Monitoring socio-economic inequalities in health in the European Union: guidelines and illustrations

A report for the Health Monitoring Program
of the European Commission

Final report

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February 2001

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Preface

As part of the Health Monitoring Programme of the European Commission, a project was carried out on "Monitoring and reporting of socio-economic differences in health indicators in the European Union". This project started in December 1998 and the main work lasted 18 months. The project consisted of two parts, one on reporting and the other on monitoring of socio-economic inequalities in health.

The 'reporting' part was co-ordinated by the Institute of Public Health of Nord Rhein Westfalia at Bielefeld (Germany). The principal objective of this part was to develop a format for the regular reporting on socio-economic inequalities in health. Particular emphasis was given to reporting on the health situation of specific disadvantaged groups. The main results of this part are presented in a report entitled "Reporting of socio-economic differences in health indicators in Europe".

The 'monitoring' part was co-ordinated by the Department of Public Health of the Erasmus University Rotterdam. Its main objective was to develop guidelines for the monitoring of socio-economic inequalities in health, and to illustrate these guidelines with analyses of changes in health inequalities in several member states. Special efforts were made to produce an extensive series of tables with new estimates of socio-economic inequalities in mortality and morbidity. The guidelines and the illustrations are presented in this report.

We truly wish that the guidelines and illustrations presented in this report will stimulate the development of information systems that are able to monitor socio-economic inequalities in most or all member states of the European Union.

The authors

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As part of this project, two workshops were held in Rotterdam (April 1999) and Bielefeld (April 2000). Apart from the members of the EU Working Group on Socio-economic Inequalities in Health, the following persons participated in one of these workshops (in alphabetical order): Maria Branting (Sweden), Joanna Brown (United Kingdom), Hilary Page (Belgium), Éva Rásky (Austria), Marit Rognerud (Norway) and Bjørn Heine Strand (Norway).

The illustrative analyses that are presented in this report would not have been possible without the willingness of central statistical offices to provide unpublished data from health interview or multi-purpose surveys and from national mortality registries.

We are most grateful to Charlie Owen (Institute of Education, London), who performed a special analysis data of the General Household Surveys of 1984 and 1996. The results of this analysis are included in table 18.8.

When developing guidelines for monitoring socio-economic inequalities in health, we were inspired by the many other projects that were carried out under the Health Monitoring Program of the European Commission. We would like to thank especially Pieter Kramers (RIVM, The Netherlands), whose comments helped us to fine-tune the guidelines so as to make them maximally useful for the Health Monitoring Program.

The authors

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Summary

Background
Socio-economic inequalities in morbidity and mortality are an important public health problem in the European Union (EU). People from lower socio-economic groups are reported to suffer 2 or 3 times more often from disease, disability or premature death. It is important to take socio-economic factors into account in the Health Monitoring System (HMS) that is being developed by the European Commission. Their inclusion will offer a unique opportunity to monitor socio-economic inequalities in morbidity and mortality not only for single member states, but also for the EU at large.

Overall aim, objectives
This report aims to contribute to the development of a system for monitoring socio-economic differences in health indicators in the European Union. The specific objectives of this report are (1) to develop guidelines for the monitoring of trends in socio-economic inequalities in morbidity and mortality and (2) to illustrate these guidelines by analysing changes in health inequalities in several member states between the 1980's and 1990's. These illustrative analyses serve the additional purpose to explore the possibilities that the currently available data sources offer to monitor inequalities in health in the EU.

Approach
The work plan consisted of three steps. First, a preliminary set of guidelines were developed by explicitly taking into account both practical and theoretical considerations. Emphasis was laid on practical considerations. For example, the proposed data sources should be available for most member states, and analytical methods should be easy to calculate and interpret. Second, the preliminary guidelines were applied in a number of illustrative analyses that were based on data from mortality registries and health interview or multi-purpose surveys. The analyses covered a broad range of health indicators and socio-economic indicators. Nearly all EU member states were included for which nationally representative data were available. Third, based on the experiences with the illustrative analyses, the definitive series of guidelines were formulated.

Results
It was possible to develop a detailed set of guidelines that were agreed upon by all participants to the project (see part two). These guidelines were found to be applicable to both mortality registries and to interview surveys. The main guidelines are summarised in chapter 2. Guidelines are given on each of the five steps that have to taken in order to monitor socio-economic inequalities in health. These steps are (1) the identification of data sources, (2) the measurement of socio-economic variables, (3) the tabulation of health indicators by socio-economic variables, (4) the statistical analyses of the data and (5) the evaluation and interpretation of the results. Chapters 4 to 8 discuss these steps in more detail, and give suggestions on precise methods and indicators to be used.

In the illustrative analyses, it was found possible to provide a first EU wide overview of trends in socio-economic inequalities in mortality and morbidity (see part three). Socio-economic inequalities in mortality (by cause of death) and in self-reported morbidity were demonstrated for each EU member state for which data were available. Relative inequalities in pre-mature mortality widened between the 1980s and the 1990s. The changes with respect to self-reported morbidity were less consistent. Detailed data results on both mortality and morbidity are presented in chapters 11 to 18. In each chapter, the potential effect of a number of data problems is evaluated carefully, often with numerical examples.

Conclusions
It is possible to monitor socio-economic inequalities in cause-specific mortality and/or self-reported morbidity in most EU member states. Including measures of socio-economic

inequalities in health will greatly enhance the informative value of a Health Monitoring System for the EU. Detailed guidelines are now available that are both theoretically acceptable and practically feasible.

Further work

At pages 5 and 6, a number of recommendations are given for future work that aims to contribute to monitoring socio-economic inequalities in health in the EU. It is stressed that the usefulness of the HMS to policy makers would be greatly enhanced by adding information on socio-economic inequalities in *determinants* of mortality and morbidity, such as health behaviours and health care utilisation.

Contributions to the Health Monitoring Program

Below, we summarise the main contributions of this report to the Health Monitoring Program of the European Commission.

On the improvement of comparability of data sets between member states

To this challenge, the report makes three contributions. First, data sources are identified that in the current situation can provide comparable data on health inequalities in most members states (chapters 4 and 10). Second, recommendations are developed on how to improve the availability, reliability and comparability of these data sets in the future. This applies especially to data on socio-economic indicators (chapter 5). Third, guidelines are given on how to analyse these data in such ways that the results are maximally robust to problems of data comparability (chapters 6 to 8).

On the improvement of indicators definitions, to be used in an EU indicator set

To this task, the report makes make three contributions. First, it identifies the socio-economic indicators that can best be used to monitor socio-economic inequalities in health in member states. Second, it provides recommendations on the precise measurement of these indicators (chapter 5). Finally, it gives recommendations on the way in which health indicators can be presented and analysed in relation to these socio-economic indicators (chapter 6).

On the improvement of the availability of data for use in the HIEMS system

The main contribution from this report is that it provides many tables with detailed estimates of socio-economic inequalities in health (chapters 11 to 18). These estimates were made as part of this project and they include several novel and highly interesting findings. The data cover most member states, both men and women, both mortality and self-reported morbidity, different socio-economic indicators, and both the 1980s and 1990s. Those with an interest in socio-economic inequalities in health will find it very helpful to have access to these data by means of the Health Indicators Exchange and Monitoring System (HIEMS).

Further work

The main step forwards: from health indicators to determinants of health

This report demonstrated that substantial inequalities in morbidity and mortality exist in all member states of the European Union, and that there is clear evidence for a widening of inequalities in mortality in many countries. These inequalities are a major challenge for public health policy, both at national levels and at the European level. In order to develop policy proposals, however, information is necessary about the specific factors that contribute to socio-economic inequalities in health. This requires the availability of data on socio-economic inequalities in *determinants* of mortality and morbidity, such as health-related behaviours and health care utilisation.

The main next step would therefore be to develop guidelines for monitoring socio-economic inequalities in these determinants, and to test these guidelines by applying them to routinely data available in member states of the European Union. Of especial interest are determinants that can be monitored by using data sources that are already available for most member states. For example, health interview and multi-purpose surveys can be used to monitor socio-economic inequalities in (a) health behaviours such as smoking, drinking and diet, (b) living and working conditions and (c) the utilisation of preventive and curative health services.

This new effort would not only result in a comprehensive overview of socio-economic inequalities in several determinants, but will also help to explain why inequalities in mortality have increased over time in many EU member states. In addition, this new effort will serve as a bridge between the present HMP project (on monitoring socio-economic inequalities in morbidity and mortality) and HMP projects that focus on monitoring the prevalence of determinants in the general population.

Areas of methodological work

1. Evaluation of potential data problems.
As shown in part three, data from mortality registries and from health interview surveys suffer from a number of problems that have the potential to bias estimates of socio-economic inequalities in mortality and morbidity. The effect of these data problems should be evaluated more systematically than was possible in the present project. For example, in health interview and similar surveys, special attention should be given to the effects of (a) high non response rates in some countries, (b) the exclusion of institutionalised populations from most surveys and (c) problems with comparability (both over time and across countries) of some health indicators.

2. Evaluation of alternative socio-economic measures.
In this report, the three core socio-economic indicators (education, occupation and income) were recommended for use in the HMS. For practical reasons, standard ways of measuring and classifying these indicators were recommended. For theoretical reasons, however, a number of alternative and promising measures may be considered for future data acquisition and monitoring. Examples include (a) life-course based measures, such as occupational class measured in different moments in life, (b) measures of wealth and accumulated life-time income, such as house ownership and (c) measures that identify specific disadvantaged groups, such as ethnic minorities. Attention should also be given to develop internationally comparable indicators of long-term unemployment.

3. Application to other data sources.
For practical reasons, this report focussed on the two data sources that are most promising for monitoring socio-economic inequalities in health indicators in the EU. However, several other

data sources are also considered for use in the HMS, and some of these sources may be used to monitor socio-economic inequalities in specific health indicators. Examples include registers of specific diseases such as cancer registers, and registries on work disability. Specific evaluations should reveal the potentials and problems of these data sources for monitoring socio-economic inequalities in specific health indicators.

Chapter 1.
Background and purposes

1.1. Why monitoring socio-economic inequalities in health?

Socio-economic inequalities in morbidity and mortality are an important public health problem in the European Union (EU). For each member state for which data are available, it has been shown that citizens who are disadvantaged in income level, occupational status or educational level are also disadvantaged in health and length of life. People from lower socio-economic groups are often reported to suffer 2 or 3 times more often from disease, disability or other health problems.

It is important to take socio-economic factors into account in the Health Monitoring System (HMS) that is being developed by the European Commission (EC). Under this system, the EC and its institutions will (a) gather nationally available data on the health situation of the population of its member states, (b) analyse and present these data in ways that are maximally comparable across member states and maximally informative to EC and national policies. When socio-economic differentials are taken into account in the HMS, this system will provide a unique opportunity to monitor socio-economic inequalities in morbidity and mortality, not only for single member states, but also for the EU at large.

Important steps have already been made in the development of systems for the monitoring of socio-economic inequalities in health. In some individual member states, considerable efforts have been made over the last two decades to use existing data sources to monitor socio-economic differences in health indicators. A large body of experience has accumulated in for example the United Kingdom, The Netherlands and the Nordic countries. In some other countries, however, the state of the art is less advanced. None the less, in nearly all EU member states there is now at least some experience with describing socio-economic inequalities in both morbidity and mortality. This experience has been combined in a number of international projects that aimed to describe inequalities in health for different parts of the European Union in a comparable way.

However, much remained to be done. An area of particular challenge is the monitoring of trends over time. For several reasons it is important to describe time trends in socio-economic inequalities in mortality and morbidity. First of all, for setting priorities it is important to assess whether or not inequalities in specific health problems are widening. Second, trend data are indispensable in order to be able to evaluate the effect that the introduction of specific actions and policies may have had on socio-economic inequalities in health indicators. Finally, analyses of recent trends helps to predict the future development of health inequalities, and to set targets for health policies.

Thus, monitoring time trends in health inequalities represents an important task. However, as will be evident in this report, this task is difficult and challenging. With this report, we aim to help the HMS to face this challenge.

1.2. Objectives and structure of the document

The overall aim of this report is to contribute to the development of a system for the monitoring of socio-economic differences in health in the EU. Guidelines will be developed that can be used in the HMS of the EC. Guidelines for monitoring socio-economic inequalities in health are not only important for the EC and its institutions, but also for the national statistical agencies that will be requested to supply the data on socio-economic inequalities in mortality and morbidity.

This report consists of two main parts (two and three). Each of these parts has its specific objectives. Part two has the objective to develop guidelines for the monitoring of trends in socio-economic differences in health. These guidelines will be highly practical. Descriptions of methods will be accompanied by details on their calculation, and guidelines for their use and interpretation. Preference will be given to methods that are easy to calculate, present and interpret. Part three has the objective to explore the possibilities to monitor time trends in socio-economic inequalities in health by using the data sources that are currently available in EU member states. An additional purpose of part three is to illustrate how the guidelines of part two work in practice.

1.3. Guidelines on what? (part two)

The development of a system that enables to monitor socio-economic inequalities in health entails two steps. First, data have to be made available on socio-economic inequalities in health in all or most member states of the European Union. Second, methods should be developed to analyse these data in a sound and uniform way.

The development of data involves two steps:
1. identification of data sources for which socio-economic inequalities can be monitored, and which may be included in a monitoring system on socio-economic inequalities in health;
2. identification and development of socio-economic indicators that are to be included in these data sources.

Guidelines on these steps are developed in chapters 4 and 5.

Methods should be specified for:
1. the creation of tabulations that provide basic information on health indicators according to socio-economic variables;
2. the use of these tabulations to describe the magnitude of health inequalities as well as changes over time in this magnitude;
3. the evaluation and interpretation of the results, with special emphasis on the evaluation of potential data problems.

Guidelines on these issues are developed in chapters 6, 7 and 8.

1.4. Illustrations of what? (part three)

The main purpose of part three is to explore the possibilities for monitoring socio-economic inequalities in health on the basis of the data sources that are currently available in most EU member states. Thus, while the guidelines of part two specify what may be the best actions to undertake, part three evaluates whether the data sources that are now available in EU member states make it possible to obtain an accurate and detailed overview view of trends in health inequalities in the EU. Part three will concentrate on the use of two data sources that offer best prospects for monitoring trends in health inequalities in the EU at large: mortality registries, and health interview or multi-purpose surveys.

An additional purpose of part three is to illustrate how the guidelines of part two work in practice. These illustrations will show how the decisions to be made depend in part on the wider monitoring context, e.g. the purpose of monitoring, and the type of data that are available. Often, decisions on one measurement issue (e.g. which socio-economic indicator to use) influence other decisions to be made (e.g. how to summarise the observed health differences according to this socio-economic indicator).

Part three is more concrete than part two. Part two aims to give general guidelines that are applicable to a wide range of situations that can be encountered in the Health Monitoring

Program. Part three, in contrast, illustrates for concrete situations how these general guidelines can best be applied. This can be exemplified by the way in which we deal with data problems. Chapter 8 of part two provides an overview of potential data problems. Part three exemplifies for specific cases how data problems are best coped with, and to what extent the results can be biased due to data problems that could not be remedied.

1.5. Relationship to other work

This document is embedded within a broad field of empirical research and methodological development. It is therefore important to specify the contribution that this document makes to the work done elsewhere.

Methodological developments.

Both within the Health Monitoring Program and elsewhere, considerable efforts are made to develop common methods and instruments, both in the field of socio-economic indicators and health indicators. This report will avoid duplication of effort and refrain from developing new socio-economic or health indicators. Instead, it will address the question which of the existing socio-economic and health indicators can best be used for monitoring socio-economic inequalities in mortality and morbidity.

Within the Health Monitoring Program, much attention is given to the further development of existing data sources. This report will contribute to this work by giving suggestions on the inclusion of socio-economic indicators (see chapter 5). In addition, this document will stimulate the *use* of existing data sources, by identifying data sources that can be used to monitoring trends in health inequalities (chapter 4), and by giving suggestions on how to analyses these data and deal with data problems (chapters 6, 7 and 8).

Empirical research

Time trends in health inequalities have been described for several countries. New in this document is that (1) parallel analyses are made for many countries simultaneously, (2) for several countries, more recent data will be used than in any previous study, and (3) extensive attention will be given to the biases that may result from data problems.

In recent years, international overviews of health inequalities have been made in several comparative projects. These projects referred to data from the 1980s or early 1990s. In the present report, however, more recent data will be used so that an up-date can be made of the results of previous comparative studies. It should be stressed, however, that the emphasis of this report is on comparisons over time instead of comparisons between countries.

Policy oriented reporting on health inequalities

This report is written parallel with the other report from this project, on “ Reporting of socio-economic differences in health indicators in Europe” . That report has the purpose to provide a format for reporting on health inequalities to policy makers. Our report complements that policy-oriented document by our emphasis on a careful analysis of existing data sources instead of the formulation of policy implications.

Another difference between the two reports relates to our emphasis on the classic indicators of socio-economic status: education, occupational class and income. These indicators are used in this report to distinguish between ‘high’ and ‘low’ groups *throughout* the social ladder. These indicators can be used to measure social *gradients* in health. However, there is an alternative perspective on health inequalities, which is to describe the health situation on specific

disadvantaged groups such as lone mothers, the long-term unemployed or ethnic minorities. Monitoring the health situation of these specific groups is more difficult because of, among other factors, small sample sizes or their exclusion from routine registers. A first step forwards is to document what is currently known in member states about the health of specific disadvantaged groups. This inventory is carried out and presented in the policy-oriented document.

Chapter 2.
The guidelines to the Health Monitoring Program

In this chapter, guidelines are given for the Health Monitoring System that is being developed by the EC. The guidelines given in this chapter follow the different steps that need to be taken in order to obtain estimates of socio-economic inequalities in mortality and morbidity. These steps are (1) the identification of data sources, (2) the measurement of socio-economic variables, (3) the tabulation of health indicators by socio-economic variables, (4) the measurement of the magnitude of health inequalities and (5) the evaluation and interpretation of the results.

The guidelines on each of these steps are summarised in the present chapter. For further details we refer to the remainder of part two. Chapter 3 presents theoretical and practical considerations that were taken into account when developing the guidelines. Chapters 4 to 8, which correspond to steps 1 to 5 above, explain in more detail how the guidelines were derived . These chapter also give more detailed information on the indicators and methods to be used.

Step 1: Identification of sources of data.

In chapter 4, guidelines are formulated with regard to data sources that can be used to monitor trends in health inequalities in most member states of the EU. Guidelines are given (a) on the choices to be made between currently available sources of data and (b) on the ways in which the availability of data in EU member states can be improved.

Guidelines on choosing between currently available data sources.

1. When nationally representative, individual-level data are available on mortality according to socio-economic indicators, these data should be used to monitor socio-economic inequalities in mortality (p.26).

2. An equally important source of data are health interview, multi-purpose and similar surveys. When nationally representative data are available from these surveys, they should be used to monitor socio-economic inequalities in self-reported morbidity (p.26).

3. When nationally representative data on mortality or self-reported morbidity are not available from these sources, regional or local studies may used under two conditions: (a) these studies are considered as no more than a temporary substitute that are only used as long as national data are not available, and (b) the restriction to specific regions or areas is recognised explicitly (p.27).

4. Other data sources are not recommended for monitoring inequalities in health in general terms. This also applies to 'ecological' studies in which mortality or morbidity indicators can be linked to socio-economic indicators at the level of small areas (p.27).

5. Specific data sources may be used for monitoring inequalities in a health problem of particular interest, such as the incidence or prevalence of particular diseases (p.28).

6. The informative value of any data source should be evaluated against the checklist given in chapter 4 (p.28).

Guidelines on improving data availability.

1. Each EU member state should aim to obtain a minimum package of information on health inequalities. According to this package, which is presented in chapter 4 (table 4.3), data should become available that make it possible to monitor socio-economic inequalities in health (a) for both mortality and self-reported morbidity, (b) according to at least two socio-economic indicators, and (c) for both men and women, and for all age groups (p.30).

2. If this minimum package cannot be met with the available data, attempts should be made to improve data availability by, for example, adding socio-economic variables to existing sources of data on population health or by linking different data sources. Concrete suggestions on improving data availability are given in chapter 4 (p.30).

3. It is highly important to improve the timeliness of the information on health inequalities that will be available through the Health Monitoring System (p.32).

Step 2: Measurement of socio-economic status

In chapter 5, guidelines are formulated on the measurement of socio-economic variables. These guidelines assume that statistical agencies have access to primary data and thus have to make choices (a) between different socio-economic indicators and (b) between different ways in which a specific indicator can be measured.

Guidelines on choosing between socio-economic indicators.

1. In general, at least two of the three core indicators of socio-economic status (education, occupation and income) should be measured in relation to the health indicator (p.35).

2. Where possible, mortality should be measured in relation to both educational level and occupational class. Education is used as a socio-economic indicator for both men and women, and for all relevant age groups. Occupation should be used only for age-sex groups in which nearly all persons can be assigned to an occupational class (p.35).

3. Where possible, self-reports on morbidity (in health interview and similar surveys) should be measured in relation to both educational level and income level. These indicators should be measured for women as well as men, and for all relevant age groups (p.37).

4. Composite measures are not recommended for routine use in individual-level data, although they may be used for the identification of disadvantaged groups of particular interest, such as poor lone mothers or disadvantaged migrant groups (p.37).

Guidelines on measuring specific socio-economic indicators.

1. Educational level should be measured by means of a hierarchical classification of the population according to their completed educational level. Part-time education and vocational training are taken into account. A distinction is made between at least four categories similar to: elementary, lower secondary, upper secondary, and tertiary (p.38).

2. Income level should be measured by means of a classification of the population according to household equivalent income. This implies that, where possible, (a) the income of all household members are summed, (b) their net (instead of gross) income is measured and (c) an adjustment is made for household size. The population is classified into groups of about equal population size, preferably income quintiles (p.40).

3. Information on occupation is used to classify subjects into ‘occupational classes’. A distinction should at least be made between non-manual classes, manual classes, farmers and other self employed. If possible, a further distinction is made between upper and lower non-manual classes, and between skilled and unskilled manual classes (p.41).

4. The occupational class should be determined on the basis of the individual’s current or last occupation. However, if many persons are not economically active, a classification on the basis of the occupation of the ‘head of household’ may be considered (p.43).

Chapter 5 gives more detailed suggestions on the measurement of socio-economic indicators.

Step 3. The tabulation of health indicators by socio-economic variables

In chapter 6 guidelines are formulated for the creation of tabulations that present health indicators according to socio-economic groups. These are for example the tabulations that national agencies may provide to the EC and its institutions. Those who create these tabulations will have to make choices with regard to (a) the general format of these tabulations and (b) the precise measurement of the health indicators.

Guidelines on the general format of tabulations

1. Tabulations are created according to the format that is presented in chapter 6 (p.45).

2. The same socio-economic classification is used for each period. As a general rule, between three and five socio-economic groups should be distinguished (p.45).

3. For each socio-economic group, information is given on the absolute occurrence of the health problem in each period, and on changes over time in the occurrence of this health problem (p.47).

4. Information is also given on the distribution of the population per socio-economic group, and on changes over time in population distributions (p.48).

Guidelines on the measurement of health indicators

1. As a general rule, the health indicator should be expressed as the rate or probability displaying the occurrence of ‘negative’ health problems. In some cases, however, measures of ‘positive’ health may be measured (p.49).

2. Where possible, mortality levels are presented as mortality rates by gender and broad age group, and by gender and cause of death (p.49).

3. Where possible, self-reported morbidity is measured by indicators on (a) perceived general health, (b) the prevalence of chronic diseases, (c) the prevalence of disability and functional limitations and (d) the prevalence of any long-standing health problem (p.50).

4. Health measures should be standardised for age in such a way that comparisons can be made not only between socio-economic groups, but also between periods and countries. Direct standardisation using the European Standard Population is recommended (p.51).

5. Where possible, measures of mortality are summarised in terms of life expectancies, and measures of mortality and self-reported morbidity are combined into synthetic measures such as disability-free life expectancy (p.52).

Step 4. The measurement of the magnitude of health inequalities

Chapter 7 provides guidelines for measuring the magnitude of health inequalities on the basis of the data that were obtained in the previous step. Central in the analysis of these data is the use of summary indices. These indices express the magnitude of health inequalities in a single figure and facilitate comparisons over time.

General guidelines on using summary indices.

1. When the purpose of the analysis is to determine whether the magnitude of health inequalities has changed over time, these changes should be assessed by means of summary indices (p.59).

2. The changes that are identified by using summary indices should be checked against the patterns that are visible in the basic tabulations (p.59).

Guidelines on the choice between alternative summary indices.

1. In any analysis, the magnitude of health differences should be summarised by rate ratios that compare two contrasting groups (p.60).

2. The rate ratios should be complemented by rate differences (i.e. a measure on absolute instead of relative differences) where feasible (p.60).

3. Other summary indices should be applied as a complement (instead of substitute) to rate ratios and rate differences.
   a. More sophisticated measures like regression-based measures may be applied to check the validity of the results obtained with the rate ratios and rate differences (p.62).
   b. When the distribution of the population over socio-economic groups has substantially changed over time, measures of ‘total impact’ may be applied to check whether taking these changes into account would lead to other conclusions (p.63).

Part three gives details on the calculation and interpretation of these measures.

Step 5. Evaluation and interpretation of the results

Chapter 8 provides guidelines on the evaluation of the results that are obtained in the previous step. Central to this evaluation is an assessment of the potential effect of data problems. When the observed changes in health inequalities cannot be attributed to data problems, the next step is to assess what else can explain the observed trends.

Guidelines on evaluating data problems.

1. Data problems should not be dismissed easily. It should instead be recognised that several data problems have the potential to bias estimates of the magnitude of health inequalities (p.65).

2. Care should be taken to reduce the potential effect of data problems where possible. Data problems should be taken into account when selecting and applying the health indicators, the socio-economic indicators and the analytical methods (p.68).

3. The effect of data problems that cannot be avoided should be evaluated where possible. These problems should be evaluated for the effect they may have on the results that were obtained. If possible, these effects are quantified by means of sensitivity analyses (p.68).

Guidelines on moving towards explanation

1. Health monitoring systems should seize the opportunities that they offer for explaining trends in socio-economic inequalities in mortality and morbidity (p.69).

2. Within a health monitoring system, empirical evidence on the causes of changes in health inequalities should be obtained in different ways (p.70).

Chapter 8 gives both a checklist on potential data problems, and a brief systematic overview of possibilities to move towards explanation.

A final remark on the need to increase analytical capacity

The experience from the present project is that monitoring of socio-economic inequalities in health requires is more than the mere gathering of data from different countries. It is highly important that, at the European level, the analytical capacity becomes available that is needed to process these data, to make checks and to draw valid conclusions. As the illustrations in part three testify, data analyses may lead to mistaken conclusions if no appropriate methods are used or if potential data problems are not evaluated carefully. Monitoring inequalities in health is no sinecure. Therefore, socio-economic inequalities in health in the European Union can only be monitored correctly when the future increase in data availability is matched by an increase in the analytical capacity of the EC and its institutions.

Chapter 3.
Theoretical and practical considerations

3.1. Purpose

The purpose of this chapter is to explain the general procedure that we followed when developing guidelines on monitoring time trends in socio-economic inequalities in health indicators.

3.2. Approach

This procedure is based on the recognition that guidelines should fulfil two general requirements. First, they should be theoretically acceptable, i.e. they should agree with current concepts of socio-economic inequalities in health. They should build on, and reinforce, the existing consensus on what constitutes monitoring trends in socio-economic inequalities in health. Second, they should be practically feasible. Among others, they should be applicable to the data that are currently available in most EU member states, and they should be relatively easy to calculate, present and interpret.

In order to meet these requirements, we will generally follow an approach that consists of three steps. First, an overview is given of what is theoretically possible. Next, these theoretical possibilities are evaluated against practical requirements. Finally, based on this evaluation, standards are formulated together with some possible alternatives. This approach secures that the recommended standards are usually applicable to the available data.

In addition to the standard guidelines, alternatives will be formulated for two situations. The first situation occurs when practical limitations force an alternative method, e.g. to avoid serious data problems. The second situation occurs when there is a strong theoretical preference for an alternative approach, and there are at least a few data sources where these alternatives can be applied to. Important for the health monitoring systems in the EU is that these theoretically preferred alternatives can also be used to guide the future development of health monitoring systems.

Thus, the guidelines are born out of a confrontation between what is theoretically desirable and what is possible in practice. Before specific recommendations are developed in the next chapters, this chapter will provide a brief overview of both the theory and practice of measuring socio-economic inequalities in health. We will present a number theoretical and practical considerations that guide the rest of part two.

3.3. Theoretical considerations

A distinction can be made between the *description* of health differences according to socio-economic variables, and the *explanation* of these differences with reference to intermediate variables. Both of these two activities face difficult but distinct tasks. These tasks should therefore be clearly specified, and not be mixed up in any analysis. The task of description is to obtain a detailed, accurate and valid overview of (trends in) health inequalities, whereas the ultimate task of explanation is to estimate the extent to which specific intermediate variables contributed to the (trends in) health inequalities that are observed.

Description

Basic to this report is the concept of social stratification, i.e. the ordering of people from 'high' to 'low' according to the access to scarce resources. This place on the social hierarchy is called socio-economic status (SES) or social class.

Several socio-economic variables determine the place of persons in the social hierarchy. The classic three core variables are educational level, occupational class and income level. The different indicators emphasis the different dimensions of SES, i.e. the different types of resources that are involved. Educational level relates to differences between people in terms of access to information and the proficiency in benefiting from new knowledge, whereas income relates to differences in access to scarce material goods. Occupational class includes both these aspects and adds to them benefits accruing from the exercise of specific jobs, such as prestige, privileges and power. Important is to recognise the complementary nature of these three indicators. Generally speaking, no indicator is theoretically superior to any other. In specific situations, however, specific socio-economic indicators may however be preferred over another. For example, income may be preferred as socio-economic indicator when the aim of analysis it to assess the potential effect of changes in tax policies.

Important is the gradient nature of SES. Differences in health related to SES are found at all levels of the society, and not only between the most deprived and the rest of the population. It is therefore important to look at inequalities in health across the entire social hierarchy. This gradient approach, which is central to this report, is complementary to an emphasis on specific disadvantaged groups.

Socio-economic status can be measured at different levels of aggregation: the individual, the household and the area of residence. For example, occupational class can both be measured in individual terms and in household terms (e.g. 'head of household' approach). Both these levels of aggregation are important to determining the individual's access to resources and there is no a priori preference to either level. In addition, the area of residence can be important too, but in a somewhat different manner. Therefore, ecological measures of SES might in some cases be used to supplement rather than to replace SES measures at the individual and household level.

Since social stratification entails the entire population, socio-economic inequalities in health also involve the entire population. This implies that health inequalities should be described with a perspective on the population that is involved. Studies are therefore preferably representative of the total population. Also, it may be desirable in specific analyses to take into account the population size of the socio-economic groups that are distinguished in the analysis.

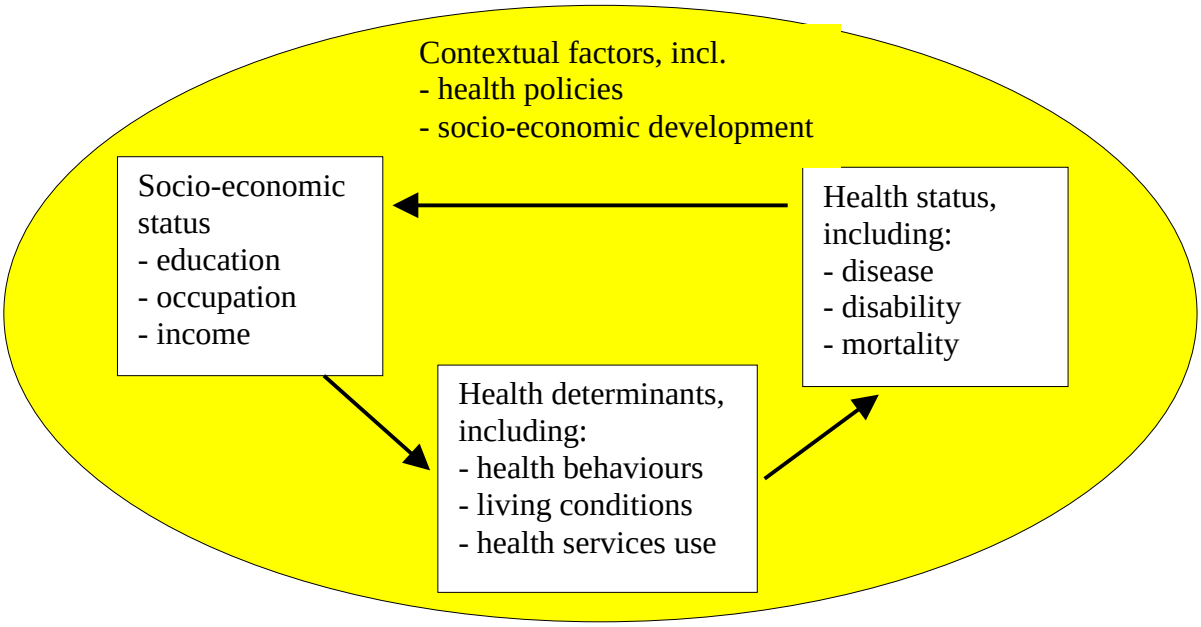
People have a specific SES ever since their birth. Each person is born into a certain social stratum based on the socio-economic status of their parents. During the life course, this SES can change slightly or dramatically. Because the SES in a previous phase of life continues to exert an influence over one's life and health, it may be important to measure not only the current SES but also to have measures of people's social trajectory during their life course. This applies especially to health problems that are determined in early life and/or that have long lag times.

