged 20-74 years.

6.4 Discussion

Summary of the findings

This is the first study which compared several countries with respect to the size of socio-economic differences in behavioural risk factors for disease. Educational differences in smoking, excessive alcohol consumption, infrequent vegetable consumption and overweight were described for 11 EU member countries using one data source: the Eurobarometer. Absolute as well as relative differences in prevalence rates were calculated.

The international patterns found for the two different inequality measures were approximately the same. In general, for smoking among men, a higher prevalence among the less educated was found. For smoking ≥ 10 cigarettes a day, a north-south gradient was found with larger differences in northern countries. For women, there were noteworthy differences between countries. In northern countries less educated women smoked more often whereas in southern countries more educated women smoked more often. For excessive alcohol consumption among men, a negative association was found for most countries. No or small inequalities for excessive drinking were consistently found for Denmark, Belgium, the Netherlands, and Germany. Women did not show significant or substantial inequalities in any of the countries. For infrequent vegetable consumption among men, large negative associations were found for northern countries whereas for southern countries associations were small or absent. For women, only two northern countries showed relatively large inequalities. Negative associations were found for overweight among women in all countries and in most countries for men too. For men, Ireland, Spain, Greece, and Portugal showed relatively small inequalities. No variations in the size of these associations between countries were found among women.

Possible data problems

The Eurobarometer surveys were designed to cover national populations aged 15 years and over. However, selective non-response might have lead to an underrepresentation of certain subpopulations. Results of studies which compared respondents and non-respondents of health interview surveys suggested that non-response might be larger among unhealthy persons, smokers, obese persons and alcoholics[23,24]. Furthermore, response rates might be lower among lower socio-economic groups[25]. Therefore, non-response might have lead to an underestimation of the inequality estimates. The question is, however, whether the international patterns found in this study are biased by differences between countries with respect to non-response rates. The average response rate in the various countries ranged from approximately 40% in the Netherlands, to approximately 50-60% in Italy, Denmark, Great Britain, Spain, Belgium, and Greece to approximately 70% in Germany, Portugal, Ireland and France. We cannot exclude the possibility that these differences have to some degree influenced the international patterns of inequalities that were observed in this study. However, it may be noted that

other national studies on socio-economic inequalities in risk factors, which are discussed in the next section, are generally in agreement with our results despite the (substantially) higher response rates in most of these studies. Accordingly, it seems unlikely that the latter patterns have been strongly biased by the effects of non-response.

This study is based on self-reported data. The validity of self-reported behavioural risk factor data are often questioned[26-29]. Self-report might be influenced by recall bias and social desirability. The inequality estimates we calculated, however, would only be biased when misreporting was associated with education. Validity studies have rarely focused on differences between educational groups. A study of tobacco consumption among immigrants from southeast Asia to the United States found an association between misreporting and education among women but not among men[30]. A study about misreporting of overweight (height and weight) did not find that more educated or less educated women estimated their height or weight differently. Among men however, the lower educated overestimated their height to a greater degree, but they underestimated their weight to a lesser degree than higher educated men[27]. The net effect on BMI estimates is an approximately equally large underestimation of the BMI in low and high educated men. The international patterns we found are only biased when countries vary in the extent to which education is associated with misreporting. Unfortunately, no information is available on this.

For all countries, identical questionnaires were used. However, some remaining comparability problems may still have arisen. Concerning the question about alcohol consumption, it was assumed that one glass of beer or wine was equal to one unit of alcohol. However, in some countries the size of glasses commonly used differs from most other countries. This is especially the case for beer glasses in Germany. This might have lead to an underestimation of the alcohol consumption. Because the contribution of beer to the total alcohol consumption in Germany was larger in lower socio-economic than in higher socio-economic classes[31], this might have caused an underestimation of the inequality estimate.

The inequality measures used in this study compared two broad educational groups. The sizes of these groups varied between countries. This might have affected the comparability of the inequality estimates of the different countries. Therefore, we also calculated a more sophisticated relative inequality measure, the Relative Index of Inequality[32,33], which distinguished four educational groups for each country. The analyses (results are not shown) indicated that the international patterns as outlined above are not sensitive to the way we categorised education. The only major exception is that the Relative Index of Inequality showed somewhat larger inequalities among men for overweight in Portugal and for alcohol consumption in the Netherlands.

Socio-economic differences in risk factors in other studies

For all countries, except for Belgium, Greece, and Ireland (women only), social gradients in smoking have been studied. The results of those studies, which deal with approximately the same population and period as our study, are in agreement with our

results[8,9,17,19-21,34,35]. For men, social gradients in smoking are observed for all countries except Portugal, whereas for women the gradients are found to be negative in the northern countries and positive in the southern countries. The only exception are French women for whom data from a national survey suggest that the social gradients are very small and negative, whereas this study found a small positive association[17].

Data on social gradients in overweight have been reported for all countries, except Belgium, Portugal, Greece and Ireland. The consistently higher prevalence of overweight that we found in this study among women in lower socio-economic groups is in agreement with other research[9,16,17]. The clear associations we found for men from Great Britain, Denmark, Germany, the Netherlands, France, and Italy are supported by national studies[9,17]. National survey data for Spain also showed a higher prevalence among less educated men, but do not support our finding that this association is weak[17,36].

For Belgium, Portugal, Greece, and Ireland, we did not find any publications which described social gradients in alcohol consumption. Studies exist for the other countries but the way in which alcohol consumption is measured differs substantially. We found a consistently small association for men from the Netherlands, Denmark, and Germany. Other national studies from these countries showed inconsistent results[17,31,35,37]. For Spanish men, we found a negative association for ≥ 6 units but not for ≥ 4 units of alcohol. A similar phenomenon has also been reported for national survey data. A negative association was shown for consuming ≥ 60 gram of alcohol (i.e. 6 glasses) a day, but not for "drinking alcohol"[10]. The negative gradient we found for men from Great Britain and France is also reported in national studies[7,38]. Therefore, our results for men are generally in agreement with other research. We did not find clear associations among women in any of the countries studied. National studies from France and Spain[10,17] also did not find an association. Similarly, research in other countries reports positive or negative associations or inconsistent results[17,31,35]. As in our study, in most of these studies the absolute differences between the social groups were found to be negligible.

Very few studies have reported on the relationship between socio-economic status and the consumption of fresh vegetables. The results of these studies correspond fairly well with our results and suggest that infrequent vegetable consumption most frequently occurs in lower socio-economic groups among men and women in Great Britain and Denmark[8,39]. For the Netherlands and Spain, for which we observed a negative association for only one of the two sexes, national studies reported a negative association for men and women combined[40,41]. One Dutch study, however, showed no association between education and the average consumption of vegetables for both men and women[42]. Some papers have focused on social differences in average nutrient intake such as vitamin C, retinol and fibre. Negative associations were found for men and women in Great Britain but not in Italy[7,43] which is again in agreement with our results.

Explanations for the social gradients in risk factors

Until now, only a few studies have focused on the explanation of social gradients in risk factors for disease[11]. For the social gradients in the risk factors considered in this study, different categories of explanations may be important[44]. One explanation is that socio-economic groups differ in cultural factors such as tastes, attitudes, beliefs, orientation towards the future and knowledge. Several studies have, for example, shown that socio-economic groups differ in their attitudes toward health related behaviour[20]. A part of these differences might be caused by the way in which health promotion campaigns are organised. Many health education programmes are thought to have resulted in a decrease in unhealthy behaviour among higher socio-economic groups more than in lower groups[8]. A second group of factors which might play a role are structural factors such as income, and living and working conditions. Material deprivation, for example, can directly lead to the inability to buy healthy food. In addition, relative poverty in the lower socio-economic strata may also lead indirectly, e.g. via stress, to unhealthy behaviour such as smoking[45]. This indirect effect is closely connected to the third group of factors which could be relevant i.e. psychosocial factors. Persons from lower socio-economic strata may be confronted with stressful circumstances more often, and they may have less coping resources to handle stress[46]. Stress and limited coping resources are related to smoking and excessive alcohol consumption[47,48]. A higher level of stress in lower socio-economic strata might therefore lead to a less healthy lifestyle in these strata. Finally, social mobility and selection processes could also contribute. A number of studies suggest that lean individuals have a higher upward social mobility rate and a lower downward mobility rate than obese peers[49]. Among women, social mobility through marriage has been related to fatness and weight, with leaner women more often marrying into higher socio-economic classes[50].

An interesting question is why the social gradients of the risk factors we studied vary between countries. A north-south pattern was found for smoking among women and to a lesser extent for heavy smoking among men. A possible explanation for this pattern is that there exists a timelag between the north and the south of Europe. In the 1950's, smoking was a habit of men of all socio-economic groups but since that time the percentage of smokers among men declined in many northern European countries, possibly as a results of the emerging awareness of the health hazards of smoking. This decline was faster in the higher socio-economic groups than in the lower socio-economic groups[14,19,51] and resulted in a negative association between smoking and socio-economic status. The same was observed for women in Great Britain[19]. For other northern countries like the Netherlands, smoking was in the 1950's a habit of women with a higher socio-economic status. Smoking prevalence rates increased during the sixties and the seventies. This increase was followed by a decline in the percentage of smokers, especially among women in the higher socio-economic groups, and resulted in a reversal of the social gradient in the 1970's[52]. It is possible that the changes in the social gradients in smoking which have taken place in northern countries have occurred much later among men in the southern countries and have not taken hold for women in these

countries. This is supported by studies from Italy and France[53-55]. A possible explanation for the time lag between the north and south is that anti-smoking campaigns started later in the south than in the north. It is, however, unlikely that this alone explains the large delay between the north and the south. The time lag could also be related to the fact that, in the last decades, people from the south have been confronted with death due to smoking in their direct environment less often. This might have resulted in a slower change in smoking behaviour despite a diffusion of knowledge about the adverse effects of smoking.

For excessive alcohol consumption among men, small inequalities were consistently found for Denmark, Belgium and the Netherlands. These small inequalities might be due to the small income inequalities[56] and the low average alcohol consumption in these countries. Excessive alcohol consumption is a way of coping with stressful circumstances in life, such as unemployment and material deprivation[57]. It might be expected that especially among populations with a high average consumption of alcohol, this type of stress could lead to alcohol abuse. Therefore, it may be expected that inequalities are smaller in egalitarian countries with a low per capita alcohol consumption.

For infrequent vegetable consumption among men, large positive associations were found for northern countries whereas for southern countries associations were small or were reversed. For women, only Great Britain and Denmark showed relatively large inequalities. The pattern might be linked to structural characteristics such as the availability of fresh vegetables. A study in Scotland which compared the availability of fruit and vegetables in two socially contrasting localities found a lower availability in the "worse" locality[58]. In less industrialised countries, e.g. southern Europe and Ireland, more people grow their own vegetables and, therefore, they might be better available and less expensive. Accordingly, smaller differences between socio-economic groups may be expected in southern Europe and Ireland. This is the case for men, but not for women. Cultural factors such as traditional dietary habits and the extent to which they are adhered to by different social groups might also play a role, although we have no clear information to assess the role of these factors.

For overweight, relatively small inequalities were found for men in Ireland, Spain, Portugal, and Greece, whereas for women inequalities were approximately the same in all countries. These patterns might be related to differences in prosperity between countries. In developing countries, associations are positive, whereas in most industrialised countries associations are negative, possibly due to the abundant availability of food and the decline of heavy physical labour among lower socio-economic groups[16]. It seems that the social gradient for overweight reverses when a country develops economically. The lower prosperity of disadvantaged groups in Ireland, Spain, Portugal and Greece (lower national income and larger income inequalities[56]) could have led to a longer persistence of a positive association than in other countries. The reversal to an inverse association would only recently seem to have been completed for men, whereas for women it probably occurred earlier for two reasons. First, for women differences

between social groups in the amount of physical labour undertaken varied less than for men. Second, parallel to changes in food availability and working conditions, the development of a country seems to be associated with a reversal of attitudes towards obesity (from "obesity is beautiful and healthy" to "obesity is ugly and unhealthy"[16]) and this appears to also have occurred among women first.

Explanation of international variations in socio-economic health inequalities

In the last decade, socio-economic health inequalities have been increasingly studied from an international perspective. Most international comparisons showed that the size of health inequalities varies between countries. The most recent and comprehensive international study showed that in the Scandinavian countries and the Netherlands inequalities in morbidity and mortality were not smaller and may be even somewhat larger than in the southern part of Europe, Germany and Switzerland[12]. Until now, explanations of variations in socio-economic inequalities mainly focused on differences between countries in welfare policy and living standards. However, international variations in the social gradients of risk factors could also be relevant.

Information on the social gradients of risk factors in the period before health inequalities were measured is required in order to estimate the contribution of social gradients of risk factors to current socio-economic inequalities in health. Nevertheless, it is interesting to determine whether the reported international patterns of socio-economic gradients of morbidity and mortality are consistent with the recent international variations in the social gradients of risk factors found in this study. All risk factors in this study are a risk factor for ischaemic heart disease (IHD). For this cause of death among men, relatively large inequalities were reported in the northern European countries and small inequalities in the more southern countries[17]. In this study, we found evidence for a similar north-south pattern among men for heavy smoking and infrequent vegetable consumption. Also for overweight, relatively small social gradients were found in some of the southern European countries.

Smoking and excessive alcohol consumption are important risk factors for cerebrovascular disease (CVA) mortality. Relatively large social inequalities in CVA mortality were found for Portugal, England and Wales, Ireland and France, and smaller inequalities for the Scandinavian countries and Spain[17]. The results of the most stringent definition of excessive alcohol consumption were in accordance with this pattern. It also agrees with our results for smoking, for which relatively large inequalities were found for Ireland, and England and Wales. For the other countries, however, inequalities in smoking were not highly correlated to the size of inequality for CVA mortality, suggesting that alcohol consumption is one of the main behavioural factors contributing to the social gradient in CVA in these countries.

A third single cause of death for which smoking is a major risk factor, is lung cancer. With exception of Portugal, significant inequalities for lung cancer were observed for other southern countries as well as for northern countries[17]. Our results for smoking are in agreement with these results for Portugal but not for the other southern countries.

The most recent international comparison on international variations in the size of educational-related inequalities in self-reported general morbidity showed that in the northern part of Europe inequalities are not smaller, and may be even somewhat larger than in the rest of Europe[17]. The north-south patterns for smoking and vegetable consumption found in this study could contribute to this pattern.

Aside from the explanation of known patterns of socio-economic health inequalities, this study suggests that in the future, countries might differ in the type of health problems in which socio-economic groups differ from each other. Our results for smoking imply that in the southern European countries, mortality due to lung cancer and respiratory diseases among women might be higher in the higher socio-economic groups for the next 10 to 20 years.

Conclusions

These results suggest that smoking and overweight possibly contribute to the existence of socio-economic inequalities in morbidity and mortality among men and women in most EU member countries. Infrequent vegetable consumption seems to contribute to health inequalities only in some of the countries we studied, whereas excessive alcohol consumption seems to contribute to socio-economic inequalities in health among men only.

There is strong evidence for international variations in the size of inequalities for most risk factors. A north-south pattern was found for smoking among men and women, and for vegetable consumption among men. For the remaining risk factors, other patterns were found.

These international patterns give indications about the circumstances that influence the degree to which risk factors are unequally distributed over socio-economic groups. Further, the results suggest that international variations in the size of inequalities in risk factors might be relevant for understanding why socio-economic inequalities in morbidity and mortality are larger in some countries than in others.

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7 Socio-economic differences in smoking in 12 European countries

Objective
This study investigates international variations in social gradients in smoking.

Data and methods
Smoking data by educational level were obtained from national health surveys or similar surveys around 1990 from 12 western European countries. Relative differences (odds ratios) and absolute differences in the prevalence of ever-smoking, current smoking, current cigarette smoking and the average number of cigarettes smoked per smoker were calculated for men and women aged 20 to 44 and 45 to 74 years, respectively.

Results
For older subjects, higher rates of current and ever-smoking among the low educated were only found for some countries. For older women (range ORs: 0.05-2.73), higher prevalence rates among the low educated were found in Great Britain, Norway and Sweden. In southern European countries, higher educated women smoked more. A north-south pattern, although less marked, was also found for older men (range ORs: 0.51-1.74). Differences for young subjects were generally larger than for older subjects. For younger subjects, prevalence rates were, in most countries, higher among the low educated. The size of the differences among young women (range ORs: 0.14-2.64) showed a similar north-south pattern as for older age groups. Among young men (range ORs: 0.70-2.87) large differences were found for northern as well as for most southern countries, except for Portugal.

Conclusion
International variations in social gradients in smoking, which are related to differences between countries in their stage of the smoking epidemic, may have contributed to the fact that socio-economic differences in mortality in northern countries are not smaller than in southern European countries. The observed age patterns suggest that the size of socio-economic differences in smoking-related diseases will increase in the coming decades in many European countries.

Table 7.1 Overview of countries included in the study, their surveys and some survey characteristics.

Country	Year	Name	Non-response rate (%)	Number of respondents aged 20-74 years[1] (*1000)	Interview method on smoking behaviour[2]
Denmark	1986/87	Danish Health and Morbidity Survey	20	4.0	face
Finland	1990/91	Health Behaviour among the Finnish Adult Population	26	6.7	self-admin.
France	1991	Enquête sur la Santé et les Soins Medicaux	17	13.4	face
West Germany	1988/91	Life and Health in Germany (National Health Survey)	30	10.6	self-admin.
Great Britain	1990/91	General Household Survey	15	15.0	face
Italy	1990/91	Multiple Household Survey	11	37.0	face
Netherlands	1991/92	Netherlands Health Interview Survey	43	10.2	self-admin
Norway	1992/94	Multi Purpose Survey	25	5.0	face
Portugal	1987	National Health Survey	26	23.7	face
Spain	1987	National Health Survey	10	24.9	face
Sweden	1991	Swedish Level of Living Survey	21	4.9	face
Switzerland	1992/93	Swiss Health Survey	29	13.3	teleph.

[1] Upper and lower age limits for West Germany are 24 and 69 years respectively; upper age limit for Finland is 64 years; lower age limit for Portugal is 25.

[2] Face = face-to-face interview, self-admin. = self-administered questionaire, teleph. = telephone interview.

7.1 Introduction

Several studies have addressed the question whether socio-economic differences in health are smaller in some countries than in others. A recent and comprehensive international study found, in contrast to earlier international studies[1,2], that in the Nordic countries and the Netherlands differences in health are as large or perhaps even larger than in other western European countries[3,4]. The results of these international comparisons raise questions about socio-economic gradients in specific risk factors for disease, such as tobacco consumption. Are there substantial variations between European countries in the magnitude of socio-economic differences in smoking? And if so, can these variations help to explain why health inequalities might be relatively large in Nordic countries and the Netherlands?

Until now, only a few studies have compared countries with respect to the magnitude of socio-economic differences in smoking[5-7]. The most comprehensive comparison was made by Pierce, who described differences in smoking prevalence by educational level in the UK, Finland, Sweden, Norway and France around 1987[6]. In all these countries, lower educated men and women smoked more than the higher educated. The largest differences were observed for the UK and Norway. The international comparability of the data used in this study was, however, far from optimal[5,6].

Our study compares 12 European countries with respect to the magnitude of socio-economic differences in smoking. It uses data from national health interview or similar surveys for 1986-1994. Many efforts were made to optimize the comparability of the data, among others by intensive cooperation between national teams.

7.2 Data and methods

Table 7.1 shows the countries included, the surveys used and some basic survey characteristics. The study was restricted to respondents aged 20 to 74 years. Separate analyses were performed for men and women and for two broad age groups, 20 to 44 and 45 to 74 years. Four smoking variables were defined: the percentage of persons who ever smoked (ever-smokers, i.e. current and former smokers), the percentage of persons who were current smokers, the percentage of persons who were current cigarette smokers and the average number of cigarettes smoked by cigarette smokers. Educational level was used as an indicator of socio-economic status. It was measured as the highest level of education a person has completed. National educational levels were re-grouped according to a standard classification of five hierarchic levels[8]: (1) no education completed, (2) first level (primary school), (3) lower secondary level, (4) upper secondary level and (5) third level, which includes university and other forms of post-secondary education. In most analyses these five groups were collapsed into two broad groups: the

low educated group comprised levels 1 to 3 and the high educated group comprised levels 4 and 5.

Differences between the two broad educational groups in the percentage of current (cigarette) smokers and ever-smokers were calculated for each country, sex and age group separately. To this end, we performed logistic regression analyses using the high educational group as the reference group. A nominal variable representing 5 year age groups was included in the regression model to correct for age. The regression coefficients and their standard errors were used to calculate odds ratios and their 95%-confidence intervals. Additional analyses for all countries combined were performed to test whether odds ratios varied significantly between countries.

The percentages of men and women aged 20 to 44 years in the low educational group were between approximately 15% to 40% in most countries but between 60% to 75% in Italy, France, Spain and Portugal. For those aged 45 to 74 years, the percentage were between approximately 45% to 75% in most countries and between approximately 80% to 95% in France and the southern European countries. Because the large cross-national variations in the size of the two broad educational groups might affect the cross-national comparability of the odds ratios, we also calculated, as a check to our results, a more sophisticated measure, the Relative Index of Inequality (RII)[9-11]. Advantages of this index are that all educational levels can be taken into account separately and that the size of the educational groups is taken into account. Countries can be compared on the basis of this index whenever a detailed hierarchical classification is available for each country. For the calculation of the RII, four hierarchic educational levels were distinguished for most countries: no education/first level, lower secondary level, higher secondary level and third level. The RII estimates showed generally the same international patterns as the odds ratios based on two broad groups; the correlation between the two indices was generally high ($r>0.9$, $p<0.01$). Because of the high correspondence between the two inequality indices, this study will present only one measure: the odds ratio comparing two broad groups.

Absolute rate differences were added to the odds ratio because they take into account differences between countries in the overall prevalence of smoking. Absolute differences were calculated by subtracting the prevalence rate of the higher educational group from that of the lower educational group. Indirect standardisation per country and sex was used to correct these prevalence rates for differences between the educational groups in age structure.

7.3 Results

Relative differences among women

Table 7.2 shows the smoking prevalence rates and the relative difference in smoking between educational levels among women, aged 20-44 and 45-74 years. The percentage

of ever-smokers among older women varied for most countries between 15% and 55% whereas the percentage of both current smokers and current cigarette smokers varied for most countries between 15% and 30%, respectively. For younger women, these percentages varied between 45% and 65%, and between 30% and 40%. Practically all current smokers were cigarette smokers.

Among older women, higher prevalence rates of ever-smoking among the low educated (odds ratios larger than 1) were found for Great Britain, Norway, Sweden and Denmark, whereas clearly higher prevalence rates among the high educated were observed for France, Italy, Spain and Portugal (odds ratios smaller than 1). For current smoking the same north-south pattern was observed. The odds ratios for current smoking were generally larger than for ever-smoking. This difference indicates that especially high educated women quitted smoking.

For younger women, odds ratios for ever- and current smokers were larger than for older women. Among young women, odds ratios for ever-smoking were larger than 1 for all countries, except for Italy, Spain and Portugal. Largest odds ratios were observed in Great Britain, Norway and Sweden. A similar north-south pattern was observed for current smoking, although odds ratios for most countries were again larger than those for ever-smoking.

Relative differences among men

Table 7.3 shows the results for men. The percentage of ever-smokers among older men varied generally between 70% and 80%, whereas the percentage of both current smokers and current cigarette smokers varied generally between 30% and 40%. For younger men, these percentages varied between 55% and 70%, and between 40% and 50%.