Explanation

Even though explaining health inequalities is not a central purpose of a health monitoring system, this system may obtain empirical evidence on the causes of health inequalities. In particularly, the health monitoring system may give the opportunities for explaining *trends* in health inequalities. Although a satisfactory explanation would be too ambitious, a monitoring system can at least offer some valuable insights.

Important is to recognise that SES and health can be related due to various mechanisms (see figure 3.1). Three types of mechanisms can be distinguished: confounding (i.e. health and SES are related because both are influenced by independent 'third' factors such as age), health selection (i.e. health status influences the SES a person can attain), and social causation (i.e. SES has a causal influence on health status). The more complex " indirect selection" mechanisms are also considered to be important, but it is not clear whether these mechanisms should be considered as a form of social causation (related to SES in early life), as a form of health selection, or as confounding.

Figure 3.1. A framework for the explanation of socio-economic inequalities in health



Most important, but not of exclusive relevance, is the social causation mechanism. This mechanism involves several possible pathways that involve intermediate variables, which include behavioural factors like smoking, material factors like housing conditions, and psychosocial factors like coping with stress. These variables are considered 'downstream' determinants whereas socio-economic variables are 'upstream' determinants: their effect on health only runs through these downstream determinants.

The aim of explanations is to obtain empirical evidence on the contribution that specific mechanisms make to the observed health differences. This evidence is preferably stated in quantitative terms, e.g. the degree to which the observed differences would be smaller in the absence of the mechanism that is studied.

The different mechanisms are usually highly complex and intertwined. Empirical evidence on the role of specific mechanisms cannot simply be derived from the choice of the socio-economic indicator. For example, even though a strong relationship between health and income is suggestive of the effect of adverse material living conditions, other causal mechanisms may be involved as well, including psychosocial stress and behavioural response to such stress. Socio-economic indicators should therefore not be judged for their ability to provide evidence on the causal mechanisms, but they should be selected rather because of their descriptive value.

Instead, empirical evidence should preferably be obtained by adding new variables that measure specific intermediate mechanisms. These variables should not only be studied for their relation to health, but also for contribution they make to health differences according to the socio-economic indicator. This study can be assessed empirically by means of multivariate analyses. This more complex type of analyses is normally outside the scope of routine health monitoring systems.

Some mechanisms should be controlled for in descriptive research. This especially applies to confounding by age and gender. If the main interest is in social causation, then the descriptive research should also aim to control for health selection effects as much as is possible.

A better understanding of trends in health inequalities involves not only the intermediate mechanisms, but also the wider societal context (see figure 3.1). Explanation in terms of these 'contextual determinants' aims to assess the extent to which variations in the national or historical context influences the magnitude of health inequalities. This influence would appear to be large if real-life variations in these determinants (between places or over time) are associated with larger or smaller health inequalities. One might question, for example, whether the increase in income inequalities, that was observed in the 1980s and 1990s for several European countries, were accompanied by an increase in income-related health inequalities.

3.4. Practical considerations

Estimates of socio-economic inequalities in health should not only be theoretically acceptable, but also practically feasible. This feasibility depends on a number of practical considerations.

First of all, data should cover a significant part of the population of the European Union. Ideally, data are available for most member states, and these data cover all age groups and both men and women. If data are strongly limited in one way or another, they may provide only a partial view of socio-economic inequalities in health. Given the variable nature of health inequalities, estimates for some part the European population may not tell much about other parts of the population. For example, large inequalities in mortality among middle aged men might co-exist with no or small inequalities among the elderly. The latter inequalities can therefore not be estimated by extrapolating from data on younger groups, but should be documented with data that include the elderly as well.

Second, estimates of health inequalities should be representative of the target population. If these estimates are made for specific subpopulations, they might not be generalizable to the target population. For example, estimates of inequalities in disability among the employed population are generally smaller than the estimates that would be observed with data on the total population at working age. The external validity can also be jeopardised when restrictions are made to specific regions or cities, or when population groups like the institutionalised elderly are excluded from the data.

Third, estimates of health inequalities should be reliable and precise. Socio-economic or health indicators may suffer from measurement problems (low reliability) or the statistical power of the data source may be insufficient (low precision). An overview of potential problems is given in chapter 8. It is important that it is often possible to cope with these problems to some extent. Preferably, problems with reliability and statistical power are tackled by a careful choice of the indicators and methods. If these problems cannot be avoided, however, they may in some cases be dealt with by quantitatively evaluating their potential impact on the results.

Fourth, estimates should be comparable over time and across countries. When monitoring trends over time, care should be take that inequality estimates in one period are comparable to the other period. If not, estimates of time trends can be biased. Similarly, when constructing an international overview, it is also important to attain minimal standards of comparability across countries. These standards can fairly low when the only purpose is to have an overview that demonstrates basic similarities observed across all over Europe. On the other hand, the standards should be higher when the purpose of the international overview is to compare countries and to identify differences between countries.

Fifth, the estimates should be easy to calculate, interpret and present. Simple measures have important advantages. First, these measures are easy to add to existing routine monitoring systems. Second, unlike sophisticated calculations, simple measures do not distract the attention from basic measurement issues. In general, errors and awkward patterns are more easily detected by using transparent measures with a clear interpretation. Third, measures with a concrete interpretation are more easily communicated to the general public and policy makers.

Obviously not all five requirements can be met in practice, and therefore greater weight should be given to some requirements than to others. In this report, we adopt an following approach consisting of two steps.

In the first step, evaluations are made against two requirements that have to be met in any case. These are requirements 1 (which states that the data should cover a significant part of the European population) and 5 (which states that measures should be easy to calculate and interpret). The first requirement is essential, because if there are no data, there is nothing to monitor. The latter requirement can easily be applied irrespective the type of data that is available.

In the next step, indicators or methods that passed the first step are evaluated against the three other requirements on: representativeness, reliability & precision, and comparability. Obviously, some subjective judgement will be inevitable when choosing between alternative indicators and methods. In order to give some room to alternative choices, we will add some flexibility by not only presenting standard guidelines but also giving alternatives that are acceptable in specific cases.

Chapter 4.
Identifying sources of information

4.1. Purpose

This purpose of this chapter is to develop guidelines that specify (1) which data sources should be used to obtain a general view of (trends in) socio-economic inequalities in health in the European Union and (2) how the availability of data on health inequalities can be improved in the near future.

4.2. Overview and evaluation of data sources

Table 4.1 gives an overview of the data sources that are available for different types of health indicators. Special emphasis is given to data sources that are being developed as part of the EU Health Monitoring Program. This table includes both sources of disease-specific data and sources of data on generic health indicators.

Table 4.1. Overview of potential sources of data for monitoring inequalities in health

Data source	Health status indicators covered
Vital registry	Mortality, length of life
Cause-of-death registry	Mortality from specific causes of death
Level of living surveys and multi-purpose surveys	Disability, symptoms, general health and quality of life
Health interview surveys	As above, plus self reported prevalence of diseases and disability
Health examination surveys	As above, plus functional impairments and biological precursors of diseases
Health care utilisation registries, e.g. hospital admissions, general practitioners consults	Incidence, case fatality and prevalence of several diseases leading utilisation of health services
Disease registers, e.g. cancer and congenital anomalies, mental health	Incidence, case fatality and prevalence of specific diseases
Surveillance systems, e.g. on infectious diseases, injuries	Incidence, case fatality and prevalence of injuries or specific (acute) diseases
Social security registries, e.g. on sickness absence, long-term work disability	Incidence and prevalence of several diseases leading to work disability

In a series of evaluations, we assessed the value of each data source against the practical criteria that were specified in chapter 3. In this way, advantages and disadvantages of each data source were identified. On the basis of these evaluations (which are not presented here in detail), we formulated the guidelines given below.

4.3. Guidelines on choosing between currently available data sources.

Guideline 1:
When nationally representative, individual-level data are available on mortality according to socio-economic indicators, these data should be used to monitor socio-economic inequalities in mortality.

Mortality registries are an important source of data in most EU member states. Especially when a link can be made between individual death certificates and records of the population censuses, these registries have few or no serious drawbacks. Main advantages are (a) the possibility to distinguish causes of death, (b) the availability of data for most age groups, (c) the coverage of long time periods and (d) the 'hard' nature of this health indicator. Unlike many other data sources, mortality registries cannot be biased by, for example, factors affecting self reports of health (a problem to health surveys) or factors affecting health care utilisation (a problem to facility-based registries).

A special case is mortality during the perinatal period and infancy. The experience of various countries is that inequalities in infant and perinatal mortality can be measured and monitored even when this is not possible for mortality at adult ages. Although mortality at the youngest ages cannot be regarded as a comprehensive measure of ill health, the relevance of perinatal and infant mortality is that they have shown to be strongly sensitive to socio-economic disadvantage in a wide variety of situations. Therefore, it may be worthwhile to make special efforts to obtain data on perinatal and infant mortality.

Despite the advantages of mortality registries, it should be recognised that mortality registries do of course provide no data on socio-economic inequalities in disease prevalence, disability or other morbidity indicators. In addition, as the illustrations in part three show, detailed data on socio-economic inequalities in mortality are not yet available for many EU member states. Therefore, complementary sources of data should be utilised.

Guideline 2:
An equally important source of data are health interview, multi-purpose and similar surveys. When nationally representative data are available from these surveys, they should be used to monitor socio-economic inequalities in self-reported morbidity.

Health interview and similar surveys are a rich and up-to-date source of information on socio-economic inequalities in morbidity. Nationally representative surveys have been held over the last years in nearly every member state of the EU. Information is available from these surveys on several health indicators and on most or all core indicators of socio-economic status. This data source is therefore recommended for monitoring inequalities in morbidity, even though, as is illustrated in part three, this monitoring is complicated by problems such as low statistical power and exclusive use of people's self reports on their health.

Guideline 3:
When nationally representative data on mortality or self-reported morbidity are not available from these sources, regional or local studies may used under two conditions: (a) these studies are considered as no more than a temporary substitute that are only used as long as national data are not available, and (b) the restriction to specific regions or areas is recognised explicitly.

Until now, several EU member states are still 'white spots' in international overviews of socio-economic inequalities in mortality or self-reported morbidity. In these cases, additional data on inequalities in mortality or self-reported morbidity may be obtained from studies or surveys held in specific regions or cities. This possibility is illustrated in chapters 11 to 14, where recent Italian data on socio-economic inequalities in mortality were not available for Italy at large, but where data were obtained from the Turin longitudinal study. Also, the data on Spain given in chapter 15 are restricted to the 8 provinces because all other Spanish provinces lack accurate data on mortality by occupational class in about 1990.

It is important to recognise that health inequality estimates for specific parts of the country may be substantially different from those that would be obtained when nationally representative data would be available. Therefore, regional or local data can only be included with the understanding that they are no more that a substitute as long as national data are not available. In addition, the text should explicitly refer to the region instead of the country at large (e.g. mention 'Turin' instead of 'Italy').

Guideline 4:
Other data sources are not recommended for monitoring inequalities in health in general terms. This also applies to 'ecological' studies in which mortality or morbidity indicators can be linked to socio-economic indicators at the level of small areas.

A few other data sources may in principle provide data on socio-economic inequalities in a broad range of health problems. Examples include hospital discharge registries and health examination surveys. Unfortunately, however, each of these data sources were found to have serious drawbacks. For example, facility-based data sources may be biased due to socio-economic differences in the tendency to utilise health care in case of sickness. Therefore, we do not recommend the use of other data sources for monitoring inequalities in health in general terms (for specific diseases, however, see guideline 5).

Special attention warrant ecological studies in which mortality or morbidity indicators are linked to socio-economic indicators at the level of small areas. This kind of studies has been proved to be valuable in several European countries. Among the main advantages of ecological studies are that (a) all age-sex groups can be covered and analysed in an identical way and (b) up-to-date analyses can be made of the most recent changes in the magnitude of health inequalities.

Despite these advantages, ecological analyses are not recommended for use in a health monitoring system for the EU. One problem with these analyses is that, due to problems known under the name of "ecological fallacy", results from ecological analyses cannot be used to estimate the magnitude of socio-economic differences in health at the individual level. Another problem with ecological analyses is their poor international comparability. Ecological estimates of health inequalities are strongly sensitive to specific local circumstances, including the urban or regional geography and the data that happen to be available at the level or urban districts or other areas. It would require a considerable effort to

make these ecological estimates comparable between countries (and even between regions or cities within a single country) and this effort can much better be directed towards improving the availability of data on health inequalities at the level where these are most appropriately measured: the level of individuals and their households.

Guideline 5:
Specific data sources may be used for monitoring inequalities in a health problem of particular interest, such as the incidence or prevalence of particular diseases.

Despite the complementary nature of mortality registries and health interview surveys, they do not cover all relevant dimensions of health. Other sources of data may be needed when there is a particular interest in monitoring the incidence or prevalence of specific diseases, or other relevant health indicators such as health behaviours or the use of preventive health care. For example, for monitoring socio-economic inequalities in the incidence of specific diseases, data may be used from disease registers such as cancer registers or registers in the field of mental health. The problems and potentials are likely to vary between data sources and should therefore be evaluated in detail for each source individually (see recommendation 3 at page 6).

Guideline 6:
The informative value of any data source should be evaluated against the checklist given in table 4.2.

The previous guidelines may be used to identify in general terms which data source may be useful and which not. After a possible candidate has been identified, the next step is to assess in more detail the likelihood that this data source can provide relevant, valid and detailed estimates of the magnitude of inequalities in health, and changes thereof. The informative value of data source strongly depends on the ability to measure socio-economic inequalities in health according to the guidelines given in the next four chapters. The information given in the next chapters is processed in table 4.2, which can be used to evaluate how informative a mortality study or health interview survey is for the monitoring of socio-economic inequalities in health.

The table consists of a set of questions on the data problems most often encountered. These questions are ordered in five sections. The first section considers the general characteristics of the data source. The next three sections contain questions on the presence of data problems that could lead to biased estimates of socio-economic inequalities in health in one point in time. The last section contains questions to be considered if trends over time are assessed. Each negative answer to a question in table 4.2 means that the informative value of the data from that source is restricted in some way. The more positive answers, the more appropriate the data source.

Table 4.2. A checklist for the evaluation of data sources

1. Relevance and	a.	Do the data cover at least two or three of the core socio-economic

timeliness	indicators (occupation, education, income)? b. In mortality studies, can a distinction be made by cause of death? c. In health interview or similar surveys, are different health status indicators included? d. Do the data refer to a recent period (less than 5 years ago)?
2. Population coverage and representativeness	a. Are both men and women included? b. Do the data cover all age groups or at least a substantial part of the entire age range (e.g. 15-74 years)? c. Are you sure that the data are not restricted to a specific city/area or to another sub-population (e.g. employees of a company)? d. Do the data include the institutionalised population and other specific groups such as foreigners? e. Are you reasonably sure that, if data come from a survey, problems with non-response do not strongly bias the results?
3. Reliability	a. Are socio-economic indicators linked to health indicators at the individual or household level (instead of the area level)? b. If education is used as the socio-economic indicator, can a distinction be made between lower educational levels (e.g. elementary and lower secondary, or <7 and 7-8 years)? c. If occupational class is used, can this indicator be determined for (nearly) people, including those who are economically inactive (e.g. housewives and retired)? d. If income is used, are data available to estimate household equivalent income? Are there no serious problems such as income unknown for many people (say, more than 20%)?
4. Precision, power	a. In interview or examination surveys, is the sample size fairly large (more than 5,000 respondents)? b. In mortality studies, is the number of deaths fairly large (more than 1,000 deaths)?
5. Usefulness for monitoring trends	a. Can three or more periods be compared? b. Do these periods together cover a sufficiently long span of time (about ten years of more)? c. In interview or examination surveys, are exactly the same health indicators used in the subsequent surveys? d. Is the measurement of socio-economic indicators comparable over time? Can the same classification be applied to each period?

Source: adapted from Kunst and Mackenbach (1995).

4.4. Guidelines on improving data availability.

In this section, we will give two guidelines related to improving the availability of data on socio-economic inequalities in health.

Guideline 1:
Each EU member state should aim to obtain the minimum package of information on health inequalities that is presented in table 4.3.

The illustrations in part three show that the evidence on trends in socio-economic inequalities in health in the EU is still highly fragmentary. In order to foster that gaps in information are filled in, a minimum package is formulated in table 4.3. According to this package, each EU member state should aim at creating data sources that facilitate the monitoring of socio-economic inequalities in health (a) for both mortality and self-reported morbidity, (b) according to at least two socio-economic indicators, and (c) for both men and women, and for all age groups.

It should be added that there are large variations between EU member states in the degree to which these conditions were met by the year 2000. Whereas the minimum package can already be filled in by the statistical agencies of the countries that are most developed statistically (e.g. England and Wales, the Nordic countries), the agencies in most other countries will have to make a considerable efforts to do reach the same situation.

Guideline 2:
If this minimum package cannot be met with the available data, attempts should be made to improve data availability.

There are several possibilities to fill in gaps in the available data. In principle, three procedures can be distinguished to generate new information at a relatively low cost.

The first procedure consists of adding socio-economic variables to existing sources of data on population health, such as health surveys or disease registers. The routine inclusion of socio-economic data in data sources that are considered for use for the Health Monitoring System, could in the long term generate a wealth of information on the socio-economic inequalities in health in the EU. The socio-economic indicator that can be obtained with the least effort and validity problems is education, although in some cases the registration of occupation may be more accurate. An experiment in the Netherlands showed that information on both the education and the occupation of patients can be included in hospital registries with fairly little effort and adequate validity.

The second procedure consists of adding health indicators to socio-economic surveys or registries. For example, a few questions on perceived general health and long-standing health problems may be added to labour force surveys or household expenditure surveys. Simple, data that reveal socio-economic inequalities in health can be generated by using straightforward questions such as " How is your health in general: very good, good, fair, poor or very poor?" or " Do you suffer from any longstanding disease or disability?" . A good example is the European Community Household Panel, where the inclusion of such questions has created new possibilities, which are not yet fully explored, to measure socio-economic

inequalities in morbidity in EU member states with higher degrees of international comparability than has been possible until now with national health surveys.

Table 4.3. A minimum package of data required to create an overview on socio-economic inequalities in morbidity and mortality.

1. Data are available that make it possible to monitor socio-economic inequalities in health for both mortality (by cause of death) and self-reported morbidity (for different health indicators, including perceived general health and disability).

2. Both mortality and self-reported morbidity estimates can be presented according to at least 2 of the 3 core socio-economic indicators (education, income and/or occupational class).

3. Both mortality and self-reported morbidity data are available for men and women, and for all relevant age groups. Coverage of all age-sex groups should be possible for at least one socio-economic indicator.

4. The data are be nationally representative. If this is not possible, local or regional data may be used as a temporary substitute. The restriction to specific areas is recognised explicitly.

5. It is possible to monitor changes over time in health inequalities since the 1990s for at least one type of health indicator, and from the early 2000's onwards for both mortality and self-reported morbidity.

The last possibility consists of linking data from different registries. A data registry containing mortality or morbidity data can be linked with a data registry with information on the socio-economic characteristics of the same population. Successful examples include mortality studies than linked mortality data from vital registries with socio-economic data from population censuses (see chapters 11 to 14). Other examples are linkages between registries and interview surveys. For example, data for Sweden and Finland presented in chapter 18 are based on a linkage between level of living surveys (with data on health indicators) and the national tax registries (with detailed data on income). Naturally, provisions may have to be made for complying with confidentially constraints.

We should finally add that it is essential for monitoring purposes that socio-economic inequalities in mortality and morbidity can be measured repeatedly through time at regular intervals. Efforts should therefore be made to secure the continued availability of data over time. Comparability in the measurement and classification of socio-economic and health indicators needs to be ensured over time. Standard socio-economic classifications should be adopted, and the responsible institutions should be wary of modifying these classifications. Health interview surveys should continue to use exactly the same interview question for at least some of the health indicators. As chapter 17 illustrates, changes in the wording of questions, their checklists or their response categories can potentially bias comparisons over time.

Guideline 3:
It is highly important to improve the timeliness of the information on health inequalities that will be available through the Health Monitoring System.

Usually, estimates of socio-economic inequalities in mortality and morbidity are published with a time lag between 5 and 10 years. Due to this time lag, current trends are unknown and the effect of recent policies cannot yet be evaluated. It is therefore important to find ways to improve the timeliness of the data. This requires efforts not only by the national agencies who deliver the data, but also by the EC and its institutions. Structures should be devised that stimulate rapid dissemination of international overviews of socio-economic inequalities in health. The Health Indicators Exchange and Monitoring System (HIEMS) has a key role to play here.

Chapter 5.
Measuring socio-economic status

5.1. Purpose

The purpose of this chapter is to develop guidelines that specify (1) which socio-economic indicators should be used to monitor socio-economic inequalities in health across the EU and (2) how these indicators should be measured.

5.2. Overview of possible socio-economic indicators

In table 5.1, an overview is given of indicators that in theory might be used to measure socio-economic status (as defined in chapter 3). Some measures may be preferred over others for theoretical reasons. However, there is no consensus on these issues, and the measures are complementary rather than exclusive. The theoretical preferences depend on many factors. For example, whether 'material' measures like income and wealth are preferred not only depends on theoretical perspectives on social stratification, but also on the specific purposes of monitoring trends (e.g. to assess whether anti-poverty actions has brought benefit to the health of disadvantaged groups).

Table 5.1 does not include separate rows on socio-demographic measures like marital status, ethnicity, and urban versus rural residence, because these measures cannot be considered as socio-economic measures in themselves. These measures may however be relevant to the extent that they are related to socio-economic disadvantage. They can therefore be used to identify specific disadvantaged groups (e.g. the long-term unemployed or socially excluded ethnic groups) especially when these variables are used in combination with the three core indicators of socio-economic status.

5.3. Evaluation against practical criteria

In a first step, the socio-economic measures given in table 5.1 were judged against the availability of data in which these socio-economic measures can be related to health indicators. The socio-economic indicators given in brackets were found to have serious problems with data availability and coverage. These indicators appear to be measured in only a few countries or in highly specific data sources.

Table 5.2 evaluates the remaining socio-economic measures against a number of other practical criteria. These evaluations are based on more detailed evaluations not reported here. It is obvious from this table that educational level offer the greatest practical advantages as an indicator of socio-economic status. These results have guided the formulation of the guidelines given below, and especially guidelines 2 and 3.

Table 5.1. Overview of possible socio-economic indicators

Core indicator	Measured at individual level	Measured at household level	Measured at area level
Education	highest level completed number of years of schooling	*(idem, of partner or parent)*	% low educated
Occupation	current occupational class *(idem, but life-time based)* *(score on social distance scale)*	idem, of 'head of household'	% low class % unemployed
Income	personal income	household income	% low income average income
Wealth		*(total amount of assets or capital)* *housing tenure or facilities*	average wealth % 'bad' house
Composite	*(combination of indices above)*		combination of indices above

An indicator is given between brackets and in italic,
if in Europe health data according to this indicator are scarce.

5.4. Guidelines on choosing between socio-economic indicators.

Guideline 1:
In general, at least two of the three core indicators of socio-economic status (education, occupation and income) should be measured in relation to the health indicator.

The practical considerations given in table 5.2 lead to the exclusion of some indicators, but are not decisive for most others. Therefore we do not recommend one single indicator as the standard. This is also done considering (a) the complementary nature of most socio-economic indicators, and (b) the observation from many studies that the use of different socio-economic indicators may lead to different results. Also in Part three, the results for education did not always appear to match those on occupational class (compare chapter 13 to 11) or those on income (compare chapter 18 to 16).

Another reason to be flexible in the choice of socio-economic indicators is that there are large variations between data sources in the type of socio-economic variables that are available. Therefore, the next two guidelines give more specific recommendations for, respectively, mortality registries and health interview surveys.

Guideline 2:
Where possible, mortality should be measured in relation to both educational level and occupational class. Education is used as a socio-economic indicator for both men and women, and for all relevant age groups. Occupational class should be used only for age-sex groups in which nearly all persons can be assigned to an occupational class.

Educational level should be included for each data source for which this is possible, as the evaluations reported in table 5.2 made clear that this socio-economic indicator offers great practical advantages.

In addition to education, it is recommended to also look at occupational class when analysing mortality data. The decisive reason to recommend this is that occupational class is the only socio-economic variable that can be linked to mortality in several EU member states (see also Part three). Thus, not using occupational class as a socio-economic indicator would imply throwing away for some countries most of the available information on socio-economic inequalities in mortality.

None the less, the analysis of mortality differences by occupational class faces serious problems. Chapters 13 and 15 illustrate these problems for the analysis of mortality differences among middle-aged men. One of the main problems is the potentially large bias resulting from the exclusion of men or women who cannot be assigned to an occupational class. When most persons are inactive (e.g. retired or home makers) and cannot be classified according to their last occupation, the potential for bias is enormous. Given this problem, the effects of which are illustrated in chapter 13, we recommend to use occupational class only for those age-sex groups for whom nearly all persons can be assigned to an occupational class.

Table 5.2. Evaluation of socio-economic indicators for which data are available

Indicator	Measure	Criteria *									
		Data are available for both women and men	Data are available for the elderly as well	No particular problems with confoun-ding	Risk of misclassi-fication is fairly small	Few or nor missing values	Measure-ment and classifica-tion are straight-forward	Fairly compar-able between countries	Fairly compar-able over time	Produces a detailed classificat ion / not skewed	Produces a strictly hierarchical classification / easy to interpret
Education	completed level	X	X	X	X	X	X	(x)	X	(x)	X
	number of years	X	X	X	-	X	X	(x)	X	(x)	X
Occupa-	own class	-	-	X	-	(x)	(x)	(x)	X	X	(x)
tion	class of 'head'	X	-	X	-	(x)	-	(x)	(x)	X	(x)
Income	personal income	X	(x)	(x)	-	(x)	(x)	(x)	X	X	X
	household income	X	(x)	(x)	-	(x)	-	(x)	X	X	X
Wealth	housing tenure	X	X	(x)	X	X	X	(x)	X	-	X
	housing facilities	X	X	(x)	(x)	X	(x)	-	X	-	X

X = the criterion is usually fulfilled. (x) = the criterion is fulfilled only partially or infrequently.

Guideline 3:
Where possible, self-reports on morbidity (in health interview and similar surveys) should be measured in relation to both educational level and income level. These indicators should be measured for women as well as men, and for all relevant age groups.

As with mortality data, educational level should be used when socio-economic inequalities are measured with survey data on self reported morbidity, as this socio-economic indicator offers great practical advantages.

In addition, guideline 3 recommends to measure income in surveys. Why income and not occupational class? Both socio-economic indicators have their advantages and their disadvantages. An important practical advantage of income over occupational class is that the former can be measured for both sexes and for a broader range of age groups. In addition to this practical reason, there is a theoretical one: income is complementary to education in many respects: (a) income emphasises material rather than cultural resources, (b) income is measured at the household level instead of the individual level, and (c) income is able to reflect changes in socio-economic position over the life course whereas a person's educational level is highly stable during the entire adult life. Given their complementary nature, the use of both educational level and income level would give a comprehensive picture of socio-economic inequalities in mortality or morbidity.

Guideline 4:
Composite measures are not recommended for routine use in individual-level data, although they may be used for the identification of disadvantaged groups of particular interest, such as poor lone mothers or disadvantaged migrant groups.

Composite indicators are not recommended for general use in a health monitoring system because there is yet not sufficient experience in different EU member states with applying these indices to measure socio-economic inequalities in health. For that reason, we recommended at page 5 to first explore the possibilities that these indicators offer for describing inequalities in health.

None the less, there may be reasons to use composite indicators for specific purposes if data are available. One reason may be that the analyst has a strong preference to use a measure that expresses a more specific concept such as " life-time accumulation of social disadvantage" . A more comprehensive measure like this might perhaps reveal health differences that are larger than the differences observed with any single indicator. In order to construct this socio-economic measure, information is needed on socio-economic position in various stages of a person's life course, and these measure are combined into a single measure expressing cumulative exposure to poor socio-economic conditions.

Another reason to use composite measures may be to identify specific groups who are characterised not only by socio-economic disadvantage, but also by some specific other situation that tend to engender socio-economic disadvantage. Examples are long-term unemployed, marginalised ethnic groups, and poor lone mothers. In order to identify these groups, socio-economic indicators should be combined with social-demographic indicators like marital status or country of birth. More details on the measurement of specific disadvantaged groups can be found in the other report of this project, on " Reporting of socio-economic differences in health indicators in Europe" .

5.5. Guidelines on measuring specific socio-economic indicators.

Guideline 1:
***Educational level** should be measured by means of a hierarchical classification of the population according to their completed educational level. Part-time education and vocational training are taken into account. A distinction is made between at least four categories similar to: elementary, lower secondary, upper secondary, and tertiary.*

Note that the recommendation is to create a hierarchical order of educational levels. A strict order from 'low' to 'high' groups is highly desirable, as this greatly facilitates the presentation and interpretation of the data.

In this recommendation, persons are assigned to an educational level according to the highest level of education that they completed. An exception may be made to students, who might be classified according to the level of education they are attending.

The recommended distinction between elementary, lower secondary, upper secondary, and tertiary education is based on the International Standard Classification of Educational 1997. This classification is summarised in table 5.3. Elementary education corresponds to ISCED level 1, lower secondary to level 2, upper/post secondary to levels 3 and 4, and tertiary to levels 5 and 6.

Our recommendation is thus to reduce the six ISCED levels to four groups. This recommendation is a compromise between two requirements. One the one hand, the groups should be small enough to give a good impression of the size of inequalities. On the other hand, they should be large enough to have a sufficient number of cases per socio-economic group. In practice, the recommended 4-level scheme is found to be a good compromise.

The application of the 4-level scheme may be complicated in some countries or data sources. The educational systems of some countries do not neatly fit the ISCED scheme. In addition, the data that are available may fail to distinguish between educational levels, especially between elementary and lower secondary levels. In chapters 11 and 16, we illustrate the application of the educational classification to data that are available from mortality registries and from health interview and similar surveys. More specifically, the illustrations show the problems that were encountered and the ways in which we had to deal with these problems.

When no information is available on the level of education that is completed or attended, a substitute measure is the number of years that a person attended school. This figure has the attractive property of being a quantitative measure of socio-economic status, but in its most simple form it fails to take into account the type, and therefore the level, of education that was attended.

Table 5.3. An educational classification based on the International Standard Classification of Education (ISCED) 1997.