Among older men, odds ratios clearly higher than 1 were found for Great Britain, Norway, the Netherlands and Germany whereas odds ratios smaller than 1 were found for Spain and Portugal. For current (cigarette) smoking a similar pattern was observed, with the exception that relatively large differences were also found for Sweden. In most countries odds ratios for current smoking were larger than those for ever-smoking, implying that, in these countries, especially high educated men quitted smoking. Comparing the results of current smoking and current *cigarette* smoking learns that the percentage of smokers who just smoke pipes or cigars only exceeded 5% in Great Britain, Denmark, the Netherlands, Switzerland and Spain. Exclusion of this group of smokers led to an increase of the odds ratio in Great Britain, Denmark and the Netherlands because pipe and cigar smoking is more common among the high educated. In Spain and Switzerland, on the other hand, exclusion resulted in a decrease of the odds ratio.

For younger men, odds ratios for ever- and current smoking were larger than for older men. Among younger men, low educated were more often ever-smokers than high educated in most countries. Large differences were again found for Great Britain, Norway and Sweden but also for France. Similar international patterns were found for current (cigarette) smoking.

Table 7.2 Prevalence rates (%) and differences between low and high educated persons (Odds Ratio and 95% Confidence Interval; high educated group is reference category) in smoking for 12 European countries. Women.

	20-44 years									45-74 years								
	Ever smoking			Current smoking			Cigarette smoking			Ever smoking			Current smoking			Cigarette smoking		
	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI
Great Britain	49.4	2.04	1.78-2.34	34.6	2.50	2.17-2.89	34.5	2.52	2.18-2.91	51.4	1.58	1.34-1.86	27.6	2.07	1.70-2.51	27.5	2.05	1.69-2.50
Norway	58.2	3.21	2.53-4.11	37.5	2.64	2.09-3.34	37.0	2.60	2.05-3.29	51.4	1.84	1.37-2.48	28.9	2.73	1.90-3.93	28.5	2.68	1.86-3.86
Sweden	55.3	2.37	1.82-3.09	33.2	2.34	1.81-3.03			n.a.	45.9	1.22	0.94-1.56	26.7	1.41	1.06-1.87			n.a.
Finland	59.0	1.64	1.29-2.09	33.5	1.93	1.53-2.44	33.4	1.92	1.52-2.43	35.8	0.80	0.63-1.02	18.7	1.14	0.85-1.52	18.7	1.14	0.85-1.52
Denmark	61.2	1.27	0.85-1.90	49.1	1.28	0.87-1.89	48.5	1.29	0.88-1.91	65.9	1.14	0.84-1.48	45.3	1.20	0.89-1.60	39.9	1.22	0.91-1.65
Netherlands	67.2	1.58	1.33-1.87	41.1	1.67	1.43-1.94	40.9	1.69	1.45-1.97	51.4	0.75	0.62-0.90	24.2	1.37	1.10-1.70	23.8	1.37	1.10-1.71
Germany	60.4	1.25	1.04-1.51	39.0	1.52	1.26-1.82	38.6	1.51	1.25-1.81	34.1	0.63	0.53-0.73	18.5	0.98	0.81-1.20	18.2	0.98	0.80-1.19
Switzerland	50.8	1.24	1.04-1.48	32.5	1.50	1.26-1.80	32.2	1.51	1.26-1.80	35.5	0.89	0.76-1.04	18.7	1.16	0.96-1.40	18.4	1.16	0.95-1.40
France	46.6	1.10	0.96-1.26	31.2	1.36	1.18-1.58			n.a.	18.3	0.42	0.34-0.52	9.9	0.61	0.46-0.81			n.a.
Italy	33.5	0.99	0.91-1.08	25.5	1.10	1.01-1.21	25.5	1.10	1.00-1.21	19.9	0.37	0.32-0.43	13.3	0.46	0.39-0.54	13.2	0.46	0.39-0.54
Spain	48.1	0.53	0.47-0.60	39.7	0.57	0.50-0.64	36.1	0.57	0.50-0.64	6.5	0.22	0.16-0.29	3.9	0.29	0.20-0.42	3.4	0.26	0.18-0.38
Portugal	12.5	0.12	0.10-0.15	9.1	0.13	0.11-0.17	9.1	0.14	0.11-0.17	2.2	0.06	0.04-0.08	1.4	0.05	0.04-0.09	1.4	0.06	0.04-0.09
Interaction education • country			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001

n.a. = not available

Table 7.3 Prevalence rates (%) and differences between low and high educated persons (Odds Ratio and 95% Confidence Interval; high educated group is reference category) in smoking for 12 European countries. Men.

	20-44 years									45-74 years								
	Ever smoking			Current smoking			Cigarette smoking			Ever smoking			Current smoking			Cigarette smoking		
	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI	%	OR	95%-CI
Great Britain	58.9	2.01	1.71-2.37	42.2	2.26	1.94-2.64	36.3	2.52	2.15-2.94	78.4	1.58	1.31-1.89	36.5	1.74	1.47-2.05	28.0	2.18	1.82-2.62
Norway	59.7	2.71	2.12-3.46	40.0	2.87	2.28-3.60	38.6	2.74	2.18-3.43	75.5	1.39	1.05-1.84	34.7	1.73	1.33-2.24	31.2	1.54	1.18-2.01
Sweden	51.4	2.52	1.94-3.27	31.9	2.59	2.00-3.34			n.a.	68.7	1.08	0.84-1.40	30.3	1.50	1.15-1.96			n.a.
Finland	70.2	1.68	1.27-2.22	47.1	1.57	1.24-1.98	44.4	1.86	1.47-2.35	73.1	1.02	0.78-1.34	36.1	1.00	0.78-1.29	33.3	1.13	0.87-1.47
Denmark	64.7	0.94	0.64-1.38	50.0	1.34	0.94-1.91	44.1	1.55	1.09-2.22	85.1	1.11	0.74-1.67	55.2	1.06	0.79-1.43	38.0	1.23	0.91-1.68
Netherlands	69.1	1.66	1.39-1.99	46.3	1.81	1.55-2.12	41.8	2.08	1.78-2.44	88.1	1.25	0.95-1.64	42.7	1.21	1.02-1.45	36.6	1.59	1.33-1.91
Germany	71.7	1.51	1.24-1.82	48.8	1.56	1.32-1.85	46.2	1.64	1.39-1.93	74.9	1.31	1.08-1.58	34.8	1.50	1.27-1.78	30.7	1.66	1.39-1.98
Switzerland	57.7	1.35	1.09-1.66	42.0	1.23	1.01-1.51	36.2	1.29	1.05-1.58	72.0	1.13	0.91-1.42	33.7	1.31	1.06-1.61	20.8	1.09	0.85-1.39
France	66.6	2.27	1.96-2.63	48.0	2.32	2.01-2.68			n.a.	71.6	1.02	0.84-1.25	31.2	1.19	0.97-1.45			n.a.
Italy	57.3	1.69	1.56-1.83	44.3	1.69	1.56-1.82	43.9	1.73	1.60-1.87	71.1	1.11	0.98-1.26	37.8	1.09	0.97-1.23	37.0	1.16	1.03-1.30
Spain	75.4	1.43	1.26-1.62	64.2	1.54	1.37-1.72	55.8	1.35	1.20-1.50	75.9	0.94	0.77-1.14	48.9	0.97	0.82-1.15	37.9	0.86	0.72-1.02
Portugal	62.0	0.70	0.61-0.81	47.2	0.80	0.70-0.91	46.8	0.82	0.72-0.94	54.2	0.51	0.43-0.61	27.7	0.65	0.54-0.77	27.4	0.68	0.57-0.81
Interaction education•country			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001

n.a. = not available

Absolute differences

Figure 7.1 shows the absolute differences in current smoking between educational levels, by sex and age group. These absolute differences showed the same international patterns as the odds ratios. A high degree of correspondence between absolute and relative measures was also observed for ever-smoking and current cigarette smoking (results not shown).

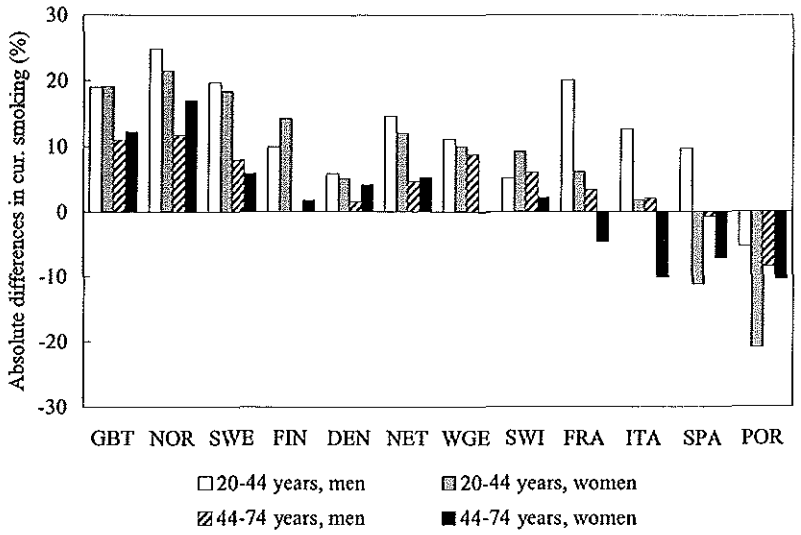

Fig. 7.1 Absolute differences between low and high educated persons in current smoking. Men and women aged 20-44 and 45-74 years.

Differences in the average number of cigarettes

Table 7.4 shows the results for the average number of cigarettes smoked per cigarette smoker. This number varied generally between 12 and 16 (women), and between 15 and 20 (men) cigarettes. For women, a higher average consumption of cigarettes among the low educated was found for Great Britain, the Netherlands, Finland, and Germany. In Spain, a higher average consumption of cigarettes was found among high educated women. For both old and young men, a higher average consumption of cigarettes among the low educated was found for Great Britain, the Netherlands, Denmark, Germany and Italy. A higher average consumption of cigarettes among the high educated was found for Swiss men.

Table 7.4 Mean number of cigarettes smoked by cigarette smokers and the differences in mean number of cigarettes smoked between low and high educationed persons for 9 European countries. Women and men, aged 20-44 and 45-74 years.

	Women				Men			
	20-44 years		45-74 years		20-44 years		45-74 years	
	Mean	Difference	Mean	Difference	Mean	Difference	Mean	Difference
Norway	12.0	-1.7	12.4	1.0	15.2	1.4	14.5	-0.9
Finland	12.2	2.7	13.0	1.5	17.2	1.6	20.0	-1.5
Denmark	13.2	-0.1	12.7	-0.9	15.8	0.3	14.5	1.1
Great Britain	14.3	3.0	13.8	1.4	17.2	2.6	16.9	0.6
Netherlands	15.9	3.0	14.8	1.8	17.5	1.9	17.0	0.4
Germany	15.8	1.1	14.4	0.9	20.4	1.7	19.1	1.2
Switzerland	13.3	0.9	13.5	0.0	17.5	-2.7	20.3	-1.1
Italy	12.1	0.2	12.5	-0.5	17.3	1.6	17.8	0.5
Spain	5.9	-2.2	1.3	-1.5	12.4	1.8	9.1	-0.5

7.4 Discussion

Evaluation of remaining data problems

A potential data problem relates to the accuracy of survey estimates of smoking prevalence rates. Non-response and the use of self-report to measure smoking probably lead to an underestimation of national smoking prevalence rates[12,13]. However, the international patterns reported here are only biased when this underestimation is associated with education, and moreover when countries vary in the strength of this association. A Swedish study investigated the effect of non-response (37%) in a health survey on observed socio-economic differences in smoking[14]. Despite large differences in smoking rates between respondents and non-respondents, socio-economic differences in smoking were not substantially or consistently under- or overestimated. This suggests that non-response only might have had a small effect on the results of this study. A few other studies have investigated whether underreporting of smoking in self-report is related to socio-economic status. Suadicani et al found no association between underreporting and socio-economic status among middle aged Danish men[15]. Wagenknecht et al[16] did find a higher rate of underreporting of smoking among the low educated for men and women from the United States. A study among immigrants from southeast Asia to the United States also found an association for women but not for men[17]. These inconsistent results seem to imply that the magnitude of the association between education and underreporting varies between countries, between men and women, and perhaps also over time, possibly due to variations in social norms concerning smoking. Therefore, we cannot exclude the possibility that the international position of some countries is somewhat biased as a result of the use of self-report to measure smoking. However, it is

unlikely that the marked international patterns that we observed can be explained completely in this way.

Other problems concerning the comparability of smoking data relate to differences between countries in interview method, and the structure and phrasing of the questions used to measure smoking behaviour. However, the effect of these differences on the international patterns reported in this study are probably marginal since, as will also be discussed in the next section, the estimated smoking differences of this study correspond fairly well with the estimates we obtained by using an international data source with similar interview methods and questions for all countries[18].

Results of other studies

The results of national studies that used other data sources but refer to approximately the same period as this study agree well with our results[19-29]. For instance, other studies from the south of Europe for instance also found very weak negative or positive associations between socio-economic status and smoking among women[21,23,28,29].

A preliminary international comparison was made by Pierce[5,6]. The results should be taken with caution since the educational classifications used in his study differed between countries[5], and because information on the comparability of the smoking data and the study populations is lacking. Nevertheless, Pierce also reported relatively large differences in smoking in Great Britain and Norway, and smaller differences in Finland. But in contrast to our study, he found relatively small differences for men and women from Sweden[5].

In another study, we calculated the size of educational differences in current smoking for men and women aged 20 to 74 years using data from the international Eurobarometer surveys[30]. Advantages of this latter survey are that the interview methods and questions are highly comparable. Disadvantages are, however, the higher non-response rates, the smaller number of respondents and the lack of data on most Nordic countries. For the remaining countries, the results of that study correspond well to the results of the present study (for the two age groups combined)[18]. The Eurobarometer data, for example, also showed a north-south pattern for women, and relatively small differences among men from Denmark as compared to Great Britain. A relatively large discrepancy was found only between the results for young men from France, for whom the Eurobarometer data showed much smaller differences than the national survey used in this study.

Explanations of our results

Several studies have shown that the habit of smoking diffuses within societies like an epidemic with four different stages[31-34]. During stage 1, smoking is still an exceptional behaviour and mainly a habit of higher socio-economic groups. Throughout stage 2, smoking becomes more common. In that stage, smoking rates among men peak at 50-80% and are equal in different socio-economic groups or are higher among the higher socio-economic groups. The diffusion of smoking among women lags 10-20 years

behind that of men. Smoking is first adopted by women from higher socio-economic groups. During stage 3, prevalence rates among men decrease to about 40% since many men stop smoking, especially the better off. Women reach their peak rate (35-45%) during this stage and at the end of this stage their rates start to decline too. In stage 4, prevalence rates keep on declining slowly for both men and women and smoking becomes more and more a habit of the lower socio-economic groups. During the smoking epidemic there is a reversal from a positive to a negative association between socio-economic status and smoking.

The countries included in this study are in different stages of this smoking epidemic. On the basis of what is known from other national studies[31] about the smoking epidemic in these countries, the southern European countries appear to be in stage 2 (Portugal) or in the beginning of stage 3 (Spain, Italy, France) whereas northern European countries appear to be at the end of stage 3 or in stage 4. These differences between countries in the progression of the smoking epidemic might explain the international variations in the social gradients in smoking we observed in this study.

As the smoking epidemic proceeds, smoking becomes more concentrated in lower socio-economic groups. Therefore, one would expect differences in smoking to be larger in countries where the smoking epidemic is more advanced. Among women, national smoking rates in the countries included in this study are still increasing, stable or only just starting to decline. This means that a *higher* smoking prevalence rate among the female population in a country indicates a more advanced progression of the smoking epidemic in that country. Thus, one would expect higher national smoking rates among women to be associated with larger socio-econonomic differences in smoking. Indeed, for both older (see figure 7.2a) and younger women, positive associations are observed between national smoking prevalences and odds ratios. The correlations were 0.70 (p=0.01) and 0.43 (p=0.17), respectively. For men, national smoking rates are decreasing in all countries, except Portugal. This means that among men a *lower* prevalence rate in a country is an indicator of the progression of the smoking epidemic in that country. Thus, one would expect lower national smoking rates among men to be associated with larger socio-economic differences in smoking. Indeed we found negative correlations between the national smoking rates and the odds ratios among both older and younger (see figure 7.2b) men. The correlations were -0.17 (p=0.11) and -0.49 (p=0.11), respectively. These results suggest that variations in the social smoking gradients between European countries are related to differences in the progression of the smoking epidemic in different parts of Europe.

One possible explanation for the time lag between the north and south in the smoking epidemic which is observed in this study and is supported by national studies, are differences in economic development and income inequalities. Due to their relatively low purchasing power, the lower socio-economic groups in Spain and Portugal may not have been able to afford the consumption of cigarettes. Another explanation may be that information on the health hazards of smoking which became known in the 1950's, was

spread later on a large scale in the south of Europe than in the north of Europe. It is, however, unlikely that this alone explains such a long lag time. An associated explanation is that smoking has been valued positively longer in the south, despite of available knowledge on the effect of smoking on health. One can only speculate about reasons for this. It might be related to the fact that in the south people have been confronted less often with smoking related deaths in their direct (family) environment. National mortality rates of ischaemic heart disease have been relatively low in southern Europe, even in spite of high smoking rates among men in the south, which is probably due to the protective effect of the southern dietary habits.

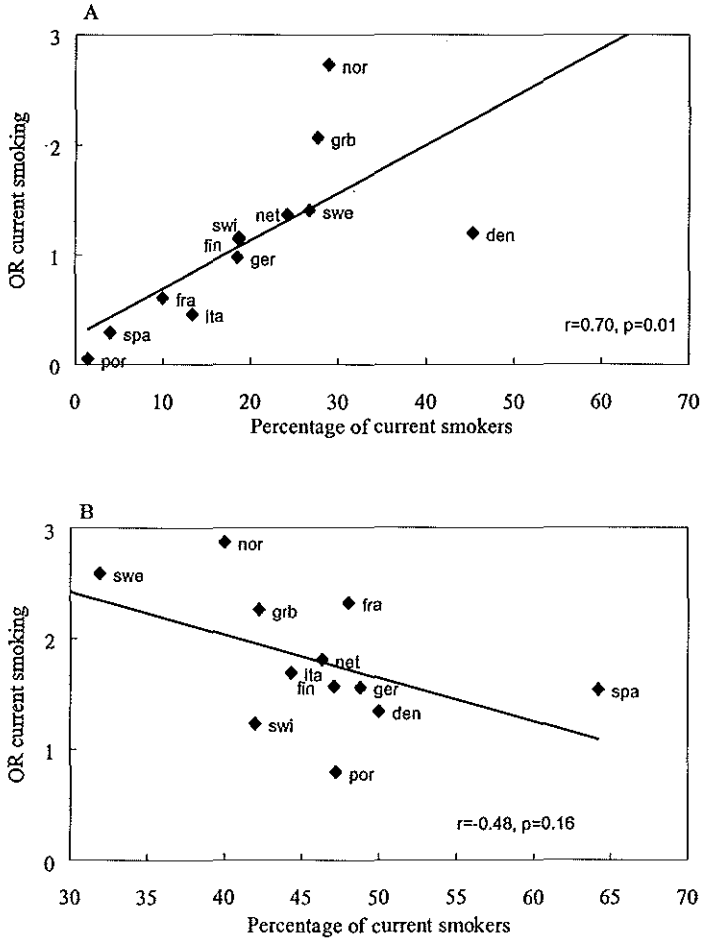

Fig. 7.2 The size of inequality in current smoking (odds ratio) plotted against the prevalence rate of current smoking. A. Women, aged 45-74 years. B. Men, aged 20-44 years.

Another reason might be the closer cultural affinity between northern Europe and the United States than between southern Europe and the United States. Because social norms with respect to smoking and smoking rates first changed in the United Stated, it is conceivable that they have diffused more rapidly across northern European countries[35]. The difference in time lag between men and women is linked to a widespread social disapproval of women.s smoking in the beginning of this century. Maybe the fact that health education in the beginning was mainly directed to men also played a part in the delay[36]. The fact that the emancipation of women which included the social acceptance of women.s smoking, in the southern countries lags behind that in northern countries, might have widen the timelag between the north and south of Europe among women as compared to men.

Contribution to socio-economic differences in health

In order to estimate whether the international variations in the social gradients of smoking might contribute to the recently reported international patterns of socio-economic gradients in health, information on social gradients in smoking some years before the measurement of health differences is necessary. However, since we considered ever-smoking as well as current smoking we think we have partly overcome this problem.

A recent comprehensive international comparison showed that socio-economic differences in total mortality and self-reported morbidity in the Nordic countries and the Netherlands are as large as or even perhaps somewhat larger than in other western European countries[3]. These results were surprising since it has often been suggested that health differences are smaller in countries with a tradition of egalitarian socio-economic and other policies. The results of this study suggest that the relatively steep social gradients in smoking in the north of Europe have contributed to the fact that health differences in the north are not smaller than in the south.

Kunst et al[4] studied differences in cause-specific mortality by occupational class for men aged 45 to 59 years using data from the eighties. They observed large differences in ischaemic heart disease in Great Britain and the Nordic countries and small differences in Switzerland, France and more southern countries. This pattern is largely consistent with the north-south pattern we found for differences in smoking behaviour among men aged 45 to 74 years. Analyses showed a significant positive association between the size of differences in ischaemic heart disease and differences in current ($r=0.65$, $p=0.06$) and ever-smoking ($r=0.76$, $p=0.02$). For lung cancer, large differences were observed for northern countries, with Finland in the leading position, as well as for southern countries[4]. An exception was Portugal for which no differences were observed. These Portuguese findings are in accordance with our results for smoking but overall there are remarkably no strong associations between the size of differences in lung cancer and differences in current ($r=0.22$, $p=0.57$) and ever-smoking ($r=0.38$, $p=0.31$). A possible explanation for the lack of a clear association is that other risk factors for lung cancer, e.g. high exposure to carcinogenic substances at work may have increased lung cancer mortality among the lower socio-economic groups in southern countries[4].

Another explanation is that the smoking data cannot give an accurrate estimate of life-time exposure to smoking in the concerning birth cohorts.

Until now, studies on socio-economic differences in mortality among adults mainly concerned men born before the second world war. This study showed that social gradients in current and ever-smoking among men and women born after the second world war (those aged 20-44 in this study) are more unfavourable for the low educated as compared to men born before that war (men aged 45-74 in this study). This suggests that if no special action is undertaken to reduce smoking rates among lower socio-economic groups there will be an increase in socio-economic differences in smoking-related morbidity and mortality in the coming decades in many European countries.

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8 Variations in height between countries and between socio-economic groups: an overview of 10 European countries

Objective
This study gives an overview of variations in average height between 10 European countries and between socio-economic groups within these countries.

Data and methods
Data for men and women aged 20-74 years were obtained from national health or similar surveys of 1987-1994. Height was self-reported in most surveys. Regression analyses were used to estimate height differences between educational groups and to evaluate whether the differences in average height between countries and between educational groups were smaller among younger birth cohorts than among older birth cohorts.

Results
Men and women were on average tallest in the Netherlands, Norway, Sweden and Denmark and shortest in France, Italy and Spain (range for men: 1.70-1.79 cm; range for women: 1.60-1.67 cm). The differences in average height between northern and southern countries were not smaller among younger birth cohorts than among older birth cohorts. In most countries, the mean height increased linearly with increasing year of birth by approximately 0.7-0.8 cm/5-year for men and approximately 0.4 cm/5-year for women. Lower educated men and women were in all countries on average shorter than higher educated men (range of differences: 1.6-3.0 cm) and women (range of differences: 1.2-2.2 cm). No clear international pattern was found with respect to the size of education-related height differences. Education-related height differences were in most countries not smaller among younger birth cohorts than among older birth cohorts.

Conclusion
The equally strong increase in attained height between generations born between ca. 1920-1970 in the north and south of Europe indicates a high degree of similarity between countries in the improvement of childhood living conditions between these countries. The persistence of education-related height differences, even in more prosperous countries, suggests that childhood living conditions in all countries will continue to contribute to socio-economic differences in both height and health over the next decades.

8.1 Introduction

Although height is largely genetically determined, it is also affected by childhood nutritional conditions as well as other living conditions such as the occurrence of disease, psychological stress, housing conditions and physical strenuous work at young ages[1-4]. Several studies have found an association between height and health and the length of life[5,6]. Comparing the average height of countries and subgroups within countries, such as different socio-economic groups, therefore provides a powerful tool to delineate differences between or within countries in current and future health prospects.

The average height has consistently been found to increase between subsequent birth cohorts. Improvements in poor living conditions have been suggested to lie behind this relationship. Therefore, secular trends in height give insight in changes in childhood living conditions and its effect on health over time[2,3,7].

Only a few studies have compared height variations between a broad range of countries using nationally representative samples. Eveleth and Tanner[8] produced a world-wide overview of variations in human growth in children aged 2 to 16 years. They used data from studies undertaken in the fifties and the sixties that were based on nationally representative samples or on samples from large cities within the countries studied. Identical growth curves were observed for European countries, but at the age of 16, children in northern countries were on average taller than in southern countries. Studying height variation among children has, however, the disadvantage that it is not possible to estimate variations in finally attained height, since it is uncertain to what extent differences in height during childhood can be compensated by catch-up growth and an extension of the growth period. De Groot et al[9] compared the height of elderly subjects born between 1913 and 1918 in 19 cities across Europe. They found that subjects were tallest among northern European populations. There are no studies which compared height differences between countries among the adult population using nationally representative data.

Many studies have reported on height variations between subgroups of populations such as socio-economic groups. Most of these concerned children or specific populations such as conscripts to military service[2,10-17]. Meredith, for example, gave a world-wide overview of variations in the body size of children in relation to the socio-economic status of their parents using data from studies from the thirties to the seventies[15]. In general, children with a high socio-economic status were on average taller when compared to children with a low socio-economic status. The size of these differences seemed to vary between countries. Only a few studies in the north of Europe investigated socio-economic height differences among adults using nationally representative data[18-21]. One of these studies compared the size of socio-economic differences between countries. Kunst et al[21] estimated education-related height differences among adults in 5 northern European countries. In all countries, higher socio-economic groups were on average taller than lower socio-economic groups. The size of these differences, for both men and

women was relatively large for Denmark and Germany, intermediate for Finland and the Netherlands and small for Sweden. No studies have, however, reported on socio-economic height differences among adults in more southern European countries.

Several studies have focused on the question whether the size of socio-economic height differences varies over time. Studies among adult populations born before the sixties in Sweden and Denmark[12,18] suggest that height differences are lessening with successive generations. This is supported by studies among juvenile populations born during the fifties and the sixties in Norway and Sweden[10,11] which showed that these differences have disappeared in these countries. However, other studies from Great Britain and Sweden[22,23] among adults born between 1920 and 1960 did not observe decreasing differences. For many European countries, no studies have investigated whether social gradients in height are diminishing.

The present study gives a comprehensive overview of height variations for men and women born between approximately 1920 and 1970 in 10 countries from the north, the west and the south of Europe. Data are used from health surveys or other nationally representative surveys carried out in the period 1987-1994. Firstly, we compared differences in average height between countries and between socio-economic groups within countries. Secondly, we addressed the question whether height differences between countries, and between socio-economic groups within countries are smaller among younger birth cohorts than among older birth cohorts.

8.2 Data and methods

Table 8.1 shows the countries included, the surveys used and some basic survey characteristics. Data sets on height by sex, 5-year age groups and educational level were created by country representatives and analysed centrally. The study included men and women aged 20 to 74 years. Exceptions were Germany and Finland for which the age limits were 24 to 69 years and 20 to 64 years, respectively. Height was self-reported in all countries, except Germany, and was registered in whole centimetres. Educational level was used as an indicator of socio-economic status. It was measured as the highest level of education a person has completed. National educational levels were re-grouped according to a standard classification of five hierarchic levels[24]: (1) no education completed, (2) first level (primary school), (3) lower secondary level, (4) upper secondary level and (5) third level, which includes university and other forms of post-secondary education. In the results presented below, these five groups were collapsed into two broad groups: the low educated group comprising levels 1 to 3 and the high educated group comprising levels 4 and 5.

Table 8.1 Overview of countries included in the study, the surveys used and some survey characteristics.

Country	Year	Name	Non-response rate (%)	Number of respondents aged 20-74 years (•1000)
Norway	1992/94	Multi Purpose Survey	25	5.0
Sweden	1991	Swedish Level of Living Survey	21	4.9
Finland	1990/91	Health Behaviour among the Finnish Adult population	26	6.7
Denmark	1986/87	Danish Health and Morbidity Survey	20	4.0
Netherlands	1991/92	Netherlands Health Interview Survey	43	10.2
Germany	1988/91	Life and Health in Germany (National Health Survey of the former FRG)	30	10.6
Switzerland	1992/93	Swiss Health Survey	29	13.3
France	1991	Enquête sur la Santé, et les Soins Medicaux	17	13.4
Italy	1990/91	Multiple Household Survey	11	37.0
Spain	1987	National Health Survey	10	24.9

Estimates of the average height for men and women were made in each country for the total population and for 10-year birth cohorts. In order to evaluate whether differences in average height between countries are smaller among younger birth cohorts than among older birth cohorts, we estimated the change in average height for each country with increasing year of birth, or in other words, with falling age. To estimate the change in average height with increasing year of birth, we used ordinary least squares regression analyses and included 5-year age groups as a continuous variable (11=20-24, 10=25-29 years, .. , .., 1=69-74) into the regression model. The resulting regression coefficient can be interpreted as the change in average height per 5-year increase in year of birth. Subsequently, analyses were performed to test whether the change in height with increasing year of birth varied between countries. For this, all countries were combined into one regression analysis and an interaction term for country and age (continuous variable) was included in the regression model. The F-test was used to test whether inclusion of the interaction term improved the model with statistical significance.

Differences between the two broad educational groups in mean height were calculated for each country and sex separately, using ordinary least squares regression analyses. In the regression model, educational level was represented by a binomial variable with the low educational group as the reference group. Nominal variables representing 5-year age groups were included in the regression model to control for age. The resulting regression coefficient can be interpreted as the average height of the high educational group minus the average height of the low educational group, i.e. the number of centimetres that higher educated people are on average taller than lower educated people. Additional analyses were performed to test whether the size of education-related height

differences varied between countries. For this, all countries were combined into one regression analysis and an interaction term for country and education was included in the regression model. The F-test was used to test whether inclusion of the interaction term improved the model with statistical significance.

Finally, for each country, regression analyses were performed in order to estimate whether the size of the difference in height between educational groups varied systematically between younger and older birth cohorts. To explore this, an interaction term for age (continuous variable) and education was added to the model. The accompanying regression coefficient can be interpreted as the change in the size of educational differences in height per 5-year decrease in age or, in other words, per 5-year increase in year of birth.

8.3 Results

Table 8.2 shows the mean height of the population by country and sex. The mean height of adult men and women varied between 170 cm and 179 cm, and between 160 cm and 167 cm, respectively. Men and women were on average tallest in the Netherlands, Norway, Sweden and Denmark and shortest in France, Italy and Spain. The differences in mean height between the north and the south of Europe were larger among men than among women.

Table 8.2 Mean height (cm) by country and sex.

Country	Men	Women
Norway	179.1	165.9
Sweden	178.1	164.7
Finland	177.3	164.1
Denmark	177.5	165.4
Netherlands	179.1	167.2
Germany	175.7	162.7
Switzerland	175.6	164.1
France	173.4	161.9
Italy	172.5	162.3
Spain	170.3	160.4

Figure 8.1 illustrates the mean height according to year of birth (based on estimates for 10-year birth cohorts) per country, for men and women, separately. For most countries, the mean height increased approximately linearly with increasing year of birth. Exceptions were Sweden, Norway and Finland for which no clear increase in height was observed between the two youngest birth cohorts, especially among men. Remarkably, the mean height of the youngest birth cohorts in southern European countries was still

below the mean height attained by the oldest birth cohorts in most northern European countries.

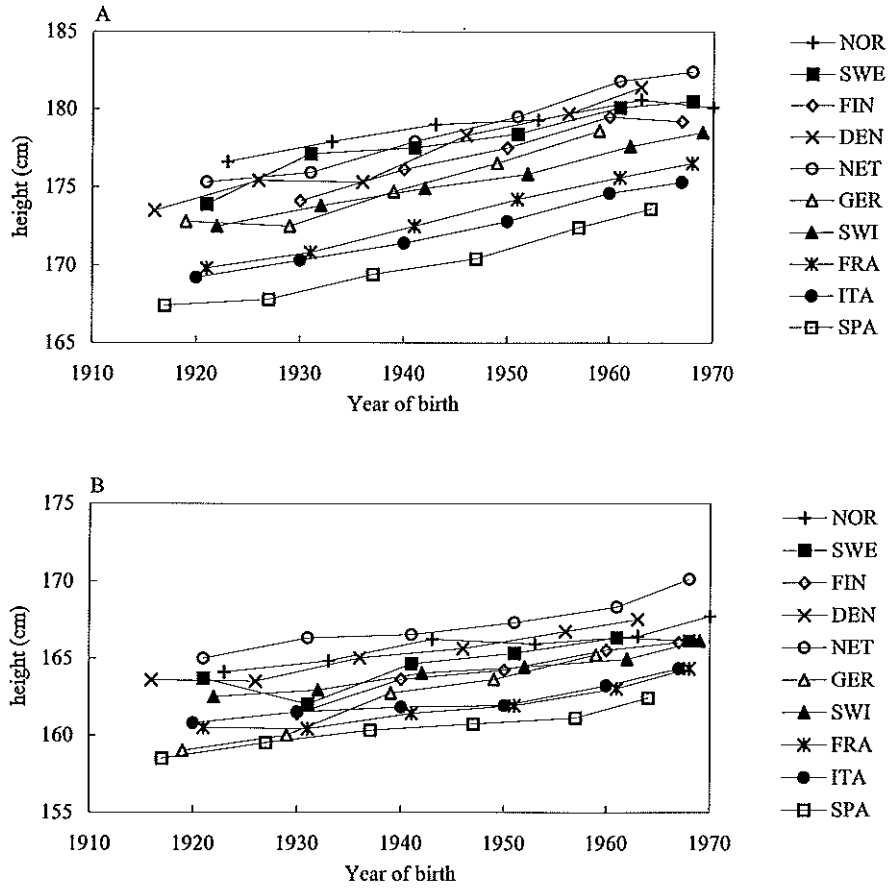

Fig. 8.1 Average height (cm) by year of birth per country. A. Men, B. Women.

Table 8.3 quantifies the change in mean height with increasing year of birth (cm/5-years increase in year of birth) in each country. Among men, the increase in mean height with each 5-year increase in year of birth was approximately 0.7-0.8 cm. A clearly smaller increase was found for Norway whereas a somewhat larger increase was found for Germany. Among women, the average increase in mean height with each 5-year increase in year of birth was in most countries approximately 0.4 cm and just as for men, a larger increase was found for Germany. The smaller rates among women as compared to men imply that the height difference between men and women is increasing in most European countries. Interaction tests showed that the rate of the increase in height with increasing year of birth differed significantly between countries for both men and women. There was, however, no systematic difference between southern Euro-

pean countries and northern European countries. This indicates that the observed difference in average height between northern countries and southern countries is not decreasing.

Table 8.3 Change in mean height with increasing year of birth (cm/5-years increase in year of birth) and 95%-confidence intervals by country and sex.

	Men		Women	
Country	Change	95%-CI	Change	95%-CI
Norway	0.44	(0.26 - 0.62)	0.33	(0.17 - 0.49)
Sweden	0.66	(0.56 - 0.76)	0.41	(0.32 - 0.50)
Finland	0.78	(0.67 - 0.89)	0.61	(0.52 - 0.70)
Denmark	0.83	(0.72 - 0.94)	0.44	(0.34 - 0.54)
Netherlands	0.86	(0.79 - 0.93)	0.44	(0.38 - 0.50)
Germany	0.95	(0.86 - 1.04)	0.83	(0.76 - 0.90)
Switzerland	0.63	(0.57 - 0.69)	0.35	(0.30 - 0.40)
France	0.75	(0.69 - 0.81)	0.39	(0.34 - 0.44)
Italy	0.68	(0.64 - 0.72)	0.32	(0.29 - 0.35)
Spain	0.70	(0.65 - 0.75)	0.36	(0.32 - 0.40)
Overall interaction country*year of birth		p<0.001		p<0.01

Table 8.4 shows the differences in height between two broad educational groups by country and by sex. In all countries, lower educated men and women were on average shorter than higher educated men and women. Among men, the differences in mean height between the two broad educational groups ranged from 1.6 to 3.0 cm. The smallest differences were found in Finland and Norway, and the largest differences were found in Denmark, Switzerland and Spain. The size of the educational differences in height among women varied between 1.2 cm and 2.2 cm. The smallest differences were found in Norway, Italy and Spain, and the largest differences were found in Germany and Switzerland. In most countries, height differences by education were larger among men than among women.

To study whether height differences between educational groups are smaller among younger age groups than among older age groups, we estimated the extent to which height differences by educational level change with increasing year of birth. Table 8.5 shows the estimated changes by sex and by country. These estimates represent changes in the size of education-related differences per 5-year increase in year of birth. Among men, in all countries except the Netherlands, the estimates were negative. This means that height differences by educational level generally were smaller among younger birth cohorts than among older birth cohorts. This decrease was largest in Sweden, Denmark and Italy. However, this decrease was not statistically significant in any of the countries

considered. Among women, height differences between educational groups were virtually constant in most countries. A decrease of educational differences was only observed for Sweden and Denmark, whereas a statistically significant increase was observed for the Netherlands and for Switzerland.

Table 8.4 Differences in mean height (cm) between two broad educational groups and 95%-confidence intervals by country and sex.

	Men		Women	
	Difference	95%-CI	Difference	95%-CI
Norway	1.8	(0.7 - 3.0)	1.2	(0.1 - 2.2)
Sweden	2.5	(1.8 - 3.1)	1.5	(0.9 - 2.0)
Finland	1.6	(1.0 - 2.2)	1.5	(0.9 - 2.0)
Denmark	2.8	(2.0 - 3.7)	1.8	(1.0 - 2.6)
Netherlands	2.5	(2.1 - 3.0)	1.6	(1.2 - 1.9)
Germany	2.2	(1.7 - 2.6)	2.2	(1.8 - 2.6)
Switzerland	2.9	(2.4 - 3.4)	2.2	(1.8 - 2.6)
France	2.6	(2.2 - 3.0)	1.6	(1.2 - 2.0)
Italy	2.5	(2.2 - 2.7)	1.3	(1.1 - 1.5)
Spain	3.0	(2.7 - 3.3)	1.3	(1.0 - 1.7)
Overall interaction country*education		p<0.001		p<0.001

Table 8.5 Change in the size of educational inequalities in mean height with increasing year of birth (cm/5-year increase in year of birth) and 95%-confidence intervals by country and sex.

	Men		Women	
Country	Change	95%-CI	Change	95%-CI
Norway	-0.07	(-0.46 - 0.33)	0.03	(-0.39 - 0.43)
Sweden	-0.19	(-0.42 - 0.05)	-0.18	(-0.40 - 0.03)
Finland	-0.06	(-0.32 - 0.28)	-0.01	(-0.28 - 0.25)
Denmark	-0.12	(-0.50 - 0.25)	-0.14	(-0.49 - 0.20)
Netherlands	0.13	(-0.02 - 0.28)	0.28	(0.14 - 0.41)
Germany	-0.01	(-0.20 - 0.19)	0.07	(-0.09 - 0.23)
Switzerland	-0.08	(-0.23 - 0.07)	0.25	(0.11 - 0.39)
France	-0.03	(-0.18 - 0.12)	-0.01	(-0.13 - 0.14)
Italy	-0.10	(-0.19 - 0.01)	0.05	(-0.04 - 0.14)
Spain	-0.06	(-0.17 - 0.05)	0.02	(-0.10 - 0.14)

8.4 Discussion

Data problems

A potential data problem relates to the measurement of height. For all countries, except Germany, we used self-reported height data. Although many studies observed a very high correlation between measured height and self-reported height[25-30], these studies also found that self-reporting leads to a slight overestimation of the average height of the study population. Moreover, some previous studies showed that this overestimation was larger among men, among older age groups and among lower socio-economic groups[25-27]. This implies that the estimated average height of men and women might be overestimated, whereas height differences between educational groups might be somewhat underestimated. However, our cross-national comparisons as regards to average height differences and education-related height differences are only biased when the validity of self-reported height also varies between countries. Although we cannot exclude that this is the case, it does not seem plausible. The large variations in average height we observed between northern and southern countries are also reported in studies in which height was measured[8,9]. Since we used measured instead of self-reported data for Germany, the average height observed for this country might be somewhat underestimated whereas the education-related differences might be somewhat overestimated as compared to other countries.

For studying changes in average height differences and in education-related height differences between birth cohorts, data on maximal attained height would have been preferable because of possible bias due to shrinkage later in life[31,32]. However, studies on secular height trends which used data on measured height[11,12,14,16] showed increases in height which closely match the rates we observed. An explanation for this close matching of the results, despite the fact that we did not use data on maximum attained height, is that we used data on self-reported height. Older age groups are maybe more likely to report their maximum attained height rather than their current height. The latter may also explain the observation made in studies on the accuracy of self-reported height that older persons over-report their height more than younger persons[25,26]. The relatively large increase in height with increasing year of birth observed for Germany might be somewhat overestimated due to the fact that we used measured data instead of self-reported data for Germany.

Another potential data problem relates to differences between countries in the percentage of non-response. Non-response might be related to height, as it has been shown to be related to other health indicators[33]. If non-response is higher among short people than among tall people, it will lead to an overestimation of the average population height. Besides, non-response rates might be lower among the lower socio-economic groups[34]. This implies that non-response also might lead to an underestimation of socio-economic height differences. It is thus possible that for countries with large non-response rates,

such as the Netherlands, Germany and Switzerland (table 8.1), the average height of the population is slightly overestimated and the size of educational height differences is slightly underestimated. However, we think that these differences in non-response rate did not substantially bias the international patterns observed in this study.

A potential data problem with respect to the estimated education-related height differences is that we distinguished only two broad educational groups. The percentages of men and women in the low educational group were between 35 and 55% in most countries but approximately 70% in France, Italy and Spain. These large cross-national variations in the size of the two broad educational groups might have affected the cross-national comparability of our measure of height differences between educational groups. Therefore, we calculated, as a check on our results, a more sophisticated measure: the Relative Index of Inequality (RII)[35-37]. Advantages of this index are that various educational levels can be taken into account separately and that countries can be compared on the basis of this index when a detailed hierarchical classification is available for each country. For the calculation of the RII, four hierarchic educational levels were distinguished for most countries: no education/first level, lower secondary level, higher secondary level and third level. The RII estimates showed the same international patterns as the measure based on two broad groups; the correlation between the two measures was high for both sexes (r . 0.9).

Comparison with other studies

The north-south pattern of the average height of adult men and women observed in this study has been earlier reported by studies among children born in the fifties and the sixties[8] and among the elderly born between 1913 and 1918[9]. Both studies used measured height data.

The increase in height with increasing year of birth observed in this study differed between countries, although we did not find any systematic differences between northern and southern European countries in the rate of this increase. This rate is determined by the increase in maximum attained height between subsequent birth cohorts but also may reflect shrinkage later in life[31,32]. Therefore, the data cannot be considered to accurately estimate secular trends in height. However, studies on secular trends in Norway, the Netherlands and Denmark, which used data on measured height of conscripts or young adults[11,12,14,16], showed increases in height between subsequent birth cohorts from the twenties/thirties to the sixties/seventies which closely match the rates that we observed among men in these countries. The rates of these increases were 0.5 cm/5 y for Norway[11], 0.7 cm/5 y and 0.9 cm/5 y for the Netherlands[14,16] and 0.9 cm/5 y for Denmark[12]. In all countries except Norway, the increase in height with increasing year of birth was larger among men than among women. These findings are in agreement with studies on secular trends among adults in northern European countries. Studies in Sweden, the Netherlands and Great Britain[22,38] observed stronger increases for men than for women, whereas a study in Norway observed equally large increases for both sexes[11,38].

National studies on socio-economic variations in height among adults, of which some used father.s social class instead of own socio-economic status, confirm our finding that persons from higher socio-economic groups are on average taller than persons from lower socio-economic groups[18-21]. It has also been reported that these differences are larger among men than among women[18,21]. Only one study investigated earlier international variations in the size of socio-economic variations in height. Kunst et al[21] observed for both men and women relatively large differences for Denmark and for Germany, intermediate differences for Finland and for the Netherlands and smallest differences for Sweden. The results of this study are in agreement with our results, with the exception of Sweden, for which we found no evidence for relatively small differences.

Results of several studies, which compared older birth cohorts to younger birth cohorts, suggest that socio-economic differences have decreased over time. These studies, which generally used the social status of the parents, concerned adult populations born before the sixties in Sweden and Denmark[12,18] or juvenile populations born during the fifties and the sixties in Norway and Sweden[10,11]. However, other studies from Great Britain and Sweden[22,23] among adults born between 1920 and 1960 did not observe decreasing differences. The findings in our study, which refer to adults born between approximately 1920 and 1970, give only weak support for a decrease of socio-economic height differences with increasing year of birth. For men, we did indeed find a decrease of the size of education-related differences in height with falling age. This decrease was, however, not statistically significant in any of the countries and in most countries it was very small. For women, most countries showed no decrease in the size of education-related height differences.

Explanations of the results

Although genetic factors are a possible explanation for the height differences between northern and southern European countries, it is also possible that differences in welfare, or more specifically, childhood living conditions contribute to these height differences. This possibility is supported by data on infant mortality, which is also considered as an indicator of childhood living standards[7]. Data on infant mortality in Europe during the last century showed that, as with height, the gap in infant mortality between northern and southern European countries has remained stable during the twentieth century[39]. Moreover, we found high and significant correlations between average heights and national infant mortality rates of 5-year birth cohorts throughout the period 1920-1970. The Pearson correlation coefficients were on the average 0.8 for men and 0.65 for women.

For all countries, a substantial increase in height was found with increasing year of birth. This increase varied overall between countries but no systematic difference in the rate of the increase was observed for northern and southern European countries indicating that the secular height trend in these countries was not systematically different over the period 1920-1970. This suggests that improvements in childhood living conditions responsible for the increase in height during that period were approximately equally as

large in southern countries as in northern European countries. This is supported by the fact that differences between countries in infant mortality rates also remained stable during that period[39]. Unfortunately, there are no international comparable figures on national living standards to confirm these suggestions.

We generally observed a smaller increase in height with increasing year of birth among women than among men. This suggests that in most countries the secular growth among women is slower than among men. An explanation supported by several studies is that growth among males is more susceptible to adverse living conditions in childhood and early adulthood than growth among females, and that males also respond more dramatically to improvements in living conditions[2,22,40]. This is consistent with our finding that socio-economic differences in height for adults are larger among men than among women.