ISCED Level		Main characteristics of educational level
1	Primary education, or First stage of basic education	- entry at the start of compulsory education (where it exists) - beginning of systematic study of reading, writing and mathematics - corresponds to first 6 years of 'basic education' (where it exists) - also include literacy programs for those too old to enter elementary school
2	Lower secondary education, or Second stage of basic education	- entry after some 6 years of primary education - full implementation of basic skills, and foundation for lifelong learning - several teachers conduct classes in their field of specialisation - end corresponds to the end of compulsory education (where it exists) - also includes remedial, special or adult education similar in content
3	(Upper) secondary education	- minimum entrance requirements (usually completion of level 2) - includes both programmes designed to provide access to tertiary education and programmes designed to lead directly to labour market - more specialisation than at level 2 - teachers need to be more qualified or specialised than at level 2 - also includes special or adult education similar in content
4	Post-secondary non-tertiary education	- admittance requires as a rule completion of level 3 - typically, programmes aim to prepare students for studies at level 5, by broadening the knowledge of those who completed level 3 - more specialisation and more complex applications than at level 3 - a typical full-time duration of between 6 months and 2 years - also includes adult education such as courses during professional life
5	First stage of tertiary education	- admittance requires as a rule completion of level 3 or 4 - programmes have a cumulative theoretical duration of at least 2 years - programmes are theoretically based, research preparatory or give access to professions with high skill requirements - completion corresponds to Bachelor's degree (English speaking countries), 'Diplom' (German) or the Licence (French) - also includes adult education similar in content
6	Second stage of tertiary education	- leads to the award of an advanced research qualification - programmes require the submission of a thesis or other product of original research

Source: Table constructed by the authors on the basis of UNESCO (1997)

Guideline 2:
***Income level** should be measured by means of a classification of the population according to household equivalent income. The population is classified into groups of about equal population size, preferably quintiles.*

The income level of a person can be used in two ways. Income indicates the socio-economic status of the income recipient, with higher personal income indicating, among other things, a better labour market position. In this report, however, income is used complementarily to education, and acts as a more proximate indicator of access to scarce material resources, wealth or standard of living.

The standard of living can be expressed most adequately when the income level is measured by means of household equivalent income. This is calculated by (a) adding all income components, (b) subtracting deductions of tax and social contributions, (c) adding the net incomes of all household members and (d) adjusting the total household income for the size of the household (i.e. the number of household members).

Many methods have been developed to take into account the size and -less often- the age composition of households. For various countries, standard formulae have been developed. A simple formula that may be used for international overviews consists of dividing the household income by the square root of the number of household members. This adjustment formulae is applied in chapter 18. As table 18.7 illustrates, this simple formulae generally yields inequality estimates that are comparable to those observed by using complex formulae.

When measuring household size, the household is preferably defined in economic terms, e.g. as a consumption unit. Other definitions, e.g. in terms of family relationships, may only be used if a definition in economic terms cannot be used.

In some health interview or other surveys, information is only available on gross income (and not on net income) or only for the respondents themselves (and not on other household members). See chapter 10 for details on individual countries. In these cases, it is may not be possible to make accurate estimates of the household equivalent income. If so, it is preferable not to use income data at all.

The second part of guideline 2 is to classify the population on the basis of income in quintiles. This implies an ordering of people from high to low income and then dividing the people thus ordered into five groups of equal population size. Chapter 18 shows how this classification works in practice. For several reasons, it may not be possible in practice to construct groups of exactly the same population size. The general recommendation in these cases is to approach as much as possible the ideal distribution with 20 percent of the total population falling into each group.

The quintile approach implies ordering the respondents according to the relative position at the income hierarchy, i.e. in terms of the percentage of all people who have a higher income. This ‘relative’ approach is recommended as it greatly facilitates comparisons both over time and across countries, since all classifications are (nearly) identical in these relative terms.

Income is considered in this report as an indicator of standard of living. It is not a perfect indicator, however. Income has practical disadvantages (see table 5.2) and also may have conceptual drawbacks. For example, income measures are inadequate when the emphasis of the research is on life-time income or long-term wealth. In these cases, other indicators may be more appropriate. Indicators of house ownership or tenure may be considered for use in these cases. Data on mortality or morbidity can be linked to information on housing tenure in many European countries. These indicators may be considered for use for specific purposes, e.g. for measuring wealth-related inequalities in mortality or morbidity among the elderly.

It may finally be noted that, when the household equivalent income of each individual is assessed, an instrument is available to identify *the poor* as those who have an income below the poverty line. Poverty lines can be established in various ways, and each country has its own lines. A common approach that can easily be used in international overviews is to define poverty in purely relative terms, that is, in relation to the income level of other persons living in the same country. A frequently used poverty line is 50 percent of the nation's median income.

Guideline 3:
Information on occupation is used to classify subjects into ***'occupational classes****'. A distinction should at least be made between non-manual classes, manual classes, farmers and other self employed. If possible, a further distinction is made between upper and lower non-manual classes, and between skilled and unskilled manual classes.*

A main issue in the measurement of occupation is how to classify people according to their place in the social stratification system. The main approach in European countries is the 'class structural' approach. In this approach, distinctions are made between people who have structurally different positions in the labour market and who, as a result, differ in terms of income, privileges, life styles and characteristics like voting behaviour. The resulting groups of people are usually referred to as 'occupational classes' or 'social classes'.

Statistical offices of most EU member states apply their own national class schemes. In addition to these national schemes, there are international class schemes that are basically similar to many national schemes. The most well known scheme is the EGP (Erikson, Goldthorpe and Portocarero) scheme. A standard approximation to this scheme was developed by Ganzeboom et al. Details on the EGP scheme are given in table 5.4.

Our recommendation is to use a class scheme that is roughly similar to the EGP scheme and to most national class schemes. The basic distinction between four classes can be applied to nearly all EU member states. The further distinction within the non-manual classes and within the manual classes may not be possible in many data sources. If this distinction can be made, however, it is recommended because large health differentials are often observed within these broad groups as well (see table 13.13 for an example).

Table 5.4. An example of a social classification based on occupational information: the EGP social class scheme.

Occupational class		Examples of occupational titles that are usually assigned to these classes	
I	Upper-grade professionals, administrators and managers; large employers	physician architect judge, lawyer university professor	village head high civil servant head of large firm banker
II	Lower-grade professionals, administrators and managers	newspaper editor * head of firm * insurance agent * primary teacher	nurse system analyst journalist designer
III	Routine non-manual employees, sales personnel, service workers	bookkeeper * salesman * ticket seller computer operator	office clerk receptionist sales clerk waiter
IVa IVb	Self-employed and artisans (with employees) Self-employed and artisans (without employees)	shop owner automobile dealer hotel operator **	market vendor pub keeper independent artisan **
IVc	Self-employed farmers and fishermen	farmer farm foremen ***	family farm worker specialised farmer ***
V	Lower-grade technicians, foremen	foreman ****	supervisor ****
VI	Skilled manual workers	cook miner butcher cabinet maker	aircraft worker goldsmith printer carpenter
VIIa	Semi- and unskilled manual workers	mail carrier nursemaid watchman assembly line worker	cigarette maker glazier driver porter
VIIb	Agricultural workers	field crop worker milker tractor driver	forester fisherman hunter

*	*Promoted to occupational class I if more than 10 subordinates*
**	*Also includes self-employed persons whose occupations are classified under class II, III, V, VI or VIIa.*
***	*Also includes self-employed persons whose occupations are classified under class VIIb*
****	*Workers in class VI are promoted to occupational class V if they have more than 10 subordinates.*

Source: Table constructed by the authors on the basis of Erikson and Goldthorpe (1992) and Ganzeboom et al (1989).

In this report, we cannot recommend one standard classification or algorithm that should be applied uniformly to all countries. This degree of standardisation is found to be difficult if not impossible in practice, due to large differences between countries in the type of data that are available. In addition, due to international variations in labour market structures, each social class scheme should be adopted to a country's specific situation. Therefore, our general recommendation is to depart from existing national class schemes. Using basic tabulations that present mortality or morbidity estimates according to these national schemes, estimates may be made of mortality or morbidity according to the four basic classes. If the basic tabulations permit, further distinctions can be made within manual classes and/or within non-manual classes.

We should emphasise that not all occupational classes have a clearly hierarchical relationship to each other. For example, there is no general rule that says that lower non-manual workers are in a better position than skilled manual workers. However, there are two groups who have a clearly hierarchical relationship: the middle and upper non-manual classes (classes I and II in the EGP scheme) are clearly more advantaged socio-economically than the manual classes (classes V, VI and VII). Therefore, socio-economic inequalities in mortality and morbidity should principally be assessed by comparing these contrasting classes.

A social class scheme that does seem to pretend to be entirely hierarchic is the well-known social class scheme of the British Registrar General, which ranks social classes from I to V. One of the drawbacks of this scheme is that it was not consistently developed on the basis of specific criteria for ranking occupations from high to low. For this and other reasons, the Registrar General's scheme cannot be promoted as a golden standard for a European health monitoring system.

If the aim of the analyst is to develop a strictly hierarchical classification of people according to their occupation, an alternative is to use one-dimensional scales such as prestige scores or social distance scales. These scales are a promising type of socio-economic indicator as they have the practical advantages of being strictly hierarchical. However, these measures are not recommended for general use in a European health monitoring system, because there is yet insufficient experience in different EU member states with using these indices to measure socio-economic inequalities in health.

Guideline 4:
The occupational class should be determined on the basis of the individual's current or ***last occupation****. However, if many persons are not economically active, a classification on the basis of the occupation of the* ***'head of household'*** *may be considered.*

The first element in this guideline that we should stress is the use of the last occupation if there is no information on the individual's current occupation. This rule is especially important to the classification of economically inactive men, such as the unemployed, work disabled, retired, and homemakers. We should stress that, when the aim of the analysis is to measure the relationship between occupational class and health indicators, the economically inactive men should be classified according to their last or longest held occupation. If these men would *not* be classified but, instead, excluded from the analysis of the association between occupational class and health indicators, their exclusion may result in a serious underestimation of class differences in health indicators. This point is explained in more detail in chapter 13 and illustrated in tables 13.5, 13.10 and 13.11.

Another issue that is addressed in this guideline relates to the choice of the reference person. This choice is particularly important for women. An enduring question in social stratification

research is how to classify married or cohabiting women: with reference to their own occupation or with reference to the occupation of their partner? Both theoretical and empirical issues are relevant to this issue. Our basic recommendations is to classify women according to their own occupation. This individual-level approach is more easy to apply in practice, among others because it does not require the availability of data on the occupation of other household members. In addition, an individual-level perspective is likely to be increasingly more applicable in the future.

We should stress, however, that the individual-level approach cannot be applied when many women are economically inactive. In that case, most of these women may have to be excluded from analyses because their occupational class can only be determined on the basis of their own occupation. The only alternative in this case would be, if the required data are available, to assign women to occupational classes on the basis of the occupation of the 'head of household' or any other reference person at the level of the household.

We should add that this references person is not necessarily a male person (e.g. husband of married women). This person should be defined in terms of socio-economic status rather than gender. For example, the 'dominance rule' may be applied, which states that a woman is classified according to her own job or her partner's job, depending on who is 'dominant' in terms of occupational class or socio-economic status. Note, by the way, that a consistent application of this principle should also be extended to men, who may in some cases be classified according to their wives' occupation.

We should finally stress that, if women are classified according to their own occupation, social class schemes may need to be adjusted to the fact that many women work in a few typically female occupations such as nurses, teachers, secretaries and shop assistants. Class schemes should be able to make further distinctions between these women in as far as these women differ in terms of class position or socio-economic status. This may imply, for example, that further a stratification is made within the class of service workers, sales personnel and lower employees (EGP class III).

Chapter 6.
Tabulating health indicators by socio-economic group

6.1. Purpose of this chapter

The purpose of this chapter is to develop guidelines on tabulations of health indicators according socio-economic group. These are for example the tabulations that national agencies may provide to the EC and its institutions. This chapter will discuss (1) the general format of these tabulations and (2) the precise measurement of the health indicators.

Closely related to these issues is the question how variations in the health indicator by socio-economic group can be summarised. This more analytical question will be dealt with in the next chapter.

6.2. Guidelines on the general format of tabulations

Guideline 1:
Tabulations are created according to the format that is presented in table 6.1.

A general scheme for the tabulation and analysis of data on health inequalities is presented in table 6.1. According to this table, trends in health inequalities are described in three steps.

1. people are divided into groups (or strata or classes) according to a socio-economic indicator. Data are presented on the population size of these groups, and thus on inequalities in education, income or any other socio-economic indicator;
2. data are presented on the occurrence of the health problem per socio-economic group. These data allow, among others, to estimate group-specific trends in the health indicator, and differences between groups with regard to these trends;
3. summary indices are used on the magnitude of differences between these groups in the occurrence of the health indicator. These indices allow to assess changes over time in the magnitude of these inequalities.

Thus, tabulations that are set up according to the format of table 6.1 allow the study of both "inequalities in trends" (step 2) and "trends in inequalities" (step 3).

Guideline 2:
The same socio-economic classification is used for each period. As a general rule, between three and five socio-economic groups should be distinguished.

The previous chapter provided guidelines on the measurement of socio-economic indicators. To the guidelines given there, we should add a few more specific details.

Table 6.1. Basic scheme for tabulating and analysing trends in socio-economic inequalities in health

Step 1: Population size

SE indicator	Share in total population (%)			Trend	
	Period 1	Period 2	Period 3	Absolute change	Relative change
Group 1 (highest)					
Group 2					
Group 3					
Group 4					
Group 5 (lowest)					
Total	100	100	100		

Step 2: Health

SE indicator	Occurrence of health problem (rate)			Trend	
	Period 1	Period 2	Period 3	Absolute change	Relative change
Group 1 (highest)					
Group 2					
Group 3					
Group 4					
Group 5 (lowest)					
Total					

Step 3: Magnitude of health differences

	Inequality index			Absolute change from period 1 to 3
	Period 1	Period 2	Period 3	
Relative version				
Absolute version				

The first issue concerns the number of groups that are to be distinguished in the tabulations. In general, between three and five groups should be distinguished. This number is a compromise between two requirements. One the one hand, the groups should be small enough to give a good impression of the size of inequalities. On the other hand, they should be large enough to have a sufficient number of cases per socio-economic group. In studies of trends over time, a distinction by more than five groups is not practical because (a) it easily yields an overwhelming amount of data to be presented and interpreted and (b) the number of cases per group often becomes too small to demonstrate differences in trends with statistical significance.

The second issue we should stress is that comparability over time should be increased as much as possible. Even though the basic socio-economic data are not fully comparable, comparability may be achieved in terms of the socio-economic classifications that are applied in the tabulations. For example, as is illustrated in chapters 12 and 13, different occupational classifications may be made approximately comparable at the level of the four broad groups that were recommended in the previous chapter (manual, non-manual, employed, farmers). Socio-economic classifications may also be made comparable by defining groups in relative terms, i.e. in terms of the relative position versus other people on the social ladder. For example, in chapter 18, income quintile groups were defined as an easy way to make income data comparable, both over time and across countries.

Finally, a careful ordering of socio-economic groups in the table would facilitate the interpretation and presentation of the data. As a general rule, groups are ordered from 'high' to 'low' according to their place in the social hierarchy. Groups that cannot be placed clearly are presented separately. For example, farmers and self employed men do not fit nicely in the hierarchical order from 'high' to 'low' occupational classes, and may therefore be placed separately in the lower part of the table. 'Unknown' groups are presented at the very bottom of the table.

Guideline 3:
For each socio-economic group, information is given on the absolute occurrence of the health problem in each period, and on changes over time in the occurrence of this health problem.

There are basically two possibilities to give information on health indicators per socio-economic group: (a) to present their occurrence in terms of absolute rates or probabilities or (b) to present their occurrence relative to that in other socio-economic groups. Relative occurrence is usually expressed as ratios, such as Standardised Mortality Ratios (SMRs). Of course, data can be presented in both respects. However, in practice this would often produce an overwhelming amount of data, and therefore it would be highly convenient to present only one type of measure. As a standard, we recommend to present absolute occurrence rates. The advantage is that these basic figures allow not only for the comparison between socio-economic groups (per period), but also for the study of trends over time (per socio-economic group).

This advantage disappears, however, when comparisons over time are not possible, e.g. with data from continuous surveys that have changed their health questionnaires. This case is illustrated in chapter 17 for indicators on long-standing health problems. In these cases, comparisons over time can only be made with respect to *relative* differences between socio-economic groups. In such a situation, the presentation of relative differences (instead of absolute rates) would not only be more convenient, but also more appropriate, since that would protect the reader against making invalid comparisons over time.

If absolute occurrence rates are comparable over time, one may address the question whether trends in the health indicator differ according to socio-economic group (i.e. whether there are "inequalities in trends"). The answer to this question would be greatly facilitated if trends in health indicators are summarised into one single measure per group
and if this measure is compared across groups. Which group-specific measure of trends should be used? If data are available for no more than two periods, the summary measure must be a comparison between the first and the second period.

If data are available for more than two periods, the simplest way is then to compare the first and the last period. As a check to this simple measure, one may assess whether estimates for the intermediate periods fall nicely in-between the estimates for the first and the last period. However, sometimes trends are not that simple. For example, during the study period an increase may turn into a decrease. In these cases, a more refined methodology may be applied, such as fitting the long-term trend by means of regression analysis. Usually, however, this approach would be too sophisticated, and it would be more informative to depict the differences in trends by other methods, e.g. graphs that visualise the trends present in the basic data. An inspection of these graphs may then reveal specific patterns, for example, that the top of the lung cancer epidemic was reached earlier in one socio-economic group than in another. Illustrations of this kind of analysis are given in chapter 12.

Guideline 4:
Information is also given on the distribution of the population per socio-economic group, and on changes over time in population distributions.

This guideline is embodied in the upper part of table 6.1. Information on population distributions should be presented because estimates of health indicators per socio-economic group cannot be interpreted properly without information on the size of these groups. In addition, this information gives an impression of the size of inequalities in socio-economic terms. For example, when income is used as the socio-economic indicator, the upper part of table 6.1 may help to determine the size of income inequalities and changes over time in these inequalities.

The standard way to present population distributions is to present, for each period separately, the percentage of the population falling into a specific group. However, this measure is not very informative if socio-economic groups are defined in purely relative terms. For example, each income *quintile* by definition should have 20 percent of the population. In that case, additional information should be added on the magnitude of income inequalities. Several measures on income inequalities are available from the economic literature. In chapter 18 we use a simple measure that fits nicely in the quintile approach: the ratio of the 80^{th} percentile to the 20^{th} percentile of the income distribution. More sophisticated measures may be applied if there is a special interest in income inequalities or in the prevalence of absolute or relative poverty.

6.3. Guidelines on the measurement of health indicators

Guideline 1:
As a general rule, the health indicator should be expressed as the rate or probability displaying the occurrence of 'negative' health problems. In some cases, however, measures of 'positive' health may be measured.

Statistically, the occurrence of health indicators can be measured in different ways: as rates, as proportions/possibilities, or as count numbers. All three possibilities can for example be applied to mortality data. If data on mortality by age group are available for all ages, these data can be used to measure:

- mortality rates, e.g. directly age-standardised mortality rates;
- mortality probabilities, e.g. the life-table based probability of dying between birth and the 65th birthday;
- the life-table based life expectancy, i.e. the number of years that new-born babies can expect to live on average, if they would be exposed to the observed risk of death throughout their life.

Count measures are possible for a wide range of health indicators, e.g. the average body length of military conscripts, the average weight at birth of a group of new-born babies, and the average number of symptoms reported in health surveys. In many of these cases, however, it is more informative to transform these data into rates or probabilities that explicitly identify those individuals with special health risks or problems, for example, the percentage of babies with birth weight less than 2500 gram, or the percentage of people with more than 5 health complaints.

As a general rule, rates or probabilities express the occurrence of a 'negative' health problem. For example, usually it makes more sense to count the few persons who died prematurely (a 'negative' approach) than to count the majority who survived (the 'positive' approach). There are exceptions to this 'negative' rule, however. For example, when presenting data on the elderly, it makes sense to also look at those elderly who have been able to survive without disability, as they provide important instances of successful healthy ageing. A well known 'positive' measure of population health, the disability-free life expectancy, is recommended for use in guideline 5.

Guideline 2:
Where possible, mortality levels are presented as mortality rates by gender and broad age group, and by gender and cause of death.

Mortality levels are basically expressed as incidence rates, which are calculated by dividing the observed number of deaths by the corresponding number of person-years (the number of people times the average number of years per person) of being exposed to the risk of dying. In longitudinal studies, the number of person-years at risk can be calculated accurately from the available data (see chapters 11 to 14). In unlinked cross-sectional studies, it is customary to estimate this number as the number of people in the middle of the study period times the number of years covered by the study period (see chapter 15).

Since the magnitude and pattern of socio-economic inequalities in mortality strongly varies according to age and gender, inequality estimates should be presented according to gender and age group. An often convenient ordering of age groups is: 0-14, 15-29, 30-44, 45-54, 60-

69 and 70+ years. Further distinctions might be made within an age group of special interest, provided that age-specific numbers of death are sufficiently large.

The distinction of causes of death has two purposes: (a) it is often the only way to obtain indications on the magnitude of inequalities with regard to specific diseases and (b) study of such specific causes of death as lung cancer and liver cirrhosis provides clues to the explanation of inequalities in all-cause mortality. These two purposes are illustrated in chapters 12 and 14 respectively.

A few general guidelines can be given on the most appropriate way of classifying causes of death. If the distinguished cause-of-death groups are broad and heterogeneous (such as all neoplasms) they say very little about the causes of health inequalities. A very detailed classification, on the other hand, produces an overwhelming quantity of data and easily runs into problems related to small numbers of death. A convenient approach (applied by us in Part three) is to distinguish the most important ICD chapters and make further distinctions within the largest chapters, e.g. between the ten largest single causes of death.

Guideline 3:
Where possible, self-reported morbidity is measured by indicators on (a) perceived general health, (b) the prevalence of chronic diseases, (c) the prevalence of disability and functional limitations and (d) the prevalence of any long-standing health problem.

Levels of self-reported morbidity are usually expressed at the proportion of respondents who report a health problem. Examples of prevalence rates calculated in this way are given in chapters 16 to 18.

Four indicators are recommended that together cover various aspects of a respondent's health. Each of the four indicators can be measured in several EU member states (see chapter 10 for details). Perceived general health is measured by a question similar to " How would you judge your present state of health in general: very good, good, fair, poor or very poor" . The prevalence of chronic conditions is measured in many surveys by presenting respondents a checklist of conditions and asking the respondent to indicate, for each condition separately, whether they suffered from that condition over the last year. The prevalence of disability and functional limitations is measured by a series of questions in which respondents are asked whether they have difficulty in activities such as climbing stairs, (un-)dressing and reading newspaper print. Finally, the prevalence of any long-standing health problem is measured by a straightforward question similar to " Do you suffer from any long-standing illness, disease or disability" . More details on the way in which these health indicators (except for the indicator on disability)were measured in this project are given in chapters 16 to 18.

Specific guidelines for the measurement of these indicators in the future Health Monitoring System are not given here, as these will depend on the recommendations that are being developed in other HMP projects (e.g. the HMP project on health interview and examination surveys). Below, we will give some general remarks that may be relevant specifically to the measurement of inequalities in morbidity.

In chapter 17, data on the prevalence of specific chronic conditions were combined into one composite indicator indicating the proportion of respondents having at least one condition. The same approach can be applied to disability, which is often measured by the proportion of respondents having difficulty with at least one activity of daily life. These composite indicators are used as general measures of morbidity and disability. For specific purposes, these indicators may be complemented with indicators measuring the prevalence of specific diseases or types of disability. For the analysis of socio-economic inequalities in disease or disability, however, the number of respondents is usually too small to investigate inequalities in specific diseases or types of disability.

Another point of consideration is how severe the measured health problem should be. Often, a choice can be made between measuring 'severe' states of health only, or including 'moderate' health problems. For example, the question on perceived general health may be used to measure those with 'poor' and 'very poor' health only, but may also add those with 'fair' health. Adding 'fair' into a measure of 'less than good' health has the practical advantage that the number of observations is increased, and with this the statistical power. However, as shown in chapter 16 and 18, different patterns of inequalities may be observed when the analysis is restricted to those with 'poor' or 'very poor' health. Therefore, it is generally preferable to assess socio-economic inequalities in terms of both 'poor' health and in terms of 'poor/fair' health.

For similar reasons, measures reporting the proportion of respondents with at least one chronic condition may be complemented, where possible, by measures that identify those who have at least two (or at least three) chronic conditions.

Guideline 4:
Health measures should be standardised for age in such a way that comparisons can be made not only between socio-economic groups, but also between periods and countries. Direct standardisation using the European Standard Population is recommended.

When health indicators are measured according to socio-economic group, the effect of any confounding variable should be removed, for example, by standardisation. Age is an obvious confounder, as it is likely to be associated with socio-economic status and with health. For example, since older people on average have lower levels of education than younger people and old age is also associated with increased disability, the failure to control for age would give a biased (too high) estimate of the association between low education and disability. Age standardisation is therefore required before any meaningful comparison of health indicators between socio-economic groups can be made.

Standardisation should be done according to a detailed classification by age group, preferably 5 years. Standardisation by 5-year age group is required whenever the estimates cover an age range that is 10 years or wider, e.g. when inequalities are studied among women in the age group 30 to 44 years.

When analysing time trends in occurrence rates, care should be taken to standardise not only for age differences between socio-economic groups, but also for age differences between time periods. When international overviews are constructed, as in the Health Monitoring System, it is also advisable to standardise for age differences between countries.

The preferred method is direct standardisation, with the European Standard Population (ESP) as the standard. By applying this technique to a specific index group, it is estimated what the occurrence rate for this group would be if this group would have the same age structure as the ESP. By applying the same technique to each index group (defined in terms of gender, socio-

economic level, period and country) comparability is achieved both between men and women, between socio-economic groups, between periods and across countries. This technique is applied throughout Part three.

If men and women are analysed together, estimates of socio-economic inequalities in health should also need be standardised by sex. It is strongly recommended, however, to analyse men and women separately, as there may be large gender differences in the magnitude and pattern of health inequalities.

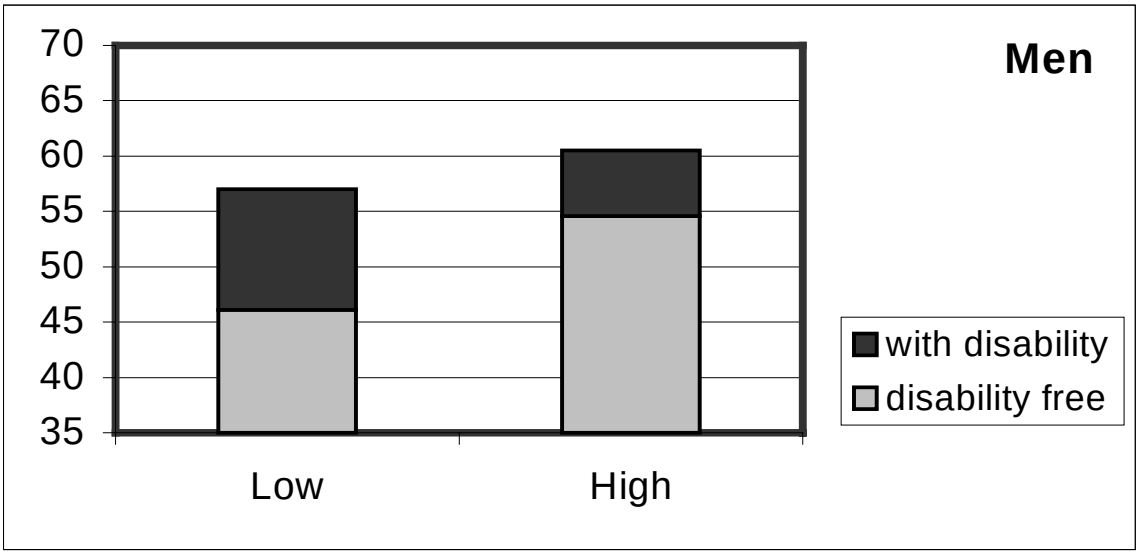
There are other variables that may act as confounders, such as ethnicity and perhaps marital status. However, these variables are usually not taken into account in routine analysis of health inequalities, and often it is not certain whether they act as confounders or as intermediate factors. Age and sex determine socio-economic status instead of the other way around, but what is the direction of the causal effect between socio-economic status and factors like place of residence and marital status? Given this uncertainty, most of these factors can better be taken into account in explanatory analyses.

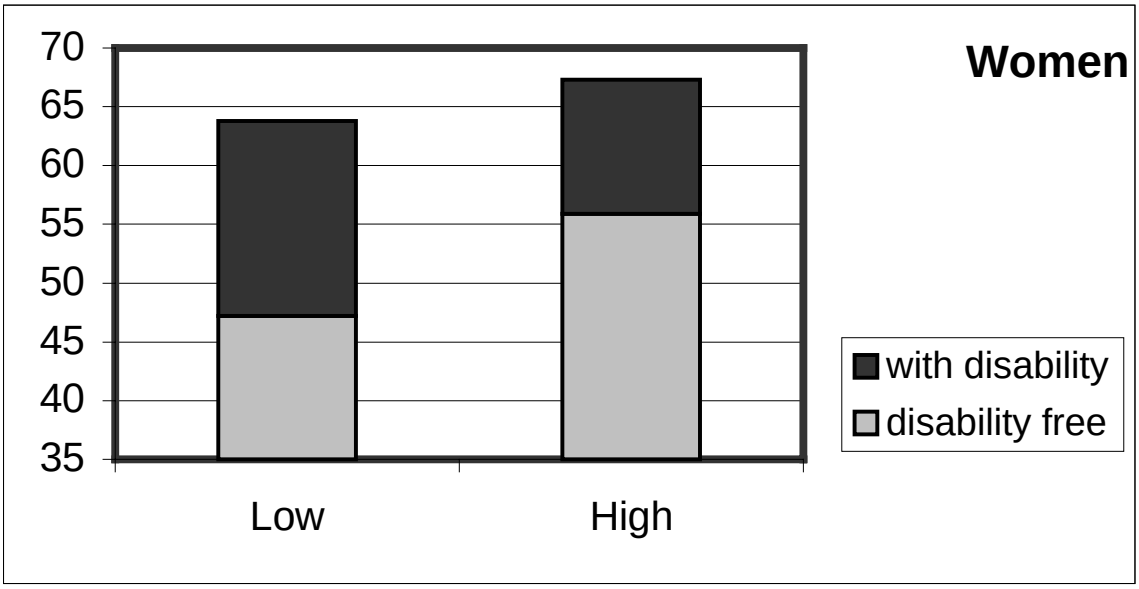
Guideline 5:
Where possible, measures of mortality are summarised in terms of life expectancies, and measures of mortality and self-reported morbidity are combined into synthetic measures such as disability-free life expectancy.

When data on socio-economic inequalities in mortality are available for a broad age range, these inequalities can be expressed in terms of life expectancies (at birth or at any other age) or other measures that are based on the life table (such as the proportion surviving to a specific age). The application of life expectancy is illustrated in chapter 11 on educational differences on mortality. A major advantage of life expectancies and related measures is their straightforward interpretation. They help to obtain a more concrete impression of the magnitude of inequalities in mortality, and to communicate this impression to a wider audience.

Measures such as disability-free life expectancy and health expectancy have been used increasingly more in research on socio-economic inequalities in health. An advantage of these measures is that they combine mortality and morbidity into one single figure with a clear and attractive interpretation. For example, if this measure is calculated using data on disability and for all age groups, it represents the average number of years without disability that people may be expected to enjoy during their entire lifetime (assuming that they would be exposed during their entire lifetime to the age-specific disability and mortality rates that are observed now).

Figure 6.1. Differences between educational groups in life expectancy at 16th birthday (LE) and disability-free life expectancy (DFLE). Netherlands, 1990-94. Source: Herten et al (1997), table 4.2.





Application of this measure is illustrated in figure 6.1 for the Netherlands, where a low educational level is associated with a shorter life expectancy after age 16 years. Men with lower educational levels not only die younger but suffer more years of disability. As a result, these men enjoy less years of good health, as compared to men with high education. Similar patterns of inequalities exist among women. The difference between low and high education is about 8.5 years for both men and women.

Calculating health expectancy measures for specific socio-economic groups is a promising way to summarise the available information on health inequalities. However, their calculation requires (a) that high-quality data are available on both mortality and morbidity, (b) that the same socio-economic classification is used in both types of data and (c) that the data refer to a broad age range, preferably all ages groups. Therefore, it may be hard to integrate these measures in a European monitoring system of socio-economic inequalities in health. None the less, given their descriptive value, it is recommended to apply health expectancy measures in each EU member state for which the necessary data have become available.

Chapter 7.
Measuring the magnitude of health inequalities

7.1. Purpose of this chapter

The purpose of this chapter is to develop guidelines for measuring the magnitude of health inequalities.

This chapter extends chapter 6. There, guidelines were given to create tabulations of health indicators according socio-economic indicators. Often, central to the analysis of these data is the use of a summary index that expresses in one single figure how large inequalities in health are. One of the main advantages of using a summary index is that this facilitates comparisons over time. Because of the key role that they play in monitoring socio-economic in health, this chapter gives guidelines on the choice and application of summary indices.