The association between educational level and height observed in this study may reflect various underlying mechanisms[41], as is illustrated in figure 8.2. Firstly, this association (e) reflects differences in childhood living conditions such as diet, housing conditions, risk for severe disease and psychosocial stress, and physically strenuous work when still growing, as associated with social class of origin (b). This is because attained educational level is highly correlated with childhood socio-economic status (a). Secondly, it reflects the effect that specific childhood conditions such as severe illness and family breakdown might have on intergenerational social mobility[42]. Such factors might not only lead to shortness (d) but also to downward social mobility, or more specifically, to a lower attained educational level than would be expected on the basis of the social class of origin (c). Finally, social gradients in height might also have a genetic component[2]. Since tallness is partly determined genetically, an accumulation of genes related to tallness among higher socio-economic groups in successive generations due to height-related social mobility cannot be excluded[43,44].

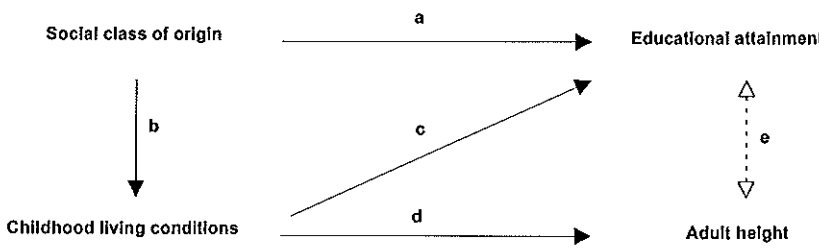

Fig. 8.2 Mechanisms reflected by the association between height and education among adults.

No clear international pattern was found for men and women with respect to the size of education-related differences in height. Analyses showed that educational height differences were not consistently smaller in countries with a higher Gross Domestic Product (GDP) or smaller income inequalities in the 1970's (results not shown). It is likely that the national context influences the size of education-related height

differences among adults in complex ways. For example, increasing national income levels might decrease the prevalence of adverse childhood living conditions among lower socio-economic groups and thereby diminish height differences by social class of origin. However, this does not necessarily mean that education-related height differences among adults are smaller in countries with high national incomes. These differences are also influenced by the strength of the relation between social class of origin and attained educational level, and the effect of childhood living conditions such as severe illness on attained educational level (see figure 8.2). One explanation for the lack of smaller education-related height differences in more prosperous countries might be that in these countries, which are likely more "open" and probably have higher rates of social mobility[45], the effect of specific childhood living conditions on attained educational level (i.e. selection effect) is larger.

For most countries, we found no consistent decrease in the size of education-related differences in height with increasing year of birth. This is remarkable since one might have expected that the differences in adverse childhood living conditions, such as malnutrition, bad housing conditions and insufficient access to medical care, have become less influencial over the past decades. However, the relatively large improvements in basic living conditions among lower socio-economic groups might have been counterbalanced by an increase in social gradients in other adverse childhood living conditions such as an unbalanced diet and maternal smoking. During the last decades, smoking prevalence rates among women of lower socio-economic groups have risen substantially in northern European countries[46]. Another explanation for the persistence of education-related height differences might be that the effect of specific childhood living conditions on attained educational level (i.e. selection effect) has become larger among younger birth cohorts.

Conclusion

The approximately equally large increase in height with increasing year of birth in both the north and the south of Europe indicates that the improvement in childhood living conditions between approximately 1920 to 1970, and its effects on health, was highly similar in both parts of Europe.

Educational-related differences in height are not consistently smaller in prosperous or more egalitarian countries than in other European countries. This suggests a large degree of similarity between European countries in education-related differences in childhood living conditions and the contribution that these differences make to socio-economic differences in morbidity and mortality.

The persistency of the size of education-related height differences with increasing year of birth suggests that the contribution of childhood living conditions to socio-economic height differences has not decreased over time. Moreover, it suggests that childhood living conditions in all countries will continue to contribute to socio-economic health differences in the next decades.

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Part III

Socio-economic differences in risk factors in relation to socio-economic differences in health

9 Socio-economic differences in cardiovascular disease mortality: an international study

Objective
The aims of the analysis were (1) to compare the size of inequalities in cardiovascular disease mortality between countries, and (2) to explore the possible contribution of cardiovascular risk factors to the explanation of between-country differences in inequalities in cardiovascular disease mortality.

Data and methods
Data on ischemic heart disease, cerebrovascular disease and total cardiovascular disease mortality by occupational class and/or educational level were obtained from national longitudinal or unlinked cross-sectional studies. Data on smoking, alcohol consumption, overweight and infrequent consumption of fresh vegetables by occupational class and/or educational level were obtained from national Health Interview Surveys or Multipurpose Surveys and from the European Union's Eurobarometer survey. Age-adjusted Rate Ratios for mortality were correlated with age-adjusted Odds Ratios for the behavioural risk factors.

Results
In all countries, mortality from cardiovascular diseases was higher among persons with lower occupational class or lower educational level. Within western Europe, a north-south gradient was apparent, with relative and absolute inequalities being larger in the north than in the south. For ischemic heart disease, but not for cerebrovascular disease, an even more striking north-south gradient was seen, with some 'reverse' inequalities in southern Europe. The United States occupied intermediate positions on most indicators. Inequalities in cardiovascular disease mortality were associated with inequalities in some risk factors, especially cigarette smoking and excessive alcohol consumption.

Conclusion
Socio-economic inequalities in cardiovascular disease mortality are a major public health problem in most industrialised countries. Closing the gap between low and high socio-economic groups offers great potential for reducing cardiovascular disease mortality. Developing effective methods of behavioural risk factor reduction in the lower socio-economic groups should be a top priority in cardiovascular disease prevention.

9.1 Introduction

It is well-known that in many industrialised countries cardiovascular disease mortality is higher among persons with lower socio-economic status than among persons with higher socio-economic status, as indicated by e.g. educational level, occupational class or income level[1,2]. Reducing the higher cardiovascular mortality rates in the lower socio-economic groups offers great potential for reducing the average rates of cardiovascular disease mortality in these countries.

In order to achieve these reductions, however, the causes of the inequalities must be known. The available evidence on the explanation of inequalities in cardiovascular disease mortality is limited, and mainly comes from epidemiological studies on ischemic heart disease mortality among selected populations within the UK, the Nordic countries or the US[3-6]. A general finding is that only part of the socio-economic gradient in ischemic heart disease mortality can be explained from a higher prevalence of classical risk factors like smoking, serum cholesterol and hypertension[3-6].

We report on a study which followed a different approach: we quantified the magnitude of inequalities in cardiovascular disease mortality in a number of industrialised countries, and then explored whether differences between countries in the magnitude of inequalities in risk factors could explain the between-country pattern of inequalities in cardiovascular disease mortality. This approach takes advantage of the large variation between countries in the epidemiology and social patterning of cardiovascular disease and its risk factors.

The aims of this study were:
- to quantify socio-economic inequalities in cardiovascular disease mortality in a large number of industrialised countries;
- to explore the possible contribution of inequalities in risk factors to the explanation of between-country differences in inequalities in cardiovascular disease mortality.

This study covers men and women aged 30-59 in the United States and in 11 countries in western Europe. Both total cardiovascular disease mortality and mortality from its main components, ischemic heart disease and cerebrovascular disease, were studied. Risk factors which were included in the analysis are cigarette smoking, alcohol consumption, overweight and lack of fresh vegetables.

9.2 Data and methods

Mortality data

An overview of data sources for mortality can be found in table 9.1. For the United States, we obtained data from the National Longitudinal Mortality Study, which

involved a 10-year follow-up of 0.5% of the population[7]. For 6 out of 11 countries in western Europe (the Nordic countries, England/Wales and Italy), we also obtained data from longitudinal studies, most of which involved a follow-up of the complete national population enumerated at the census. The exceptions were England and Wales, where a 1% sample of the national population was followed up[8], and Italy where the available study covered the population of the city of Turin only[9]. For the other 5 countries in western Europe, data were obtained from cross-sectional studies. In these studies, mortality was classified according to socio-economic information on the death certificate, and was related to the population present in the same period, classified according to socio-economic information obtained during the census. Broadly speaking, the longitudinal mortality data covered the 1980s (with classification by occupation or education and by age based on the situation around 1980), while the cross-sectional data covered a couple of years surrounding the beginning of the decade.

Table 9.1 Overview of sources of data for mortality.

Country	Period	Number of deaths from cardiovascular diseases in the study (30-59 years)	
		Men	Women
USA[1]	1979-89	1,499	689
Finland	1981-90	22,336	5,319
Sweden	1980-86	19,038	-
Norway	1980-90	11,226	2,841
Denmark	1981-90	14,141	5,059
England/Wales[2]	1981-89	1,500	-
Ireland	1980-82	3,653	-
France	1981-83	34,161	-
Switzerland	1979-82	5,172	-
Italy (T)[3]	1981-89	2,034	717
Spain	1980-82	26,729	-
Portugal	1980-82	7,562	-

[1] 0.5% sample of the population.

[2] 1% sample of the population.

[3] City of Turin.

For all countries, mortality could be classified by occupational class, but only for men. In order to avoid comparability problems, a common occupational class scheme, the Erikson-Goldthorpe-Portocarero (EGP) scheme[10], was applied to as many countries as possible. EGP conversion algorithms[10,11] were applied to individual-level data on occupational title (by 3-digit code), employment status and supervisory status. These conver-

sion schemes could not be applied to the data available for Denmark, Ireland, Italy, Spain, and Portugal. Data from these countries, classified on the basis of national schemes, could however be made comparable to the EGP scheme at the level of three broad classes: non-manual occupations, manual occupations, and farmers/farm labourers[12]. We will report on the Rate Ratio of mortality among men in manual as compared to men in non-manual occupations.

In most countries, there was insufficient information on the former occupation of economically inactive men (retired, disabled, unemployed, etc.), who therefore would have had to be excluded from the analysis. This exclusion is likely to lead to an underestimation of mortality differences between occupational classes[13,14]. We therefore applied a procedure which corrects for this underestimation, and which was based on the population share and the relative mortality level of economically inactive men. This adjustment was made for cardiovascular diseases separately. Further details on this procedure, as well as on tests of its performance, can be found elsewhere[12,15].

For some of the countries in this study, mortality could also be classified by level of education. In contrast to occupational class, level of education could be used in an internationally comparable way for the classification of women. Educational level was measured as the highest level of education which the subject had completed. OECD guidelines were used to reclassify the original educational categories into a common scheme[16]. In different countries, different degrees of detail in educational classification could be achieved. We will report on the Rate Ratio of mortality of men and women with lower secondary, primary or no completed education, as compared to men and women with upper secondary or tertiary education.

Cardiovascular disease mortality was defined as mortality from underlying causes coded 390-459 according to the ninth revision of the International Classification of Diseases[17]. The corresponding code-numbers for ischemic heart disease and cerebrovascular disease were 410-414 and 430-438, respectively. Among men, the proportion of cardiovascular disease mortality which is accounted for by ischemic heart disease ranged from 39% in Portugal to 78% in Norway and Ireland, and cerebrovascular disease accounted for between 10% in Norway and Switzerland and 39% in Portugal. Among women, the proportions of ischemic heart disease were smaller and those of cerebrovascular disease were larger than among men, but the international pattern of these proportions was the same.

Rate Ratios and their 95% confidence intervals were calculated on the basis of Poisson regression analysis. The regression models included age as a nominal variable (5-year age-groups). In the case of the US, regression models also included ethnicity (Hispanic/other white/black/all other), because we consider ethnicity to be a potential confounder of the relationship between socio-economic variables and mortality. Ethnicity is associated with, and causally antecedent to, educational achievement, and is also an independent risk factor for mortality[18]. In practice, this adjustment had very little impact on the results.

Although Rate Ratios are our primary outcome measure, we will also present data on absolute levels of cardiovascular disease mortality by occupational class and educational level. The Rate Ratios are adequate measures for analytical purposes, for example for comparison with (relative) inequalities in risk factors, but absolute differences in cardiovascular disease mortality are more relevant for public health policy.

Risk factor data

Data on risk factors were obtained from two sources: national health interview or multipurpose surveys (available for 8 western European countries[15] and for the US[19]), and Eurobarometer surveys. The latter is a multipurpose survey commissioned by the European Union and executed in a standardised way in all member states (available for seven western European countries in our study[20]).

National health interview or multipurpose survey data were available to quantify inequalities in current cigarette smoking by level of education. The data covered the period ca. 1987 - ca. 1993. In order to create maximum correspondence with the cohorts for which we have mortality data, we restricted the analysis to the age-group 40-69. These were the cohorts which were 30-59 around 1980, and in the absence of strong secular trends and selection effects, inequalities in risk factors observed in these cohorts around 1990 were likely to reflect the differences in exposure within the cohorts for which we analysed inequalities in mortality. Sample sizes in this age-group ranged between ca. 1000 in Denmark and ca. 10.000 in Italy. Eurobarometer data were available to quantify inequalities in a wider range of risk factors, both by level of education and by occupational class. Data were available for current cigarette smoking, moderate alcohol consumption (1-4 glasses/day), excessive alcohol consumption (> 4 glasses/day for men, > 3 glasses/day for women), overweight (Body Mass Index > 27), and lack of fresh vegetables (< 3 days per week). The data covered the period 1987-1991 and we restricted the analysis to the age-group 40-69, for the same reasons as mentioned above. Sample sizes in this age-group were between ca. 400 and ca. 1700 in all countries.

In the national surveys, a similar educational measure was available as in the mortality studies, which permitted us to calculate age-adjusted Odds Ratios of risk factor prevalence among men and women with lower secondary, primary or no education, as compared to men and women with upper secondary and tertiary education, using logistic regression. In the Eurobarometers, the educational groups which could be compared were those with 0-11 years of education and those with 12 years of education or more, whereas also a classification into manual and non-manual occupations could be made. The regression models included age as a nominal variable (5-year age-groups).

In order to explore the possible contribution of inequalities in behavioural risk factors to inequalities in cardiovascular disease mortality, we calculated Pearson correlation coefficients between the age-adjusted Odds Ratios for the risk factors and the age-adjusted Rate Ratios for mortality. Because of the limited number of countries for which educational differences in mortality could be calculated, we restricted this correlation analysis

Table 9.3 presents the correlations between inequalities in risk factors and inequalities in mortality among men. The international pattern of inequalities in cardiovascular disease mortality corresponded rather closely with that of inequalities in cigarette smoking and excessive alcohol consumption. This was particularly evident for inequalities in risk factors by level of education, where several correlations above 0.80 were found. Countries with larger inequalities in cigarette smoking and with larger inequalities in excessive alcohol consumption also had larger inequalities in cardiovascular, ischemic and cerebrovascular disease mortality (figure 9.3). Negative correlations were seen for moderate alcohol consumption.

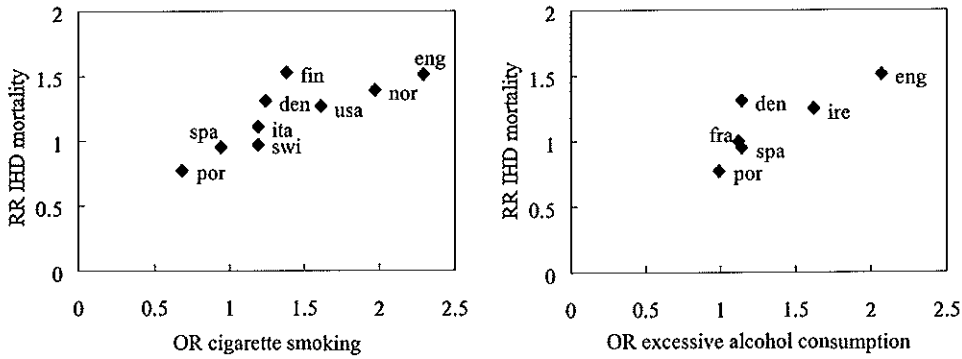

Fig 9.3 Scatter plots for inequalities in selected risk factors against inequalities in ischemic heart disease mortality.

9.4 Discussion

Summary of findings

We found socio-economic inequalities in cardiovascular disease mortality in all countries included in this study, thereby confirming many earlier reports covering single countries[3-6,21-26]. The main contribution of our study is that we have documented important variations between countries in the magnitude, and sometimes the direction, of these inequalities.

For total cardiovascular disease mortality, inequalities were larger in the Nordic countries, and England/Wales and Ireland, than in the south of Europe. This applied to both relative and absolute measures of inequalities, and suggested that the potential benefits of lowering cardiovascular disease mortality in the lower socio-economic groups were larger in the former group of countries than in the latter group of countries. This international pattern was mainly determined by ischemic heart disease mortality, for which we even found 'reverse' gradients in some southern European countries. There was no north-south gradient for inequalities in cerebrovascular disease mortality.

There was, however, substantial variation between countries in the magnitude of these differences. This variation could best be observed for mortality by occupational class among middle-aged men. Absolute differences were smallest in Portugal and largest in Finland, due to a combination of low (high) average death rates and small (large) relative differences in mortality. Generally speaking, there appeared to be a north-south gradient in western Europe, with average rates, absolute differences and relative differences being larger in the north than in the south. The United States occupied an intermediate position.

Figure 9.1 illustrates the international variation in relative differences by occupational class. The north-south gradient within western Europe for cardiovascular disease mortality could clearly be discerned, with Rate Ratios ranging between 1.55 (95% CI: 1.50-1.61) in Finland and 1.01 (95% CI: 0.95-1.08) in Portugal. For ischemic heart disease an even more striking north-south gradient is evident. Rate Ratios were clearly above 1.00 in the Nordic countries, in England and Wales, and Ireland, but below 1.00 in Spain and Portugal, indicating that in the latter countries mortality from ischemic heart disease was higher in the higher occupational classes. For cerebrovascular disease, the international pattern was different, with a very high Rate Ratio in England and Wales, and Rate Ratios above 1.00 in the south of Europe too.

Less clear international patterns were seen for mortality among men and women by educational level, for which data were available in a subset of countries (figure 9.2). Still, within western Europe there was a clear contrast between the three Nordic countries (large inequalities in cardiovascular disease mortality among both men and women) and Italy (smaller inequalities). It was also interesting to note that Rate Ratios were generally higher for women than for men.

Risk factors

Because of space limitations, we refrain from presenting detailed data on inequalities in behavioural risk factors. Although we found higher prevalences in the lower socio-economic groups for most risk factors in most countries, we also found marked international differences in these patterns. Men and women in lower occupational and/or educational groups more often were current cigarette smokers, except in Spain and Portugal (men) and all southern European countries (women) where 'reverse' patterns were found. Men and women in lower socio-economic groups also less often were moderate alcohol consumers in all countries. Among men, prevalence rates of excessive alcohol consumption generally were higher in the lower socio-economic groups (differences being largest in England/Wales and Ireland), but among women no clear differences were found in any of the countries. Men and women in lower socio-economic groups more often were overweight in all countries, with differences being smallest in Ireland, Spain and Portugal. Finally, men and women in lower socio-economic groups less frequently ate fresh vegetables, with differences being smallest in Italy, France and Portugal.

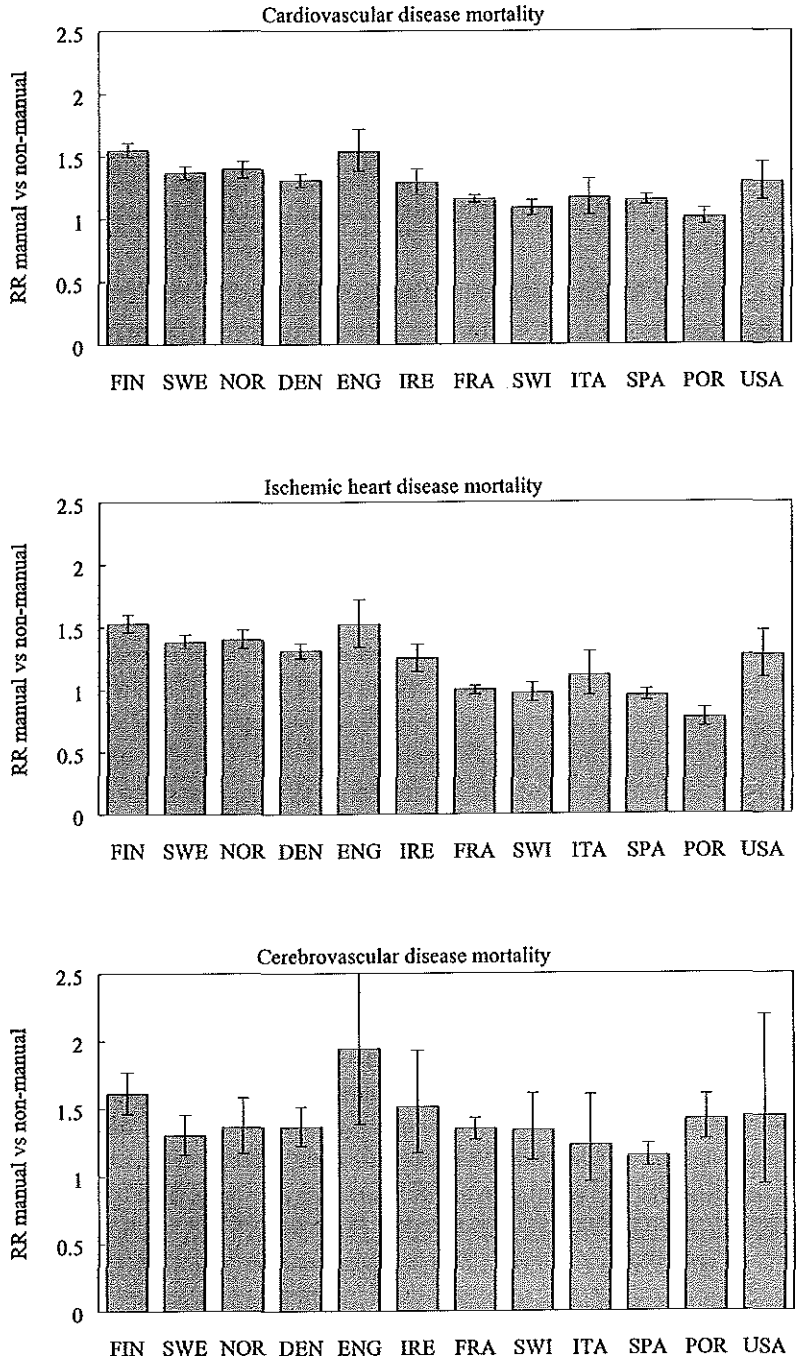

Fig. 9.1 Inequalities in cardiovascular disease mortality by occupational class, men 30-59 years.

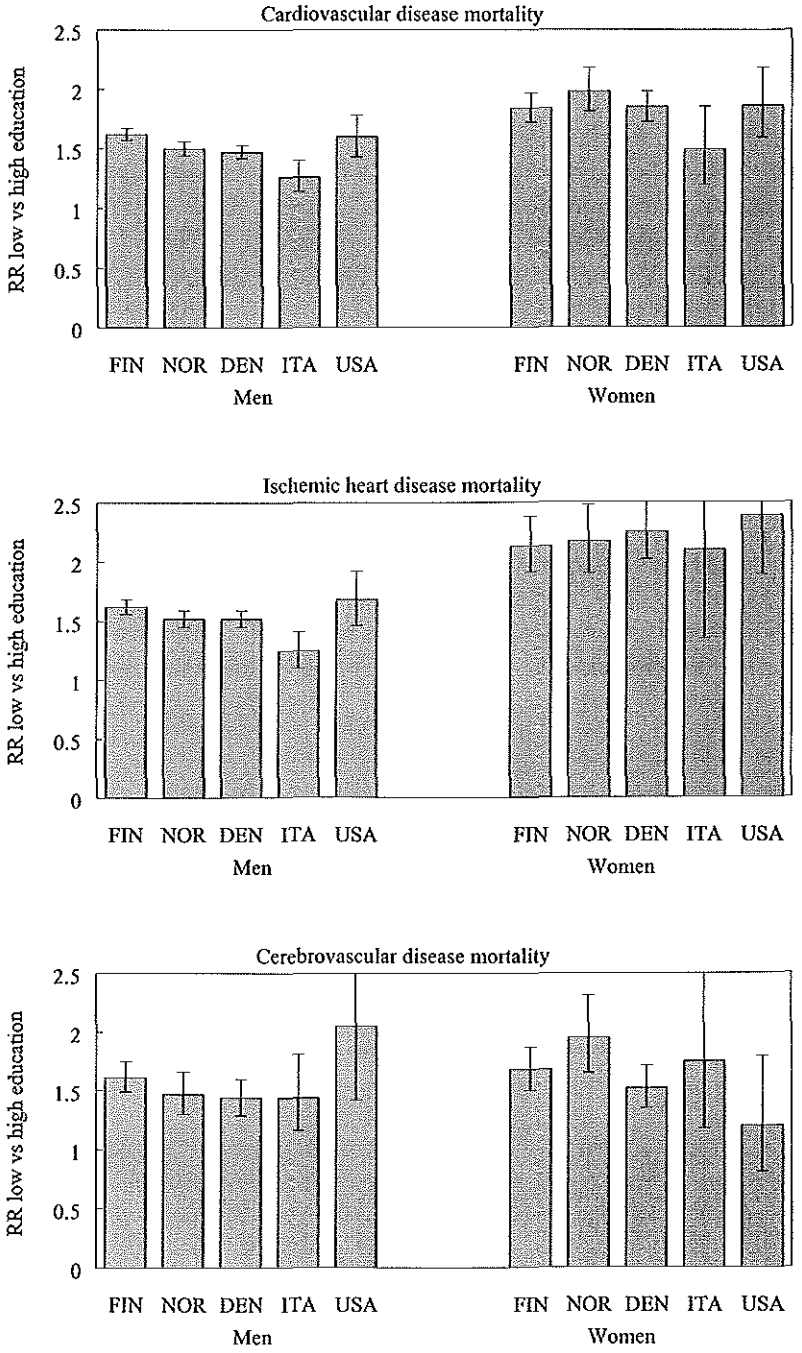

Fig. 9.2 Inequalities in cardiovascular disease by level of education, men and women 30-59 years.

Table 9.3 Correlation between inequality in behavioural risk factors and inequality in cardiovascular disease mortality, men.

Inequality in mortality[1] from	Current cigarette smoking[2] (n = 9)	Current cigarette smoking[3] (n = 8)	Moderate alcohol consumption[4] (n = 6)	Excessive alcohol consumption[4] (n = 6)	Overweight[3] (n = 8)	Lack fresh vegetables[4] (n = 7)
Inequality in risk factors by level of education[5]						
Cardiovascular disease mortality	0.79†	0.87†	-0.75	0.89†	-0.06	0.32
Ischemic heart disease mortality	0.82†	0.83†	-0.79	0.83†	-0.07	0.37
Cerebrovascular disease mortality	0.67	0.81	-0.22	0.88†	-0.04	0.22
Inequality in risk factors by occupational class[6]						
Cardiovascular disease mortality	n.a.	0.70	-0.28	0.60	0.35	0.25
Ischemic heart disease mortality	n.a.	0.65	-0.33	0.57	0.47	0.32
Cerebrovascular disease mortality	n.a.	0.75	0.27	0.64	-0.02	0.25

1 Age-adjusted rate ratio for manual versus non-manual occupational class, men aged 30-59 in the early 1980's.

2 National survey data.

3 Eurobarometer data plus US national survey data.

4 Eurobarometer data.

5 Age-adjusted odds ratio for lower versus higher level of education, men aged 40-69 around 1990.

6 Age-adjusted odds ratio for manual versus non-manual occupational class, men aged 40-69 around 1990.

† = $p < 0.05$

to the data on inequalities in mortality by occupational class. Although a comparison of these data with inequalities in risk factors by occupational class seemed most suitable, we also calculated correlations with inequalities in risk factors by educational level, because the occupational data in the Eurobarometer were rather crude and because the national survey data, which were only available by educational level, covered a larger number of countries.

9.3 Results

Mortality

Table 9.2 gives an overview of the age-adjusted rates of cardiovascular disease mortality by occupational class and educational level observed in this study. In all countries, mortality was higher among persons with lower occupational class or (in the subset of countries for which these data were available) lower educational level. This applied to both men and women.

Table 9.2 Rates of cardiovascular disease mortality, men and women aged 30-59 years, by occupational class and level of education, ca. 1983 (deaths per 100.000 person-years)[1].

Country	Men				Women	
	Occupational class		Educational level		Educational level	
	High	Low	High	Low	High	Low
USA	198	248	187	290	68	122
Finland	211	320	198	308	44	79
Sweden	134	184	n.a.	n.a.	n.a.	n.a.
Norway	153	212	138	209	39	54
Denmark	156	204	132	188	38	68
England/Wales	180	276	n.a.	n.a.	n.a.	n.a.
Ireland	231	298	n.a.	n.a.	n.a.	n.a.
France	112	131	n.a.	n.a.	n.a.	n.a.
Switzerland	123	133	n.a.	n.a.	n.a.	n.a.
Italy (T)	140	163	127	157	39	58
Spain	120	139	n.a.	n.a.	n.a.	n.a.
Portugal	143	147	n.a.	n.a.	n.a.	n.a.

[1] Because of differences between studies in design (e.g. certain exclusions, length of follow-up, etc.), these absolute rates could not be calculated directly from the observed numbers of cardiovascular deaths in each study. Instead, we used the national mortality rates from cardiovascular diseases (obtained from the World Health Organisation and standardised to the European Standard Population), and multiplied these by the Standardised Mortality Ratios for high and low socio-economic groups (calculated with data from the studies in table 9.1).

The risk factor data suggested that these international patterns were at least partly due to differences between countries in the social patterning of behaviour. It appeared that inequalities in cardiovascular disease mortality were consistently larger in countries where inequalities in cigarette smoking and in excessive alcohol consumption were larger.

Evaluation of data problems

Although we have made every effort to increase comparability of data between countries, the validity of our results might have been threatened by residual differences between countries in data collection. We identified four potential problem areas: certification and coding of causes of death, measurement of socio-economic inequalities in mortality, reliability of survey data, and mismatches between the mortality and the risk factor data.

Despite efforts of the World Health Organisation at standardising data collection, countries are known to differ in their procedures and practices of certification and coding of causes of death, including certification and coding of cardiovascular disease mortality[27]. It is possible that rates of cardiovascular disease mortality and particularly ischemic heart disease mortality were underestimated in the south of Europe, because recognition of this disease is less well developed than in the north of Europe. This would have affected the comparison of the absolute rates as presented in table 9.2, but not necessarily the comparison of the Rate Ratios presented in figure 9.1. What matters for the validity of the comparison of Rate Ratios is, whether the degree of underestimation of cardiovascular disease mortality differed between socio-economic groups, and whether this difference was larger in some countries than in others. There is no direct evidence to support or refute this possibility, but the fact that the inequalities in total mortality (without a distinction by cause of death) were also smaller in the south of Europe[12,28], suggests that substantial bias is unlikely.

Despite our own efforts at increasing comparability between countries in measurement of socio-economic inequalities in mortality (e.g. by reclassification of the original individual-level data into common occupational class and educational level schemes), there might have been residual comparability problems which affected our results. Examples are differences in study design (longitudinal or unlinked cross-sectional), in year of study (early 1980's or whole decade), and in the measurement of occupation (approximate EGP-schemes in some countries, correction for exclusion of economically inactive men). Elsewhere, we made an extensive evaluation of these residual comparability problems[12,15], and our conclusion was that the margins of uncertainty were rather wide and differed in width between countries and socio-economic indicators. Due to a cumulating of various data problems, the margins of uncertainty were particularly wide for inequalities by occupational class in Ireland, Spain and Portugal. Most countries with wide margins of uncertainty had small inequalities in cardiovascular disease mortality, but there was no reason to assume that the net effect of the residual comparability problems was to underestimate inequalities in mortality: some problems may produce

bias in an upward, others in a downward direction[12,15]. Nevertheless, it is good to be careful in drawing conclusions, and to focus on the overall picture, not on one of these countries in isolation.

The data on behavioural risk factors from the Eurobarometer Surveys were based on identical questions in each country, but the phrasing of the questions on smoking in the national surveys slightly differed between countries. It is unlikely that this has seriously biased our results, because the correlations between inequalities in smoking and inequalities in mortality were very similar for the Eurobarometer and the national surveys (table 9.3). A more important source of bias might be that the behavioural risk factor data were entirely based on self-report. Misreporting (recall bias, social desirability, ...) may be associated with socio-economic status[29-31], but the main question for our study is whether this association differs between countries. Similarly, non-response may be associated with socio-economic status[32,33], and although a Swedish study showed that socio-economic inequalities in smoking were not very sensitive to differences between responders and non-responders in smoking[34], we cannot entirely exclude the possibility of bias in the international pattern of socio-economic inequalities in risk factors as observed in our study. Unfortunately, it is unlikely that better data will become available in the foreseeable future.

Unfortunately, the mortality and risk factor data came from different sources, and a direct assessment of the contribution of these risk factors to inequalities in cardiovascular mortality between individuals inside each country was impossible. Instead, we combined these data in a cross-national analysis, and the results of this aggregate-level or 'ecological' analysis should not be taken as indicative of the corresponding individual-level relationships. For example, a cross-national correlation between inequalities in smoking and inequalities in ischemic heart disease mortality of 1.00 would not imply that within each country all between-individual inequalities in ischemic heart disease mortality are due to inequalities in smoking. Nevertheless, the high cross-national correlations which we found for smoking and ischemic heart disease can only be meaningfully interpreted if smoking is important at the individual level too - which it of course is. There is even some evidence that the relative excess risk of ischemic heart disease due to smoking is larger in the lower social classes, possibly because of an interaction of smoking with other risk factors[35]. This increases the likelihood that inequalities in smoking are very important for the explanation of inequalities in cardiovascular mortality.

The inequalities in risk factors were measured on the basis of data collected around 1990, while the inequalities in mortality were measured on the basis of data collected in the early or full 1980's. In order to improve the correspondence between these two types of data, we took care to measure inequalities in risk factors in the same cohorts as the mortality data came from (see Data and methods section). This procedure was based on the assumption that within these cohorts, inequalities in risk factors have not changed between the early 1980's and around 1990. We do not know whether this assumption

holds. Several national studies have documented a widening of inequalities in smoking behaviour during the 1980's[36-39] and a similar widening may have occurred for other risk factors. We consider it unlikely, however, that this has seriously biased our results. The trends in the social patterning of the smoking epidemic are slow and similar trends have been observed in many countries, so that substantial changes in the international pattern of inequalities in smoking within a ten-year period are unlikely.

Interpretation

Systematic international comparisons of socio-economic inequalities in cardiovascular disease mortality have seldom been made, included a smaller range of countries, and paid less attention to potential comparability problems[40-42]. Our study confirms previous reports on smaller inequalities in cardiovascular disease mortality in southern Europe[41, 42], and also provides some clues as to the possible causes of this situation.

The main contributor to this international pattern was ischemic heart disease mortality, and it is likely that the smaller (perhaps even 'reversed') inequalities in ischemic heart disease mortality were at least partly due to differences with northern Europe in the social patterning of cigarette smoking and alcohol consumption. In southern Europe, smoking was less frequent in the lower socio-economic groups, and this is likely to reflect an earlier stage in the smoking epidemic: in many countries in northern Europe and in the US, uptake of smoking started in the higher socio-economic groups, and so had the uptake of stopping smoking[43-45]. In southern Europe, inequalities in excessive alcohol consumption were also smaller than in northern Europe. Perhaps surprisingly, the largest Odds Ratios for excessive alcohol consumption (>4 glasses/day) were found in England and Wales (OR = 2.07). As excessive alcohol consumption increases the risk of ischemic heart disease and cerebrovascular disease mortality[46-48], this may help to explain the larger inequalities in cardiovascular disease mortality, although inequalities in excessive alcohol consumption are correlated with inequalities in smoking, and the latter may thus act as confounders. The international pattern of inequalities in excessive alcohol consumption changed slightly upon increasing the lower limit to 6 glasses/day. England and Wales still had the largest inequalities (OR = 3.99), but Spain is now ranked second. The correlation with inequalities in cardiovascular disease mortality declined from 0.89 (table 9.3) to 0.57 (results not shown). A similar decline occurred for ischemic heart disease mortality (from 0.83 to 0.41) but not for cerebrovascular disease mortality (from 0.88 to 0.72), suggesting that inequalities in very excessive alcohol consumption were more important for the latter.

There was less evidence in our data for a contribution from the traditional Mediterranean diet, which has been claimed to have cardioprotective effects[46,47] and which is likely to be more prevalent in the lower than in the higher socio-economic groups in southern Europe[51]. The only dietary factor (other than alcohol consumption) for which we had data was lack of fresh vegetables, and although inequalities in this variable were smaller in southern Europe, the correlation with inequalities in ischemic heart disease mortality was only moderately positive (table 9.3).

This interpretation of our results fits into the popular 'diffusion theory' of the epidemic of ischemic heart disease mortality[52-54]. According to this theory, the rise of ischemic heart disease started in the higher socio-economic groups in the richer countries, because these were the first who appreciated and could afford the behaviours (smoking, a diet rich in saturated fats, lack of physical exercise, ...) which increase the risk of ischemic heart disease. From them, the disease spread to other populations (lower socio-economic groups, poorer countries), partly as a result of rising living standards, partly as a result of imitation. When the epidemic started to decline, the higher socio-economic groups in the richer countries were again the first to benefit, because they were the first to adopt the behavioural changes (stopping smoking, less saturated fat, more exercise) which were required for a reduction in risk of ischemic heart disease. As a result, the well-known inverse gradient of ischemic heart disease mortality emerged. From this perspective, the situation in southern Europe may represent a pre- or early epidemic stage, from which an epidemic of ischemic heart disease and/or inverse gradients could still develop. Although there is no evidence of rising mortality from ischemic heart disease in southern Europe, reports from Spain and France suggest that inverse gradients in ischemic heart disease mortality have emerged during the 1980's[55, 56]. Also an analysis of age-specific prevalences of smoking showed that inverse gradients of cigarette smoking had already emerged among young men in southern Europe around 1990[57].

The fact that inequalities in cerebrovascular disease mortality were not smaller in southern Europe is difficult to explain on the basis of our data alone. Correlations with inequalities in risk factors, particularly smoking and excessive alcohol consumption, were generally the same for ischemic heart disease and for cerebrovascular disease mortality (table 9.3), although inequalities in very excessive alcohol consumption had higher correlations with the latter. It is likely, therefore, that other risk factors were involved, such as other components of the Mediterranean diet. Although the Mediterranean diet protects against ischemic heart disease, the relatively high rates of cerebrovascular disease mortality in southern Europe suggested that it may increase the risk of cerebrovascular disease, for example through high sodium intakes[58, 59]. If lower socio-economic groups in southern Europe still more frequently observed the traditional diet, this would at least partly explain the lower rates of ischemic heart disease mortality and the higher rates of cerebrovascular disease mortality. Differences between countries in blood pressure control, and particularly in accessibility of blood pressure control to lower socio-economic groups, are another explanation.

It is interesting to note that the US occupied an intermediate position between northern and southern Europe, at least with regard to inequalities in total cardiovascular disease mortality. This may reflect the more heterogeneous nature of the US population, which may average out the experience of some subpopulations with larger inequalities. In a further analysis of the US data, however, we found no evidence of systematic differences between ethnic groups in the size of inequalities in cardiovascular disease mortality (results not shown). Unfortunately, we were not able to analyse the US data by country of birth, so that we could not compare inequalities among whites of northern

European descent with those among whites of southern European descent.

Our emphasis on behavioural risk factors should not distract from the fact that these were themselves closely linked to material and/or structural factors[60]. Stronks et al[61] showed that in the Netherlands a substantial part (20-40%) of the differences in smoking behaviour between socio-economic groups appeared to be associated with adverse material conditions. Also qualitative studies, most of which were carried out in the United Kingdom, indicated that adverse material circumstances may induce people to smoke and hinder people to stop smoking[43]. Smoking and other behavioural risk factors such as excessive alcohol consumption may be considered as a way of coping with adverse circumstances.

Conclusion

Our international comparison shows that (1) in most of the countries included in our study, socio-economic inequalities in cardiovascular disease mortality are a major challenge to public health, and in the few countries where they are not, they may well become in the future; (2) these inequalities are partly based on inequalities in behavioural risk factors, and developing methods to improve health-related behaviour in the lower socio-economic groups should be a top priority in cardiovascular disease prevention.

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10 Discussion

10.1 Introduction

For some considerable time[1-3], higher rates of morbidity and mortality have been reported among lower socio-economic groups in many European countries. In the last decade, many studies have been carried out to explain these persistent health differences[4-11]. Unfortunately, there is still a lack of understanding of the circumstances associated with these differences. Therefore, the development of interventions aimed at reducing them is still hampered. Cross-national comparisons of socio-economic health differences in societies that differ with respect to national characteristics, such as national living standards, and economic and social policies may shed more light on determinants associated with the size of socio-economic differences in health[12]. International studies have additional purposes[12]. First, they can provide a yardstick for researchers and policy makers to judge the size of these differences in their own country. Secondly, they might be helpful in assessing whether research findings that seek to explain socio-economic health differences can be extrapolated from one country to another.

This study extends earlier work on international variations in the size of socio-economic inequalities in morbidity[13-25]. In comparison with previous research, this study is more comprehensive[13,15-19,21,22,24,25]. It includes more countries, and more indicators of morbidity and socio-economic status. Furthermore, in comparison with most previous studies, more effort was made to optimise the comparability of the results and the evaluation of remaining data problems. This is the first study that gives an overview of socio-economic differences in various risk factors for health in European countries, and it is the first study that evaluates whether international variations in socio-economic differences in these risk factors contribute to variations in the size of socio-economic health differences.

Section 10.2 of this chapter gives an overview of the main results. Subsequently, the effect of the remaining data problems regarding the validity of the results are discussed (10.3). Finally, the explanations (10.4) and the implications (10.5) of our findings are addressed and suggestions for further research are given (10.6).

10.2 Main findings

Socio-economic differences in self-reported morbidity

The first research question of this thesis was how large are socio-economic differences in morbidity in different European countries, and are these differences smaller in some countries than in others? This question was addressed in part I of this thesis.

A total of 12 European countries was studied, using nationally representative data of health surveys or similar surveys carried out between 1985 and 1992. Three different indicators of socio-economic status were used: educational level, occupational class and income (adjusted for household size). Four different indicators of self-reported morbidity were included: perceived general health, long-term disabilities, chronic conditions and any longstanding health problem. The availability of data per country varied by morbidity indicator and socio-economic indicator, as shown in table 1.2. The size of morbidity differences by education and by income was measured by means of the Relative Index of Inequality (RII) (except in the analyses of East versus West Germany described in chapter 5[1]), which is considered to be the most appropriate inequality index for comparing countries with respect to education and income[26,27]. The RII calculated in this study can be interpreted as the odds ratio for having a health problem for those at the bottom of the socio-economic hierarchy as compared to those at the top. Application of this index requires the availability of a detailed and strictly hierarchical classification of socio-economic groups. Since this requirement was not compatible with the occupational classification we used, occupational differences in morbidity were measured with a simple odds ratio which compared the morbidity rates of low manual classes to those of high non-manual classes. The analyses were restricted to non-institutionalised men and women aged 25-69 years since survey data on this population were available for all countries.

Table 10.1 summarises the main results of the first part of this thesis. For all countries, higher morbidity rates were found among the lower socio-economic groups. The table shows for which countries socio-economic differences in self-reported morbidity were found to be relatively large or small. The relative position was determined on the basis of the general pattern observed over different morbidity indicators, and is given by sex and by socio-economic indicator. Differences in morbidity by educational level for 11 European countries were reported in chapter 2 while results for one additional country, East Germany, were reported in chapter 5. Differences were found to be relatively large in Sweden, Norway and Denmark, and relatively small in Spain, Switzerland, and West

[1] Morbidity differences by educational level and income in East Germany were only measured by means of odds ratios that compared morbidity rates of low educational/income groups with those of high educational/income groups. Additional analyses showed that these broad odds ratios resulted in the same international position as the RII.

and East Germany. The position of the Netherlands strongly varied according to sex; relatively large differences were found for men but not for women. The relative position of some countries, e.g. West Germany, varied according to the morbidity indicator.

Differences in morbidity by occupational class, which were described in chapter 3, were studied for seven European countries. The analyses were restricted to men since no internationally comparable data on occupational class were available for women. The morbidity difference between two broad hierarchical groups of classes, manual workers and higher non-manual classes, was approximately equally large in all countries. Consistently larger inequality estimates, with no or marginally overlapping confidence intervals, were only found for Sweden in comparison with Germany.

Morbidity differences by income were reported for six countries in chapter 4, while results for one additional country, East Germany, were reported in chapter 5. The size of the differences was in most cases large for Great Britain and the Netherlands (men only) and small for East Germany. For the remaining countries, income-related inequalities in morbidity were not consistently different from each other.

Table 10.1 Overview of the relative position of countries with respect to the size of socio-economic differences in morbidity by sex and socio-economic indicator.

	Men			Women	
	Education	Occupation	Income	Education	Income
	RII	OR	OR	RII	OR
Norway	+			(+)	
Sweden	+	(+)	0	+	0
Finland	(+)		0	0	0
Denmark	(+)	0		+	
Great Britain	0	0	(+)	0	+
Netherlands	(+)	0	(+)	0	0
West Germany	(-)	(-)	0	0	0
East Germany	(-)		(-)	(-)	(-)
Switzerland	(-)	0		(-)	
France	0	0		0	0
Italy	0			0	
Spain	(-)			0	

\+ = there is evidence that differences in morbidity are larger than in countries with a '0'.

(+) = idem, but the evidence is weak.

\- = there is evidence that differences in morbidity are smaller than in countries with a '0'.

(-) = idem, but the evidence is weak.

Table 10.2 Overview of the size and the direction of the association between risk factors and educational level. Estimates are based on data from the Eurobarometer surveys.

	Men				Women			
	Smoking yes/no	Alcohol cons. ≥ 4 glasses/day	Vegetable cons. < 3-4 days/week	Overweight BMI > 25	Smoking yes/no	Alcohol cons. ≥ 3 glasses/day	Vegetable cons. < 3-4 days/week	Overweight BMI > 25
Great Britain	++	0	++	+	++	0	++	++
Ireland	++	++	++	0	++	0	0	++
Denmark	+	0	++	+	++	0	++	++
Netherlands	++	0	++	+	++	0	0	++
Belgium	+	0	0	++	+	0	0	++
Germany	++	0	++	++	+	0	0	++
France	+	0	0	++	-	0	0	++
Spain	++	0	0	0	--	0	0	++
Portugal	0	++	0	0	--	0	0	++
Italy	+	[1]	0	+	0	0	0	++
Greece	++	++	0	0	--	0	0	++

0 = no significant association,

\+ = higher prevalence rates among lower socio-economic groups,

\- = higher prevalence rates among higher socio-economic groups, and

an extra + or – means that the association is relatively strong.

[1] Data on alcohol consumption for Italy were not included since they were unrealistic possibly because of a coding mistake.

Socio-economic differences in risk factors

The second question was how large are socio-economic differences in risk factors in the various European countries, and are these differences smaller in some countries than in others? This question was addressed in part II of this thesis.