7.2. Overview of possible summary indices

An overview is given in the table 7.1. In this table, 12 different measures are distinguished which are distinct from each other in one or more conceptual orientations. There are several decisions that can be made conceptually.

1) Whether **or** not take into account population distributions (i.e. inequalities in socio-economic indicators) when measuring the magnitude of health inequalities

    a) If population distributions are *not* taken into account, compare only two socio-economic groups (simple measures) **or** make comparisons across all groups (sophisticated measures).

        i) If comparisons are made between only two groups, chose extreme groups **or** broad groups.

        ii) If comparisons are made across all groups, define each group's position in terms of 'absolute' socio-economic resources (e.g. income less than 10,000 euros) **or** in terms of 'relative' rank in the total population (e.g. the lowest income quintile).

    b) If population distributions are taken into account, decide what to consider as the reference situation of 'no inequalities': all people have the same *high* socio-economic status (the PAR perspective) **or** all people have the same *average* status (the ID perspective).

2) Express the occurrence of the health indicator in 'absolute' terms (e.g. rates) **or** in 'relative' terms (e.g. ratios that compare each group to a reference group).

It should be emphasised that there are more indices possible in theory than those presented in table 7.1. For example, regression-based indices are presented only for summary measures that do not take into account population distributions. However, measures such as the PAR and ID can also be calculated on the basis of regression analyses that first model the 'effect' of socio-economic status on health. However, this scheme does not attempt to give an

exhaustive overview of all possible indices, but only to present those measures that are found to be most useful and informative in practice. Table 7.1 is given to show the conceptual implications of these selected indices.

Omitted from table 7.1 is a summary index that is often used in health economics: the Concentration Index. This measure is not presented here separately because mathematically it is similar to the Relative Index of Inequality. Its method of calculation, however, is somewhat more complicated and it is convenient only to those (mostly economists) who are have ample experience with applying GINI coefficients and other techniques based on the Lorentz curve.

Table 7.1. Overview of summary indices

		Summary index (with example of an interpretation)	
		On the 'absolute' occurrence of health problems	On the 'relative' occurrence of health problems
Indices that compare two contrasting groups	Compare extreme groups	**Rate Difference** e.g. the absolute difference in mortality between professionals unskilled manual workers	**Rate Ratio** idem, but the *proportional* mortality difference
	Compare broad groups	**Rate Difference** e.g. the absolute difference in mortality between non-manual and manual classes	**Rate Ratio** idem, but the *proportional* mortality difference
Regression-based indices that take into account all groups separately	Based on 'absolute' SES	'**Absolute effect index'** e.g. the absolute increase in health associated with an income increase of 1000 Euro	'**Relative effect index'** idem, but the *proportional* increase in health
	Based on 'relative' SES	'**Slope Index of Inequality' (SII)** e.g. the health difference between the top and bottom of the income hierarchy	**'Relative Index of Inequality' (RII)** idem, but the *proportional* health difference
"Total impact" indices that explicitly take into account population distributions	The PAR perspective (equality by levelling up)	**Population Attributable Risk (PAR)** e.g. the total number of cases that would be avoided in the hypothetical situation that all people would have (the rate of those with) tertiary education	**PAR (%)** idem, but as a *proportion* of all cases (of death, disease, etc) in the total population
	The ID perspective (equality by redistribution)	**Index of Dissimilarity (ID)** e.g. the total number of cases to be redistributed between groups in order to obtain the same average rate for all groups	**ID (%)** idem, but as a *proportion* of all cases (of death, disease, etc) in the total population

Most summary indices can be calculated on the basis of the data that are presented according to the format of table 6.1. The only exception is that a numerical estimate of the 'absolute' socio-economic position is needed to calculate the 'effect index'. When this index is applied to educational level as the socio-economic indicator, each educational level must first be quantified, for example, as the number of years of education that is minimally required to complete that educational level. This approach is illustrated in chapter 11.

7.3. Evaluation of summary indices

Not only important are the conceptual implications of the summary indices, but also how they work in practice. In the evaluations presented below, we do not distinguish the 'absolute' and 'relative' versions of each measure, as the practical implications of using a specific summary indices do not depend on whether the 'absolute' or 'relative' version of this index will be applied.

The evaluations that we made are summarised in tables 7.2, 7.3 and 7.4. Table 7.2 evaluates the indices against a few theoretical criteria or situations, while table 7.3 evaluates the indices against practical criteria. Table 7.4 focuses on the requirements that each summary index sets to comparability of data over time.

Table 7.2. Evaluation of summary indices against general criteria

Summary index	Problem: the index ...			
	cannot distinguish between positive and inverse gradients	cannot take into account health differences within broad groups	is highly sensitive to 'erratic' values of the lowest group	is highly sensitive to 'erratic' values of the highest group
Rate difference comparing two extreme groups			X	X
Rate difference comparing two broad groups		X		
The regression-based absolute 'effect' index				
The regression-based Slope Index of Inequality				
Index of Dissimilarity (ID)	X			
Population Attributable Risk (PAR)				X

Table 7.3. Evaluation of summary indices against practical criteria

Summary measure	Problem: the index ...					
	is extra sensitive to inaccurate measure-ment of SES	has low statistical efficiency (power, precision)	requires making extra assump-tions on SES	is complex to calculate and interpret	cannot simply be converted from absolute to relative measures	is difficult to use for inter-national overviews and com-parisons
Rate difference comparing two extreme groups	X	X				X
Rate difference comparing two broad groups						
The regression-based absolute 'effect' index			X	X	X	X
The regression-based Slope Index of Inequality			X	X	X	
Index of Dissimilarity (ID)				X		
Population Attributable Risk (PAR)	X	X				X

Table 7.4. Evaluation of summary indices against their requirements with regard to comparability over time

Summary index	Requirement	Problems with meeting the requirement often occur for ...		
		Education	Occupational class	Income
Rate difference comparing two extreme groups	The same two extreme groups are used for each period	X	X	X
Rate difference comparing two broad groups	The same two broad groups are used for each period			
The regression-based absolute 'effect' index	The classification used for each period is strictly hierarchical		X	
The regression-based Slope Index of Inequality	The same numerical measure of SES is used for each period		X	
Index of Dissimilarity (ID)	Exactly the same classification is used for each period		X	X
Population Attributable Risk (PAR)	The same high reference group is distinguished for each period		X	X

From these evaluations, it is clear that the simple comparison between two broad group offers the most practical advantages (table 7.3). However, this measure may produce invalid results in some situations (table 7.2). Other summary measures also have specific advantages and disadvantages, implying that they may perform well in some situations but worse in others. These findings were taken into account when developing the guidelines given below.

7.4. General guidelines on using summary indices.

Guideline 1:
When the purpose of the analysis is to determine whether the magnitude of health inequalities has changed over time, these changes should be assessed by means of summary indices.

Summary indices should be considered as part of the basic analytical scheme presented in chapter 6 (table 6.1). This scheme stresses the need to look at both the basic data as presented in step 1 and 2, and the summary indices calculated in step 3. These summary indices express the magnitude of the health differences between advantaged and disadvantaged sections of the population. One of the main advantages of such a summary index is that it facilitates comparisons over time. Put simply, inequalities in health can be said to widen if this summary index increases, and to diminish if this summary index decreases.

In addition, other comparisons are also facilitated by summary indices, such as comparisons between men and women, between countries, and between different health indicators. For example, causes of death could be compared in chapter 13 in terms of the mortality ratio comparing manual to non-manual classes.

Summary indices also provide a means to translate the magnitude of socio-economic inequalities in health in concrete terms that are readily grasped by non-statisticians. An example is the Population Attributable Risk (PAR), which may be used to express the importance of health inequalities in concrete terms that can be communicated to a broad audience. The PAR also exemplifies that summary indices can also be used to take into account the population size of groups with high mortality and morbidity rates.

Guideline 2:
The changes that are identified by using summary indices should be checked against the patterns that are visible in the basic tabulations.

Summary indices should always complement instead of replace the basic description of health inequalities. The estimates from summary measures should be checked against the basic data. Checks are needed to assess whether the summary index adequately represents the observed variation between socio-economic groups in mortality or morbidity. One should be aware of the risk that important details would be missed by reliance on summary indices only. For example, in chapters 11 and 13, it is shown that mortality trends in specific groups such as self employed men or those with intermediate educational levels can deviate strongly from what would be expected given the trends in other groups. It is important to identify these deviations, not only because they are important for the groups concerned, but also because they may challenge the more general conclusion (e.g. “ inequalities widened”) that one would draw by looking at the summary indices only.

7.5. Guidelines on the choice between alternative summary indices.

Guideline 1:
In any analysis, the magnitude of health differences should be summarised by rate ratios that compare two contrasting groups.

For practical reasons (see tables 7.3 and 7.4), the most convenient summary index is the simple comparison between two contrasting groups in terms of rate ratios. Our basic recommendation is therefore to use rate ratios in any analysis of changes over time in socio-economic inequalities in mortality and morbidity.

A main question is *which* groups are to be compared in the rate ratio. In principle, a comparison of extreme groups (e.g. the lowest 20% vs. the highest 20% incomes, or unskilled manual classes vs. upper non-manual classes) is to be preferred because this usually gives a good impression of the real magnitude of socio-economic inequalities in mortality and morbidity.

In many cases, however, a comparison of extreme groups presents practical problems, e.g. with statistical power or with comparability over time. In these cases, a more robust rate ratio is obtained by comparing *broad* groups, such as the lowest 40% incomes vs. the highest 40% incomes, or all manual classes vs. all non-manual classes). The practical advantages of comparing broad groups instead of extreme groups are shown in tables 7.3 and 7.4. When one of these practical advantages are judged to be important in a specific situation, a comparison between broad groups is recommended over a comparison of extreme groups. For this reason, for example, most comparisons in chapters 14 and 15 are based on the rate ratios comparing all manual classes vs. all non-manual classes.

Guideline 2:
The rate ratios should be complemented by rate differences (i.e. a measure on absolute instead of relative differences) where feasible.

There is a general consensus that both relative and absolute measures of socio-economic inequalities in health are important. Relative measures are more commonly applied because these are of higher analytical interest. Absolute differences, however, have the advantage that they better express the importance of inequalities for the population that is affected. For example, a 50 percent mortality excess may be considered to be a more serious problem in a country with high overall mortality rates than a 50 percent mortality excess in a country with low overall levels. Since rate ratios can easily be translated into rate differences, it is usually worth the additional effort to look at both.

When both ‘relative’ and ‘absolute’ differences are applied in analyses of trends over time, it is important to assess whether the two types of measures produce different results. If they do, the question raises whether more importance should be attached to one measure as compared to the other. Take as an example chapter 13, on mortality differences between manual and non-manual classes. In most countries, the absolute differences in mortality appeared to be constant over time, but the relative differences (rate ratios) increased. Should the constant

absolute differences be given more importance, or should the increase in relative differences be stressed in the final conclusion?

The answer may lie in the way in which trends in health inequalities are judged normatively. If these trends are judged from the perspective of the people themselves, often an absolute perspective is judged more important. What matters to the people is the absolute chance of falling ill or being healthy, and if the absolute improvement in health is as large in lower classes as in higher classes, health inequalities might judged to have remained equally important. A contrasting perspective considers health inequalities in terms of redistribution, or the extent to which all groups receive a fair share of the total stock of health or ill health. Under this perspective, with an emphasis on *shares*, the relative perspective is more important. In the example given above, one would conclude that inequalities in mortality widened because manual classes received an increasingly larger share of the total burden of mortality.

It is difficult specify in general terms whether preference should be given to either absolute or relative measures. Often, both relative and absolute measures are considered to be informative for the purposes of the analyses. In these cases, it is appropriate to take both measures into account by formulating final conclusions such as " Relative inequalities increased, although absolute differences remained constant over time" .

It should be noted that in some cases absolute measures cannot be applied because of limitations to the data. An example gives chapter 16, where trends in inequalities in long-standing health problems cannot be studied in terms of absolute prevalence rates, but only in terms of 'relative' differences, because in some countries the data for the two periods were not sufficiently comparable to study changes in absolute prevalence rates. As a consequence, socio-economic inequalities in morbidity were assessed only in relative measures like rate ratios.

Guideline 3:
Other summary indices should be applied as a complement (instead of substitute) to rate ratios and rate differences.

Guidelines 3a and 3b below formulate a number of reasons that may prompt the application of summary indices other than rate ratios and rate differences. We should warn, however, that most of these indices have a number of practical limitations. Tables 7.3 and 7.4 set out these limitations. These might impede the use of a summary index in specific circumstances, even though it would have been interesting to apply these indices.

Guideline 3a:
More sophisticated measures like regression-based measures may be applied to check the validity of the results obtained with the rate ratios and rate differences.

One reason for interest in alternative summary indices is that they can be used to check the results that are obtained with rate ratios and rate differences. Note from table 7.2 that rate ratios may cause invalid results because of ignoring information on health differences within broad groups (if two broad groups are compared) or by their exclusive reliance on the information for the extreme groups (if only two extreme groups are compared). As a check, it may therefore be useful to also calculate summary indices that take into account the morbidity or mortality estimates of each socio-economic group individually. Regression-based indices are especially valuable for this purpose.

Of these indices, the Relative Index of Inequality (RII) and its absolute equivalent (the SII) are most useful. A main advantage of these indices is that they can be applied to a socio-economic classification whenever this classification is strictly hierarchical. This condition is met in standard educational schemes and income classifications. When applied to these classifications, the RII has the additional advantage to yield values that are comparable over time and between countries. Examples on the application of the RII are given in Part three in chapters 11, 16 and 18.

Even though regression-based measures do utilise more of the available information, they do so at the expense of greater complexity in calculation and interpretation. An important recommendation is therefore that simple measures are used as a general rule, including for presentations, but that statisticians check the results obtained with simple measures against the results obtained with methodologically more refined measures.

Guideline 3b:
When the distribution of the population over socio-economic groups has substantially changed over time, measures of 'total impact' may be applied to assess whether taking these changes into account would lead to other conclusions.

The measures discussed so far compare specific socio-economic groups such as those with high education versus those with low education. In this way, they look at the *effect* that a fixed change in socio-economic status has on mortality or morbidity. There are alternative measures that do not only take into account this effect, but that in addition are sensitive to the population size of the groups that are compared. These measures come up with a measure of the *total impact* that socio-economic inequalities have on overall levels of mortality and morbidity. The use of these measures may be considered especially if the socio-economic distribution of the population has substantially changed over time.

The Population Attributable Risk (PAR) is perhaps most informative. This measure can be interpreted as the proportional reduction in overall mortality or morbidity levels that would occur in the hypothetical case that each socio-economic group would have the rates of the most advantaged groups. The application of the PAR is exemplified in chapters 11 and 13. The PAR not only reflects the mortality or morbidity level of lower groups as compared to higher groups, but also their population size: the larger the groups with high rates, the larger the potential effect on overall levels of mortality or morbidity. Therefore, the PAR may be used especially to evaluate the effect of changes in the size of disadvantaged socio-economic groups.

The Index of Dissimilarity (ID) may also be used to evaluate the effect of population change and to provide the reader with an concrete, intuitive idea of how important the observed inequalities are for the health of the population at large. This index can be interpreted as the total number of cases of disease or death that should be redistributed in order to obtain the same level for all socio-economic groups. This interpretation is subtly different from that of the PAR: whereas the ID evaluates the extent to which the population distribution approaches the situation of the same *average* socio-economic level for all, the PAR evaluates changes towards the situation of the same *high* socio-economic level for all.

As is illustrated in chapter 13, the PAR and the ID may yield distinct results and offer complementary perspectives on socio-economic inequalities in mortality and morbidity. Therefore, we recommend to use both measures, especially if the purpose of the analysis is to assess the general importance of the observed (trends in) socio-economic inequalities in mortality and morbidity.

Chapter 8.
Evaluating and interpreting the results

8.1. Purpose of this chapter

The purpose of this chapter is to develop guidelines on the evaluation of health inequality estimates that will be generated by health monitoring systems. This step involves both the evaluation of data problems and the search for substantial explanations.

This chapter will put emphasis on the evaluation of the potential effect of data problems. In this way, this chapter aims to contribute to (a) a greater awareness of the problems that may be inherent to the use for monitoring purposes of specific data sources and (b) the application of methods that are maximally robust against these data problems.

8.2. Guidelines on evaluating data problems.

In part three, a detailed account is given of the different kinds of data problems that may be encountered when using mortality registries or health interview surveys for the monitoring of socio-economic inequalities in mortality or morbidity. The experiences presented in part three are summarised below in the form of three guidelines.

Inevitably, these guidelines are formulated in rather general terms. The reader is referred to part three for getting a more concrete idea of the kind of data problems that may be encountered, the way in which these problems may be dealt with, and the extent to which remaining problems may bias the results.

Guideline 1:
Data problems should not be dismissed easily. It should instead be recognised that several data problems have the potential to bias estimates of the magnitude of health inequalities.

An overview of potential data problems is given in table 8.1. This overview includes problems that may bias (a) estimates of socio-economic inequalities in mortality and morbidity in one moment in time or (b) estimates of *changes over* time in the magnitude of these inequalities. The main purpose of table 8.1 is to provide a checklist to be used to identify (and not overlook) problems that may affect estimates of the magnitude, pattern and trends in socio-economic inequalities in health.

The potential effect of some of the data problems is demonstrated in part three. Table 8.2 gives an overview of all data problems that are evaluated in some detail in part three. Most evaluations are based on quantitative analyses, but some of the evaluations draw only upon qualitative insights from the research literature coupled with some reasonable speculation. These evaluations may give the reader an impression of the ways in which, and the extent to which, mortality registries and health surveys can be used to monitor socio-economic inequalities in mortality and morbidity in the European Union.

Table 8.1. Checklist of potential data problems

Area	Affecting the measurement of inequalities in health at one moment in time	Affecting the measurement of time trends in these inequalities
Delimitation and representative-ness of study population	Exclusion from the study of specific subpopulations, e.g. - non respondents to surveys - specific SES groups, e.g. self employed - others, e.g. institutionalised, foreigners Exclusion from analysis of those with missing values due to, e.g. - unknown SES, e.g. inactive men - health status unknown, e.g. cause of death	Changes in delimitation of the population, e.g. - different age groups - different geography - different survey samples Changes in *problems with* representativeness (see cell to the left)
Measurement and classification of health indicators	Misclassification due to, e.g. - problems with self reports - inaccurate registry of causes of death - incomplete coverage by e.g. hospital registries Failure to measure all aspects of health that were aimed to be studied, e.g. - restriction of moderate instead of severe levels ill health - incomplete selections of diseases or disability items	Changes in the measurement and classification, e.g. - different health questionnaires - different classifications of diseases Changes in *problems with* measurement and classification (see cell to the left) Changes in population health not taken into account, e.g. changing mix of diseases
Measurement and classification of socio-economic indicators	Misclassification due to, e.g. - lack of detailed basic data - the 'numerator/denominator bias' - use of crude social class schemes, e.g. ISCO based schemes - inaccurate measurement of e.g. income Failure to measure all relevant groups separately, e.g. - those with elementary education only - non-manual workers with lowest status	Changes in data, indicators and classifications Changes in *problems with* measurement and classification (see cell to the left) Social changes not taken into account, e.g. changes in - educational systems - income structure - position of specific occupations
Confounding	Confounding inherent to a specific indicator of SES or health, e.g. - insurance coverage as a proxy for income - facility-based measures of health	Changes in the effect of confounding
Power, precision	Wide confidence intervals to inequality estimates	Overlap in the confidence intervals to inequality estimates for different periods

One of the striking results is that some data problems have the potential to seriously affect estimates of socio-economic inequalities in mortality and morbidity. Examples are given in for example tables 13.10, 13.12, 16.5 and 18.8. Perhaps most dramatic is the example that is elaborated in chapter 15, where the numerator/denominator bias is evaluated with data from Ireland, Spain and Portugal. From the evaluations made there, we conclude that, unfortunately, the bias seemed to be so strong in the case of Spain and Portugal that nothing could be concluded about changes in mortality differences by occupational class.

Table 8.2. Overview of data problems discussed in part three

Section	Problem	Empirical illustration
11.5	Skewed educational distributions	no table
12.5	Problems with cause-of-death registration	no table
13.5	Exclusion of men with unknown social class	tables 13.5, 13.10 & 13.11
13.5	Changes in social class scheme	table 13.12
13.5	Distinction of broad social classes only	table 13.13
15.2,15.6	Numerator/denominator bias	tables 15.1 & 15.12
16.3	Large chance fluctuations, low precision	tables 16.6 & 16.8
	(also illustrated in e.g. chapters 12 and 14)	
16.5	Poor comparability of health indicators	table 16.5
16.5	Skewed educational distributions	table 16.9
16.5	Non-response to interview surveys	table 16.10
16.5	Exclusion of foreigners or institutionalised	no table
17.5	Changes in survey questions	table 17.5
17.5	Non-medical determinants of reporting behaviour	no table
18.5	Income unknown due to non response	table 18.6
18.5	Inaccurate reporting of income	no table
18.5	Changes in measurement of income	table 18.7
18.5	Other choice of surveys	table 18.8

The data for Ireland could be given more credibility, and indicate that changes over time in Ireland were similar to those in for example England and Wales. But also the Irish case shows the potential effect of the numerator/denominator bias. In table 15.12 we demonstrate that a subtle change in the denominator data would cause a bias that would be easily go unnoticed, but that would lead to an entirely different view of changes over time. This example warns that the researcher should be highly alert for the potential effect of data problems. These problems should not be easily dismissed as being of little effect!

Guideline 2:
Care should be taken to reduce the potential effect of data problems where possible. Data problems should be taken into account when selecting and applying the health indicators, the socio-economic indicators and the analytical methods.

Given the potential effects of data problems, indicators and methods should be applied that are maximally robust against these problems. In part three, on several occasions the choice of the indicator or analytical approach was determined by the wish to minimise the effect of potential data problems. Five example are:

1. The Relative Index of Inequality was given a prominent role in the analysis of educational differences in mortality and morbidity, because this measure yields values that are comparable between countries and over time, despite differences in educational systems. See chapters 11 and 16 for details.
2. The analysis of educational differences in cause-specific mortality was restricted to the age group 30-59 years because for older age groups the educational classification was highly skewed for many countries. See chapter 12.
3. In the analysis of mortality differences by occupational class, no distinction was made between skilled and unskilled manual workers because it was judged that this distinction could not be made in a comparable way for different countries or for different periods. See chapters 13 to 15.
4. The health indicators 'fair/poor general health' was given priority instead of the indicator 'poor general health' because the latter suffered more from the large chance fluctuations that affect the health interview and similar surveys with less than about 10,000 respondents. See chapters 16 and 18.
5. Educational differences in long-standing health problems were measured only in relative terms (rate ratios), because changes in survey questions made it impossible for some countries to study trends in absolute rates and absolute differences. See chapter 17.

These examples show that data problems can be taken into account in when selecting and applying the health indicators, the socio-economic indicators and the analytical methods. Usually, coping with data problems implies throwing away some information or leaving out approaches that are interesting in theory, but not feasible in practice.

Guideline 3:
The effect of data problems that cannot be avoided should be evaluated where possible. These problems should be evaluated for the effect they may have on the results that were obtained. If possible, these effects are quantified by means of sensitivity analyses.

Unfortunately, many data problems cannot be resolved or avoided. If these data problems are suspected to have serious effects, it may be informative to apply sensitivity analyses with the aim to estimate the magnitude of the bias. The quantitative evaluations that are carried in part three are listed in the last column of table 8.2. These evaluations illustrate a few points.

First, data problems should be evaluated in relation to the results that are obtained. A 10 percent bias may be small if the aim of a study is to determine whether or not inequalities in mortality or morbidity have increased, but this bias is important when the aim is to assess *how much* inequalities have increased. A concrete example gives chapter 14 on mortality by causes of death. Even though several data problems may bias estimates of mortality differences by occupational class, it is difficult to attribute to these problems the specific finding in chapter 14 that inequalities in mortality for some causes of death are much larger than for other causes of death.

Second, the experience from part three tells that often it cannot be predicted *a priori* which data problems have substantial effects and which data problems are less serious. Relatively small effects were observed for, among others, changes in the formulae used to calculate household equivalent income (table 18.7). Also, a series of simulations that are reported in table 16.10 suggests that the effects of non-response to interview surveys are less serious than might be suspected. These evaluations stress the importance to evaluate the potential effect of data problems where possible. Data sources should not be disregarded too easily because of suspected data problems. Otherwise, one runs the risk to throw away the baby with the bath water.

8.3. Guidelines on moving towards explanation

When the evaluation of data problems indicates that the observed changes in health inequalities cannot be attributed to data problems, the next step is to assess what else can explain the observed trends. If artefacts do not explain these trends, substantial explanations should be sought for. The purpose of this section is to indicate by which means insights can be obtained into the background of trends in socio-economic inequalities in mortality and morbidity.

We should stress that the illustrative analyses in part three do not aim to provide explanations for the trends that are observed. Given the lack of experience with explaining changes in inequalities in health (not only in part three, but also in the general literature), only a few general guidelines can be formulated in this phase. These guidelines are meant to stimulate and possibly direct future research in this field.

Guideline 1:
Health monitoring systems should seize the opportunities that they offer for explaining trends in socio-economic inequalities in mortality and morbidity.

Part three demonstrates that substantial inequalities in morbidity and mortality exist in all member states of the European Union, and that there is clear evidence for a widening of inequalities in mortality in many countries. These inequalities are a major challenge for public health policy, both at national levels and at the European level. In order to develop policy proposals, however, information is necessary about the specific factors that contribute to socio-economic inequalities in health. Potentially relevant factors include health behaviours, working conditions, and the utilisation of health care services.

Explaining socio-economic inequalities in health is a challenging but difficult task. Research on health inequalities is gradually moving from description to explanation, and the steps that are made are important but small. New insights into the background of health inequalities will have to be obtained by utilising all possible sources of information.

One of these sources are health monitoring systems. Even though explaining health inequalities is not a purpose of an European health monitoring system, this system may obtain empirical evidence on the causes of health inequalities. In particularly, the health monitoring system presents opportunities to explain *trends over time* in the magnitude of health inequalities. This opportunity should not be lost.

Guideline 2:
Within a health monitoring system, empirical evidence on the causes of changes in health inequalities should be obtained in different ways.

Table 8.3 gives a brief overview of the opportunities that health monitoring systems offer to contribute to explaining changes over time in socio-economic inequalities in mortality and morbidity. Three approaches are distinguished.

Table 8.3. Overview of ways to obtain indications on the background of trends in health inequalities

Key variable in analyses	Approach		
	In-depth descriptions of trends in health inequalities	Comparisons with trends in explanatory factors	Compare periods after multivariate analyses at the individual level
Socio-economic indicators	Describing trends by comparing socio-economic indicators	Comparison to socio-economic developments, e.g. trends in income inequalities	Including into these analyses two or more socio-economic variables
Health indicators	Describing trends by comparing health indicators, e.g. causes of death	Comparison to health trends, e.g. changes in epidemiological profiles	*not applicable*
Health determinants	*not applicable*	Comparison to trends in social gradients in health determinants	Including into these analyses one or more health determinants
Contextual determinants	*not applicable*	Comparison to contextual changes, e.g. health care reforms	*not applicable*

The first approach is to describe in more detail trends in socio-economic inequalities in mortality and morbidity, with the specific aim to generate clues for the explanation of these trends. Data from health interview surveys may be used especially to compare the patterns that are observed for income and education; any difference between these two indicators may be indicative of the role of material vs. cultural factors. A way to further exploit mortality registries is to distinguish causes of death. This approach, which is illustrated in chapter 14, may yield indications on the role of disease-specific risk factors such as smoking and excessive alcohol consumption.

The second approach is to compare the observed trends in health inequalities to trends in explanatory factors. Most promising is the analysis of health determinants that can be monitored by using data sources that are already available for most member states. For example, health interview and multi-purpose surveys can be used to monitor socio-economic inequalities in (a) health behaviours such as smoking, drinking and diet, (b) living and working conditions and (c) the utilisation of preventive and curative health services. This effort would not only result in a comprehensive overview of socio-economic inequalities in

several determinants, but will also help to explain why inequalities in mortality have increased over time in many EU member states.

The third approach logically follows the second one. This approach combines the comparative analyses that has been applied in this report with the multivariate individual-level analyses that are applied in most explanatory studies. In this new approach, a comparison is made between periods with respect to (a) the health inequalities as they are observed after controlling for age only and (b) the health inequalities as they are observed after also controlling for some health determinants. This new approach can provide a more thorough and more precise assessment of the contribution that specific health determinants make to changes in health inequalities.

The three approaches are complementary. Their combined application may help monitoring systems to inform policy makers about the factors determining trends in health inequalities and about possibilities to make these trends more favourable in the near future.

Chapter 9. Introduction to part three

9.1. Purposes of part three

The main purpose of part three is to explore the possibilities to monitor trends in socio-economic inequalities in health by using the data sources that are currently available in EU member states. Thus, while the guidelines of part two specify what may be the best actions to undertake, part three evaluates whether applying these guidelines to the data that are now available for EU member states will lead to an accurate and detailed overview of trends in health inequalities in the EU.

An additional purpose of part three is to illustrate how the guidelines that are given in part two work in practice. These illustrations will show how decisions to be made depend on, among other factors, the objectives of the analysis and the type of data that are available. The illustrations will also show how decisions on one measurement issue (e.g. which socio-economic indicator to use) influence other decisions to be made (e.g. how to summarise the observed health differences according to this socio-economic indicator). In a similar way, it will be shown that data problems will have to be evaluated in relation to the results that are obtained.

9.2. The evidence on trends in health inequalities from previous studies

Until now, studies on trends in health inequalities have been carried out for several European countries. These studies differed in various respects, including the health indicators that were chosen, the social classifications and data sources that were used, and the periods that were covered. Therefore, it is difficult to produce a consistent overview of trends in the European Union at large. The only consistent finding is that inequalities in mortality have widened during the 1970s and 1980s. However, uncertain is whether these inequalities have widened at about the same pace in all countries, and whether this widening occurred among different causes of death and age groups.

The unfavourable trends during the 1970s and 1980s also raise the question whether inequalities in health have further widened until the 1990s, and whether this occurred both for premature mortality and for morbidity. Prior to this study, no consistent overview could be construed on the basis of the few studies that dealt with trends in health inequalities until the 1990s.

As compared to previous studies, the overview of trends in socio-economic inequalities in health that will be presented in this part is more comprehensive, more consistent and more up to date. It is more comprehensive because it covers broad age groups, both genders, several health indicators and all core socio-economic indicators. It is more consistent because the guidelines given in part two are applied consistently to each analysis and each country. Finally, it is more up-to-date because for many countries this is the first time that inequality estimates for the 1990s are compared to those made for earlier periods.

9.3. Selection of illustrations

The analyses are restricted to the two types of data sources that, according to our evaluations made in chapter 4, offer the best prospects for monitoring trends in health inequalities throughout the European Union. These are the health interview and similar surveys and mortality registries. Detailed information on these two sources of information is given in chapter 10.

Illustrations are selected in such a way that a broad range of countries and indicators are covered. In each illustration, all EU member states are included for which nationally (or regionally) representative data were available. Each of the three core socio-economic indicators (education, income, occupation) is included in one or more chapters. Most illustrations are on both men and women, except for the illustrations on inequalities in mortality by occupational class, which are difficult to measure for women in a way that is both accurate and comparable across many countries. Most illustrations cover broad age groups or focus on middle-aged populations. No illustrations deal with children, because internationally comparable data on health inequalities among children were difficult to obtain.

The results presented here cannot be assumed to be representative for countries, age-sex groups or health indicators that are not covered. As the illustrations show, there is much variability: widening health inequalities are observed for some populations or health indicators, while a decrease is observed in other cases. However, the general picture that emerges from these illustrations is that inequalities in health are highly persistent over time, and in many cases they are increasing.

9.4. Overview of methodology

The illustrations follow the guidelines given in part two. This does not imply, however, that the same methods are used in each illustration. The guidelines given in part two allow for some flexibility. Different methods may be required depending on, among other factors, the specific purpose of the monitoring, the preferred socio-economic and health indicators, and the need to cope with specific data problems. The need to be flexible will be illustrated in this part by the application of sometimes different methods.