A total of 16 countries was studied, using data from two types of data sources, i.e. national health surveys or similar surveys carried out between 1985-1994, and the international Eurobarometer surveys of 1987-1991. Risk factors measured in the Eurobarometer surveys were smoking, excessive alcohol consumption, infrequent vegetable consumption and overweight. Data on smoking and height, a proxy for childhood living conditions, were obtained from national surveys. Educational level was used as a socio-economic indicator. An overview of the availability of the data on risk factors for morbidity and mortality in each country by data source was given in table 1.3. Absolute differences and relative differences (odds ratios) in the prevalence rates of risk factors between two broad educational groups were calculated. The international position of countries was generally the same for measures reporting on relative differences and on absolute differences. The analyses were restricted to men and women aged 20-74 years.

The results for the Eurobarometer surveys (see chapter 6) are summarised in table 10.2. Since the prevalence rates of risk factors were not consistently higher among lower socio-economic groups, the table gives an indication of the size as well as of the direction of the association between the risk factors and educational level in the various countries. Because of the small number of respondents for most risk factors, estimated social gradients in risk factors generally had large confidence intervals. Most noteworthy was the international pattern of social gradients in *smoking* among women. In northern countries, lower educated women smoked more often whereas in southern countries higher educated women smoked more often. Among men, lower educated men smoked more often than higher educated men in all countries, except in Portugal. In contrast to women, no clear north-south pattern was found for smoking among men, although we did observe a north-south gradient for smoking 10 or more cigarettes a day with larger differences in northern European countries (results are not included in table 10.2). For *excessive alcohol consumption* among men, a negative assocation was found for several countries. No or small differences for excessive drinking were found for Denmark, Belgium, the Netherlands, Germany and France. These results were generally confirmed by the results for a more severe definition of excessive drinking, i.e. drinking more than six glasses a day (results are not included in table 10.2). Women did not show significant or substantial differences in excessive alcohol consumption in any of the countries. For *infrequent vegetable consumption*, large negative associations among men were found for northern European countries whereas for southern European countries, associations were small or absent. For women, only two northern European countries showed relatively large differences. Negative associations were found for *overweight* among women in all countries and in most countries for men too. For men, Ireland, Spain, Greece, and Portugal showed relatively small differences. No variations in the size of these differences were found among women.

In chapter 7, socio-economic differences in smoking were also studied using national survey data. The additive value of using national surveys was that data were also available for the Scandinavian countries and Switzerland, and that smoking differences could be studied in more detail (i.e. for different smoking variables and for two broad age groups). Furthermore, it gave a good opportunity to check whether the same results were found using different data sources. The results from the national surveys confirmed the results found using the Eurobarometer data. For older and younger women, higher prevalence rates among *lower* educated women were found in northern European countries whereas in southern European countries *higher* educated women smoked more. A north-south pattern, although less marked, was also found for older men. Among young men, large differences were found for northern countries as well as for most southern countries, except for Portugal. Figure 10.1 illustrates the correspondence between the results for smoking among women based on the two different data sources.

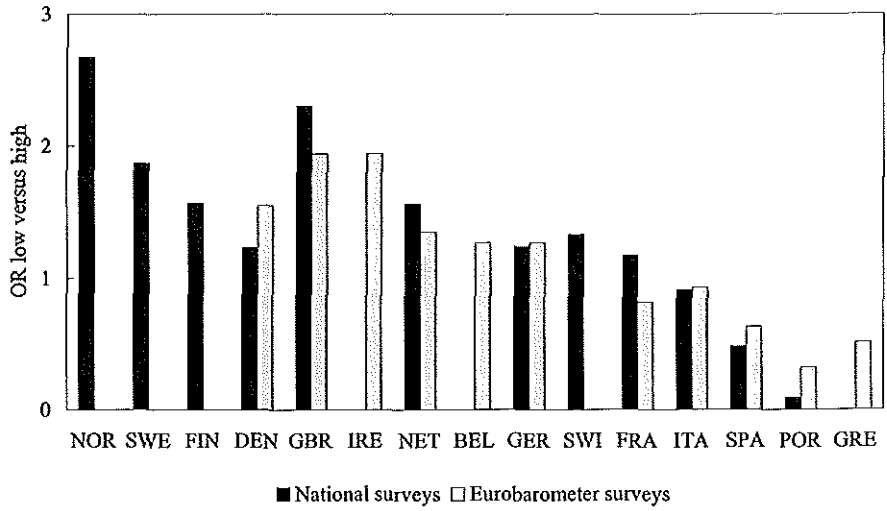

Fig. 10.1 Relative differences in the prevalence of current smoking between lower and higher educated women, aged 20-74 years.

Socio-economic differences in height, described in chapter 8, were only estimated using national survey data. In all countries, higher educated men and women were on average taller than lower educated men and women. Figure 10.2 shows the number of centimetres that higher educated men and women were on average taller than lower educated men and women. The size of the differences varied between countries. For men, there was a tendency for differences to be somewhat smaller in the Nordic countries but no clear international pattern was observed for women. Height is assumed to reflect childhood living conditions[28]. Therefore, the lack of large and consistent international variations in height differences suggests a high degree of similarity between countries with respect to differences in childhood living conditions between educational groups.

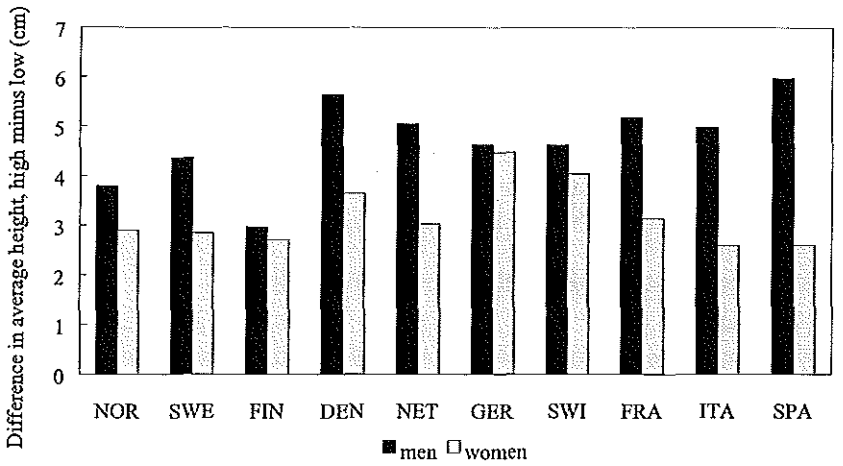

Fig. 10.2 Absolute differences in average height between higher and lower educated men and women, aged 20-74 years.

Social gradients in risk factors in relation to socio-economic health differences

The third research question considered was whether international variations in social gradients in risk factors contribute to the explanation of international variations in health inequalities. This question was addressed in part III. To answer the question quantitatively, the correlation between social gradients in risk factors and the size of socio-economic differences in cardiovascular disease mortality among men was estimated for 8 European countries and the USA (chapter 9). The analyses focused on cardiovascular disease mortality since most of the risk factors included in this study are stronger predictors of cardiovascular disease than for generic morbidity indicators and total mortality. For the analyses, social gradients in risk factors and socio-economic differences in cardiovascular disease mortality were calculated for approximately the same birth cohort (born between 1925-1955). High correlations were found between social gradients in smoking and excessive alcohol consumption, and the size of socio-economic differences in cardiovascular disease mortality. These high correlations suggested that international variations in social gradients in these two risk factors for cardiovascular disease may partly explain international variations in socio-economic differences in cardiovascular disease mortality.

10.3 The effect of remaining data problems

Several authors have pointed to the many data problems that may bias international comparisons of socio-economic health differences, especially those concerning morbidity[29-32]. The comparability of the data used in this thesis was enhanced as far as possible, especially by restricting the analyses to highly comparable data. Some data pro-

blems, however, could not be avoided and might have affected the internal validity of this study. These problems are related to the measurement of the morbidity indicators, the risk factors and the socio-economic indicators and to the general characteristics of the surveys used. The potential effect of the remaining data problems on the results reported in the different parts of this thesis was evaluated extensively[33-36]. The main conclusions of these evaluations are summarised in the next paragraphs. Finally, the effect of the restrictive selection of data on the external validity of the results is discussed.

Socio-economic differences in self-reported morbidity

Morbidity indicators

In this study, four indicators of morbidity were included, covering various aspects of a respondent's health. Cross-national comparisons were only made for morbidity indicators that were judged to be highly comparable with respect to the structure and the wording of the respective survey questions. However, some comparability problems remained (e.g. the effect of choosing another cut-off point for perceived general health, the effect of the absence of a specific item of long-term disability). Therefore, as many analyses as possible were performed to evaluate the sensitivity of the results to these comparability problems The results of these analyses suggested that the international positions of countries that were observed in this thesis were robust to these remaining problems. More details about the survey questions that were considered to be highly comparable, the remaining comparability problems and the results of the sensitivity analyses can be found in chapter 2 of this thesis and elsewhere[34].

A more important problem with regard to the morbidity indicators used in this study is related to their self-reported nature. The answer to a question on the presence of an objective health problem does not only depend on the 'objective' presence of the problem, but is also determined by factors such as the terminology used to define it, the propensity to report it and the use of (diagnostic) health care[37,38]. Several validity studies have shown that the completeness of the reporting of objective health problems varies according to socio-economic status, and that socio-economic differences in objectively defined health problems are likely to be underestimated when they are based on self-report[39,40]. If this extent of underestimation is approximately the same in all countries, the international comparisons have not been seriously biased. However, one cannot be sure that there are no international variations in the extent to which socio-economic differences in objective health problems are underestimated by self-report.

The only indicator available for all countries was the question on perceived general health. This indicator concerns the subjective perception of a person's own health and can be seen as a measure that takes into account all health aspects relevant for the person in question. There is no gold standard to judge the validity of a subjectively defined health measure, but perceived general health has been shown to be related to physical and mental health measures, to the use of health care and medication, to health-related behaviour and to mortality[41-43]. The assessment of a person's own health might not only depend on his/her perceptions of health but also on his/her tendency to report nega-

tively, i.e. negative affectivity. Countries and socio-economic groups might vary in perceptions of health as well as in the extent of negative affectivity[38,44-47]. The question is if these differences can explain our finding that socio-economic differences in perceived general health are not consistently smaller in the Scandinavian countries and the Netherlands. Perhaps the relatively large health differences in the Scandinavian countries and the Netherlands are due to larger differences between socio-economic groups in *negative affectivity* in these countries as compared to other countries. A recent study from Norway, however, did not find any evidence for a higher tendency to report negatively on one's own health among lower socio-economic groups[8,48]. Moreover, a recent study from the Netherlands showed that controlling for negative affectivity only had a small effect on the size of socio-economic differences in perceived general health[8,48]. On the contrary, it is possible that the relatively large health differences in the Scandinavian countries and the Netherlands are related to differences between countries in *perceptions of health*. Socio-economic differences in perceived general health may be larger in countries with a relatively high health consciousness and where health behaviour receives quite a large amount of attention in the media. In such countries, people from lower socio-economic groups may be more aware of their health problems as compared to countries where the media gives little attention to health. Health consciousness and attention to health behaviour vary over time[49] and might be larger in the northern European countries.

The international pattern for perceived general health was not consistently confirmed by the pattern for the other morbidity indicators. The different patterns found for the various indicators of morbidity might be due to data problems that are specific to one of the morbidity indicators and/or because they refer to different aspects of a person's health. It should, however, also be stated that differences in the more objective indicators (such as long-term disabilities) in the Scandinavian countries and the Netherlands were not small from an international perspective.

Socio-economic indicators

Despite differences between countries in relation to educational systems, national educational classes could be re-coded to a standard schedule of hierarchical levels (chapter 2). However, only three broad educational levels could be distinguished in a standardized way for all countries. This distinction was applied to the calculation of the inequality index, the RII. Application of this index requires the availability of a detailed and strictly hierarchical classification of socio-economic groups. The use of only three broad educational levels resulted in some loss of detail of the educational classifications, in particular in Spain, Italy and France. In these countries, a relatively large part of the population belonged to the three lowest educational groups that were combined into one. However, analyses in which a more detailed educational classification was used for these southern countries (see chapter 2, table 5) showed that their international position was fairly insensitive to the number of educational levels distinguished.

The use of the EGP-scheme to classify men into occupational classes in all countries considerably enhanced the international comparability of the estimated occupational differences in morbidity. Some data problems associated with the basic available information, however, could not be avoided or they were inherent to the algorithms used to allocate persons to EGP-classes. These problems might have biased the size of the differences in Great Britain (overestimation) and France (over- or underestimation). However, an extensive evaluation of these remaining problems (chapter 3) showed that they cannot have had a large effect on our central finding that occupational-related differences in self-reported morbidity were approximately equally large in all countries included.

The comparability of income data was optimised by several inclusion criteria (chapter 4). However, some differences between countries remained with respect to the preciseness of the measurement of income and the percentage of respondents for which income data were missing. These differences might have biased the comparison of countries with respect to the size of income-related differences in morbidity. It is possible, for example, that the position of Finland and Sweden is overestimated as compared to other countries because their data might be less biased by misclassification and selective non-response. This implies that the international position of Finland and Sweden with respect to income may be more favourable than was observed in this study.

The international pattern with respect to socio-economic differences in self-reported morbidity varied between socio-economic indicators. For educational level, larger differences were found for most Nordic countries and the Netherlands than for the other countries, while for occupational class approximately equally large inequalities were found for all countries. For income, on the other hand, relatively large inequalities were found for Great Britain and for the Netherlands (men only). Perhaps the substantially different international position of some of the countries for the various socio-economic indicators is the result of data problems that are specific for one of the socio-economic indicators. Another explanation is that different socio-economic indicators refer to different resources (i.e. knowledge, prestige, disposable income). Countries might vary in the relative importance of these resources for health. Moreover, countries might vary in the effect that health can have on these different resources.

Survey characteristics

Another comparability problem was that the national surveys used, differed from each other in regard to general characteristics, such as the year of the survey, the sampling source of the study population, the exclusion of foreigners, the interview techniques, the use of proxy interviews and the non-response rates[33]. If inequality estimates are sensitive to these survey characteristics, the comparability of the inequality estimates for the different countries will be reduced. The survey characteristic that might have biased our inequality estimates the most is the non-response rate. Non-response rates bias health inequality estimates if they are related to socio-economic status and, given one's socio-economic status, to health status. There are indications, although this is not observed in

all studies, that response rates are lower in lower socio-economic groups and in less healthy people[50-53]. This would imply that non-response leads to an underestimation of health inequality estimates. The higher the percentage of non-response rates, the larger this underestimation may be. The main question is whether differences between surveys in these and other characteristics can explain the international patterns observed in this study.

It cannot be excluded that the position of some countries is affected by their particular survey characteristics. For instance, we cannot exclude the possibility that the relatively small inequalities found for West Germany are partly due to an underestimation because of the relatively high non-response rate and the exclusion of foreigners. Unfortunately, it is hard to say *to what extent* differences in survey characteristics have biased the international patterns we observed. An extensive evaluation showed that the number of deviant survey characteristics that might have caused an underestimation in the size of inequality[33] is not clearly related to the observed size of inequalities in a country. For example, relatively large inequalities were found in the Netherlands, in spite of the large non-response rate, the exclusion of foreigners and the use of proxy interviews in the Dutch survey. This shows that the effect of these general characteristics is not necessarily so large that it hides truly large inequalities.

In addition to the survey characteristics we evaluated, there might be differences between surveys that are more difficult to evaluate. An example is the general quality of data collection and processing procedures. If surveys differ in their general quality and if the size of health inequalities is underestimated in low-quality surveys, this may bias international variations in the size of health inequalities. It is hard to evaluate this effect. However, the relatively small income-related inequalities in perceived general health found for Sweden which had high quality income data (chapter 4), suggests that a higher data quality does not necessarily hide truly smaller health inequalities.

One way to obtain more certainty about the potential effects of differences in the general characteristics of surveys, is to evaluate whether or not the same international position is observed for a country when data from different surveys are used. Previous comparative studies provided some examples. These studies have used different surveys for the Nordic countries, and for East and West Germany. In general, the results of these studies are fairly in agreement with our findings for these countries (see chapter 2).

Conclusion

It is not possible to exclude the possibility that remaining data problems have biased the international patterns of socio-economic morbidity differences reported in this thesis. However, we think it is unlikely that these problems can explain our observation that health differences are not consistently smaller in the Nordic countries and the Netherlands than in other western European countries. This remarkable observation is supported by the most recent cross-national comparisons on socio-economic differences in *mortality*[12,54].

Socio-economic differences in risk factors

Risk factors

Data on smoking, alcohol consumption, vegetable consumption, and height and weight (overweight) obtained from Eurobarometer surveys were measured with identical questions in each country. On the other hand, in the national surveys used in this study, minor differences were present in the measurement of smoking and height. The effect of these differences on the observed international variations in socio-economic differences in smoking and height is, however, likely to be small.

A more probable important source of bias is that this study is based on self-reported data. The validity of self-reported data on smoking, alcohol consumption, diet, and height and weight is often questioned[55-59]. Self-report might be influenced by recall bias and social desirability. The inequality estimates we calculated, however, are only biased when reporting bias is associated with education. Several studies have investigated whether the validity of self-reported height and weight is associated with one's educational level[60-65]. Some of these studies showed that self-report led to an underestimation of height differences between educational groups among both men and women[60-62]. Moreover, these studies showed that self-report lead to an underestimation of education-related differences in regard to being overweight among women[61,62] but to an overestimation among men[62]. However, these associations were not consistently found in all studies performed[61,63-65]. Inconsistent results were also reported with respect to smoking[66-68]. We are not aware of any study that has investigated the effect of self-reporting on social gradients in alcohol or vegetable consumption. Important for the present study is whether countries vary in the extent to which education is associated with the validity of self-report. This possibility cannot be excluded, because self-report is sensitive to social norms, and the countries we studied are likely to differ in these social norms, especially those related to behavioural factors. For example, drinking four or more alcoholic glasses a day is probably more accepted in southern European countries than in northern European countries, whereas a reverse picture applies to smoking among women. It seems, however, not plausible that most of the marked international patterns observed in this study can be explained in this way to any great extent.

Socio-economic indicators

Socio-economic differences in risk factors were only reported using educational level as an indicator of socio-economic status. For the estimation of education-related differences in risk factors, prevalence rates of two broad educational groups were compared. The sizes of these groups varied strongly between countries. This might have affected the comparability of the inequality estimates of the different countries. Therefore, additional analyses were performed to evaluate whether the same international patterns were found with the more sophisticated inequality measure, the RII. For the calculation of this measure, four educational groups were generally distinguished in each country. The results of these analyses indicated that the international patterns as outlined above were not sensitive to the extent to which we combined educational levels.

Survey characteristics

General survey characteristics such as non-response rates and interview techniques might influence estimates of social gradients in the prevalence of risk factors. Variations between countries in the characteristics of their national surveys might have biased the international patterns observed for social gradients in smoking and height. But also for the Eurobarometer surveys, for which similar survey methods were used in all countries, bias cannot be excluded since countries varied strongly in regard to non-response rates (chapter 6). The potential effect of these differences was discussed in detail in part II of this thesis. The main conclusion was that it is unlikely that the international patterns of social gradients in risk factors for health can be largely explained by the effects of non-response or differences in interview techniques.

Our impression that the effect of differences between countries in general survey characteristics and in the measurement of risk factors and education is likely to be relatively small, is partly based on our findings regarding social gradients in smoking (figure 10.1). The inequality estimates observed for the national surveys (relatively low non-response rates, differences in interview techniques, minor differences in questions on smoking) highly corresponded with the estimates based on the Eurobarometer surveys (relatively high non-response rates, identical interview techniques and identical questions for all countries).

Conclusion

The social gradients for individual countries observed in this thesis might have been biased by a number of remaining data problems. It is, however, highly unlikely that comparability problems with respect to the measurement of risk factors and socio-economic status, and survey characteristics have substantially biased the marked international patterns we found. What is uncertain however is to what extent the use of self-report might have biased our international patterns of social gradients in behavioural risk factors (e.g. excessive alcohol consumption), but it does not seem plausible that the international patterns observed in this study can be explained in this way to any great extent.

Social gradients in risk factors in relation to socio-economic health differences

Mortality data versus risk factors data

In chapter 9, the correlation between social gradients in risk factors and the size of socio-economic differences in cardiovascular disease mortality among men for eight European countries and the United States was estimated . Inequalities in risk factors were measured on the basis of data collected around 1990, while the inequalities in mortality were measured on the basis of data collected early or during the 1980's. In order to improve the correspondence between these two types of data, we were careful to measure inequalities in risk factors for the same cohorts as the mortality data originated from. This procedure was based on the assumption that within these cohorts, inequalities in risk factors have not changed during the 1980's. It is uncertain whether this assumption holds. It is, however, not likely that changes over time have seriously

biased our results. Because trends in the social pattern of risk factors are likely to be slow and the international patterns are marked, substantial changes in the international pattern of inequalities in risk factors within a ten-year period are unlikely to occur.

External validity of the results

Socio-economic differences in self-reported morbidity

In this study, socio-economic differences were studied for four indicators of morbidity. However, only perceived general health was available for all countries. Therefore, our results heavily depend on that indicator. The international pattern found for perceived general health was not always confirmed by the pattern found for other morbidity indicators. The same applies to measures of socio-economic status. Only educational level was available for all countries and the international position of some countries varied between socio-economic indicators. This implies that we cannot exclude that the position of some countries would have been different if four morbidity indicators and three socio-economic indicators had been available for all countries involved.

In addition, we only compared countries with respect to variations in the size of relative differences in socio-economic inequalities in morbidity. From a public health point of view, it might be equally relevant to study absolute differences between socio-economic groups[26]. Unfortunately, cross-national differences in overall prevalence rates of morbidity indicators and absolute inequalities are probably highly sensitive to small deviations in the morbidity questions and other methodological differences between the surveys[59, 69]. Therefore, it was not possible to compare countries on the basis of estimates of absolute inequalities. Different international patterns might have been found if international variations in the size of absolute differences had been studied.

Socio-economic differences in risk factors

Socio-economic differences in risk factors were only reported using educational level as an indicator of socio-economic status. Some studies have shown that the size of social gradients in risk factors varies between different socio-economic indicators. Behavioural factors may be related more strongly to educational level than to other socio-economic indicators. It is possible that, as for morbidity differences, the international position of countries would have been different if other socio-economic indicators had been used. For the study described in chapter 9, social gradients in risk factors were also estimated using occupational class as socio-economic indicator. The results showed that the international patterns for occupational class as for educational level were in general the same, although the position of some countries was somewhat different.

Social gradients in risk factors in relation to socio-economic health differences

The correlations estimated between social gradients in risk factors and socio-economic differences in cardiovascular mortality were restricted to men born between ca. 1925-1955 in eight European countries and the United States. Data on social gradients in excessive alcohol consumption, infrequent vegetable consumption and overweight were not available for some of the countries. The lack of data on risk factors for some coun-

tries might have influenced the estimates of the strength of the correlation. It seems, however, unlikely that this would have led to different conclusions with respect to the possible contribution of social gradients in risk factors to international variations in socio-economic differences in cardiovascular disease mortality among men born between ca. 1925-1955.

10.4 Explanations of the results

Socio-economic differences in self-reported morbidity

The size of education and income related differences in morbidity estimated in this study varied between countries. Relatively large differences in morbidity between educational groups were observed for the Scandinavian countries and the Netherlands, while differences in morbidity between income groups were relatively large for Great Britain and the Netherlands (men only) and small for East Germany. No strong evidence was found which suggested that socio-economic differences in morbidity in general (i.e. considering all three socio-economic indicators) were clearly larger or smaller in some countries than in others.

The lack of consistently smaller differences in the Scandinavian countries, especially in Sweden, and the Netherlands is remarkable. It is contrary to expectations that these inequalities should be smaller in countries with more egalitarian socio-economic and other policies, such as the Scandinavian countries and the Netherlands. Several reasons can be suggested to support this expectation. First, the social security systems of these countries can be characterised by generous disability and unemployment benefits. Generous benefits prevent a strong decrease in disposable income among those who are no longer able to work because of ill-health. Therefore, one might expect that these generous benefits have minimised the effect of ill-health on disposable income in these countries (i.e. reduction of the selection effect). Moreover, the welfare models in the Scandinavian countries and the Netherlands can be characterised by high state expenditure on social measures and progressive tax systems. The latter as well as the generous benefits have contributed to the fact that in the 1980's both the Netherlands and the Scandinavian countries had relatively small income inequalities[70]. This may be expected to have contributed to a less skewed distribution of specific risk factors among the population (i.e. reduction of the causal effect). In addition, disadvantaged population groups in these countries have virtually free access to high-quality medical care. Finally, in the Scandinavian countries much attention has been given to improvement of working conditions, especially those of manual workers. Sweden's egalitarian socio-economic policies already date back to the 1930's, while those in Norway, Denmark, Finland and the Netherlands were developed in the post-war period.

Although we did not find generally smaller socio-economic differences in morbidity in more egalitarian countries, we did find some evidence that income-related differences in

morbidity are smaller in countries with smaller income inequalities. This suggests that egalitarian policies do exert a demonstratable influence on income-related differences in health. This suggestion is supported by additional analyses in which we estimated income-related differences in morbidity while adjusting for other socio-economic indicators. For example, the relatively large differences in perceived general health among men in Great Britain as compared to Finland and Sweden disappeared after adjustment for employment status. Adjusting for employment status removes, among others, most of the effects of ill-health on income. This suggests that the relatively small income-related differences in Sweden and Finland may be due to a smaller effect of ill-health on disposable income in Sweden and Finland as compared to Great Britain. This is in agreement with the effects one could expect from the generous disability benefits in the Scandinavian countries, as outlined above.

A possible explanation for the unexpected international patterns observed in this study for education and occupation is that the countries involved differ in their amount of intergenerational social mobility. In more 'open' countries, the educational level and occupational status achieved depends less on the socio-economic status of a person's parents, but more on personal characteristics, including health and health-related factors[71,72]. This may reinforce both 'direct' and 'indirect' selection mechanisms. In this way, a larger degree of social mobility might contribute to larger differences in health. The few studies that have compared countries with respect to social mobility rates did not yield consistent results[73-75]. One authorative study showed, nevertheless, that mobility rates were somewhat higher in Sweden than in France, and England and Wales[75]. However, it is unlikely that these observed differences in social mobility have a major impact. The effect of international variations in the extent of direct selection is especially likely to be small since several studies in Sweden, Norway, Great Britain and the Netherlands suggested that the contribution of direct selection to socio-economic health differences is limited[9,76,77].

Another explanation for the international patterns we observed is that socio-economic differences in specific risk factors, such as behavioural risk factors, are relatively large in the Scandinavian countries and the Netherlands. In part II of this thesis, it was shown that socio-economic differences in smoking were relatively large in northern Europe, including most Scandinavian countries, the Netherlands and Great Britain (chapter 6 and 7). Relatively large inequalities among men from northern European countries were also observed for infrequent vegetable consumption (chapter 6). This explanation is also supported by the high correlation found between social gradients in a number of behavioural risk factors (especially smoking and excessive alcohol consumption) and the size of socio-economic differences in cardiovascular disease mortality among men (chapter 9). Moreover, we found that socio-economic differences in height, a proxy for childhood living conditions, were at least not consistently smaller in northern European countries than elsewhere (chapter 8).

Socio-economic differences in risk factors

Possible explanations for international variations in social gradients of behavioural risk factors included in this study are discussed in chapter 6 and 7. National characteristics which might have influenced these international patterns include cultural factors such as traditional dietary and drinking habits, and knowledge about associated health risks. The effect of these national characteristics probably interact with structural characteristics such as prosperity and the size of income inequalities. The most remarkable international pattern was the north-south pattern found for social gradients in smoking. Additional analyses, which are described in chapter 7, suggest that the variations between northern and southern European countries in social smoking gradients are largely related to the diffusion of the smoking epidemic from the north to the south of Europe. This diffusion is probably conditioned by cultural factors as well as by structural ones.

Possible explanations for the international patterns of socio-economic differences in height, a proxy of childhood circumstances, are discussed in detail in chapter 8. Contrary to what one might expect, education-related differences in height were not consistently smaller in more egalitarian countries. One possible explanation is that the relatively large improvements in basic living conditions among lower socio-economic groups in these countries are counterbalanced by an increase in social gradients in other adverse childhood living conditions such as maternal smoking. Another explanation for the lack of smaller education-related height differences in more prosperous countries is that in these countries the effect of specific childhood living conditions on attained educational level is larger, because of higher social mobility rates.

Conclusion

Although we give some explanations for the remarkable international patterns observed in this study, many of our findings are still unclear. This applies, among others, to the relatively small inequalities in morbidity in West Germany, the inconsistencies between the international patterns that were observed for the different indicators of self-reported morbidity, the different indicators for socio-economic status, and the cross-national variations in social gradients of some risk factors. The patterns that were observed and the tentative explanation we have given indicate that the way in which the magnitude of health differences is influenced by national features and characteristics is very complex. For the explanation of cross-national variations in health inequalities, one often has to go far back in time. Moreover, one has to take into account the complex mechanisms by which several cultural as well as structural national characteristics influence social gradients in various risk factors and selection mechanisms simultaneously.

10.5 Implications of the results

International comparisons of socio-economic health differences can be useful for several reasons[12]. First, they might contribute to the explanation of socio-economic

health differences by identifying national determinants associated with the size of socio-economic health differences. Second, they provide a yardstick for researchers and policy makers to judge the size of socio-economic differences in their own country. And finally, cross-national comparisons might be helpful to assess whether research findings from one country can be extrapolated to another country. In the next paragraphs, the implications of this study are discussed.

Explanation

Cross-national comparison is an obvious method to investigate the effect of national characteristics on the size of socio-economic differences in health. Some previous studies showed that health inequalities were relatively small in Sweden. These small inequalities have been attributed to the long tradition of egalitarian policies in this country. The studies described in part I of this thesis showed, however, that socio-economic differences in health are not consistently smaller in egalitarian countries. This does not mean that egalitarian socio-economic policies do not contribute to the reduction of health differences. It does, however, indicate that egalitarian policies alone are no guarantee for success.

Possibly, the favourable effect of egalitarian socio-economic policies are concealed by the effect that other national characteristics have on behavioural risk factors. In this study, we observed differences between countries in social gradients of behavioural risk factors. Most striking is the north-south pattern we observed for social gradients in smoking with largest negative associations for the north of Europe. The international patterns of social gradients in risk factors observed in this study indicate that these gradients are influenced by cultural as well as structural national characteristics. The international pattern observed for smoking is related to differences between countries according to what stage they have reached in the smoking epidemic. This epidemic started first in the north of Europe. One possible explanation for the time lag between the north and the south is that information on the health hazards of smoking and interventions to reduce smoking which have resulted in a substantial decrease in smoking, especially among higher socio-economic groups, spread on a large scale later in the south than in the north of Europe. Therefore, in order to turn the tide, interventions which improve or maintain health-promoting behaviour in the lower socio-economic groups should be developed and implemented. The strong correlations found between social gradients in some of the behavioural risk factors and socio-economic differences in cardiovascular disease mortality suggest that such interventions can substantially reduce socio-economic differences in health in the north of Europe whereas this might counterbalance an increase in socio-economic differences in cardiovascular disease mortality in the south of Europe.

Judgement

The lack of strong evidence supporting the view that socio-economic differences in morbidity are generally larger or smaller in some countries than in others, stresses the need for all countries to put socio-economic health differences high on the national

policy and research agenda. This need is also stressed by our finding that social gradients for smoking in all countries are steeper among younger birth cohorts than among older birth cohorts. This implies that, if no substantial action is undertaken, socio-economic differences in smoking related diseases will increase in the coming decades. A final reason for concern is our finding that socio-economic differences in height, a proxy of childhood living conditions, have not diminished among younger birth cohorts as compared to older birth cohorts. This means that childhood living conditions will continue to contribute to socio-economic health differences in many European countries.

Extrapolation of research findings

Although no strong evidence exists that supports that the magnitude of socio-economic differences in health in general varies substantially between western European countries, this does not mean that these differences have the same background in all countries. A first indication for variations in underlying causes is given by the fact that the international position of several countries varied according to socio-economic indicators. Moreover, this study showed that countries varied with respect to social gradients in several risk factors for morbidity and mortality (chapter 6 and 7) and thus probably also in the contribution that these risk factors make to socio-economic health differences. This inference is supported by the large international variations in socio-economic differences in cause-specific mortality[78], e.g. socio-economic differences in cardiovascular disease mortality are larger in northern European countries than in southern European countries (chapter 9). This implies that research findings relating to socio-economic differences in specific health problems and findings from explanatory studies cannot always be extrapolated from one country to another. Researchers must keep this in mind when comparing their results with those in other countries.

10.6 Suggestions for future research

In the next paragraphs, we discuss the issue of what we can learn from future cross-national comparisons of socio-economic differences in self-reported morbidity and risk factors and the way in which future comparisons can be improved.

Why comparing countries in the future?

First, researchers and policy makers will maintain an interest in judging the size of socio-economic differences in health and risk factors for health in their own country by comparison with other countries. Monitoring socio-economic differences in health indicators as well as changes in these differences over time among European countries might especially be of interest within the framework of the unification of (western) Europe. We investigated socio-economic differences in morbidity in a broad range of western European countries using three socio-economic indicators, four indicators of self-reported morbidity and five risk factors for health. However, the data were still

fragmentary. For example, perceived general health was the only morbidity indicator available for all countries and social gradients could be studied only for a few risk factors. In addition, some comparability problems could not be resolved. A more balanced evaluation of the international position of individual countries will be possible in future studies when the availability and comparability of data from European countries is enhanced.

Another reason for cross-national comparisons is that they are often the principal method to assess how national features, such as particular national policies or interventions, influence socio-economic differences in health or risk factors for health. The patterns observed in this study highlight, however, the complex way in which national characteristics influence socio-economic health differences. Therefore, superficial comparisons cannot provide strong evidence for the effect of specific national social, economic or health care policies. Future studies on the effect of specific national policies or other national features therefore should preferably focus on in-depth comparisons among a few contrasting countries using more extensive data, for example national longitudinal studies on the explanation of socio-economic differences in health and its risk factors. Unfortunately, for many countries such data are not available.

The lack of longitudinal studies explaining socio-economic differences in health indicators in many European countries highlights another reason for future international comparisons of socio-economic differences in specific health indicators. Comparing countries with respect to social gradients in risk factors for disease may help to judge whether it is appropriate to extrapolate findings from the few countries for which explanatory studies are available. In this study we showed, for example, that social gradients in smoking among women varied substantially, while social gradients in overweight were about the same in all countries. Future comparisons on social gradients among other risk factors for health, such as physical and psychosocial working conditions, might also be very helpful for this type of judgement.

How can future comprehensive cross-national studies be improved?

Although this was the most comprehensive international comparison with respect to socio-economic differences in morbidity and risk factors performed so far, it encountered strong limitations due to the scarcity of comparable data[79,80]. Our conclusions on international variations in the size of socio-economic differences in morbidity heavily depended on one indicator of morbidity, i.e. perceived general health. Moreover, some remaining comparability problems with respect to the measurement of morbidity could not be avoided. Future comparisons of socio-economic differences in morbidity can be enhanced by harmonisation of the measurement of morbidity in European countries. The first steps towards harmonisation of the measurement of morbidity in national health surveys have already been taken. WHO Europe formulated, in collaboration with Statistics Netherlands[81], guidelines for the harmonisation of methods and instruments for health interview surveys. These guidelines stress the importance of paying attention not only to indicators of physical health but also to indicators of mental health.

EUROSTAT has recently initiated a European panel survey which includes several health indicators. However, harmonisation of health indicators among European countries will not solve all problems completely. As discussed earlier, countries might differ in factors such as perceptions of health, medical culture and traditions. This might lead to artificial variations between countries in observed prevalence rates, even with identical survey questions. More research on the validity and comparability of morbidity indicators across different European countries is therefore desirable.

Another reason necessity for future studies is the enhancement of the availability of comparable data on socio-economic indicators, especially with respect to occupational class and income. In this study, morbidity differences between occupational class could be compared on the basis of a common social class scheme for only seven of the 12 countries. No comparable occupational data were available for women; countries especially differed in the information obtained for women who were not currently employed. With respect to income, only six countries could be compared and even among these countries, substantial differences in the measurement of income remained. Most problematic were the differences in the preciseness of the measurement of income and the percentage of respondents for which income data were missing. Detailed recommendations with respect to enhancement of the international comparability of educational groups and occupational class have been given by Kunst[12].

Our overview of socio-economic differences in risk factors for morbidity and mortality had to be restricted to a few, mostly behavioural, factors. It would be interesting to study other behavioural risk factors (e.g. physical activity), but also non-behavioural risk factors, such as housing conditions (e.g. dampness), physical working conditions (e.g. the exposure to toxic substances and monotonous movements) and psychosocial working conditions (e.g. job control). Unfortunately, the availability of data in national surveys was poor for these factors[82]. Moreover the questions were generally not comparable for those countries for which data were available. Future comparisons between socio-economic differences in risk factors will thus heavily depend on new initiatives with respect to data collection and harmonization.

Finally, at the onset of our study, there were no nationally representative data on socio-economic differences in morbidity and/or risk factors for health for some western European countries (including Greece, Portugal, Belgium and Austria) and most eastern European countries. Inclusion of the latter group of countries would be highly interesting considering their substantially different socio-economic and health care systems.

In conclusion, several reasons can be distinguished for studying cross-national variations in socio-economic differences in health indicators among European countries in the future. To enhance the validity and benefits of such future studies, the availability and comparability of data among European countries needs to be improved. The feasibility of these improvements will largely depend on future initiatives of researchers and statistical offices with respect to internationally coordinated surveys.

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Summary

In all European countries for which data are available, rates of mortality and morbidity have been found to be higher among groups with a lower educational level, a lower occupational class or a lower income. Possible explanations for socio-economic health differences have been widely discussed and during the last ten years, more and more studies have tried to quantify the contribution of different explanatory factors. However, the complex mechanisms which bring about the persistence nature of socio-economic differences around the world as well as over time is not yet completely understood.

Socio-economic inequalities in health have been increasingly studied from an international perspective. Different reasons can be distinguished for studying international variations. Comparing the size of socio-economic health differences in one's own country with that of others may provide a yardstick to judge the size of the differences in one's own country. Moreover, international comparisons may shed new light on the way in which national characteristics might influence the pattern and magnitude of socio-economic inequalities in health. Finally, they might be helpful in evaluating whether findings of studies with respect to the explanation of socio-economic health differences can be extrapolated from one country to another.

The study presented in this thesis aims to compare the magnitude of socio-economic differences in health indicators between western European countries. Furthermore, it investigates whether there are international variations in the size of socio-economic differences in risk factors for morbidity and mortality and whether these variations might help to explain international variations in the size of socio-economic health differences.

As compared to previous comparative studies on morbidity, this study gives a more comprehensive overview. First, we included 12 countries from both the north, the west and the south of Europe, using data from national health surveys or similar surveys of 1985-1993. Second, four different indicators of self-reported morbidity were included, namely perceived general health, long-term disabilities, chronic conditions and any-longstanding health problem. Third, three different indicators of socio-economic status were used: educational level, occupational class and income.

With respect to international variations in the size of socio-economic differences in risk factors for morbidity and mortality, this study can be seen as the first comprehensive one. The size of socio-economic differences in one or more risk factors was measured for 16 countries. Two types of data source were used. Data from national health surveys or similar surveys of 1986-1994 were used for 12 European countries to study socio-economic differences in smoking and height, which is a considered to be an indicator for living conditions during childhood. Data were also obtained from the Eurobarometer surveys of 1987-1991 to study socio-economic differences in smoking, excessive alcohol consumption, infrequent consumption of fresh vegetables and overweight in 11 European countries.

In comparison to previous cross-national comparisons, more effort was made to improve the comparability of the data and methods. The comparability of the morbidity data was enhanced by restricting the analyses to those countries where the survey data were judged to be highly comparable with respect to the structure and wording of the survey questions. The comparability of data on education and occupational class was enhanced by recoding individual data on education and occupation in a uniform way for all countries. Finally, the comparability of the methods was enhanced by performing all data analyses at one place, according to a standard protocol. Some remaining data problems could not be solved but a considerable number of sensitivity analyses have been performed to evaluate the possible effect of these problems.

Part I of this thesis (chapters 2 to 5) describes international variations in the size and pattern of socio-economic differences in self-reported morbidity among 12 western European countries. The results concern men and women aged 25-69 years. In chapter 2, differences in morbidity by educational level are studied for men and women from 11 European countries. A standardised scheme of educational levels was applied to each national survey. The size of health differences was measured by means of the regression based Relative Index of Inequality (RII). For all countries, the prevalence of ill health increased steadily with decreasing educational level. In general, there was a tendency for education-related differences in morbidity to be relatively large in Sweden, Norway and Denmark and to be relatively small in Spain, Switzerland and West Germany. Intermediate positions were observed for Finland, Great Britain, France and Italy. The position of the Netherlands strongly varied according to sex: relatively large differences were found for men whereas relatively small differences were found for women. The relative position of some countries, e.g. West Germany, varied according to morbidity indicator used.

In chapter 3 differences in morbidity by occupational class are studied among men in seven countries: France, Switzerland, West Germany, Great Britain, the Netherlands, Denmark, and Sweden. Women are not included since no internationally comparable data on occupational class were available for women. For each country, individual-level data on occupation were recoded according to one standard occupational class scheme: the Erikson-Goldthorpe social class scheme. For all countries, a lower than average

prevalence of morbidity was found for higher and lower administrators and professionals as well as for routine non-manual workers, whereas a higher than average prevalence was found for skilled and unskilled manual workers and agricultural workers. Self-employed men were in general healthier than the average population. The relative health of farmers differed between countries. The size of morbidity differences was summarised by an odds ratio comparing two broad hierarchical classes: manual workers versus administrators and professionals. The morbidity difference between these two broad classes was approximately equally large in all countries. Consistently larger inequality estimates, with no or slightly overlapping confidence intervals, were only found for Sweden in comparison to West Germany.

Chapter 4 gives an overview of morbidity differences by income level in six European countries: France, West Germany, Great Britain, the Netherlands, Finland and Sweden. Income was measured as net household income adjusted for household size. Respondents were regrouped into decile groups on the basis of this household equivalent income. The size of income-related differences in morbidity was summarised using, among others, the RII. For most countries, the prevalence of ill health increased regularly with decreasing income level. The RII for perceived general health was relatively large in Great Britain and small in Sweden, Finland and Germany, and showed a moderate correlation with the size of income inequalities. Different international patterns were observed for other indicators of morbidity. Furthermore, the position of some countries, especially the Netherlands, varied by sex. The size of income-related differences in health decreased substantially when controlled for educational level, occupational class and employment status. The residual impact of income on perceived general health was approximately equally large for most countries.

In chapter 5, socio-economic health differences in East and West Germany are compared using data from two cross-sectional nationally representative surveys conducted in 1990/92. The surveys used nearly identical questionnaires. Socio-economic status was measured by household equivalent income and by educational level. Morbidity was assessed by perceived general health and by the number of chronic conditions. Absolute differences as well as relative differences (odds ratios) in morbidity rates between low and high SES groups were calculated. Almost all measures of health inequalities indicated that health inequalities favouring the upper socio-economic groups exist in East Germany as well as in West Germany. There were no major differences in the extent of health inequalities between both parts of Germany despite the fact that they have experienced different social systems during the past 45 years.

Part II describes international variations in the size of socio-economic differences in risk factors for morbidity and mortality among 16 western European countries. The results concern men and women, aged 20-74 years. In chapter 6, education-related differences in smoking, excessive alcohol consumption, infrequent vegetable consumption and overweight are studied for 11 countries of the European Union. Data were obtained from the Eurobarometer survey. Relative differences (odds ratios) and absolute

differences in the prevalence of risk factors are calculated. International variations were found for most risk factors. Most noteworthy was the international pattern of social gradients in *smoking* among women. In northern countries, lower educated women smoked more often whereas in southern countries higher educated women smoked more often. In contrast to women, no clear north-south pattern was found for smoking among men, although we did observe a similar north-south gradient for smoking 10 or more cigarettes a day. For *excessive alcohol consumption* among men, a negative assocation was found for most countries but no or small differences were found for Denmark, Belgium, the Netherlands, Germany and France. Women did not show significant or substantial differences in excessive alcohol consumption in any of the countries. For *infrequent vegetable consumption* large negative associations among men were found for northern European countries whereas for southern European countries associations were small or absent. For women, only two northern European countries showed relatively large differences. Negative associations were found for *overweight* among women in all countries and in most countries for men too. For men, Ireland, Spain, Greece, and Portugal showed relatively small differences. No variations in the size of these differences between countries were found among women.

International variations in education-related differences in smoking are studied in more detail in chapter 7. Data wer obtained from national surveys of 12 European countries, including the Scandinavian countries and Switzerland. Relative differences (odds ratios) and absolute differences in the prevalence of ever-smoking, current smoking, current cigarette smoking and the number of cigarettes smoked per smoker are calculated for men and women aged 20 to 44 and 45 to 74 years. For older women, higher prevalence rates among the lower educated were found in Great Britain, Norway and Sweden whereas in southern European countries, higher educated women smoked more. A north-south pattern, although less marked, was also found for older men. For younger subjects, prevalence rates were, in most countries, higher among the lower educated. The size of the differences among young women showed a similar north-south pattern as for older age groups. Among young men, large differences were found for northern as well as for most southern countries, except Portugal. These observed international variations in social gradients in smoking were related to differences between countries according to what stage they had reached in the smoking epidemic. The more advanced the epidemic was, the more smoking was concentrated among the lower socio-economic groups.

Chapter 8 describes variations in average height between 10 European countries, and between socio-economic groups within these countries. National survey data are used. Men and women were on average tallest in the Netherlands, Norway, Sweden and Denmark and shortest in France, Italy and Spain (range for men: 1.70-1.79 cm; range for women: 1.60-1.67 cm). Mean height generally increased linearly with increasing year of birth. The differences in average height between southern and northern European countries were not smaller among younger birth cohorts than among older birth cohorts, or in other words, the south has not caught-up during the last decades. In all

countries, lower educated men and women were on average shorter than higher educated men and women. No clear international pattern was found with respect to the size of education-related height differences. In most countries, education-related height differences were not smaller among younger birth cohorts than among older birth cohorts. The persistence of education-related height differences, even in more prosperous countries, suggests that inequalities in childhood living conditions in all countries will continue to contribute to inequalities in both height and health over the next decades.

Part III focuses on the possible contribution of international variations in social gradients of risk factors to international variations in the size of socio-economic health differences. In chapter 9, the size of inequalities in cardiovascular disease mortality is compared between nine countries (eight European countries and the US), and the contribution of risk factors to the explanation of these cross-national variations in cardiovascular disease mortality is assessed. In all countries, mortality from cardiovascular diseases was higher among persons with lower occupational class or lower educational level. Within western Europe, a north-south gradient was apparent, with inequalities being larger in the north of Europe than in the south It appeared that inequalities in cardiovascular disease mortality were consistently larger in countries where inequalities in cigarette smoking and in excessive alcohol consumption were larger. This suggested that these international patterns were at least partly due to differences between countries in the social patterning of behaviour.