Part of the differences between the illustrations derive from the fact that some illustrations focus on "trends in inequalities", while a others focus on "inequalities in trends". As discussed in chapter 6, both perspectives are valid and informative, depending on the purpose of the monitoring. For that reason, both approaches are represented in part three. Most illustrations are on "trends in inequalities", but chapters 12 and 16 are on "inequalities in trends".

The illustrations offer the opportunity to illustrate in more detail the way in which one may cope with the data problems that are discussed briefly in chapter 8. We will exemplify that data problems may in part be coped by adapting the methodology, e.g. in the measurement of the socio-economic indicator and in the choice of the summary indices. In addition, we will illustrate that remaining data problems need to be judged in relation to the results that are obtained. If possible, sensitivity analyses are carried out in order to determine whether or not the results are robust to these data problems.

Chapter 10.
Overview of data from mortality registries and interview surveys

In this chapter, we present an inventory of data that are available from national mortality registries, and health interview surveys or similar surveys. This inventory formed the basis for our choice of the data to be used for the illustrative analyses. The results of this inventory are given in tables 10.1 to 10.5. The main findings are summarised below.

10.1 Mortality (tables 10.1 and 10.2)

In 12 countries, nationally representative data on mortality by socio-economic variables are available for both the early 1980s and early 1990s. Longitudinal studies provide nationally representative data for 6 countries, linked cross-sectional studies for 2 countries, and unlinked cross-sectional studies for 4 countries. Unfortunately, by 1999, data for the 1990s were not yet available for Austria and Switzerland.

Mortality among the elderly or among the children can now be related to socio-economic variables in 8 countries.

In all countries, mortality among middle-aged men can be related to occupational class. In many of these countries, occupational information is lacking for part of economically inactive men. This lack of information is even greater for women. In 7 countries, mortality among middle-aged men and women can be related to educational level in both the 1980s and 1990s.

Causes of death can be distinguished in each data set, except the French longitudinal data set.

10.2. Morbidity (tables 10.3 to 10.5)

In 13 countries, a series of national health surveys have been carried out at least two times since the 1980s. Except for 2 countries, these surveys together cover a period of at least 7 years. Most of these surveys include at least about 10,000 respondents per period.

The surveys of about 7 countries include questions on the health status of children.

All surveys include questions on the education of adult respondents. All surveys include questions on the current occupation of adult respondents, but not always on the last occupation of inactive men and women. In about one half of all countries, questions on income are sufficiently detailed to construct measures of household equivalent income for both the 1980s and the 1990s.

In 12 countries, perceived general health in measured in a comparable way for both survey periods. In 8 countries, the prevalence of specific chronic conditions is measured in a comparable way for both periods. In 6 (northern) countries, the open question on any long-standing health problem is asked for both periods. In about 5 countries, the prevalence of specific long-term disabilities is measured in a comparable way for both periods.

10.3 Final remarks

Not all data sources that were identified in this inventory are used in the illustrative analyses that are reported in the next chapters. In some cases, the participants had no access to these data sources or they could more easily supply data from another survey or study.

The available data offer much more possibilities for analyses than the analyses reported in the next chapters. For example, trends in health inequalities may be assessed for (1) other age groups, such as children or elderly, for whom data appear to be available for several countries; (2) other health indicators, such as specific causes of death like liver cirrhosis, or health expectancy measures; and (3) trends over a longer period of time, since for some countries data are available to study inequalities in mortality and morbidity since the 1970s.

These opportunities for analyses have not been seized in the present report because (a) the analysis of all these data would require much more time than was available and (b) the analysis reported below are sufficiently varied to provide illustrations of the guidelines that were given in part two.

Table 10.1 Mortality data: general characteristics

Country	Study design	Distinction of causes of death		Periods for which data are available		Ages for which data are available		SE indicators available for children		SE indicators available for the elderly (70+)	
		study 1	study 2	study 1	study 2	period 1	period 2	period 1	period 2	period 1	period 2
Finland	Longit	yes	yes	81-85	91-95	all	all	educ, occ parents	educ, occ parents	educ, occ earlier census	educ, occ earlier census
Sweden	Longit	yes	yes	80-86	90-95	0-64	all	occ parents	occ parents	occ earlier census	occ earlier census
Norway	Longit	yes	yes	81-85	91-95	all	all	educationp arents	education parents	educ, occ earlier census	educ, occ earlier census
Denmark	Longit	yes	yes	81-85	91-95	all	all	education parents	education parents	occupation earlier census	occupation earlier census
England/W	Longit	yes	yes	81-85	90-95	all	all	occup parents	occup parents	occupation earlier census	occupation earlier census
France	Longit	(yes) [1]	(yes) [1]	82-89	90-95	all	all	educ, occ parents	educ, occ parents	educ, occ earlier census	educ, occ earlier census
Italy (Turin)	Longit	yes	yes	81-85	91-95	all	all	education parents	education parents	educ, occ earlier census	educ, occ earlier census
Italy	Longit [6]	yes	yes	81	91	18-74	all	no	education parents	education	education
Austria [7]	Longit [6]	yes	yes	81	91	all	all	no	no	education	education
Ireland	Cr-sec	(yes)[2]	(yes)[2]	80-82	90-92	±25-60	25-60	no	no	no	no
Switzerland [7]	Cr-sec	yes	yes	79-82	91-94	±25-65	±25-65	no	no	occupation	occup, educ
Spain [3]	Cr-sec	yes	yes	80-82	88-90	±40-60	25-60	no	no	no	no
Portugal	Cr-sec	yes	yes	80-82	90-92	±25-60	25-60	no	no	no	no

For footnotes see table 10.2

Table 10.2 Mortality data: socio-economic indicators for adults

Country	Study design	Number of occupational categories in basic data		Information on former occupation of (part of) inactive men		Idem... inactive women		Information on education		Lowest educational group (% of all men 60 y.)	
		study 1	study 2	study 1	study 2	period 1	period 2	period 1	period 2	period 1	period 2
Finland	Longit	>100	>100	yes	yes	yes	yes	yes	yes	primary (80)	primary (65)
Sweden	Longit	>100	>100	no	yes	no	yes	no	yes	--	?
Norway	Longit	>100	(>100) [4]	yes	(yes) [4]	yes	(yes) [4]	yes	yes	<9 yrs (60)	<9 yrs (40)
Denmark	Longit	> 100	> 100	yes	yes	yes	yes	yes	yes	primary (80)	primary
England/W	Longit	>100	>100	yes [5]	yes [5]	yes [5]	yes [5]	yes	yes	A level	Vocational
France	Longit	>100	>100	yes	yes	yes	yes	yes	yes	no diplo (40)	no diplome
Italy (Turin)	Longit	>100	>100	no	(yes) [5]	no	(yes) [5]	yes	yes	illiterate (12)	illiterate (7)
Italy	Longit [6]	<20	>100	no	(yes) [5]	no	(yes) [5]	yes	yes	illiterate (12)	illiterate (7)
Austria [7]	Longit [6]	> 100	> 100	part	part	no	no	yes	yes	elementary	elementary
Ireland	Cr-sec	<20	<20	part	part	part	part	no	no	--	--
Switzerland [7]	Cr-sec	>100	> 100	no	?	no	?	no	yes	--	elementary
Spain [3]	Cr-sec	<20	<20	part	part	no	--	no	no [8]	--	--
Portugal	Cr-sec	<20	<20	part	part	no	no	no	no	--	--

1 Causes of death in France can only be distinguished by combining longitudinal data with data from the unlinked cross-sectional study.
2 Irish cause-of-death data are only available for a broader classification than the ICD 3-digit level.
3 Trend studies cannot be made for Spain as a whole, but only for 8 provinces out of 50. These 8 provinces are nationally representative.
4 For Norway, information on occupation is only available from a unrepresentative 25% sample, or from linkage to the earlier censuses.
5 Information on occupation is available from linkage to earlier censuses.
6 The studies for Italy and Austria cover all deaths that occurred during the 6 months after a population census of 1981, and 12 months after the 1991 census.
7 Data from the second Austrian and Swiss studies are not available before the year 2000.
8 Longitudinal ata on mortality by educational level are available for the cities of Madrid and Barcelona in the 1990s.

Table 10.3 Survey data: general characteristics

Country	Survey periods			Number (*1000) of respondents		Children included? (with at least a few health indicators)		Education available? (between parentheses if not fully comparable)		Occupation available? (between par. if not for most inactive men)	
	1	2	diffe-rence	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2
Finland	86	94	8	12	9	no	no	yes	yes	yes	yes
Sweden	≤ 88	97	≥ 9	21 [5]	21 [5]	y	yes	yes	yes	yes	yes
Norway	85	95	10	11	10	yes	yes	yes	yes	(yes)	yes
Denmark	87	94	7	5	5	n	(yes)	yes	(yes)	yes	(yes)
Great Britain	≤ 89	96	≥ 7	25	22	yes	yes	yes	(yes)	yes	yes
Netherlands	≤ 89	97	≥ 8	30 [5]	30 [5]	yes	yes	yes	yes	yes	yes
W Germany	85	90½	5 ½	5	5	n	n	yes	yes	yes	yes
France	≤ 89	94	≥ 5	30	30	yes	yes	yes	yes	yes	yes
Switzerland	92½	97	4 ½	16	13	n	n	yes	yes	yes	yes
Austria	83	91	8	63	56	yes	yes	yes	yes	(yes)	(yes)
Italy	86½	94	7 ½	132	60	yes	yes	yes	yes	yes	yes
Spain [4]	87	95	8	30	6 [4]	yes	yes	yes	(yes)	yes	yes
Ireland [3]	87	94	7	8	9	no	no	yes	yes	yes	yes

For footnotes see table 10.5

Table 10.4 Survey data: income measures

Country	Family income? (between par. if not fully comparable)		>10 classes distinguished in the basis data?		Nett income? (between par. if the measure is between nett and gross)		% income unknown	
	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2
Finland	yes	yes	yes	yes	yes	yes	0	0
Sweden	yes	yes	yes	yes	yes	yes	0	0
Norway	yes	yes	no	yes	no	yes	0	0
Denmark	yes	yes	yes	yes	no	no	12	12
Great Britain	yes	yes	yes	yes	yes	yes	8	8
Netherlands	yes	(yes)	yes	yes	yes	yes	20	20
Germany	yes	yes	yes	yes	yes	yes	8	8
France	yes	yes	yes	yes	(yes)	(yes)	10	10
Switzerland	yes	(yes)	no	yes	no	no	13	±15
Austria	no	no	-	-	-	-	-	-
Italy	no	yes	-	yes	-	yes	-	?
Spain [4]	yes	no	no	-	yes	-	40	-
Ireland [3]	yes	yes	yes	yes	yes	yes	low	low

For footnotes see table 10.5

Table 10.5 Survey data: health indicators

Country	Perceived general health		Any long-standing health problem		List of long-term disabilities		List of chronic conditions	
	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2	survey 1	survey 2
Finland	yes	yes	yes	yes	yes	yes	no	no
Sweden	yes	yes	yes	yes	yes	yes	no [1]	no [1]
Norway	yes	yes	no	no	yes	(yes)	yes	(yes)
Denmark	yes	(yes)	yes	yes	yes	no [2]	yes	yes
Great Britain	yes	yes	yes	yes	no	no [2]	no	no
Netherlands	yes	yes	yes	yes	yes	no [2]	yes	yes
Germany	yes	yes	no	no	yes	no	yes	yes
France	yes	yes	no	no	yes	yes	yes	yes
Switzerland	yes	yes	yes	yes	yes	yes	yes	yes
Austria	yes	yes	no	no	no	no	yes	yes
Italy	yes	yes	no	yes	yes	yes	yes	yes
Spain [4]	yes	yes	yes	(yes)	no	no [2]	yes	(yes)
Ireland [3]	no	yes	yes	(yes)	no	no	yes	no

Note: (..) problems with the comparability to the questions used in survey 1

Notes

1 Data on the prevalence of chronic conditions are available from another Swedish survey, held in both 1981 and 1991.
2 Asked only to the elderly (about 65 years and over).
3 The Irish survey is set apart because of none of the 4 health indicators is measured in both surveys in a comparable way.
4 In addition to the Spanish survey for 1995, comparable surveys are available for 1993 and 1997.
5 For the continuous surveys of the Netherlands and Sweden, the table gives the number of respondents per 3-year period.

Chapter 11.
Changes in mortality differences according to educational level

11.1 Background and purposes

An association between educational level and mortality has been observed consistently in a large number of studies. However, there is evidence of strong variability in the magnitude of educational differences in mortality. For example, these differences are generally larger among men than among women, and they are larger in some European countries (e.g. France) than in others (e.g. Denmark). Given this variability, it is important to monitor changes over time in educational differences in mortality. Previous studies have shown that in various European countries these mortality differences have widened during the 1970s and the 1980s. Until now, changes until the 1990s have been documented for a few countries only. For example, studies from Finland and England & Wales observed a widening of mortality differences according to occupational class.

The purpose of this chapter is to determine for four countries whether educational differences in all-cause mortality have continued to increase until the 1990s, or whether the past increase has now been stopped and perhaps even been followed by a decline. Data on recent trends in educational differences in mortality are analysed for Finland, Norway, Denmark, and Turin.

11.2 Materials and methods

Materials

For each country, number of deaths by 5-year age group, sex and educational level were obtained for three periods: about 1980-85, 1985-89 and 1990-94. These data were obtained from a longitudinal mortality follow-up of populations censuses that were carried out in about 1980 and about 1990 respectively. Persons enumerated in the 1990 census were followed for 5 years, and persons enumerated in the 1980 census were followed for 10 years. The Nordic studies cover the entire national population. The Italian study is restricted to the city of Turin and its surroundings. Table 11.1 gives the total number of person-years at risk and deaths observed in each study.

Most analyses concern men and women in the age group 30 to 74 years. The age was measured as age at the start of each sub period. In the Italian data, however, the lower age bound was 35 instead of 30 years. In Denmark, the persons aged 60 years and over had to excluded because the educational level was not known for most men and women 60 years and over in 1980.

In each study, men and women were classified according to their completed educational level into three levels: up to lower secondary, upper secondary, and post-secondary education. Details on these educational levels are given in table 11.2, while table 11.3 shows the distribution of the population according to these levels. As may be expected, in every country the proportion of population in the highest educational level is higher among men than among women, and this proportion increases over time for both men and women. This proportion is largest in Norway and smallest in Turin. Cross-national variations in educational distributions not only reflect differences in overall educational levels, but are in part determined by cross-national differences in educational systems and classifications.

Table 11.1 Numbers of person-years at risk and deaths observed per study

Country	Period	Number of person-years at risk (*1000)		Number of deaths	
		Men	Women	Men	Women
Finland	1981-85	5584	6325	82086	52256
	1986-90	5904	6633	79845	50175
	1991-95	6438	6906	75597	44990
Norway	1980-85	4709	4927	64945	37270
	1985-90	4837	5038	63542	37471
	1990-95	5076	5228	56160	34027
Denmark *	1981-85	4043	4049	23021	14682
	1986-90	4248	4250	23155	15086
	1991-95	3492	4549	23145	15263
Turin †	1982-86	1322	1511	15958	10700
	1987-91	1089	1259	14128	8922
	1992-96	1206	1363	12727	7941

* Age group 30-59 years. † Age group 35-74 years.

Table 11.2 Overview of educational classifications

Country	Educational level	Description	Number of years of education
Finland	High	Third level	16
	Mid	Secondary education	11
	Low	Elementary or no education completed	8
Norway	High	Third level	16
	Mid	Secondary education	11
	Low	Elementary or no education completed	8
Denmark	High	Higher & medium education	16
	Mid	Compulsory (9 y.) to short gymnasium	12
	Low	Compulsory schooling (8 years)	8
Turin	High	Third level	16
	Mid	Secondary education	10
	Low	Elementary or no education completed	5

Table 11.3A Population distribution by educational level: men 30-74 years

Country	Educational level	Proportion (%) of the total population		
		1980-1984	1985-89	1990-94
Finland	High	9.8	11.6	11.9
	Mid	27.6	34.8	39.2
	Low	62.6	53.7	48.9
Norway	High	16.3	18.9	21.9
	Mid	42.2	45.6	48.8
	Low	41.5	35.5	29.3
Denmark *	High	14.0	15.5	16.2
	Mid	27.3	34.8	43.3
	Low	58.7	49.7	40.6
Turin †	High	7.9	8.2	10.2
	Mid	43.1	44.6	55.6
	Low	49.1	47.3	34.2

Table 11.3B Population distribution by educational level: women 30-74 years

Country	Educational level	Proportion (%) of the total population		
		1980-1984	1985-89	1990-94
Finland	High	7.8	9.3	11.1
	Mid	24.8	31.6	37.7
	Low	67.4	59.1	51.2
Norway	High	10.2	13.2	17.0
	Mid	39.8	43.4	47.3
	Low	50.0	43.4	35.7
Denmark *	High	7.1	9.2	14.5
	Mid	36.0	44.0	48.4
	Low	56.9	46.8	37.1
Turin	High	3.7	4.0	6.2
	Mid	35.8	37.3	48.8
	Low	60.5	58.8	45.0

* Age group 30-59 years. † Age group 35-74 years.

Methods

The mortality level per educational level was measured by means of directly standardised mortality rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation procedure, control was made for differences in age structure between educational levels, and in addition between men and women, between countries and between periods.

The time/place comparability of absolute mortality levels was affected, however, because of differences in length of mortality follow-up, different age ranges and possibly other factors. However, national mortality registrations with a complete coverage of every country's population could be used as an alternative source. National estimates of the age-specific mortality rates from WHO publications were used to adjust our own estimates of absolute mortality levels so that these levels were comparable between both educational levels, countries and periods.

The magnitude of mortality differences by educational level was measured by means of two complementary inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the age-standardised mortality rates that were observed for the highest (post-secondary) and the lowest (up to lower-secondary) educational level.
2. Rate ratios. These could be calculated simply as the ratio of the two mortality rates mentioned above. However, in order to be able to estimate this ratio together with 95 percent confidence intervals, we applied Poisson regression analysis. The regression model included a series of terms representing 5-year age groups, and a term that represented the contrast between the highest and lowest educational level. These regression-based estimates, which are presented in the next section, were found to be almost identical to the rate ratios calculated in a simple way.

As a check to the results that were obtained with the rate ratios, we also calculated two regression-based inequality indices.

1. The Relative Index of Inequality, in which the 'relative' socio-economic position of each educational group was measured on the basis its cumulative population share (see Mackenbach & Kunst 1995). This quantitative measure was related to mortality by means of Poisson regression, in which the regression model included a series of terms representing 5-year age groups.
2. A regression-based index based on an 'absolute' measure of the socio-economic position of each educational group: the number of years of schooling corresponding to each educational level (see Mackenbach & Kunst 1995). Table 11.2 gives the number of years of schooling that were assumed to correspond to each educational level. This index, which we will call the "effect index", was also estimated by means of Poisson regression analysis.

Finally, an index was calculated that explicitly takes into account the distribution of the population over educational levels. This index, the Population Attributable Risk (PAR), used the upper educational level as the reference group. The PAR was calculated on the basis of the age-standardised mortality rates according to standard formulae (see Mackenbach & Kunst 1995).

11.3 Results

Rates per group

Basic information on mortality rates per educational level is presented in table 11.4. For both sexes, each country and each period, mortality rates are higher in lower educational groups. Among men, mortality differences between educational levels are larger than mortality differences between countries. For example, high educated men in high-mortality countries (e.g. Finland) have a lower mortality than low educated men in low-mortality countries (e.g. Norway). Also note that, despite the secular mortality decline, in 1990-94 low educated men still had higher mortality levels than high educated men had 10 years before. The same patterns are observed for women.

Table 11.4A Directly standardised mortality rate according to educational level: men 30-74 years

Country	Educational level	Death rate (per 1000 person years)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	High	9.0	7.6	6.9	-2.1
	Mid	11.2	10.4	9.8	-1.4
	Low	14.4	13.8	12.5	-1.9
	Total	**13.0**	**11.9**	**10.8**	**-2.2**
Norway	High	7.5	7.2	6.1	-1.3
	Mid	9.1	9.3	8.2	-0.8
	Low	10.8	11.6	10.5	-0.3
	Total	**9.5**	**9.7**	**8.4**	**-1.1**
Denmark *	High	3.5	3.4	2.8	-0.7
	Mid	4.9	4.7	4.4	-0.5
	Low	5.1	5.4	5.3	-0.2
	Total	**4.8**	**4.8**	**4.8**	**-0.0**
Turin †	High	7.9	6.8	6.3	-1.6
	Mid	10.5	9.1	8.1	-2.3
	Low	11.6	10.4	10.0	-1.6
	Total	**10.8**	**9.5**	**8.6**	**-2.2**

* Age group 30-59 years. † Age group 35-74 years.

Summary indices

It is not evident from table 11.4 whether educational differences in mortality have decreased over time. To answer this question, periods should be compared on the basis of one or a few indices on the *magnitude* of mortality differences. In table 11.5 the absolute difference in mortality rates are presented for the three periods. The differences among men increased over time in each country except Turin. Among women, too, increasing mortality differences are observed in every country.

Table 11.4B Directly standardised mortality rate according to educational level: women 30-74 years

Country	Educational level	Death rate (per 1000 person years)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	High	4.0	3.8	3.4	-0.6
	Mid	4.5	4.5	4.1	-0.4
	Low	5.7	5.6	5.3	-0.4
	Total	**5.2**	**5.1**	**4.6**	**-0.6**
Norway	High	3.6	3.5	3.2	-0.4
	Mid	4.2	4.1	3.9	-0.3
	Low	5.2	5.3	5.1	-0.0
	Total	**4.6**	**4.5**	**4.2**	**-0.4**
Denmark *	High	2.4	2.2	2.2	-0.2
	Mid	2.8	2.8	2.6	-0.1
	Low	3.3	3.4	3.3	0.0
	Total	**3.0**	**3.0**	**2.8**	**-0.2**
Turin †	High	4.5	3.8	3.0	-1.4
	Mid	4.7	4.2	3.8	-0.9
	Low	5.4	4.6	4.4	-1.0
	Total	**5.1**	**4.4**	**4.0**	**-1.1**

* Age group 30-59 years. † Age group 35-74 years.

Trends in absolute mortality differences are determined by trends in (a) the national mortality level and (b) the relative differences between educational levels. The latter differences are measured by the rate ratios given in the second column of table 11.5 as well in figure 11.1. For example, the rate ratio of 1.70 for Finnish men in the first period implies a 70 percent higher mortality of lower educated men as compared to higher educated men. Relative inequalities increased in each country among both sexes. In about one half of all cases, the confidence intervals for 1990-94 do not overlap with those for 1980-84, implying that the increase in the rate ratios is statistically significant. The pace of this increase, as measured by the rate ratios, varied considerably between countries and sexes.

A disadvantage of the rate ratio measure is that it does not take into account the mortality level of the intermediate educational level. It is important to take this level into account as in some instances the intermediate group exhibits deviant trends. Among Finnish men, for example, mortality trends were least favourable for this middle group (Table 11.4A).

Regression-based indices are able to take into account all educational levels simultaneously. Table 11.6 present two of these indices: the RII and the " effect index" . The RII has a fairly complex interpretation. For example, the RII for Finnish men in the first period is 1.71. This can be interpreted to mean that the least educated man (i.e. the hypothetical man at the

Table 11.5A The magnitude of mortality differences by educational level: men 30-74 years

Country	Inequality index	Inequality index (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	Rate Difference	5.5	6.2	5.7	0.2
	Rate Ratio	1.70	1.88	1.99	0.29
		(1.65-1.76)	(1.82-1.94)	(1.92-2.05)	
Norway	Rate Difference	3.4	4.3	4.4	1.0
	Rate Ratio	1.49	1.64	1.72	0.23
		(1.44-1.53)	(1.59-1.69)	(1.67-1.77)	
Denmark *	Rate Difference	1.7	2.1	2.4	0.8
	Rate Ratio	1.50	1.64	1.87	0.37
		(1.43-1.57)	(1.56-1.71)	(1.79-1.96)	
Turin †	Rate Difference	3.7	3.5	3.7	0.0
	Rate Ratio	1.47	1.53	1.57	0.10
		(1.37-1.58)	(1.41-1.64)	(1.46-1.70)	

Table 11.5B The magnitude of mortality differences by educational level: women 30-74 years

Country	Inequality index	Inequality index (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	Rate Difference	1.6	1.8	1.9	0.2
	Rate Ratio	1.42	1.51	1.57	0.15
		(1.35-1.49)	(1.44-1.58)	(1.50-1.64)	
Norway	Rate Difference	1.6	1.8	1.9	0.4
	Rate Ratio	1.25	1.34	1.59	0.34
		(1.20-1.31)	(1.28-1.40)	(1.52-1.66)	
Denmark *	Rate Difference	0.9	1.2	1.1	0.2
	Rate Ratio	1.41	1.50	1.52	0.11
		(1.30-1.54)	(1.40-1.62)	(1.44-1.61)	
Turin †	Rate Difference	0.9	0.8	1.3	0.4
	Rate Ratio	1.15	1.20	1.40	0.25
		(1.00-1.33)	(1.04-1.39)	(1.22-1.60)	

* Age group 30-59 years. † Age group 35-74 years.

Figure 11.1. Rate Ratios per country and period. Men (above) and women (below). Source: table 11.5.

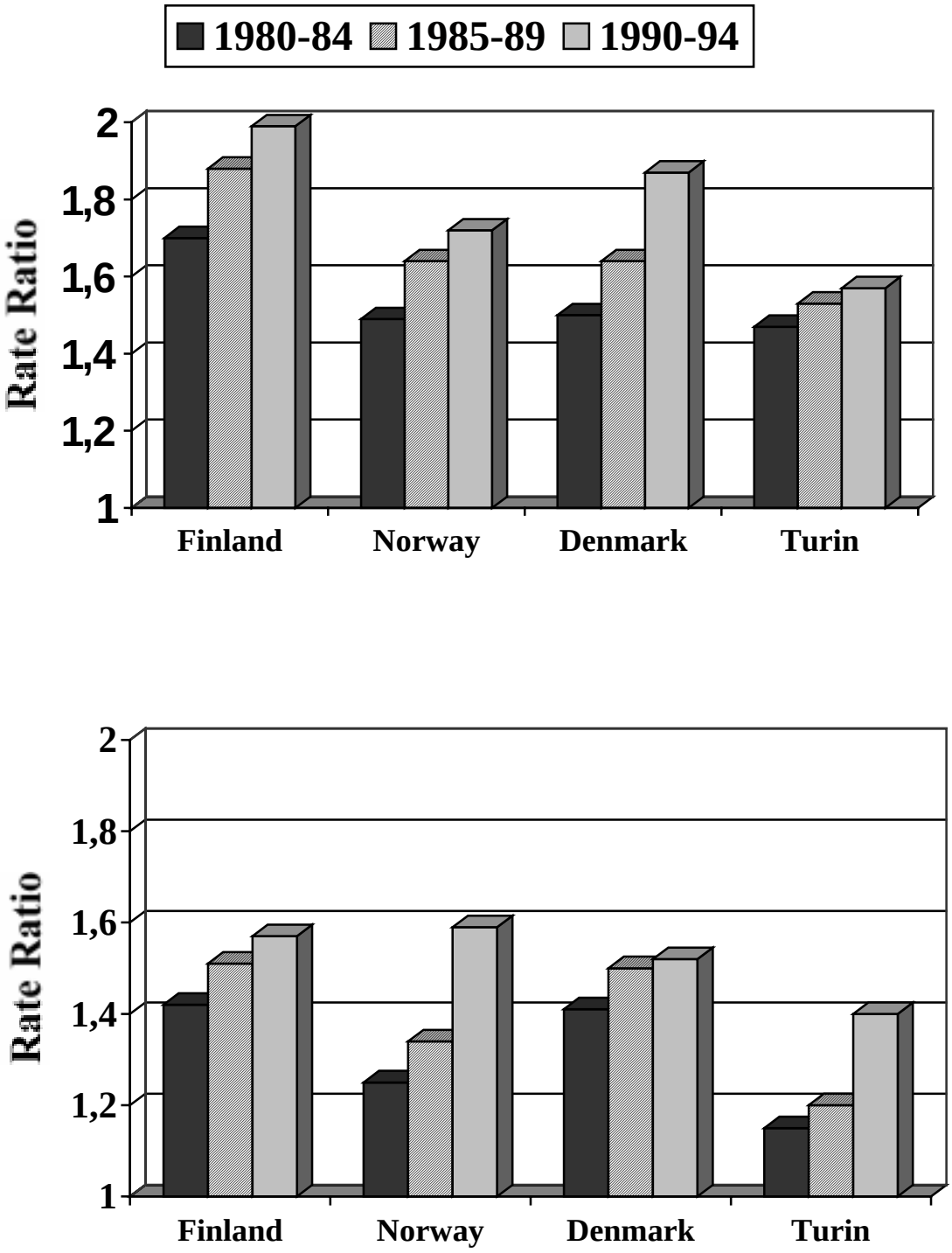


Table 11.6A Regression-based estimates of the magnitude of mortality differences by educational level: men 30-74 years

Country	Inequality index	Inequality index (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	RII	2.01 (1.94-2.08)	2.08 (2.01-2.15)	2.15 (2.08-2.23)	0.14
	Effect Index	5.9 (5.6-6.2)	6.5 (6.2-6.8)	7.0 (6.7-7.3)	1.1
Norway	RII	1.62 (1.57-1.67)	1.82 (1.76-1.88)	1.95 (1.89-2.02)	0.33
	Effect Index	4.8 (4.5-5.1)	5.9 (5.6-6.2)	6.4 (6.1-6.8)	1.6
Denmark *	RII	1.60 (1.51-1.69)	1.76 (1.67-1.86)	1.99 (1.89-2.10)	0.39
	Effect Index	4.3 (3.7-4.7)	5.1 (4.7-5.6)	6.5 (6.0-7.0)	2.2
Turin †	RII	1.41 (1.32-1.50)	1.48 (1.39-1.59)	1.63 (1.52-1.74)	0.22
	Effect Index	2.8 (2.3-3.3)	3.2 (2.7-3.7)	3.9 (3.3-4.4)	1.1

* Age group 30-59 years. † Age group 35-74 years.

bottom of the educational hierarchy) has a 71 percent higher mortality than the most educated man (at the top of the hierarchy). This 71 percent difference takes into account the association between mortality and education throughout the educational hierarchy. The " effect index" can be interpreted as the percent decrease in mortality for each additional year of education. For example, the 4.4 value for Finland implies that an increase in educational level with one year is associated with, on average, a 4.4 percent *de*crease in the mortality rate.

According to both regression-based indices, relative inequalities in mortality have increased in all countries and for both sexes. They thus confirm the patterns that were already observed with the simple rate ratios. Also, the pace of increase appears to vary according to country, with the largest increases in Denmark among men and in Norway among women.

Table 11.6B Regression-based estimates of the magnitude of mortality differences by educational level: women 30-74 years

Country	Inequality index	Inequality index (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	RII	1.71 (1.62-1.79)	1.70 (1.62-1.78)	1.84 (1.76-1.93)	0.13
	Effect Index	4.4 (4.0-4.8)	4.7 (4.2-5.1)	5.3 (4.9-5.7)	0.9
Norway	RII	1.52 (1.46-1.59)	1.64 (1.57-1.71)	1.87 (1.78-1.95)	0.35
	Effect Index	3.8 (3.3-4.3)	4.5 (4.1-5.0)	6.2 (5.7-6.7)	2.4
Denmark *	RII	1.50 (1.40-1.61)	1.65 (1.54-1.77)	1.69 (1.58-1.80)	0.19
	Effect Index	4.1 (3.4-4.9)	5.0 (4.3-5.7)	4.9 (4.3-5.5)	0.8
Turin †	RII	1.31 (1.20-1.43)	1.22 (1.11-1.33)	1.35 (1.23-1.48)	0.04
	Effect Index	2.2 (1.5-3.0)	1.7 (0.9-2.5)	2.6 (1.8-3.4)	0.4

* Age group 30-59 years. † Age group 35-74 years.

Population Attributable Risk

The summary indices discussed above do not take into account changes in population distributions. Throughout the study period, however, there was a shift in the population distribution from lower to higher educational levels. This trend can be considered to be favourable, as it implies that ever less people were exposed to the higher mortality risk associated with lower education. A summary measure that takes this development into account is the Population Attributable Risk (PAR), that presented in table 11.7.