In the final chapter, an overview of the main results is given (10.2) and the effect of remaining data problems on the validity of the results are discussed (10.3). Remaining data problems which may have affected the internal validity of our results concern the measurement of the morbidity indicators, the measurement of the risk factors, the measurement of the socio-economic indicators and some general characteristics of the surveys used in this study. Moreover, our restriction to data with the best cross-national comparability may have affected the external validity of the results. Because of these problems it is not possible to exclude the possibility that the international position of some countries is biased. However, it is not likely that these problems can explain our remarkable observation that morbidity differences are not smaller in the Scandinavian countries and the Netherlands than in other western European countries. Moreover, it is not plausible that these problems have substantially biased the marked international patterns of social gradients in risk factors that we found.

In section 10.4, possible explanations are given for some of the remarkable international patterns observed in this study. A possible explanation for the patterns observed for education and occupation is that the countries involved differ in the amount of intergenerational social mobility. A larger degree of social mobility may add to larger differences in health. It is, however, unlikely that international differences in social mobility have a major impact. An explanation which is supported by the results of this thesis is that socio-economic differences in specific risk factors, such as behavioural risk factors, are relatively large in the Nordic countries and the Netherlands. The

international patterns observed in this thesis, and the different explanations given indicate that inequalities in morbidity are influenced by the national context in highly complex ways.

Section 10.5 discusses the implications of our findings for policies and future research. First, our finding that socio-economic differences in health are not necessarily smaller in egalitarian countries, does not indicate that egalitarian socio-economic policies do not contribute to the reduction of health differences. Possibly, the favourable effects of such policies can be concealed by the effect that other national characteristics have on health inequalities. None the less, the results of our study do indicate that egalitarian policies alone are no guarantee for success. Second, our finding that socio-economic differences in morbidity are not generally larger or smaller in some countries than in others, stresses the need for all countries to put socio-economic health differences high on their national policy and research agenda. Third, although there is no strong evidence that the magnitude of socio-economic differences in health in general varies substantially between western European countries, this does not mean that these differences have the same background in all countries. A first indication for variations in underlying causes is given by the fact that the international position of several countries varied according to sex, health indicator and/or socio-economic indicator. Moreover, this study showed that countries varied with respect to social gradients in several risk factors (chapter 6 and 7). This implies that research findings on socio-economic differences in specific health problems and findings from explanatory studies often cannot simply be extrapolated from one country to another.

Section 10.6 discusses reasons for future studies on socio-economic differences in health indicators among a broad range of European countries. To enhance the validity and benefits of such future studies, the availability and comparability of data among European countries needs to be improved. The feasibility of these improvements are likely to depend largely on future international collobaration of health surveys.

Samenvatting

In alle Europese landen waarvan gegevens beschikbaar zijn, hebben onderzoeken aangetoond dat mensen met een laag inkomen, een lage opleiding en een lage beroepsklasse vaker ziek zijn en eerder sterven. Mogelijke verklaringen voor deze sociaal-economische gezondheidsverschillen zijn in de literatuur uitgebreid beschreven. In de afgelopen tien jaar hebben diverse studies geprobeerd om de bijdrage van de verschillende verklaringen te kwantificeren. De complexe mechanismen die de persistente sociaal-economische gezondheidsverschillen veroorzaken zijn echter nog niet helemaal duidelijk.

Sociaal-economische gezondheidsverschillen worden in toenemende mate bestudeerd vanuit een internationaal perspectief. Hiervoor zijn diverse redenen te noemen. Ten eerste kunnen vergelijkingen van de omvang van sociaal-economische verschillen in het eigen land met die in andere landen voorzien in een maatstaf waarmee de omvang van de verschillen in het eigen land zijn te beoordelen. Ten tweede kunnen internationale vergelijkingen mogelijk een licht werpen op de manier waarop nationale kenmerken het patroon en de omvang van sociaal-economische gezondheidsverschillen beïnvloeden. Tot slot kunnen dergelijke onderzoeken behulpzaam zijn bij het beoordelen of resultaten van onderzoeken naar sociaal-economische gezondheidsverschillen van het ene land naar het andere land geëxtrapoleerd mogen worden.

Het onderzoek dat in dit proefschrift beschreven wordt, heeft tot doel Westeuropese landen te vergelijken met betrekking tot de omvang van sociaal-economische verschillen in diverse indicatoren voor gezondheid. De studie bouwt verder op eerdere onderzoeken die landen hebben vergeleken met betrekking tot de omvang van sociaal-economische verschillen in zelf-gerapporteerde gezondheid. Bovendien worden in dit proefschrift internationale variaties in de omvang van sociaal-economische verschillen in risicofactoren voor morbiditeit en mortaliteit bestudeerd. Daarnaast wordt nagegaan in hoeverre deze variaties mogelijk een bijdrage leveren aan internationale variaties in de omvang van sociaal-economische gezondheidsverschillen.

In vergelijking tot eerdere internationale vergelijkingen naar de omvang van sociaal-economische verschillen in morbiditeit is de studie die in dit proefschrift beschreven wordt veelomvattender. Ten eerste worden 12 landen uit zowel het noorden, het westen

en het zuiden van Europa vergeleken. Hiertoe wordt gebruik gemaakt van gegevens van nationale gezondheidsenquêtes of vergelijkbare enquêtes gehouden tussen 1985 en 1993. Ten tweede worden vier verschillende indicatoren van zelf-gerapporteerde morbiditeit bestudeerd, te weten: eigen oordeel gezondheid, langdurige beperkingen, chronische aandoeningen en enig landurig gezondheidsprobleem. Ten derde worden drie verschillende indicatoren voor sociaal-economische status gebruikt: opleiding, beroepsklasse en inkomen.

Dit is de eerste uitgebreide studie naar internationale variaties in de omvang van sociaal-economische verschillen in risicofactoren voor morbiditeit en mortaliteit. De omvang van sociaal-economische verschillen in één of meerdere risicofactoren wordt bestudeerd voor 16 Europese landen. Hiervoor worden twee typen databronnen gebruikt. Van 12 Europese landen worden de gegevens gebruikt van nationale gezondheidsenquêtes of vergelijkbare enquêtes gehouden tussen 1985 en 1994 voor het bestuderen van sociaal-economische verschillen in roken en lengte. Lengte wordt gezien als een indicator voor levensomstandigheden tijdens de kinderjaren. Gegevens van de Eurobarometer surveys welke gehouden gehouden tussen 1987 en 1991 worden gebruikt voor het bestuderen van sociaal-economische verschillen in roken, excessief alcoholgebruik, niet frequente consumptie van verse groente en overgewicht.

In vergelijking tot eerdere internationale vergelijkingen is in deze studie meer moeite gedaan om de vergelijkbaarheid van de gegevens en de methoden te optimaliseren. De vergelijkbaarheid van de morbiditeitsgegevens is geoptimaliseerd door de analyse te beperken tot die landen waarvoor de vragen uit de enquête wat betreft structuur en formulering goed vergelijkbaar zijn. De vergelijkbaarheid van gegevens over opleiding en beroep zijn geoptimaliseerd door individuele opleidings- en beroepsgegevens voor alle landen op een uniforme wijze te hercoderen. Tot slot is de vergelijkbaarheid van de methoden gegarandeerd doordat alle gegevensanalyses op één plaats en volgens een standaard protocol zijn uitgevoerd. Een aantal vergelijkbaarheidsproblemen konden echter niet worden voorkomen. Daarom is een groot aantal gevoeligheidsanalyses uitgevoerd om het effect van deze problemen te evalueren.

Deel I van dit proefschrift (hoofdstuk 2 tot 5) beschrijft internationale variaties in de omvang en in de patronen van sociaal-economische verschillen in zelf-gerapporteerde morbiditeit voor 12 Westeuropese landen. De resultaten hebben betrekking op mannen en vrouwen in de leeftijd van 25 tot 69 jaar. In hoofdstuk 2 worden morbiditeitsverschillen naar opleiding bestudeerd voor mannen en vrouwen uit 11 Europese landen. In alle landen is gebruik gemaakt van een uniforme indeling van opleidingsnivo's. De omvang van de gezondheidsverschillen is gemeten met de 'Relative Index of Inequality' (RII). Voor alle landen nam de prevalentie van morbiditeit systematisch toe met het afnemen van het opleidingsnivo. De tendens was relatief grote verschillen in morbiditeit tussen laag en hoog opgeleiden in Zweden, Noorwegen en Denemarken en relatief kleine verschillen in Spanje, Zwitserland en West-Duitsland. Finland, Groot Brittannië, Frankrijk en Italië bevonden zich in een middenpositie. De positie van Nederland

varieerde sterk. Voor mannen waren de verschillen relatief groot, voor vrouwen relatief klein. De positie van sommige landen, bijvoorbeeld West-Duitsland, varieerde afhankelijk van de bestudeerde morbiditeitsindicator.

In hoofdstuk 3 worden verschillen in morbiditeit naar beroepklasse bestudeerd voor mannen uit zeven landen: Frankrijk, Zwitserland, West-Duitsland, Groot-Brittannië, Nederland, Denemarken en Zweden. De verschillen voor vrouwen zijn niet bestudeerd aangezien er geen internationaal vergelijkbare gegevens voor vrouwen beschikbaar waren. Voor ieder land zijn de individuele beroepsgegevens opnieuw gecodeerd naar een standaard beroepsclassificatie: het Erikson-Goldthorpe beroepsklassen schema. Voor alle landen werd een lager dan gemiddelde prevalentie van morbiditeit gevonden voor de 'hogere employees' (administrators and professionals) en 'lagere employees' (routine non-manual workers). Een hoger dan gemiddelde prevalentie van morbiditeit werd gevonden voor geschoolde en ongeschoolde handarbeiders (skilled and unskilled manual workers) en voor landarbeiders (agricultural labourers). De relatieve gezondheid van agrariërs varieerde tussen landen. Zelfstandigen waren in het algemeen gezonder dan gemiddeld. De omvang van morbiditeitsverschillen naar beroep is samengevat met een odds ratio die de prevalentie van twee brede beroepsklassen vergelijkt: handarbeiders (manual workers) en hogere employees (administrators and professionals). De morbiditeitsverschillen tussen deze twee brede beroepklassen waren in alle landen ongeveer even groot. Consistent grotere verschillen zonder of slechts met marginaal overlappende betrouwbaarheidsintervallen werden alleen gevonden voor Zweden in vergelijking tot West-Duitsland.

Hoofdstuk 4 geeft een overzicht van gezondheidsverschillen naar inkomen in zes Europese landen: Frankrijk, West-Duitsland, Groot-Brittannië, Nederland, Finland en Zweden. Inkomen is gemeten als het netto huishoudinkomen gecorrigeerd voor de grootte van de huishouding. Respondenten zijn opnieuw gegroepeerd in decielen op basis van het equivalente huishoudinkomen. De omvang van inkomensgerelateerde verschillen in morbiditeit is, onder andere, samengevat aan de hand van de RII. Voor de meeste landen nam de prevalentie van morbiditeit systematisch af met het toenemen van het inkomen. De RII voor eigen oordeel gezondheid was relatief groot in Groot-Brittannië en relatief klein in Zweden, Finland en Duitsland, en toonde een relatie met de omvang van de inkomensverschillen. Voor de andere morbiditeitsindicatoren werden afwijkende internationale patronen gevonden. Tevens varieerde de positie van sommige landen, en van Nederland in het bijzonder, tussen mannen en vrouwen. De omvang van inkomensgerelateerde verschillen in morbiditeit nam substantieel af na correctie voor opleiding, beroepsklasse en economische activiteit. De resterende invloed van inkomen op het eigen oordeel gezondheid was in de meeste landen ongeveer even groot.

In hoofdstuk 5 worden sociaal-economische gezondheidsverschillen in Oost en West-Duitland vergeleken. Hiertoe is gebruik gemaakt van gegevens van twee cross-sectionele, representatieve surveys uitgevoerd in de periode 1990-1992. De enquête-vragen van beide surveys waren vrijwel identiek. Morbiditeit is gemeten als het eigen

oordeel gezondheid en het aantal chronische aandoeningen. Zowel absolute als relatieve verschillen in morbiditeit tussen lage en hoge sociaal-economische groepen zijn berekend. Bijna alle maten van gezondheidsverschillen toonden aan dat de prevalentie van morbiditeit lager was onder de hogere sociaal-economische groepen en dat dit zowel voor Oost als voor West-Duitsland geldt. Er waren echter geen belangrijke verschillen in de omvang van de sociaal-economische gezondheidsverschillen tussen de beide Duitslanden. Dit ondanks het feit dat beide landen de afgelopen 45 jaar aan verschillende sociale systemen hebben blootgestaan.

Deel II van dit proefschrift beschrijft internationale variaties in de omvang van sociaal-economische verschillen in risicofactoren voor morbiditeit en mortaliteit voor 16 Europese landen. De resultaten hebben betrekking op mannen en vrouwen in de leeftijd van 20 tot 74 jaar. Opleiding is gebruikt als indicator van sociaal-economische status.

In hoofdstuk 6 worden sociaal-economische verschillen in roken, overgewicht, excessief alcoholgebruik en infrequente consumptie van groente bestudeerd voor 11 Europese landen. Hiertoe is gebruik gemaakt van de Eurobarometer surveys. Zowel relatieve als absolute verschillen in de prevalentie van risicofactoren zijn bestudeerd. Voor de meeste risicofactoren werden variaties gevonden tussen landen. Meest opvallend was het internationale patroon voor roken voor vrouwen. In noordelijke landen rookten lager opgeleiden vaker terwijl in zuidelijke landen hoger opgeleiden vaker rookten. In tegenstelling tot vrouwen werd voor mannen geen duidelijk noord-zuid patroon gevonden, hoewel er wel een noord-zuid patroon aanwezig was voor het roken van 10 of meer sigaretten per dag. Voor excessief alcoholgebruik werd voor mannen uit de meeste landen een negatieve associatie gevonden. Geen of slechts kleine verschillen werden gevonden voor Denemarken, België, Nederland, Duitsland en Frankrijk. Voor vrouwen werden in geen van de landen significante of relevante verschillen gevonden voor excessief alcoholgebruik. Voor infrequente consumptie van groente werden voor mannen grote negatieve associaties gevonden in een aantal noordelijke landen terwijl in de zuidelijke landen de associaties klein of totaal afwezig waren. Voor vrouwen toonden slecht twee noordelijke Europese landen relatief grote verschillen. Voor overgewicht werden voor mannen en vrouwen in alle landen negatieve associaties gevonden. Voor vrouwen werden geen variaties tussen landen gevonden in de omvang van de verschillen. Voor mannen waren de verschillen relatief klein in Ierland, Spanje, Griekenland en Portugal.

Internationale variaties in sociaal-economische verschillen in roken worden in detail bestudeerd in hoofdstuk 7. Hiertoe is gebruik gemaakt van gegevens van nationale surveys uit 12 Europese landen, inclusief de Scandinavische landen en Zwitserland. Relatieve verschillen (odds ratios) en absolute verschillen in de prevalentie van ooit-roken, huidig roken, huidig sigaretten roken en het aantal sigaretten per roker zijn berekend voor mannen en vrouwen in de leeftijd van 20 tot 44 en 45 tot 74 jaar. Voor oudere vrouwen werden hogere prevalenties onder de lager opgeleiden gevonden in Groot Brittannië, Noorwegen en Zweden terwijl in de zuidelijke Europese landen hoger

opgeleide vrouwen vaker rookten. Een vergelijkbaar noord-zuid patroon, hoewel minder markant, werd ook gevonden voor oudere mannen. Voor jongere mannen en vrouwen was de prevalentie in de meeste landen hoger onder de lager opgeleiden. De omvang van de verschillen onder jonge vrouwen toonde een vergelijkbaar noord-zuid patroon als voor oudere vrouwen. Voor jonge mannen werden relatief grote verschillen gevonden voor zowel noordelijke als zuidelijke Europese landen, met uitzondering van Portugal. De geobserveerde internationale variaties in sociale gradienten in roken waren gerelateerd aan verschillen tussen landen in hun stadium van de rookepidemie. Hoe eerder de rookepidemie gestart was, hoe meer roken geconcentreerd was onder de lagere sociaal-economische groepen.

Hoofdstuk 8 beschrijft variaties in lengte tussen 10 Europese landen en tussen sociaal-economische groepen binnen die landen. Hiertoe zijn gegevens van nationale surveys gebruikt. Mannen en vrouwen waren gemiddeld het langst in Nederland, Noorwegen, Zweden en Denemarken en het kortst in Frankrijk, Italië en Spanje (range mannen: 1.70-1.79 cm, range vrouwen: 1.60-1.67 cm). De gemiddelde lengte nam in het algemeen lineair toe met het toenemen van het geboortejaar. De verschillen in gemiddelde lengte tussen zuidelijke en noordelijke Europese landen waren niet kleiner onder jongere geboortencohorten in vergelijking tot oudere geboortencohorten, m.a.w. het lengteverschil tussen het noorden en het zuiden van Europa is gedurende de laatste tientallen jaren niet kleiner geworden. In alle landen waren lager opgeleide mannen en vrouwen gemiddeld korter dan hoger opgeleide mannen en vrouwen. De omvang van deze verschillen in lengte toonde geen duidelijk internationaal patroon. In de meeste landen waren de lengteverschillen tussen laag en hoog opgeleiden onder jongere geboortencohorten niet kleiner dan onder oudere geboortencohorten. De persistente lengteverschillen tussen sociaal-economische groepen, zelfs in de meer welvarende landen, suggereert dat leefomstandigheden tijdens de kinderjaren in de komende decennia zullen blijven bijdragen aan zowel sociaal-economische verschillen in lengte alsmede in gezondheid.

Deel III van het proefschrift richt zich op de mogelijk bijdrage van internationale variaties in sociale gradiënten van risicofactoren aan internationale variaties in de omvang van sociaal-economische gezondheidsverschillen. In hoofdstuk 9 worden negen landen (acht Europese landen en de Verenigde Staten) vergeleken met betrekking tot de omvang van sociaal-economische verschillen in sterfte aan cardiovasculaire ziekten. Tevens wordt de mogelijke bijdrage van risicofactoren aan deze internationale variaties in de omvang van sociaal-economische verschillen in cardiovasculaire sterfte onderzocht. In alle landen was de sterfte aan cardiovasculaire ziekten hoger onder personen met een lagere beroepsklasse of lagere opleiding. Binnen West-Europa was een noord-zuid patroon aanwezig. De verschillen waren groter in het noorden dan in het zuiden van Europa. De gegevens betreffende de risicofactoren suggeren dat deze internationale patronen ten minste gedeeltelijk samenhangen met verschillen tussen landen in het sociale patroon van gedrag. Het bleek dat sociaal-economische verschillen in cardiovasculaire sterfte consistent groter waren in landen met grote verschillen in het roken van sigaretten en in excessief alcoholgebruik.

In het laatste hoofdstuk wordt een overzicht gegeven van de belangrijkste resultaten (10.2) en wordt het effect van resterende dataproblemen op de validiteit van de resultaten bediscussieerd (10.3). Resterende dataproblemen die mogelijk een effect gehad hebben op de interne validiteit hebben betrekking op de meting van de morbiditeitsindicatoren en de risicofactoren, de meting van de sociaal-economische indicatoren en een aantal algemene kenmerken van de surveys die gebruikt zijn voor dit onderzoek. Tevens kan de strikte selectie van gegevens t.b.v. het optimaliseren van de internationale vergelijkbaarheid van de gebruikte gegevens de externe validiteit van de resultaten beïnvloed hebben. Vanwege deze problemen is het niet uit te sluiten dat de internationale positie van sommige landen enigszins vertekend is. Het is echter niet waarschijnlijk dat dataproblemen onze bevinding dat sociaal-economische verschillen niet noodzakerlijkerwijs kleiner zijn in de Scandinavische landen en Nederland dan in andere Westeuropese landen verklaren. Tevens is het niet aannemelijk dat deze problemen een substantieel effect hebben gehad op het door ons gevonden internationale patronen met betrekking tot sociale gradiënten in risicofactoren.

In paragraaf 10.4 worden mogelijk verklaringen gegeven voor het opmerkelijke internationale patroon dat in deze studie gevonden is. Een mogelijke verklaring voor het gevonden patroon voor opleiding en beroep is dat landen verschillen in de mate van intergenerationele sociale mobiliteit. Een grotere sociale mobiliteit kan leiden tot een toename van de omvang van gezondheidsverschillen. Het is echter niet waarschijnlijk dat internationale verschillen in sociale mobiliteit een groot effect hebben. Een verklaring die ondersteund wordt door onze bevindingen is dat sociaal-economische verschillen in specifieke risicofactoren, zoals de gedragsgerelateerde risicofactoren, relatief groot zijn in de Scandinavische landen en Nederland. De internationale patronen gevonden in dit onderzoek en de verklaringen die hiervoor aangedragen worden, indiceren in ieder geval dat de wijze waarop de omvang van sociaal-economische gezondheidsverschillen door nationale gebeurtenissen en kenmerken wordt beïnvloed zeer complex is.

Paragraaf 10.5 bekijkt de implicaties van onze resultaten voor beleid en toekomstig onderzoek. Onze bevinding dat sociaal-economische verschillen niet kleiner zijn in meer egalitaire landen wil nog niet zeggen dat egalitair sociaal-economisch beleid geen bijdrage levert aan het verkleinen van deze verschillen. Het is mogelijk dat het gunstige effect van een dergelijk beleid verborgen wordt door effecten die andere nationale kenmerken hebben op de omvang van de gezondheidsverschillen. De resultaten van deze studie tonen echter wel aan dat egalitair beleid alleen geen garantie is voor succes. Onze bevinding dat sociaal-economische verschillen in alle landen bestaan en dat zij niet consistent kleiner of groter zijn in één van de landen, benadrukt dat in alle landen sociaal-economische gezondheidsverschillen op de nationale politieke agenda en de onderzoeksagenda zouden moeten staan. De afwezigheid van grote internationale variaties in de omvang van de sociaal-economische gezondheidsverschillen betekent echter niet dat deze verschillen in alle landen dezelfde achtergrond hebben. Een eerste indicatie voor variaties tussen landen in het belang van mogelijke achterliggende factoren wordt

gegeven door het feit dat de internationale positie van een aantal landen varieerde tussen sociaal-economische indicatoren. Verder werd in dit onderzoek gevonden (hoofdstuk 6 en 7) dat de scheefheid van sociale gradiënten in een aantal risicofactoren aanzienlijk verschilde tussen landen. Dit betekent dat onderzoeksresultaten betreffende sociaal-economische gezondheidsverschillen vaak niet simpelweg van het ene naar het andere land geëxtrapoleerd kunnen worden.

Paragraaf 10.6 bespreekt redenen voor toekomstig onderzoek naar sociaal-economische verschillen in gezondheidsindicatoren in een brede groep van Europese landen. Voor het verbeteren van de validiteit en de doelmatigheid van dergelijke toekomstige studies is het noodzakelijk dat zowel de beschikbaarheid als de vergelijkbaarheid van gegevens van Europese landen worden verbeterd. De uitvoerbaarheid van dergelijke verbeteringen hangt waarschijnlijk in hoge mate af van toekomstige internationale samenwerking op het gebied van gezondheidsenquêtes.

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Curriculum Vitae

The author was born in Lage Zwaluwe, the Netherlands on September 19th 1969. She completed secondary school at the Thomas More College in Oudenbosch before she started, in 1987, her studies in Human Nutrition at the Wageningen Agricultural University (WAU). During her studies, she did research at the Department of Human Nutrition and the Department of Epidemiology and Public Health of the WAU, and at the Physiological Institute of the University of Lausanne, Switzerland.

After her graduation in 1993, she became a PhD student at the Netherlands Institute for Health Sciences (NIHES). She performed her research project described in this thesis at the Department of Public Health of the Erasmus University, but was also affiliated to the Department of Health Care Policy and Management of the same university. In June 1995, she obtained a MSc in Epidemiology.

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