The PAR for Finnish men in the first period is 0.31. This figure can be interpreted as to imply that overall mortality rates of Finnish men would be reduced by 31 percent in the hypothetical case that everyone experiences the rates of the highest socio-economic group. The PAR increased only slightly, not only in Finland, but also in most other countries. This small increase is the result of two contrasting trends (a) increasing relative inequalities in mortality (as observed in tables 11.5 and 11.6) and (b) decreasing proportion of the population in the lower two educational levels (as observed in table 11.3). Thus, the net result is that the total impact of educational inequalities on overall mortality (as expressed by the PAR) increased to only a small extent.

Table 11.7 Mortality differences by educational level according to the Population Attributable Risk: men and women 30-74 years

Sex	The PAR			
Country	1980-1984	1985-89	1990-94	Change ('80 to '90)
Men				
Finland	0.31	0.36	0.36	0.05
Norway	0.22	0.26	0.27	0.05
Denmark *	0.27	0.31	0.37	0.10
Turin †	0.27	0.28	0.27	0.00
Women				
Finland	0.23	0.26	0.27	0.04
Norway	0.22	0.23	0.24	0.02
Denmark *	0.22	0.27	0.23	0.01
Turin †	0.13	0.14	0.24	0.11

* Age group 30-59 years. † Age group 35-74 years.

Among women, only in Turin did the PAR increase substantially. The main reason for this is that a strong increase occurred in the mortality difference between the highest and intermediate educational level. The difference between the rates of these two groups increased from 0.2 in the first period to 0.8 in the last period (see table 11.4B). This case exemplifies that the PAR takes into account the mortality difference between the highest group on the one hand, and all other groups on the other hand.

Age-specific patterns

The results presented until now collapses the mortality experiences of widely different age groups, and might perhaps conceal widely divergent trends for specific age groups. For that reason, a distinction by age group is made in table 11.8. Relative inequalities in mortality are expressed by means of the RII, which has the advantage to take into account differences between age groups in educational distributions (i.e. that younger generations have higher educational levels).

Among men in 1980-84, the RII reveals the well-known pattern of larger relative inequalities at younger age groups. In Turin, for example, the RII of 1.92 for men 30-44 years implies a 92 percent mortality difference between the top and bottom of the educational hierarchy, as compared to a 35 percent difference among men 60-74 years. Between 1980-84 and 1990-94, the mortality difference in Turin's younger men increased substantially (the RII of 3.02 implies a 202 percent difference), while the increase was modest in the older age group. The other countries show the same pattern of large increases among younger men and small increases among older men.

Table 11.8A The magnitude of educational differences in mortality in specific age groups: men

Country	Age-group	RII (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	30-44	2.87 (2.63-3.14)	2.93 (2.71-3.17)	3.36 (3.11-3.64)	0.49
	45-59	2.16 (2.02-2.30)	2.34 (2.21-2.49)	2.22 (2.09-2.36)	0.06
	60-74	1.72 (1.63-1.80)	1.70 (1.62-1.78)	1.80 (1.72-1.88)	0.08
Norway	30-44	3.16 (2.79-3.59)	3.70 (3.29-4.16)	3.85 (3.42-4.35)	0.69
	45-59	1.87 (1.76-1.99)	2.17 (2.03-2.32)	2.48 (2.31-2.67)	0.61
	60-74	1.43 (1.38-1.49)	1.60 (1.54-1.66)	1.70 (1.63-1.77)	0.27
Denmark	30-44	1.98 (1.77-2.20)	1.66 (1.56-1.77)	2.86 (2.58-3.16)	0.88
	45-59	1.47 (1.37-1.57)	1.98 (1.79-2.19)	1.75 (1.65-1.86)	0.28
Turin	30-44	1.92 (1.50-2.46)	2.15 (1.53-2.51)	3.02 (2.28-4.02)	1.10
	45-59	1.44 (1.28-1.61)	1.79 (1.53-2.09)	2.03 (1.77-2.34)	0.59
	60-74	1.35 (1.24-1.46)	1.40 (1.28-1.53)	1.43 (1.32-1.56)	0.08

The results for women are less clear. In 1980-84, relative mortality differences were not consistently larger in younger age groups than in older age groups. The 'male' pattern existed in Finland only. By 1990-94, however, this pattern was emerging in most other countries too. Remarkably, relative differences in mortality among older women even decreased in Finland and in Turin.

Table 11.8B The magnitude of educational differences in mortality in specific age groups: women

Country	Age-group	RII (plus 95% confidence interval)			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	30-44	2.13 (1.84-2.48)	2.44 (2.14-2.79)	3.29 (2.89-3.75)	1.16
	45-59	1.63 (1.47-1.80)	1.71 (1.56-1.88)	1.92 (1.75-2.10)	0.29
	60-74	1.67 (1.57-1.78)	1.58 (1.49-1.68)	1.61 (1.52-1.70)	-0.06
Norway	30-44	1.46 (1.23-1.73)	2.13 (1.81-2.50)	2.45 (2.08-2.90)	0.99
	45-59	1.63 (1.49-1.79)	1.57 (1.43-1.73)	2.01 (1.81-2.22)	0.38
	60-74	1.49 (1.42-1.57)	1.62 (1.54-1.70)	1.78 (1.69-1.88)	0.29
Denmark	30-44	1.50 (1.31-1.71)	1.73 (1.52-1.96)	2.04 (1.79-2.34)	0.54
	45-59	1.49 (1.37-1.63)	1.63 (1.50-1.76)	1.61 (1.50-1.73)	0.12
Turin	30-44	1.05 (0.78-1.42)	1.14 (0.76-1.70)	1.62 (1.11-2.37)	0.57
	45-59	1.12 (0.95-1.32)	1.02 (0.80-1.32)	1.24 (1.03-1.50)	0.12
	60-74	1.45 (1.29-1.61)	1.31 (1.08-1.59)	1.36 (1.22-1.53)	-0.09

When making comparisons between age groups, one should not loose sight of the fact that death is a relatively rare event at younger ages. Therefore, in table 11.9 inequalities are also measured in terms of rate differences, which depend on (a) the relative size of inequalities as expressed by rate ratios and (b) the absolute overall levels of mortality. When expressed in these absolute terms, inequalities in mortality were clearly larger in older age groups. (In a similar way, absolute mortality differences were much larger among middle-aged men than among middle-aged women.) Thus, when expressed in the absolute number of deaths involved, inequalities are most important at ages 60 years and over.

Table 11.9 The absolute size of educational differences in mortality in specific age groups (1990-94 only)

Sex	Rate Difference		
Country	30-44	45-59	60-74
Men			
Finland	2.7	4.8	12.3
Norway	1.4	3.3	7.1
Denmark	1.8	3.2	-
Turin	1.6	3.4	8.1
Women			
Finland	0.9	1.3	4.6
Norway	0.5	1.6	5.1
Denmark	0.7	1.6	-
Turin	0.4	0.7	4.0

Life expectancy measures

Another way to express levels of mortality is by using life expectancy measures. Table 11.10 gives a measure that can be calculated on the basis of the data that we had on mortality between ages 30 to 74 years in three countries: the partial life expectancy. This measure can be interpreted as follows: the number of years that a person who reached the 30th birthday can expect to live until the 75th birthday. If mortality risks below 75 years would be zero, this person could expect to live 45 years between the 30th and 75th birthday. Due to mortality between ages 30 and 75 years, the true values are below 45 years.

For Finnish men in 1980-84, the partial life expectancy was 40.37 years for high educated men. Low educated men lived almost 3 years less. In addition, inequalities increased until 1990-94, when the partial life expectancy was increased by 1 year for high educated men and by only half a year for low educated men. A similar pattern of large and increasing inequalities is observed among men in Norway and Turin.

Table 11.10A The partial life expectancy according to educational level: men between 30th and 75th birthday

Country	Educational level	Partial life expectancy			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	High	40.37	41.08	41.39	1.02
	Mid	39.08	39.39	39.54	0.46
	Low	37.48	37.56	38.01	0.53
Norway	High	41.27	41.36	41.83	0.56
	Mid	40.28	40.15	40.67	0.39
	Low	39.22	38.83	39.32	0.10
Turin	High	40.80	36.59	41.71	0.91
	Mid	39.67	35.37	40.62	0.95
	Low	38.99	34.68	39.39	0.40

A slightly different pattern is observed among women. Among them, inequalities in partial life expectancy were much smaller than among men (just as was observed with the rate differences given in table 11.9). However, also among women inequalities increased over time. In Finland and Norway, this widening was in part due to an absolute decline in the life expectancy of low educated women.

Table 11.10B The partial life expectancy according to educational level: women between 30th and 75th birthday

Country	Educational level	Partial life expectancy			
		1980-1984	1985-89	1990-94	Change ('80 to '90)
Finland	High	42.79	42.92	43.08	0.29
	Mid	42.54	42.51	42.70	0.16
	Low	41.92	41.89	41.89	-0.03
Norway	High	42.97	43.02	43.16	0.19
	Mid	42.64	42.62	42.76	0.12
	Low	42.08	41.99	42.01	-0.07
Turin	High	42.31	37.78	43.19	0.88
	Mid	42.36	37.63	42.78	0.42
	Low	42.05	37.49	42.46	0.41

11.4 Summary of findings

1. There are substantial mortality differences in all countries, for both men and women, and in different age groups.
2. These inequalities increased between the early 1980s and early 1990s.
3. The pace of increase varied according to country, sex and age group.
4. The widening of the gap in mortality is larger when expressed in relative terms instead of absolute terms.
5. When expressed in terms of Population Attributable Risk, the importance of these inequalities for public health at large increased only moderately.

11.5 Evaluation of potential problems

A main data problem that is evident from table 11.3 is the skewed educational distribution, with more than one half of the population being combined into the category of those with none, elementary or lower secondary education. This category is especially large among women in 1980. The skewed distribution has as a consequence that no information is available on mortality differentials within the broad lowest category, and that estimates of mortality differentials are based on the differences that observed between the relatively few persons with high levels of education and the rest of the population. A main question is, therefore, whether other results would have been obtained when a distinction could be made within the lowest educational category. Unfortunately, this question could not be addressed with the mortality data that are available from these countries. An evaluation could however be made with the morbidity data. The results, which are given in section 16.5 (table 16.9), suggest that similar results would be obtained if distinctions would be made within the broad lower educational level. Despite this perhaps reassuring evidence, one should be cautious and recognise that the estimates given in the present chapter do not necessarily represent mortality differences across the entire educational hierarchy.

In most data sets, the educational level is known for virtually all persons. The only exception is the Danish data set, in which the educational level was not known for the generations that were 60 years or older at the time of the 1981 census. For that reason, all estimates from Denmark had to be confined to men and women younger that 60 years.

11.6 Conclusion for health monitoring

Data on mortality by educational level can be used to monitor inequalities in mortality among both men and women. Data for the 1980s have the disadvantages to be available for a limited number of EU member states and to suffer from skewed educational distribution.

Fortunately, these disadvantages will apply increasingly less in the 1990s and later decades, as data will become available for increasingly more countries and future elderly populations will have increasingly higher educational levels.

Chapter 12.
Educational differences in trends in cause-specific mortality

12.1 Background and purposes

Statistics from all EU member states showed large secular changes in mortality from many specific causes of death, with increases for some causes and decreases for other causes of death. These changes have been found to vary strongly according to socio-demographic factors such as age group, sex and region. There is also evidence from several countries that these changes varied according to socio-economic factors. For example, the decrease in ischemic heart disease mortality that occurred since the 1960s or 1970s in most European countries, first started and was most pronounced among higher socio-economic groups.

Routine monitoring of socio-economic differences in mortality trends is important for several reasons. First, mortality trends might be least favourable among those groups who were already disadvantaged at the onset. Second, inequalities in mortality trends may help to identify the role of specific determinants and to evaluate differential effects of programmes and policies. For example, differences in the timing and pace of the decline of ischemic heart disease mortality has in part been attributed to the fact that higher social groups took most benefits from the first anti-smoking campaigns and other life style related preventive actions.

The purpose of this chapter is to describe educational differences in trends in cause-specific mortality between 1980-84 and 1990-94. Four countries are studied: Finland, Norway, Denmark and Turin. Other countries were excluded because of lack of nationally representative data on mortality by educational level in the early 1980s (even though data were available for the 1990s). The causes of death that will be studied are lung cancer, breast cancer, ischemic heart disease, cerebrovascular disease, respiratory disease, and external causes of death.

12.2 Material and methods

The reader is referred to chapter 11 for details on the data sources and the educational classifications that were used.

The analysis is restricted to men and women in the age group 30-59 years. Older age groups were excluded because (1) the educational distributions of elderly people are highly skewed towards the lowest group, and (2) the magnitude and changes in educational differences in mortality were much more pronounced among middle-aged persons than among those who were older than 60 years (see chapter 11).

The mortality level per educational level was measured by means of directly standardised mortality rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation method, control was made for differences in age structure between educational levels, between men and women, between countries as well as between periods.

The time/place comparability of absolute mortality levels was affected because of differences between studies in, among other factors, length of mortality follow-up and the exclusion of subpopulations such as foreigners. In chapter 11, we described that estimates for all-cause mortality were adjusted by using national estimates of all-cause mortality levels from WHO publications. The same adjustment procedure were applied in that chapter to all-cause mortality were also applied in this chapter to cause-specific mortality.

Trends in mortality per educational level are summarised by simply comparing the standardised death rate for 1990-94 to the rate for 1980-84. For each educational level separately, mortality change is measured in both absolute terms (as the absolute difference between 1980-84 and 1990-94) and in relative terms (as the percent decline between 1980-84 and 1990-94).

12.3 Results

Results for all-cause mortality are presented in table 12.1 and figure 12.1. In 1980-84, mortality rates were lower among higher educated men and women in each of the four countries. Educational groups also differed with respect to the subsequent trends in mortality. Among men, the largest declines were observed in higher educational groups. For example, in Finland the highest group experienced a 26 percent decline as compared to a 9 percent decline in the lower two groups. Other countries also showed inequalities in trends, when the latter are expressed in relative terms. Even when trends are expressed in absolute terms, they are more favourable among higher educated men than among lower educated men (see last column). In Denmark, mortality rates actually increased among low educated men.

Table 12.1A Differences by educational level in mortality from all causes: men 30-59 years

Country	Educational level	Death rate (per 1000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	3.7	2.9	2.7	-26	-1.0
	Mid	5.1	4.7	4.7	-9	-0.4
	Low	7.0	7.3	6.4	-9	-0.6
	Total	**6.1**	**5.7**	**5.1**	**-15**	**-0.9**
Norway	High	2.7	2.7	2.2	-18	-0.5
	Mid	3.8	3.8	3.4	-12	-0.5
	Low	5.0	5.4	4.8	-2	-0.1
	Total	**4.0**	**4.0**	**3.4**	**-15**	**-0.6**
Denmark	High	3.5	3.4	2.8	-19	-0.7
	Mid	4.6	4.7	4.4	-4	-0.2
	Low	5.1	5.4	5.3	2	0.1
	Total	**4.8**	**4.8**	**4.5**	**-6**	**-0.3**
Turin †	High	3.5	2.7	2.3	-33	-1.2
	Mid	4.4	4.0	3.3	-24	-1.1
	Low	5.2	4.6	4.8	-8	-0.4
	Total	**4.7**	**4.2**	**3.6**	**-23**	**-1.1**

† Age group 35-59 years.

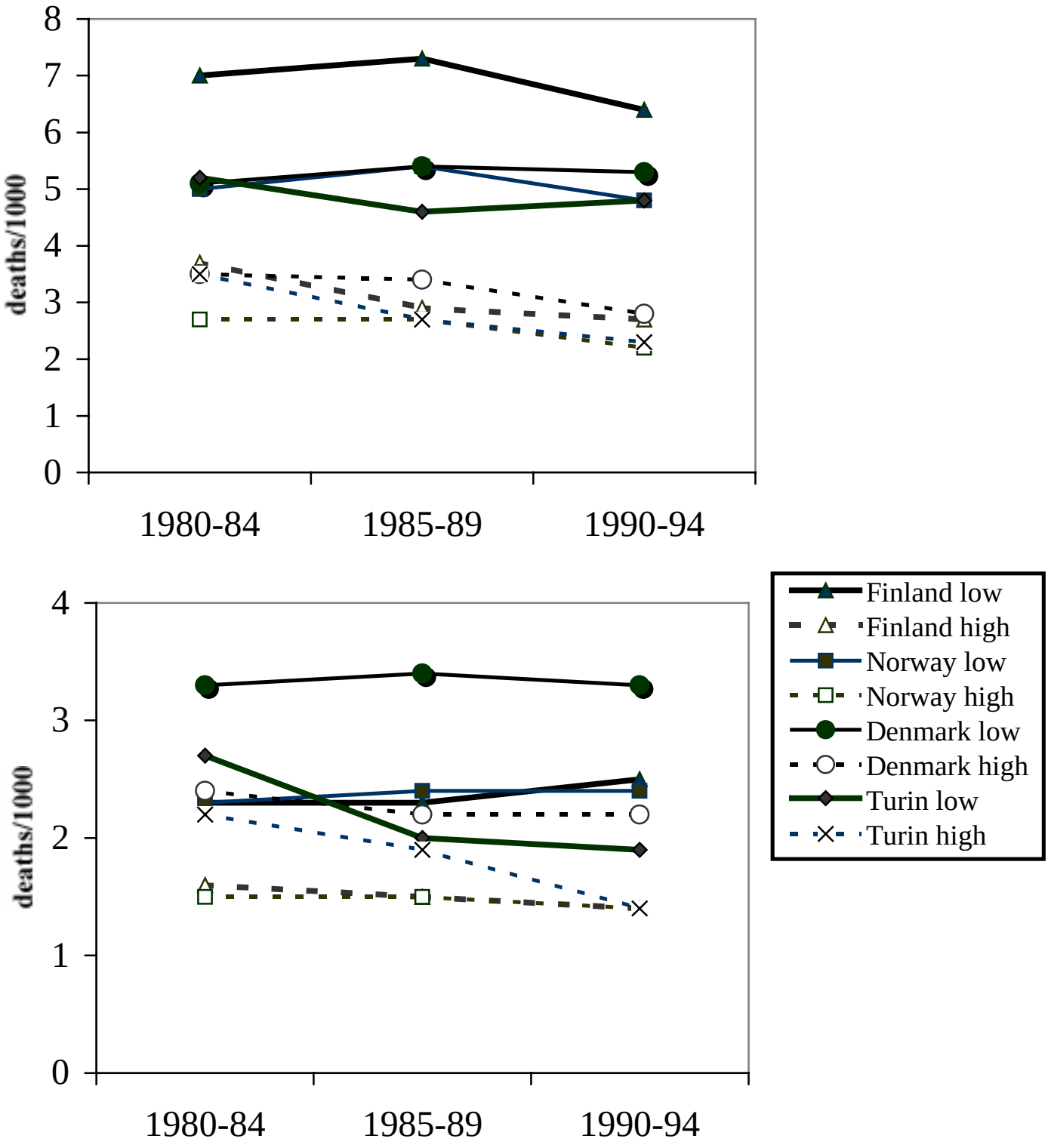
Among women, the largest declines in all-cause mortality are also observed among the highest educational group. In the three Nordic countries, women in the lower group even experienced an increase in mortality. None the less, mortality trends among women were not as unequal as among men. The main reason is that mortality declines were generally modest even among high educated women.

It should be noted that for several countries the absolute decline in mortality for the entire country is larger than the decline observed for any educational level. This finding may seem erroneous, but is due to the fact that the overall mortality rate is favourably influenced by the changing educational distribution, with an increasing part of the population belonging to groups with low mortality.

Table 12.1B Differences by educational level in mortality from all causes: women 30-59 years

Country	Educational level	Death rate (per 1000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	1.6	1.5	1.4	-11	-0.2
	Mid	1.8	1.8	1.7	-5	-0.1
	Low	2.3	2.3	2.5	8	0.2
	Total	**2.1**	**2.0**	**2.0**	**-5**	**-0.1**
Norway	High	1.5	1.5	1.4	-7	-0.1
	Mid	1.8	1.9	1.7	-4	-0.1
	Low	2.3	2.4	2.4	5	0.1
	Total	**1.9**	**2.0**	**1.8**	**-7**	**-0.1**
Denmark	High	2.4	2.2	2.2	-9	-0.2
	Mid	2.8	2.8	2.6	-5	-0.1
	Low	3.3	3.4	3.3	0	0.0
	Total	**3.0**	**3.0**	**2.8**	**-7**	**-0.2**
Turin	High	2.2	1.9	1.4	-38	-0.8
	Mid	2.0	1.9	1.7	-19	-0.4
	Low	2.7	2.0	1.9	-29	-0.8
	Total	**2.1**	**2.0**	**1.7**	**-18**	**-0.4**

Figure 12.1. Educational differences in trends in all-cause mortality. Men (above) and women (below) in 4 countries.



Results for lung cancer mortality are presented in table 12.2. Among men, national mortality rates declined strongly in most countries, but were stable in Norway. Underlying these national mortality trends are widely different trends for specific educational groups. In relative terms, mortality declines are largest among high educated men. In Norway, Denmark and Turin, these men also experienced the largest decline in absolute terms, even though in 1980-84 their mortality rates were already much lower than in other groups. Only in Finland did lower educated men enjoy a greater absolute mortality decline than higher educated men. Their favourable mortality trend strongly contrasts with the mortality increase among low educated men in Norway.

Table 12.2A Differences by educational level in mortality from lung cancer: men 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	18.9	11.0	9.6	-49	-9.3
	Mid	30.7	22.9	22.4	-27	-8.3
	Low	57.6	40.9	35.1	-39	-22.6
	Total	**45.2**	**30.3**	**26.1**	**-42**	**-19.1**
Norway	High	16.2	14.8	13.5	-16	-2.7
	Mid	23.6	22.2	22.8	-4	-0.9
	Low	31.1	37.2	38.1	23	7.0
	Total	**24.9**	**25.0**	**24.1**	**-3**	**-0.8**
Denmark	High	23.8	23.0	14.4	-39	-9.4
	Mid	37.9	36.1	34.2	-10	-3.8
	Low	50.1	48.8	43.5	-13	-6.6
	Total	**43.1**	**40.4**	**34.8**	**-19**	**-8.3**
Turin	High	45.3	22.7	30.8	-32	-14.6
	Mid	55.8	59.0	46.7	-16	-9.0
	Low	68.5	69.0	58.4	-15	-10.2
	Total	**60.7**	**60.5**	**48.3**	**-21**	**-12.5**

Trends in lung cancer mortality among women also differed according to educational level. In all countries, lung cancer mortality is increasing among women younger than 60 years. In Finland, the increase is largest among high educated women, at least in relative terms. An opposite pattern is observed for Norway, where increases are largest among low educated women. Denmark shows an intermediate position, with no differences in relative increases, but larger absolute increases among lower groups. In Turin, levels and trends in lung cancer mortality do not clearly differ according to educational level. Thus, each country shows a distinct pattern of (in)equalities in trends.

Table 12.2B Differences by educational level in mortality from lung cancer: women 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	2.9	3.1	4.3	48	1.4
	Mid	3.9	4.2	5.3	36	1.4
	Low	6.3	6.6	7.5	18	1.1
	Total	**5.3**	**5.3**	**6.1**	**15**	**0.8**
Norway	High	4.5	5.9	5.1	14	0.6
	Mid	7.9	11.1	11.6	47	3.7
	Low	10.6	15.1	19.5	84	8.9
	Total	**8.6**	**11.6**	**12.4**	**44**	**3.8**
Denmark	High	12.0	6.4	14.6	21	2.6
	Mid	17.2	20.6	21.9	27	4.7
	Low	28.7	31.9	35.9	25	7.1
	Total	**23.4**	**24.6**	**26.0**	**11**	**2.6**
Turin	High	8.9	13.8	11.7	31	2.8
	Mid	9.1	10.6	8.0	-12	-1.1
	Low	7.4	7.7	9.0	22	1.6
	Total	**8.2**	**9.1**	**8.7**	**6**	**0.5**

The same variability, but in a somewhat different pattern, is observed for breast cancer mortality (table 12.3). The least favourable mortality trends were observed among low educated women in the case of Finland, but among high educated women in the case of Norway. No substantial differences were observed in Turin, at least in relative trends. While it is remarkable that social gradients in breast cancer mortality seemed to have reversed in Finland, no similar trend occurred in the other two countries.

Table 12.3 Differences by educational level in mortality from breast cancer: women 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	30.6	29.3	24.0	-22	-6.6
	Mid	23.3	25.4	23.2	0	-0.0
	Low	20.4	22.3	25.0	22	4.6
	Total	**22.2**	**24.3**	**24.1**	**8**	**1.9**
Norway	High	22.6	28.4	28.6	27	6.0
	Mid	22.7	28.7	23.9	5	1.2
	Low	22.4	22.4	23.9	6	1.4
	Total	**22.6**	**26.5**	**24.9**	**10**	**2.3**
Turin	High	36.8	30.2	32.0	-13	-4.8
	Mid	36.6	34.2	31.2	-15	-5.5
	Low	29.5	23.0	27.3	-8	-2.2
	Total	**32.6**	**27.7**	**29.8**	**-9**	**-2.9**

Mortality from ischaemic heart disease declined in all countries among both men and women (table 12.4 and figure 12.2). Among men, the relative decline was consistently larger among the higher educated groups. When expressed in absolute terms, the mortality decline was not consistently larger or smaller among high educated men. Among women, the largest relative decline was observed in Finland for higher educated women. In other countries, however, relative declines are not clearly related to educational level, and absolute declines are even larger among lower educated women.

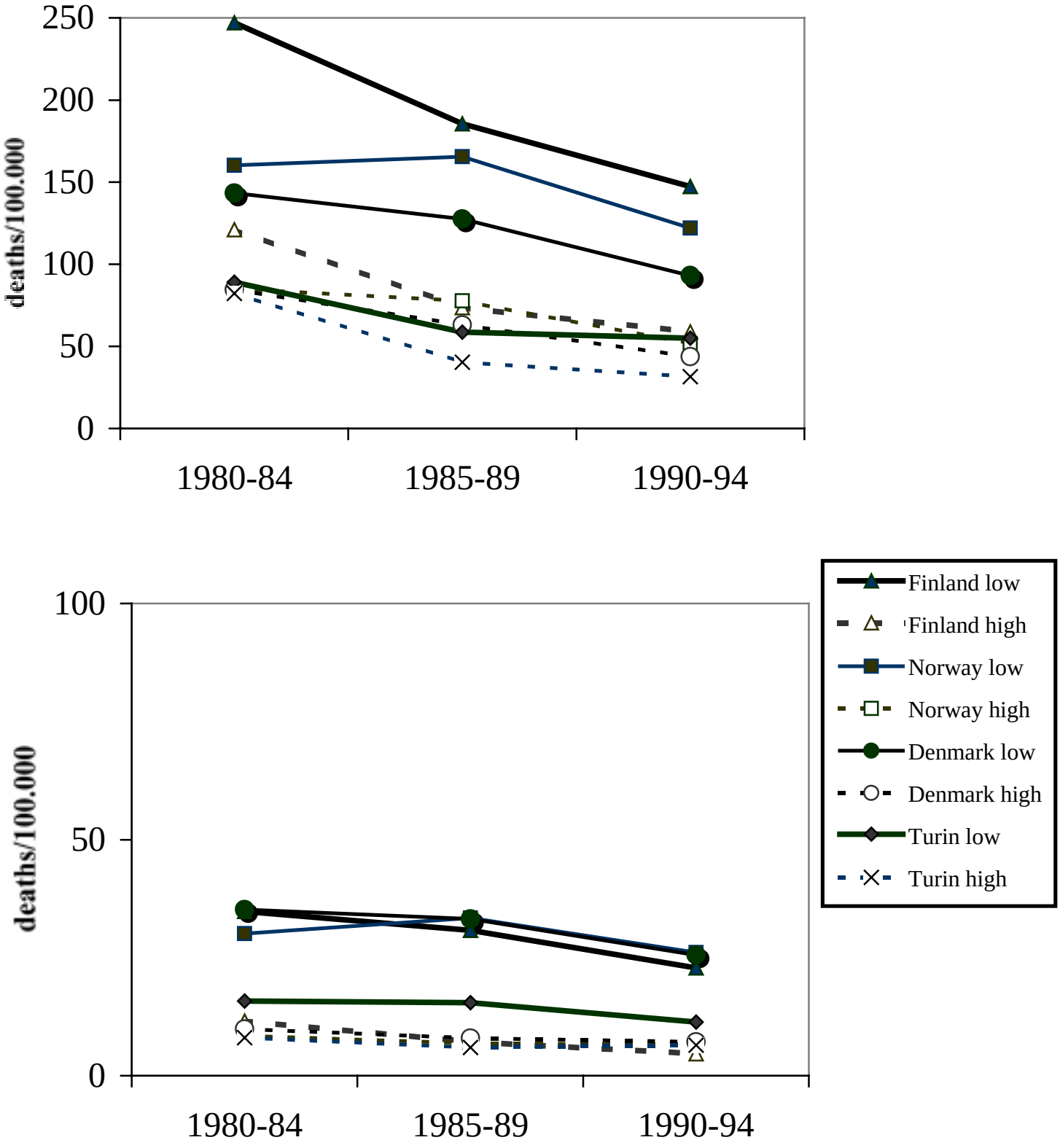
Table 12.4A Differences by educational level in mortality from ischemic heart disease: men 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	121.0	73.7	58.9	-51	-62.1
	Mid	192.8	131.3	108.3	-44	-84.4
	Low	247.0	185.6	147.3	-40	-99.7
	Total	**216.7**	**151.0**	**118.4**	**-45**	**-98.3**
Norway	High	85.2	77.8	51.8	-39	-33.4
	Mid	127.8	118.0	81.1	-37	-46.8
	Low	160.2	165.5	122.0	-24	-38.1
	Total	**131.3**	**123.2**	**83.5**	**-36**	**-47.8**
Denmark	High	84.6	63.2	43.8	-48	-40.7
	Mid	118.5	99.2	69.7	-41	-48.8
	Low	143.3	127.6	93.2	-35	-50.1
	Total	**128.3**	**107.8**	**75.1**	**-42**	**-53.3**
Turin	High	82.4	40.4	31.6	-62	-50.8
	Mid	81.1	56.5	42.7	-47	-38.4
	Low	89.1	58.7	55.1	-38	-34.0
	Total	**85.1**	**56.2**	**44.9**	**-47**	**-40.1**

Table 12.4B Differences by educational level in mortality from ischemic heart disease: women 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	11.6	7.2	4.7	-59	-6.9
	Mid	22.6	17.6	11.9	-48	-10.7
	Low	34.8	30.8	22.8	-34	-12.0
	Total	**29.0**	**23.2**	**15.5**	**-47**	**-13.5**
Norway	High	8.5	6.9	6.6	-22	-1.9
	Mid	15.7	18.4	15.0	-4	-0.7
	Low	30.1	33.4	26.1	-13	-3.9
	Total	**20.9**	**21.7**	**16.3**	**-22**	**-4.6**
Denmark	High	9.9	8.0	7.2	-28	-2.8
	Mid	19.3	16.8	13.9	-28	-5.4
	Low	35.2	33.2	25.6	-27	-9.6
	Total	**27.7**	**23.7**	**17.3**	**-38**	**-10.4**
Turin	High	8.1	6.0	6.5	-20	-1.6
	Mid	11.4	9.9	7.2	-36	-4.1
	Low	15.8	15.5	11.4	-28	-4.4
	Total	**13.7**	**12.9**	**8.7**	**-36**	**-5.0**

Figure 12.2. Educational differences in trends in mortality from ischaemic heart disease. Men (above) and women (below) in 4 countries.



Mortality from cerebrovascular disease mortality declined in all countries among both men and women (table 12.5). In many cases, the pace of mortality decline strongly varied according to educational level. In Norway, stroke mortality rates remained stable among lower educated men, whereas they halved among higher educated men. Precisely the opposite occurred in Turin. As a result, the social gradient in stroke mortality became steep among Norwegian men, but inconsistent among Italian men.

Table 12.5A Differences by educational level in mortality from cerebrovascular disease: men 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	24.7	16.5	16.1	-35	-8.7
	Mid	30.2	25.8	26.7	-12	-3.5
	Low	41.5	38.5	35.1	-15	-6.4
	Total	**36.2**	**31.0**	**28.8**	**-20**	**-7.3**
Norway	High	11.9	11.7	6.1	-48	-5.8
	Mid	16.2	15.7	13.3	-18	-2.9
	Low	20.8	20.8	20.6	-1	-0.3
	Total	**17.1**	**16.3**	**13.3**	**-22**	**-3.8**
Denmark	High	13.8	11.9	13.3	-4	-0.5
	Mid	16.0	19.5	17.8	11	1.7
	Low	21.6	21.5	18.9	-12	-2.6
	Total	**19.0**	**19.3**	**17.5**	**-8**	**-1.5**
Turin	High	18.0	16.5	17.2	-4	-0.8
	Mid	25.4	24.3	15.3	-40	-10.1
	Low	31.9	24.8	21.0	-34	-11.0
	Total	**27.8**	**23.9**	**17.1**	**-38**	**-10.7**

Table 12.5B Differences by educational level in mortality from cerebrovascular disease: women 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	12.5	9.6	8.6	-31	-3.9
	Mid	17.4	12.6	13.1	-25	-4.3
	Low	23.8	21.7	18.8	-21	-4.9
	Total	**20.8**	**16.9**	**14.9**	**-29**	**-6.0**
Norway	High	7.9	5.6	4.9	-38	-3.0
	Mid	8.4	9.5	8.4	0	-0.0
	Low	15.3	14.5	12.8	-17	-2.6
	Total	**11.3**	**10.6**	**8.8**	**-22**	**-2.4**
Denmark	High	12.8	9.1	9.2	-28	-3.6
	Mid	11.7	12.3	13.0	11	1.3
	Low	16.1	17.3	15.3	-5	-0.7
	Total	**14.3**	**14.4**	**13.3**	**-7**	**-1.0**
Turin	High	7.8	12.2	5.6	-28	-2.2
	Mid	10.1	11.6	9.6	-5	-0.5
	Low	17.0	15.5	10.4	-39	-6.6
	Total	**13.9**	**13.8**	**9.6**	**-31**	**-4.3**

Mortality from respiratory diseases is of interest because of the large inequalities that were observed for most European countries in the 1980s. Table 12.6 is added in order to determine whether mortality trends since the 1980s were more favourable in the lower groups, so that they are catching up with the higher groups. The evidence from table 12.6 is not consistent. In relative terms, the mortality decline was not larger among the lower educated than among the higher educated. In absolute terms, lower groups generally enjoyed larger declines.

Table 12.6A Differences by educational level in mortality from respiratory disease: men 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	6.7	5.5	5.9	-11	-0.7
	Mid	11.5	11.8	12.0	4	0.5
	Low	26.1	22.7	23.5	-10	-2.6
	Total	**19.5**	**16.4**	**16.1**	**-17**	**-3.4**
Norway	High	5.7	5.5	2.7	-53	-3.1
	Mid	12.0	8.2	10.4	-13	-1.6
	Low	17.8	15.6	14.2	-20	-3.6
	Total	**12.9**	**9.8**	**9.4**	**-27**	**-3.5**
Denmark	High	4.9	6.3	4.3	-12	-0.6
	Mid	13.1	11.5	10.6	-19	-2.5
	Low	20.9	21.4	17.7	-16	-3.2
	Total	**16.5**	**15.6**	**12.4**	**-25**	**-4.1**
Turin	High	4.5	11.7	3.2	-28	-1.3
	Mid	12.2	9.6	4.5	-63	-7.7
	Low	16.9	17.4	14.4	-15	-2.5
	Total	**13.7**	**13.3**	**7.2**	**-48**	**-6.5**

Table 12.6B Differences by educational level in mortality from respiratory disease: women 30-59 years

Country	Educational level	Death rate (per 100.00 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	2.8	2.2	2.3	-20	-0.6
	Mid	4.1	3.8	4.3	5	0.2
	Low	7.9	8.2	10.4	31	2.4
	Total	**6.3**	**5.9**	**6.6**	**4**	**0.2**
Norway	High	3.4	1.9	2.7	-22	-0.8
	Mid	4.9	4.9	5.2	6	0.3
	Low	**8.7**	**10.0**	**12.2**	40	3.5
	Total	**6.4**	**6.1**	**6.6**	**4**	**0.2**
Denmark	High	6.3	4.7	8.5	34	2.1
	Mid	9.7	10.5	9.7	0	0.0
	Low	16.8	21.0	20.4	22	3.7
	Total	**13.5**	**14.9**	**13.5**	**0**	**0.0**
Turin	High	1.4	3.4	0.0	-100	-1.4
	Mid	4.1	4.2	2.7	-34	-1.4
	Low	6.8	3.6	5.4	-21	-1.4
	Total	**5.5**	**3.8**	**3.5**	**-36**	**-2.0**

National levels of injury mortality remained more of less stable among men (table 12.7). However, substantial increases or decreases in mortality occurred at specific educational levels. In both Finland, Denmark and Turin, mortality trends were more favourable among high educated men than among men with low or middle education. Among women, however, the patterns were much less marked. Inequalities in injury mortality were small in 1980-84, and mortality trends in the following trends did not greatly vary according to educational level.

Table 12.7A Differences by educational level in mortality from external causes: men 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	67.2	65.7	62.7	-7	-4.6
	Mid	93.5	122.5	134.1	43	40.6
	Low	145.3	164.3	183.2	26	38.0
	Total	**120.9**	**136.2**	**145.6**	**20**	**24.7**
Norway	High	36.2	40.9	32.9	-9	-3.3
	Mid	57.0	60.0	50.9	-11	-6.1
	Low	83.3	88.5	76.8	-8	-6.5
	Total	**62.5**	**64.2**	**52.5**	**-16**	**-9.9**
Denmark	High	61.1	54.3	39.9	-35	-21.2
	Mid	70.0	72.1	67.1	-4	-2.9
	Low	76.2	83.5	82.4	8	6.2
	Total	**72.4**	**75.0**	**68.9**	**-5**	**-3.5**
Turin	High	36.6	13.0	26.1	-29	-10.5
	Mid	31.3	23.0	31.7	1	0.4
	Low	42.0	26.1	41.4	-1	-0.6
	Total	**34.6**	**23.6**	**33.8**	**-2**	**-0.8**

Table 12.7B Differences by educational level in mortality from external causes: women 30-59 years

Country	Educational level	Death rate (per 100.000 person years)			Trend in death rate	
		1980-1984	1985-89	1990-94	% change ('80 to '90)	Trend ('90 - '80)
Finland	High	27.8	24.5	28.2	1	0.4
	Mid	22.8	32.1	32.8	44	10.0
	Low	30.9	37.7	47.6	54	16.7
	Total	**28.2**	**34.1**	**38.3**	**36**	**10.1**
Norway	High	21.2	17.6	17.7	-16	-3.5
	Mid	19.0	18.8	15.4	-19	-3.6
	Low	18.8	22.5	19.9	6	1.1
	Total	**19.2**	**19.9**	**17.1**	**-11**	**-2.1**
Denmark	High	42.4	39.3	27.0	-36	-15.5
	Mid	43.2	39.3	29.0	-33	-14.2
	Low	39.4	38.8	30.8	-22	-8.7
	Total	**41.0**	**39.1**	**29.4**	**-28**	**-11.6**
Turin	High	26.8	14.6	18.1	-33	-8.7
	Mid	16.6	9.3	14.9	-10	-1.7
	Low	15.4	10.2	10.4	-32	-5.0
	Total	**16.4**	**10.1**	**13.5**	**-18**	**-2.9**

12.4 Summary of findings

1. In many cases, trends in mortality strongly differed according to educational level
2. In general, mortality trends were more favourable among higher educated groups
3. However, the precise patterns of 'inequalities in trends' varied by country, gender and cause of death.

12.5 Evaluation of potential problems

Problems related to the educational classifications were discussed in section 11.5. The main problem identified in that section was the skewed distribution, with a large part of the population belonging to the lowest educational level. In the present chapter, that problem was largely circumvented by restricting the analysis to middle-aged men and women, who have more even educational distributions.

An unfortunate consequence of this decision is that the analyses were based on relatively few deaths. As a result, chance fluctuations in numbers of death were relatively large and these fluctuations may explain some of the observed inequalities in mortality trends. Especially for smaller causes of death it was difficult to demonstrate with statistical significance that mortality trends differed by educational level. One should therefore be reluctant to attach much importance to the haphazard but non-significant patterns that were observed in some cases. None the less, a general trends towards divergence or convergence of mortality trends could be established for most causes of death.

The quality of cause-of-death registrations is another area of concern. Problems with the registration and coding of causes of death may have affected the results for some causes of death. Perhaps most problematic is the registration of deaths from ischemic heart disease, part of which may be assigned to other heart diseases, other circulatory diseases, or sudden death. If this misreporting occurs more frequently among lower educational groups than among higher groups, the relative mortality level of lower groups might be underestimated. A way to evaluate the potential bias is to assess what results would be obtained if other circulatory diseases (except cerebrovascular disease) would be added to ischemic heart disease. Analyses that we made of data from the four countries showed that this more robust cause-of-death group showed the same socio-economic differences (in terms of both magnitude and trends over time) as those that are reported here for ischemic heart disease alone.

12.6 Conclusion for health monitoring

Data on mortality by educational level can be used to monitor inequalities in cause-specific mortality among both men and women. However, when restricting the analysis to younger age groups, the statistical power is often too low to study small causes of death.

Chapter 13.
Changes in mortality differences according to occupational class

13.1 Background and purposes

Mortality differences between men from manual and non-manual classes have been demonstrated for about 15 European countries in the 1980s. Studies from some of these countries have shown that class differences in mortality have increased since then. However, changes in inequalities in mortality have not yet been documented for many countries. An international overview of trends is needed in order to determine whether the widening of health inequalities, which is often referred to in both scientific and policy documents, is a generalised phenomenon across the entire European Union.

For individual countries, a re-assessment of the data is needed for several reasons. First, in many studies, the potential effect of all possible data problems has not been evaluated systematically, so that the strength of the evidence on widening health inequalities is yet uncertain. Second, most studies have not taken into account the fact that occupational classes with the largest excess mortality have become smaller over time. When increasingly less persons belong to the groups with high mortality, the total impact of inequalities on mortality in the population at large might diminish.

The purpose of this chapter is to determine for several European countries whether or not occupational class differences in all-cause mortality have increased between the 1980s and 1990s. These class differences are expressed both in terms of the magnitude of the mortality difference between two or more classes, and in terms of the public health impact of these differences. Data on trends in class differences in mortality were available for 9 countries. In this and the next chapter, we will look at the 6 countries with data from nationally (or regionally) representative longitudinal studies. In chapter 15, results are presented of a brief analyses based on data from cross-sectional studies.

13.2 Materials and methods

Materials

An overview of the data sources is given in table 13.1. Numbers of death by 5-year age group and occupational class were obtained from longitudinal mortality follow-up of the populations censuses that were carried out in about 1980 and about 1990 respectively. Persons enumerated in the 1990 census were followed from about 1990 to 1995. Persons enumerated in the 1980 census were followed from about 1980 to 1985 and from about 1985 to 1989. In this way, three 5-year periods between about 1980 and 1995 were distinguished.

Most studies covered the entire national population. The data for England and Wales apply to a 1 percent sample of private households. The Italian study is restricted to the city of Turin and its surroundings.

The age was measured as age at the start of each sub period. Data are analysed for men in the age group 30 to 59 years. In the data for Sweden, England & Wales and Turin, however, the lower age bound was 35 instead of 30 years.

Men older than 60 years had to be excluded because of lack of detailed occupational information of retired men in most studies. Women had to be excluded from analysis because it was impossible for many countries to assign women to occupational classes (on the basis of

their own occupation or their partner's occupation) in a way that was both valid and comparable over time.

Table 13.1 Overview of data sources

Country	Period	Person-years at risk, men 30-59 years (* 1000)	Number of deaths among men 30-59 years	Restrictions in coverage
Finland	1981-85	4491	31598	none
	1986-90	4882	31885	id.
	1991-95	5144	29082	id.
Sweden	1981-85	7199	26653	none
	1986-90	5827	24461	id.
	1991-95	8045	27182	id.
Norway	1980-85	3278	16338	none
	1985-90	3355	15285	none
	1990-95	3699	12133	25 % sample *
Denmark	1981-85	4360	21276	none
	1986-90	4457	19820	id.
	1991-95	4589	18379	id.
England / Wales	1981-85	458	2372	1% sample of private households
	1986-90	381	2070	
	1991-95	497	1941	
Turin	1982-86	1041	5361	Turin
	1987-91	805	4464	id.
	1992-96	886	3785	id.

* Greater weight is given to rural areas than to cities.

The measurement of occupational class

Four broad occupational classes were distinguished: non-manual workers, manual workers, farmers and farm labourers, and self-employed men. Details on specific countries are given in table 13.2. The Erikson-Goldthorpe-Portocarero (EGP) scheme was used as a reference. In Sweden, Norway and England & Wales, EGP algorithms were available for the 1980s, and similar algorithms were applied to data for the 1990s. In most other countries, national social class schemes were used. With all national class schemes a distinction could be made

Table 13.2 Information on measurement of occupational class

Country	Basic data available	Social class scheme used	Changes over time	Classes excluded
Finland	3 / 4 digit codes	national scheme	none	none

Sweden	3 / 4 digit codes	EGP scheme	none	none
Norway	3 / 4 digit codes	EGP scheme	none	none
Denmark	3 / 4 digit codes	national scheme	none	none
England / Wales	3 / 4 digit codes	EGP scheme	none	none
Turin	3 / 4 digit codes	national scheme	none	agricultural

Table 13.3 Population distribution by occupational class: men 30-59 years

Country	Occupational class	Proportion (%) of the total population		
		1980-84	1985-89	1990-94
Finland	Non-manual	30.8	33.4	34.8
	Self employed	6.5	7.7	9.7
	Agricultural	11.0	9.2	8.2
	Manual	51.7	49.7	47.2
Sweden	Non-manual	43.6	44.3	46.3
	Self employed	8.9	9.0	7.5
	Agricultural	5.9	5.4	4.3
	Manual	41.5	41.3	41.9
Norway	Non-manual	43.7	44.6	48.7
	Self employed	5.4	4.9	5.2
	Agricultural	8.1	7.2	6.8
	Manual	42.7	43.3	39.3
Denmark	Non-manual	40.4	42.8	44.8
	Self employed	12.4	11.1	11.0
	Agricultural	10.1	8.5	7.4
	Manual	37.1	37.6	36.8
England / Wales	Non-manual	32.9	33.6	38.3
	Self employed	10.8	11.2	17.3
	Agricultural	3.0	2.9	2.7
	Manual	53.4	52.2	41.6
Turin	Non-manual	34.1	34.4	42.0
	Self employed	15.7	15.9	17.5
	Manual	50.1	49.7	40.4

between the four main social classes. In the Turin study, farmers and farm labourers were not distinguished because they formed a negligible part of the Turin city population.

Where possible, the same algorithm or classification scheme was applied to both periods in order to maintain as much as possible comparability over time. Substantial changes over time in classifications were not reported for any country.

Table 13.3 presents the distribution of men by occupational class in the three periods, while the number of deaths per class is given in table 13.4. In all countries, the non-manual and manual classes are the largest two classes. The share of self employed men is modest and stable in most countries except in England & Wales and Turin. In nearly all countries, the share of manual and agricultural classes decreases over time, while the share of non-manual classes increases.

Table 13.4 The total number of deaths according to occupational class: men 30-59 years

Country	Occupational class	Number of deaths		
		1980-84	1985-1989	1990-94
Finland	Non-manual	6135	6578	6487
	Self employed	2154	2448	2506
	Agricultural	4375	3530	2604
	Manual	18934	19329	17485
Sweden	Non-manual	9801	8843	10013
	Self employed	2345	2362	2229
	Agricultural	1746	1547	1444
	Manual	12761	11709	13496
Norway	Non-manual	5583	5363	4708
	Self employed	1111	897	722
	Agricultural	1231	1142	970
	Manual	8413	7883	5733
Denmark	Non-manual	7229	7365	7256
	Self employed	3057	2518	2293
	Agricultural	2004	1575	1311
	Manual	8986	8362	7519
England / Wales	Non-manual	619	532	581
	Self employed	211	199	285
	Agricultural	71	47	49
	Manual	1471	1292	1026
Turin	Non-manual	1456	1252	1153
	Self employed	904	709	707
	Manual	3001	2503	1925

The occupational class of deceased men was determined on the basis of the occupation that they had at the time of the population census. For some men, however, information was lacking on their current occupation. This especially applies to men who were economically inactive at the time of the census. In these cases, their occupational class was, as far as

possible, determined on the basis of information on a previously held occupation. This information could be obtained in some countries (especially Finland and England & Wales) by linkage to a previous population census.

Despite these efforts, the proportion of men with unknown class was considerable in some countries. Table 13.5 gives detailed information on these men. Their mortality levels are relatively high, due to the fact that most of the men with unknown occupational class are economically inactive men like retired or work disabled men. Unfortunately, their exclusion from analysis is likely to lead to an underestimation of the magnitude of mortality differences between occupational classes, because these men not only have high mortality rates but in addition most of them originate from lower occupational classes. However, an adjustment procedure was available to correct for this underestimation (Kunst & Groenhof 1996a, Kunst et al 1998b).

Table 13.5 Information on men with occupation unknown

Country	Period	Proportion (%) of total number of person-years at risk	Proportion (%) of total number of deaths	Relative risk of mortality unknown vs. known	Correction factor to RR manual vs. nonmanual
Finland	1981-85	1.2	3.5	2.85	1.011
	1986-90	1.1	3.2	2.97	1.011
	1991-95	1.0	3.2	3.30	1.011
Sweden	1981-85	9.7	33.0	4.55	1.137
	1986-90	8.2	23.6	3.45	1.088
	1991-95	5.7	16.3	3.19	1.057
Norway	1980-85	7.4	15.4	2.27	1.044
	1985-90	7.5	12.7	1.80	1.029
	1990-95	6.4	21.0	3.87	1.081
Denmark	1981-85	7.3	26.2	4.48	1.107
	1986-90	8.5	30.3	4.66	1.126
	1991-95	10.1	33.9	4.58	1.142
England /	1981-85	5.1	10.4	2.17	1.040
Wales	1986-90	6.1	7.2	2.06	1.043
	1991-95	4.7	12.4	2.87	1.058
Turin	1982-86	3.0	8.7	3.07	1.042
	1987-91	2.3	4.8	2.17	1.018
	1992-96	2.5	5.8	2.44	1.024

and this procedure was applied to our data. Table 13.5 shows one of the correction factors that were produced by this procedure and that were used to adjust the mortality measures presented in this chapter.

Methods

The mortality level per occupational class was measured by means of age-adjusted mortality rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation procedure, control was made for differences in age structure between occupational classes and, in addition, between countries and periods.

The time/place comparability of absolute mortality levels was affected, however, because of differences in length of mortality follow-up, the precise age ranges and possibly other factors. However, national mortality registrations with a complete coverage of every country's population could be used as an alternative source. National estimates of the age-specific mortality rates from WHO publications were used to adjust our own estimates of absolute mortality levels so that these levels were comparable between both occupational classes, countries and periods.

The magnitude of mortality differences by occupational class was measured by means of two complementary inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the age-standardised mortality rates that were observed for non-manual and manual classes.
2. Rate ratios. These can be calculated simply as the ratio of the two mortality rates mentioned above. However, in order to be able to estimate this ratio together with 95 percent confidence intervals, we applied Poisson regression analysis. The regression model included a series of terms representing 5-year age groups, and a term that represented the contrast between the non-manual and manual class. These regression-based estimates, which are presented in the next section, were found to be almost identical to rate ratios calculated in the simple way.

In addition, two indices were calculated that explicitly take into account the distribution of the population over occupational classes.

1. The Population Attributable Risk (PAR), in which the class of non-manual workers was the reference group. The PAR was calculated on the basis of the age-standardised mortality rates according to standard formulae (Mackenbach & Kunst 1997).
2. The Index of Dissimilarity (ID), based on a distinction between the four broad occupational classes. The ID was calculated on the basis of the age-standardised mortality rates according to the formulae given by Mackenbach & Kunst (1997).

13.3 Results

Death rates according to occupational class are presented in table 13.6. In each country and period, manual classes have higher mortality rates than non-manual classes. The mortality rates of the two other classes, self employed and agricultural men, are generally in-between. However, farmers in for example Denmark have lower mortality rates even in comparison to non-manual classes.

Table 13.6 Death rate according to occupational class: men 30-59 years

Country	Occupational class	Death rate (per 1000 person years)			Change	
		1980-84	1985-1989	1990-94	Absolute ('90 - '80)	Relative (%) (absolute/'80)
Finland	Non-manual	4.7	4.0	3.6	-1.1	-23
	Self employed	6.1	5.6	4.8	-1.2	-20
	Agricultural	5.9	5.4	4.7	-1.2	-20
	Manual	7.4	7.2	6.9	-0.6	-8

	Total	**6.3**	**5.8**	**5.3**	**-1.0**	**-16**
Sweden	Non-manual	3.4	3.0	2.5	-0.9	-26
	Self employed	3.9	3.9	3.2	-0.7	-18
	Agricultural	3.7	3.8	3.5	-0.2	-5
	Manual	5.1	4.7	4.1	-1.0	-20
	Total	**4.2**	**3.8**	**3.3**	**-0.9**	**-21**
Norway	Non-manual	3.7	3.5	2.8	-0.9	-24
	Self employed	5.0	4.4	3.8	-1.2	-24
	Agricultural	3.4	3.6	3.5	0.1	3
	Manual	5.2	5.1	4.3	-0.9	-17
	Total	**4.4**	**4.2**	**3.5**	**-0.9**	**-20**
Denmark	Non-manual	4.3	4.4	3.9	-0.4	-9
	Self employed	5.3	5.2	4.6	-0.7	-13
	Agricultural	3.5	3.5	3.5	0.0	0
	Manual	6.2	6.2	5.7	-0.4	-6
	Total	**5.0**	**5.1**	**4.6**	**-0.4**	**-8**
England / Wales	Non-manual	3.9	3.3	3.0	-0.9	-23
	Self employed	4.3	3.7	3.2	-1.1	-26
	Agricultural	4.2	3.3	3.1	-1.1	-26
	Manual	5.3	4.9	4.6	-0.7	-13
	Total	**4.7**	**4.2**	**3.7**	**-1.0**	**-21**
Turin	Non-manual	4.0	3.7	3.0	-1.0	-25
	Self employed	5.1	4.2	3.9	-1.2	-24
	Manual	5.3	4.7	4.3	-1.0	-19
	Total	**4.8**	**4.3**	**3.7**	**-1.1**	**-23**

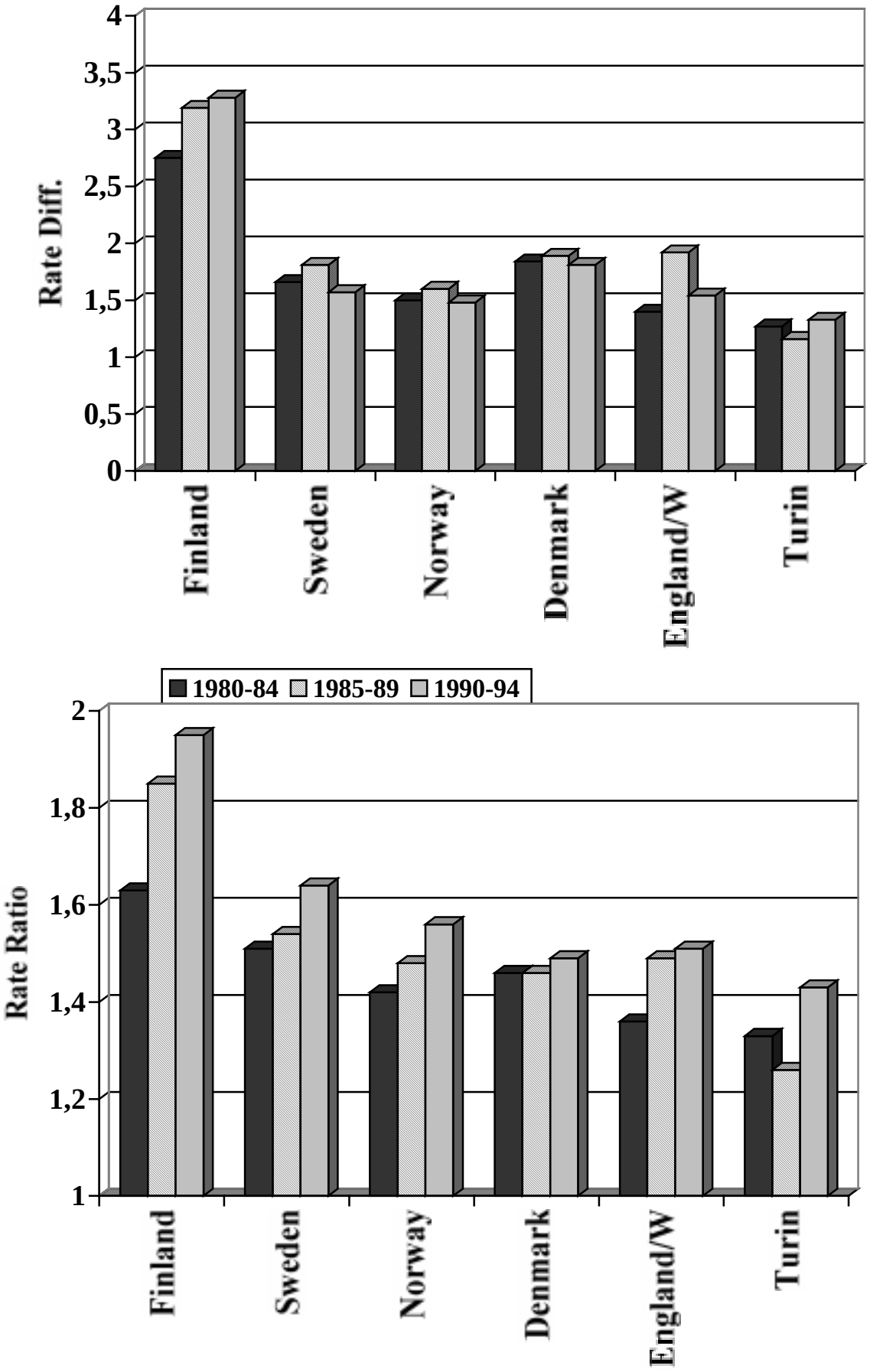
Mortality trends between the 1980s and 1990s are summarised in the last columns of table 13.6. National mortality rates have declined considerably between 1982 and 1992 in most countries except Denmark, where the decline was small. Mortality declines were enjoyed by each occupational class, except for farmers in Norway and Denmark. In absolute terms, the mortality decline was the about same for manual and non-manual workers in most countries. However, a strong non-manual advantage was observed in Finland. In relative terms, mortality declined faster in non-manual classes than in manual classes in all countries. This class difference was relatively large in Finland and England & Wales.

Table 13.7 and figure 13.1 show how these similarities and dissimilarities in mortality declines influenced the magnitude of class differentials in mortality. For each country, this magnitude is given in both absolute terms (as rate differences) and in relative terms (as rate ratios). In absolute terms, the advantage of non-manual classes over manual classes has remained more or less stable in most countries. In Finland and England & Wales, however, the larger absolute decline in non-manual classes resulted in a widening of absolute mortality differences. In relative terms, the advantage of non-manual classes over manual classes increased everywhere. This increase was relatively large in Finland, and relatively small in Denmark.

Table 13.7 The magnitude of mortality differences by occupational class: men 30-59 years

Country	Inequality index	1980-84	1985-1989	1990-94	Change (‘80 to ‘90)
Finland	Rate difference	2.75	3.19	3.28	0.53
	Rate ratio	1.63	1.85	1.95	0.32
	(95 % C.I.)	(1.58-1.68)	(1.79-1.90)	(1.90-2.01)	
Sweden	Rate difference	1.66	1.64	1.57	-0.09
	Rate ratio	1.51	1.53	1.64	0.13
	(95 % C.I.)	(1.47-1.55)	(1.49-1.58)	(1.59-1.68)	
Norway	Rate difference	1.50	1.60	1.48	-0.01
	Rate ratio	1.42	1.48	1.56	0.14
	(95 % C.I.)	(1.37-1.47)	(1.43-1.53)	(1.50-1.62)	
Denmark	Rate difference	1.84	1.89	1.81	-0.03
	Rate ratio	1.46	1.46	1.49	0.03
	(95 % C.I.)	(1.41-1.51)	(1.41-1.50)	(1.44-1.53)	
England	Rate difference	1.40	1.65	1.54	0.14
/ Wales	Rate ratio	1.36	1.49	1.51	0.15
	(95 % C.I.)	(1.24-1.49)	(1.42-1.65)	(1.36-1.67)	
Turin	Rate difference	1.27	1.02	1.33	0.06
	Rate ratio	1.33	1.27	1.43	0.10
	(95 % C.I.)	(1.25-1.42)	(1.19-1.36)	(1.33-1.54)	

Figure 13.1. The magnitude of mortality differences by occupational class expressed in terms of rate differences (above) and rate ratios (below).



Until here, we mainly looked at changes by comparing the first to the last period. Some more detailed information can be obtained by looking at the middle period as well. Inequalities estimates for the middle period are usually in-between the estimates for the first and last period. In some countries, however, the trends are less regular. An acceleration of trends (larger increases at the end of the study period) is observed for Sweden and Turin, whereas a deceleration (smaller increases at the end) seems to have occurred in Finland and England & Wales.

Taking into account population distributions

The rate ratios and rate differences do not take into account changes in the occupational composition of the male working population, which changed considerably in a few countries. Even though the relative mortality excess of manual classes increased over time, in some countries ever less men belonged to manual classes. This population change is taken into account by the Population Attributable Risk (PAR), which is presented in table 13.8. (Note that the PAR was applied also in section 11.3). The PAR shows essentially the same trends as the rate ratios, with the largest increases in Finland. In no country the PAR decreased, despite the decrease in the share of manual classes. Inspection of table 13.3 reveals why: in most countries this decrease is relatively small. Only in England & Wales and Turin, where the proportion of manual classes declined substantially, did the PAR remain about stable despite increasing rate ratios.

Table 13.8 The magnitude of class differences in mortality expressed by indices that take into account population distributions: men 30-59 years

Country	Inequality index	1980-84	1985-1989	1990-94	Change ('80 to '90)
Finland	ID	9.08	11.52	13.51	4.43
	PAR	0.26	0.32	0.33	0.07
Sweden	ID	9.03	9.23	10.88	1.85
	PAR	0.18	0.20	0.23	0.05
Norway	ID	8.65	8.98	9.58	0.92
	PAR	0.16	0.18	0.20	0.04
Denmark	ID	8.84	8.82	8.79	-0.05
	PAR	0.14	0.14	0.15	0.01
England / Wales	ID	6.89	9.23	9.75	2.85
	PAR	0.17	0.21	0.19	0.02
Turin	ID	5.67	5.06	7.94	2.27
	PAR	0.17	0.14	0.19	0.02

Table 13.8 includes another summary index, the Index of Dissimilarity (ID). The value of about 9 for Finland in the first period can be interpreted to mean that 9 percent of all deaths would have to be redistributed to obtain the same mortality rates for all occupational classes.

This value takes into account the population share and mortality level of all classes separately, and it is larger if the classes with, respectively, the highest and lowest mortality rates are larger. The ID shows about the same trends as the PAR, with the largest increases in Finland. However, large increases are also observed for some other countries, most notably for England & Wales. The increase in England & Wales is related to the mortality trends of farmers and self employed men. While these classes had an already lower-than-average mortality level in the 1980s, they experienced the largest relative declines in the subsequent decade (table 13.6). Thus, these classes approached the non-manual groups (which is a favourable development from the PAR perspective) but moved away from the overall average (which is unfavourable from the ID perspective). The increase in the ID for England & Wales, as well for some other countries, thus reflects a general divergence of class-specific mortality rates.

Age-specific patterns

The results presented until now collapses the mortality experiences of different ages, and might perhaps conceal divergent trends for more specific age groups. For that reason, a distinction by age group is made in table 13.9. Relative inequalities in mortality are expressed in these age groups by means of the rate ratios that compare manual to non-manual classes. (Recall from table 11.9 in section 11.3 that looking at absolute rate differences produces entirely different age patterns).

Among men in 1980-84, the rate ratios show the well-known pattern of larger relative inequalities for younger age groups. In Sweden, for example, the mortality excess of manual over non-manual classes was 80 percent at 35-44 years as compared to 41 percent at 45-59 years. Only in England & Wales no marked age pattern is observed. Trends over time are not consistently related to age group. In some countries, widening of inequalities in mortality is observed for 30-44 years as well as for 45-59 years. In Sweden, Norway and Denmark, however, changes were small and irregular for the youngest age group.

13.4 Summary of findings

1. Substantial class differences in mortality existed in the 1990s in each country.
2. In relative terms, these differences widened in all countries, while in absolute terms they increased only in a few countries.
3. Taking into account population distributions produces a more favourable picture when measured with the PAR, but a less favourable picture according to the ID.
4. The pace of increase varied according to sub-period, age group and country, with the largest increases occurring in Finland.

Table 13.9 The magnitude of class differences in mortality among men in specific age groups

Country	Age group	Rate Ratio (plus 95% Confidence Intervals)			
		1980-84	1985-1989	1990-94	Change ('80 to '90)
Finland	30-44	1.90 (1.80-2.00)	2.14 (2.04-2.25)	2.28 (2.17-2.39)	0.38
	45-59	1.53 (1.48-1.58)	1.71 (1.65-1.77)	1.80 (1.74-1.86)	0.27
Sweden	30-44 †	1.80 (1.71-1.90)	1.65 (1.55-1.75)	1.75 (1.66-1.84)	-0.05
	45-59	1.41 (1.37-1.46)	1.48 (1.44-1.53)	1.60 (1.56-1.65)	0.19
Norway	30-44	1.71 (1.59-1.85)	1.76 (1.65-1.89)	1.68 (1.57-1.80)	-0.03
	45-59	1.34 (1.29-1.39)	1.39 (1.34-1.45)	1.49 (1.43-1.57)	0.15
Denmark	30-44	1.69 (1.59-1.80)	1.54 (1.45-1.63)	1.62 (1.52-1.72)	-0.07
	45-59	1.38 (1.33-1.43)	1.42 (1.36-1.47)	1.43 (1.38-1.49)	0.06
England	30-44 †	1.38 (1.09-1.74)	1.30 (1.02-1.67)	1.55 (1.25-1.93)	0.17
	45-59	1.36 (1.23-1.50)	1.53 (1.37-1.71)	1.50 (1.34-1.69)	0.15
Turin	30-44 †	1.47 (1.27-1.70)	1.22 (1.02-1.46)	1.59 (1.36-1.86)	0.12
	45-59	1.30 (1.21-1.39)	1.27 (1.17-1.38)	1.40 (1.29-1.52)	0.10

† Age group 35-44 years.

13.5 Evaluation of potential problems

Exclusion of men with social class unknown

For most countries, the occupation of a part of men was not known (see table 13.5). Their mortality levels are relatively high, due to the fact that most of the men with unknown occupational class are economically inactive men like retired or work disabled men. Unfortunately, their exclusion from analysis is likely to lead to an underestimation of class differences in mortality, because these men not only have high mortality rates but they in addition originate mostly from lower occupational classes. In order to correct for this problem

we applied an adjustment procedure (see methods section). As an example, table 13.5 showed the correction factors that were applied to adjust the rate ratios that compare manual to non-manual classes. A substantial correction had to made especially for Sweden, Norway and Denmark.

The question that should be addressed now is to what extent we have been able to adequately correct for the exclusion of men with occupation unknown. More specifically, have we been able to produce unbiased estimates of changes in the magnitude of inequalities? This question will be evaluated with additional, unpublished data that were available from Finland and England & Wales.

Table 13.10 shows the evaluation with the Finnish data. The upper and middle parts of the table evaluate the two assumptions on which adjustment procedure rests. These assumptions are that (a) the proportion of men who are inactive (or who are unclassified) is about 2 times higher among manual classes than among non-manual classes and (b) the relative risk of dying of inactive men as compared to active men is the same within manual classes as within non-manual classes. The upper part of table 13.10 shows that assumption (a) approximately holds for Finland for both 1981-85 and 1991-95. The middle part of the table also supports assumption (b).

Table 13.10 Evaluation of the procedure to adjust for the exclusion of economically inactive men. Finland, men 30-59 years.

	1981-85	1991-95	Change ('80 to '90)
Proportion (%, person years) of men that are inactive			
- in total population	14.9	17.1	-
- in manual class (a)	19.0	22.7	-
- in non-manual class (b)	8.0	9.5	-
Manual compared to non-manual (a/b)	2.38	2.39	-
Mortality rate ratio: inactive vs. active men			
- in total population	3.52	3.87	-
- in manual class	3.30	3.35	-
- in non-manual class	3.54	4.19	-
Mortality rate ratio: manual vs. non-manual			
- in total population	1.61	1.95	0.34
- among active men only	1.34	1.64	0.30
- the latter adjusted to the total population	1.54	1.93	0.39

The lower part of table 13.10 shows how the adjustment procedure would perform when it would be used to correct the rate ratios that compare manual to non-manual classes. In the total population (active and inactive) this rate ratio increased from 1.61 to 1.95. When the rate ratios would be estimated for the active population only (as happened to many other countries in our study) they would seem to be much lower: 1.34 and 1.64. Application of the adjustment procedure would bring the rate ratios fairly closer to the values observed for the total population. But most important for the present chapter is that, irrespective of which data and methods are used, we would observe a strong increase in inequalities in mortality in Finland.

Table 13.11 presents an evaluation that was possible with additional data from England & Wales. The available data could be used to test the general performance of the adjustment procedure. The upper and middle part give the parameters that are used as the input to this procedure. The lower part of the table shows how the adjustment procedure would perform when applied to correct the rate ratios that compare manual to non-manual classes. Among all

men this rate ratio increased over time from 1.35 to 1.51. This estimate includes men who were 'unclassified' at the last census but could be classified based upon additional information, e.g. from death certificates. When these 'unclassified' men would be excluded from the estimates (as happened to our estimates for many other countries) the rate ratios would be lower (1.32 and 1.33) and no increase over time would be observed. Application of the adjustment procedure would bring the estimates of the magnitude and time trends much closer to 'real' estimate. However, in this case, the increase over time would still be underestimated after application of the adjustment procedure.

Table 13.11 Evaluation of the procedure to adjust for the exclusion of men who were 'unclassified' at the census. England and Wales, men 35-59 years.

	1981-85	1991-95	Change ('80 to '90)
Proportion (%) of men who are 'unclassified'			
- of person-years at risk	4.1	7.3	
- of all deaths	9.6	18.4	
Mortality rate ratio: unclassified vs. classified			
- in total population	2.48	2.86	
Mortality rate ratio: manual vs. non-manual			
- in total population	1.35	1.51	0.16
- only among men 'classified' at census	1.32	1.33	0.01
- the latter adjusted to the total population	1.37	1.45	0.08

Source: ONS data on mortality by social class (according to the Registrar General scheme) in the 1981 and 1991 cohort respectively.

To conclude, these two examples illustrate the potentially strong effects of excluding (economically inactive) men with unknown occupation. If most of these men had to be excluded and no adjustment is made for their exclusion, the results may produce a misleading impression of the magnitude and/or time trends of class differences in mortality. Our adjustment procedure can bring these biased estimates reasonably close to the 'true' values. However, some inaccuracy is inevitable and some uncertainty therefore remains. In the present chapter, this especially applies to the estimates that were made for Sweden, Norway and Denmark.

Alternative social classifications

Even though the Erikson-Goldthorpe social class scheme was used as a general reference, there was inevitably some variation between countries in the social class schemes used and in the occupational information that was available to construct these schemes. This variability raises the question to what extent the choice for a specific class scheme would influence the observed magnitude and trends in class differences in mortality

One evaluation is presented in table 13.12. In the Turin study, two data sets were created based on two different class schemes. For 1982-86, the two class schemes produced nearly identical results, both in terms of population distribution and in terms of class differences in mortality. For example, the rate ratios that compare manual to non-manual classes were 1.33 and 1.36 for the two class schemes. (Another study found a rate ratio of 1.35 when using the Erikson-Goldthorpe scheme). For 1991-96, however, the two class schemes produced less consistent results. Population distributions differed, mainly because of different ways of defining the class of self-employed men in the 1992 census. Although estimates of class

differences in mortality are roughly similar, the two schemes produce different estimates of trends over time. Rate ratios calculated under the first class scheme show an increase that would be considered 'normal' (i.e. as large as in most other countries) while the rate ratios under the second class scheme would instead give the impression that inequalities remained stable over time. In terms of the ID, however, the results are more consistent.

Table 13.12 Evaluation of alternative social classifications. Turin, men 35-59 years.

		1982-86	1992-96	Change ('80 to '90)
National class scheme	Population distribution (%)			
	- non-manual	34.1	42.0	7.9
	- self-employed	15.7	17.5	1.8
	- manual	50.1	40.4	-9.7
	RR manual vs. non-manual	1.33	1.43	0.10
	Index of Dissimilarity	5.67	7.94	2.27
Esping Andersen scheme	Population distribution (%)			
	- non-manual	32.2	30.4	-1.8
	- self-employed	17.5	25.4	7.9
	- manual	50.2	44.2	-6.0
	RR manual vs. non-manual	1.36	1.39	0.03
	Index of Dissimilarity	5.65	6.92	1.27

This example from Turin illustrates the more general experience that different social class schemes can produce different impressions of the magnitude and trends of class differences in mortality. However, the example also illustrates that inequality estimates are fairly robust if a classification into a few broad and clearly defined social classes is used.

Differences within manual and non-manual classes

In the analyses up to now, no distinctions were made within the broad classes of manual and non-manual workers respectively. The main reasons to do so were that (a) in some countries this distinction could not be made with the available data and (b) in the other countries there may be large problems with the comparability of data over time. None the less, the question arises whether similar trends would be observed when a finer distinction would have been made. Perhaps the broad classes of manual and non-manual workers combines sub-classes with widely different mortality trends.

Table 13.13 presents an example of the information that would be gained with a more detailed distinction of social classes. In the longitudinal study for England & Wales, mortality differences are given according to the British Registrar General's class scheme. For each period, the mortality level of each class is expressed as a ratio to the mortality level of the upper non-manual class. In order to secure comparability over time with this more detailed social classification, all estimates are based on a 15 year follow-up to the 1981 cohort. The results for 1981-85 show the well-known pattern of increasing mortality rates when moving from class I to class V. With this finer classification, larger mortality differences are observed than with the simple contrast between manual and non-manual classes. Between 1981-85 and 1991-95, the class differences generally increased, with the larger increases in the lower occupational classes. The mortality trend of the lower non-manual class is somewhat

irregular, perhaps due to the relatively small number of deaths in this class (about 200 per sub-period).

Table 13.13 Taking into account mortality differences within the manual and non-manual classes. England and Wales, men 35-59 years:

Social class	Relative mortality risk (change since 1981-85)				
	1981-85	1986-90		1991-95	
Class I, II (upper non-manual = reference)	1.00	1.00		1.00	
Class III N (lower non-manual)	1.26	1.20	(-0.06)	1.32	(0.11)
Class III M (skilled worker)	1.32	1.37	(0.05)	1.44	(0.12)
Class IV,V (un/semi-skilled worker)	1.61	1.72	(0.11)	1.80	(0.19)
Manual as compared to non-manual	1.35	1.43	(0.08)	1.46	(0.11)

Source: ONS data on mortality by social class (according to the Registrar General's scheme) in the 1981 cohort. Including men who were 'unclassified' at the census.

This example from England & Wales illustrates the more general point that inequality measures that are based on the simple manual versus non-manual distinction are usually able to represent the general trend in class differences in mortality. However, a further distinction may reveal patterns that may be unexpected, and it can help top identify more precisely those groups where mortality trends are least favourable.

13.6 Conclusion for health monitoring

Longitudinal, census-based data on mortality by occupational class can be used to monitor class differences in mortality among middle-aged men. However, in both the analysis and interpretation of the results, care should taken to deal with (inactive) men for whom the social class cannot be determined.

The trends presented in this chapter apply to middle aged men. Given the scarcity of data and problems with unknown class, it is unlikely that trends in class differences in mortality can be assessed in many countries either for women or for elderly men.

Chapter 14.
Changes in class differences in mortality: the contribution of specific causes of death

14.1 Background and purposes

The previous chapter showed that relative inequalities in mortality among middle-aged men increased in most European countries. The increase was substantial in a few countries but modest in most others. These findings raise questions about the circumstances that determine the pace by which mortality differences increase in the past and in the future.

A first indication on the nature of these determinants can be obtained by distinguishing causes of death. For example, if widening gaps in mortality are observed for alcohol-related causes rather than smoking-related causes, this would not only provide evidence on the relative contribution of alcohol vs. smoking to widening of inequalities, but also give some indications on the type of cultural and social conditions that are behind these trends.

The purpose of this chapter is to determine which causes of death have contributed to the widening of relative inequalities in mortality among middle aged men. Causes of death may contribute to this widening in two complementary ways. The first obvious way is that relative inequalities have widened for specific causes of death, and especially the quantitatively more important causes like heart disease. The second way is that the cause-of-death composition of all-cause mortality has changed in such a way that an increasing proportion of all deaths are due to causes of death with large relative inequalities. Both mechanisms will be studied in this chapter.

As this is an exploratory and illustrative analysis, a distinction is made between only four broad groups of causes of death: neoplasms, circulatory diseases, all other diseases, and injuries. The analysis concerns men 30 to 59 years in the 6 European countries for which we have census-based longitudinal data.

14.2 Materials and methods

The reader is referred to chapter 13 for an overview of the data sources and the social class schemes that are used.

Causes of death were defined by applying the same ICD (8, 9 or 10) codes to each country. In terms of the ICD 9, these codes were 140-239 for neoplasms, 390-459 for circulatory diseases, 800-999 for injuries, and all other ICD codes for ‘other diseases’.

The mortality level per occupational class was measured by means of directly standardised mortality rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard.

The time/place comparability of absolute mortality levels was affected because of differences between studies in, among other factors, length of mortality follow-up and the precise age ranges that are covered. In chapter 13, we described how the estimates for all-cause mortality were adjusted by taking national estimates from WHO publications. The same adjustment factors that were applied in that chapter to all-cause mortality were also applied in the present analysis on cause-specific mortality.

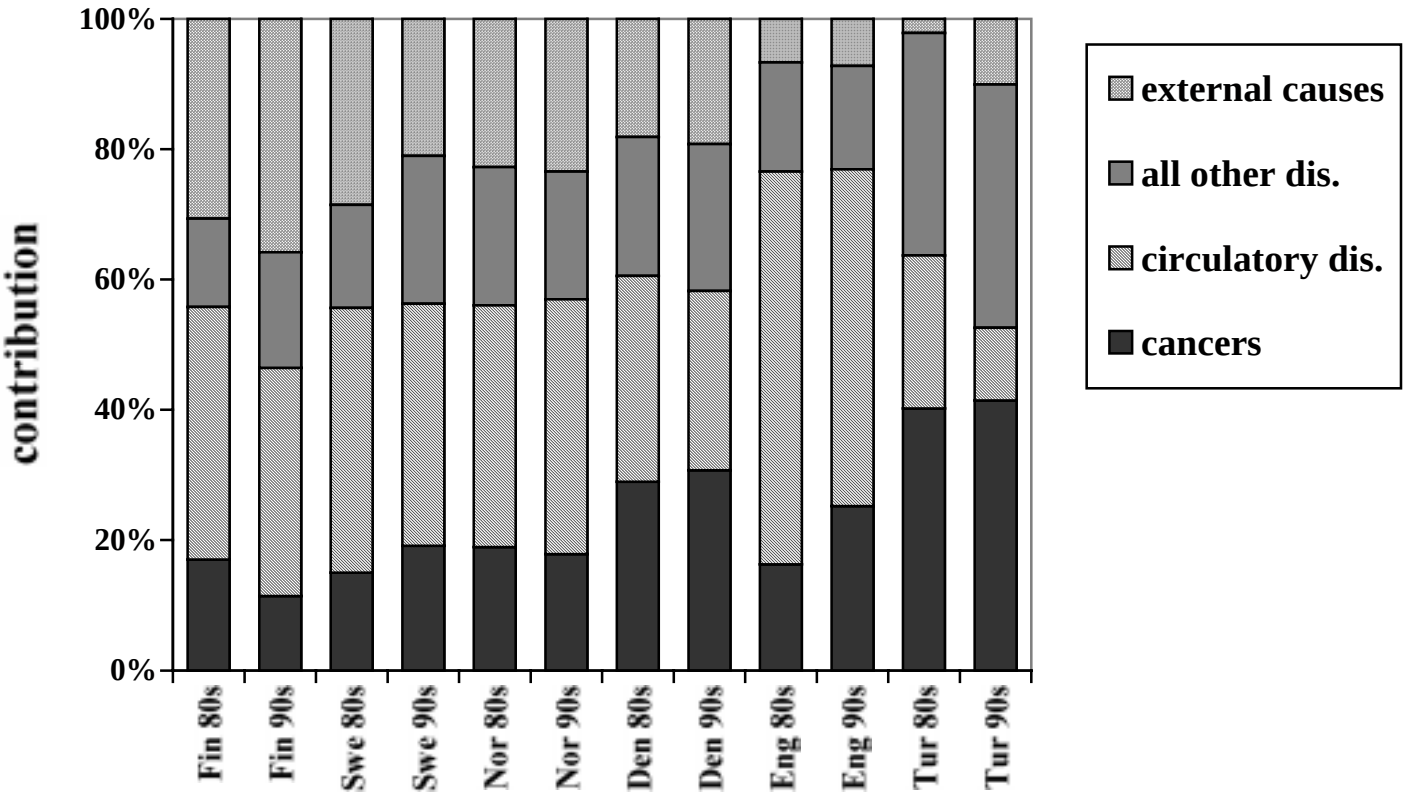
The magnitude of class differences in cause-specific mortality was measured by means of two complementary inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the age-standardised mortality rates that were observed for non-manual and for the manual classes.
2. Rate ratios. These were estimated by means of Poisson regression analysis. The regression model included a series of terms representing 5-year age groups, and a term that represented the contrast between non-manual and manual classes.

Both measures were adjusted for the exclusion of economically inactive men for whom the last occupation was unknown. This adjustment procedure, which is described and evaluated in chapter 13, was applied to each cause of death separately.

Rate differences for specific causes of death add up to the rate differences for all-cause mortality. Thus, dividing the rate difference for a specific cause to the one for all-cause mortality yields a measure on the contribution that this cause makes to inequalities in all-cause mortality. This contribution is included in tables 14.1 and 14.2 and summarised in figure 14.1

Figure 14.1. Contribution of cause-of-death groups to class differences in all-cause mortality. Source: tables 14.1 and 14.2.



14.3 Results

Table 14.1 presents estimates of differences between manual and non-manual classes in cause-specific mortality in 1980-1984. For each cause-of-death group and in each country, manual classes have higher death rates than non-manual classes. In relative terms (rate ratios) inequalities in injury mortality are large in the Nordic countries. Also the 'other diseases' group has relatively large inequalities in most countries. Small relative inequalities are observed for neoplasms. In absolute terms (rate differences) inequalities are largest for circulatory diseases. In all countries except Turin, circulatory diseases contribute most to inequalities in all-cause mortality. In England & Wales, their contribution even amounts to 60 percent.

Table 14.1 Death rate according to cause of death and occupational class: men 30-59 years, 1980-84

Country	Cause of death	Death rate (per 100.00 person years)		Inequality index		
		Non-manual	Manual	Rate Ratio	Rate difference	Contribution (in %) *
Finland	All neoplasms	104.2	151.1	1.44	46.9	17.0
	All circulatory d.	237.5	344.3	1.49	106.7	38.8
	All other diseases	54.3	91.7	1.71	37.4	13.6
	Injuries	71.3	155.7	2.17	84.4	30.7
Sweden	All neoplasms	107.4	132.4	1.24	25.0	15.0
	All circulatory d.	145.6	213.2	1.48	67.6	40.6
	All other diseases	39.5	65.8	1.70	26.3	15.8
	Injuries	52.4	100.0	1.94	47.6	28.6
Norway	All neoplasms	102.7	131.1	1.28	28.4	18.9
	All circulatory d.	164.5	220.0	1.35	55.5	37.1
	All other diseases	56.6	88.3	1.58	31.7	21.2
	Injuries	44.8	78.9	1.80	34.1	22.8
Denmark	All neoplasms	138.3	191.5	1.40	53.2	29.0
	All circulatory d.	165.1	223.2	1.38	58.0	31.6
	All other diseases	73.6	112.6	1.57	39.0	21.3
	Injuries	57.0	90.4	1.65	33.4	18.2
England / Wales	All neoplasms	132.8	155.7	1.17	22.9	16.3
	All circulatory d.	179.3	263.8	1.47	84.5	60.2
	All other diseases	48.0	71.5	1.50	23.5	16.8
	Injuries	27.1	36.5	1.33	9.4	6.7
Turin	All neoplasms	150.7	208.0	1.34	51.0	40.2
	All circulatory d.	136.4	166.3	1.23	29.9	23.5
	All other diseases	70.8	114.1	1.65	43.3	34.1
	Injuries	38.6	41.4	1.08	2.8	2.2

** The contribution of each cause of death to inequalities in total mortality.*

The same estimates are presented in table 14.2 for 1990-1994. As in the early 1980s, manual classes had higher mortality rates than non-manual classes in each country and for each group of causes of death. In relative terms, inequalities were generally largest for injuries and smallest for neoplasms. In absolute terms, inequalities were generally largest for circulatory diseases, although neoplasms were the most important cause of death in Denmark and Turin, and injuries in Finland.

Table 14.2 Death rate according to cause of death and occupational class: men 30-59 years, 1990-94

Country	Cause of death	Death rate (per 100.00 person years)		Inequality index		
		Non-manual	Manual	Rate Ratio	Rate difference	Contribution (in %) *
Finland	All neoplasms	86.3	123.8	1.41	37.5	11.4
	All circulatory d.	131.1	245.9	1.91	114.9	35.0
	All other diseases	57.4	115.7	2.02	58.3	17.8
	Injuries	82.5	200.1	2.46	117.6	35.8
Sweden	All neoplasms	81.4	111.4	1.37	30.0	19.1
	All circulatory d.	84.4	142.8	1.71	58.4	37.2
	All other diseases	43.3	78.9	1.83	35.6	22.7
	Injuries	42.0	75.1	1.77	33.0	21.0
Norway	All neoplasms	93.4	119.9	1.29	26.5	17.8
	All circulatory d.	91.1	149.2	1.68	58.1	39.1
	All other diseases	55.4	84.4	1.54	29.0	19.5
	Injuries	38.8	73.7	1.88	34.9	23.5
Denmark	All neoplasms	138.1	193.8	1.43	55.6	30.7
	All circulatory d.	110.2	160.1	1.50	49.9	27.5
	All other diseases	98.3	139.0	1.41	40.8	22.5
	Injuries	46.4	81.3	1.75	34.9	19.2
England / Wales	All neoplasms	106.7	145.5	1.37	38.8	25.2
	All circulatory d.	116.2	195.9	1.69	79.7	51.7
	All other diseases	54.2	78.6	1.45	24.4	15.8
	Injuries	22.2	33.5	1.47	11.2	7.3
Turin	All neoplasms	126.1	181.3	1.44	55.2	41.4
	All circulatory d.	90.1	105.0	1.16	14.9	11.2
	All other diseases	57.3	107.0	1.57	49.7	37.3
	Injuries	25.7	39.2	1.60	13.5	10.1

** The contribution of each cause of death to inequalities in total mortality.*

Table 14.3 is included in order to evaluate the possibility that the widening of class differences in total mortality is in part due to a changing cause-of-death composition of all-cause mortality. In Finland, the contribution of circulatory diseases in total mortality

decreased while the share of 'other diseases' and injuries increased. Since the latter two groups had the largest relative inequalities in mortality, both in 1980-84 and 1990-94, the increase in their importance must have contributed to the widening class differences in all-cause mortality in Finland (see chapter 13). Something similar happened in Turin, where two causes of death with large relative inequalities (neoplasms and other diseases) increased their share in all-cause mortality. In all other countries, however, no such patterns are observed.

Table 14.3. The contribution of specific causes of death to all-cause mortality. Men 30-59 years.

Country	Cause of death	Contribution (%) to all deaths		
		1980-84	1990-94	Change ('80 to '90)
Finland	All neoplasms	21.1	20.1	-0.9
	All circulatory d.	48.1	36.2	-11.9
	All other diseases	12.1	16.6	4.5
	Injuries	18.8	27.1	8.3
Sweden	All neoplasms	28.0	29.2	1.2
	All circulatory d.	41.9	34.5	-7.4
	All other diseases	12.3	18.5	6.2
	Injuries	17.8	17.8	0.0
Norway	All neoplasms	26.4	30.2	3.8
	All circulatory d.	43.4	34.0	-9.3
	All other diseases	16.3	19.8	3.5
	Injuries	13.9	15.9	2.0
Denmark	All neoplasms	31.4	34.3	3.0
	All circulatory d.	36.9	27.9	-9.0
	All other diseases	17.7	24.5	6.8
	Injuries	14.0	13.2	-0.8
England / Wales	All neoplasms	31.5	33.5	2.0
	All circulatory d.	48.4	41.5	-7.0
	All other diseases	13.1	17.6	4.6
	Injuries	7.0	7.4	0.4
Turin	All neoplasms	39.1	42.0	2.9
	All circulatory d.	32.4	26.7	-5.8
	All other diseases	19.8	22.5	2.6
	Injuries	8.6	8.9	0.3

Table 14.4 is included in order to evaluate the second explanation of widening inequalities in all-cause mortality: relative inequalities have widened for specific causes of death. There is clear support for this explanation: in each country class differences increased for most causes of death. Large and statistically significant increases were observed for circulatory diseases in most countries, except Denmark and Turin. The trends observed for other causes of death greatly varied between countries. For example, neoplasms contributed to the widening of mortality differences in England, while injuries played a prominent role in Turin.

Table 14.4. The magnitude of manual vs. non-manual differences in mortality from specific causes of death. Men 30-59 years.

Country	Cause of death	Manual vs. non-manual rate ratio (95 % confidence interval)				
		1980-84		1990-94		Change ('80 to '90)
Finland	All neoplasms	1.44	(1.35- 1.54)	1.41	(1.32- 1.50)	-0.03
	All circulatory d.	1.49	(1.43- 1.55)	1.91	(1.82- 2.01)	0.42
	All other diseases	1.71	(1.57- 1.86)	2.02	(1.88- 2.16)	0.31
	Injuries	2.17	(2.04- 2.32)	2.46	(2.33- 2.60)	0.29
Sweden	All neoplasms	1.24	(1.18- 1.31)	1.37	(1.31- 1.44)	0.13
	All circulatory d.	1.48	(1.42- 1.54)	1.71	(1.64- 1.79)	0.23
	All other diseases	1.70	(1.57- 1.83)	1.83	(1.72- 1.95)	0.13
	Injuries	1.94	(1.82- 2.07)	1.77	(1.67- 1.88)	-0.17
Norway	All neoplasms	1.28	(1.20- 1.37)	1.29	(1.20- 1.39)	0.01
	All circulatory d.	1.35	(1.28- 1.42)	1.68	(1.57- 1.80)	0.33
	All other diseases	1.58	(1.45- 1.72)	1.54	(1.42- 1.68)	-0.04
	Injuries	1.80	(1.64- 1.97)	1.88	(1.71- 2.06)	0.08
Denmark	All neoplasms	1.40	(1.32- 1.48)	1.43	(1.35- 1.51)	0.03
	All circulatory d.	1.38	(1.31- 1.45)	1.50	(1.41- 1.60)	0.12
	All other diseases	1.57	(1.46- 1.69)	1.41	(1.32- 1.51)	-0.16
	Injuries	1.65	(1.53- 1.79)	1.75	(1.60- 1.90)	0.10
England / Wales	All neoplasms	1.17	(0.99- 1.38)	1.37	(1.15- 1.63)	0.20
	All circulatory d.	1.47	(1.28- 1.69)	1.69	(1.44- 1.98)	0.22
	All other diseases	1.50	(1.15- 1.95)	1.45	(1.14- 1.85)	-0.05
	Injuries	1.33	(0.93- 1.88)	1.47	(1.02- 2.13)	0.14
Turin	All neoplasms	1.34	(1.21- 1.48)	1.44	(1.29- 1.62)	0.10
	All circulatory d.	1.23	(1.10- 1.38)	1.16	(1.01- 1.34)	-0.07
	All other diseases	1.65	(1.42- 1.90)	1.83	(1.56- 2.16)	0.18
	Injuries	1.08	(0.87- 1.33)	1.47	(1.14- 1.90)	0.39

14.4 Summary of findings

1. In each period and in each country, manual classes have higher death rates than non-manual classes for each of the four cause-of-death groups.
2. Changes in the cause-of-death composition of total mortality contributed to the widening of all-cause mortality differences in Finland and Turin, but less so elsewhere.
3. Relative inequalities generally increased for each cause of death, and especially for circulatory diseases.

14.5 Evaluation of potential problems

Problems related to the use of occupational class schemes were discussed in section 13.5. The main problem identified in that section was the exclusion of (economically inactive) men with unknown occupational class. As illustrated in that section, their exclusion causes an underestimation of the mortality difference between manual and non-manual classes. For cause-specific analysis, it is important to recognise that this underestimation can differ by cause of death. Usually, it is larger for disease of a more chronic nature, such as respiratory diseases. This differential bias may distort the comparison between causes of death. However, in the present analyses we corrected (albeit imperfectly) for this bias by means of the adjustment procedure that is presented and evaluated in chapter 13.

In analyses of smaller causes of death, the estimates were based on relatively few deaths. As a result, chance fluctuations in numbers of death were relatively large and these fluctuations may explain some of the observed changes in inequalities in mortality. In general, it was difficult to demonstrate with statistical significance that cause-specific mortality trends differed by occupational class. Conventional 95 percent levels of statistical significance could only be reached for the largest causes of death group (circulatory diseases) or when changes were large (e.g. injuries in Finland). Given the potentially large role of chance fluctuations, the conclusions in 14.4 were drawn only in more general terms.

The quality of cause-of-death registrations is another area of concern. This issue is discussed in some detail in section 12.5. Problems with the registration and coding of causes of death are likely to have little effect on the results presented in this chapter, as the analysis was confined to very broad groups of causes of death.

14.6 Conclusion for health monitoring

Longitudinal data on mortality by occupational class can be used to monitor inequalities in cause-specific mortality among middle-aged men. For smaller causes of death, the statistical power is often too low to demonstrate changes in the magnitude of inequalities.

Chapter 15.
Monitoring changes in class differences in mortality by using unlinked cross-sectional data

15.1 Background and purposes

Essential for monitoring socio-economic inequalities in mortality is that in some way information can be acquired on the socio-economic status on the deceased. In the six countries included in the previous two chapters, a link could be established between the death registry and population census records. This linkage made it possible to perform large-scale longitudinal studies, in which the socio-economic status of all persons are measured at the time of the population census, and they are followed over time to observe their mortality experience. This longitudinal approach is the most appropriate way to measure socio-economic inequalities in mortality.

In most European countries, however, a linkage between death registry and population censuses cannot yet be made. For some of these countries, an alternative source of data are 'unlinked' cross-sectional studies. In this type of study, the number of deaths during a time interval is related to the number of persons who during that same time interval were exposed to the risk of dying. The term 'unlinked' refers to the fact that the socio-economic information on the deceased and that on the living population are derived from two different sources: (a) the death registry, which provides numbers of deaths according to socio-economic status as it is registered on the death certificate, and (b) the population census, which provides the corresponding population numbers according to the same socio-economic characteristics, as it is determined during the census.

The purpose of this chapter is to utilise this source of data to study trends in class differences in mortality among middle-aged men in three countries: Ireland, Spain and Portugal. For these countries, we will perform part of the analyses that were performed in the previous two chapters for countries with longitudinal data. But before we report on these analyses, we need to briefly discuss the specific features and problems of unlinked cross-sectional data.

15.2 Problems inherent to unlinked cross-sectional studies

Unlinked cross-sectional studies are a less satisfactory source of data on inequalities in mortality than are longitudinal studies, because inherent in these studies are some problems that may bias strongly inequality estimates. The first problem is related to the cross-sectional nature of the study, and the second to its 'unlinked' nature.

Biases related to the cross-sectional nature

Longitudinal studies consist of a follow-up in which first the occupation of persons is measured at a specific moment in time and then these persons are followed over the next years in order to observe their mortality experience. If these persons die, their occupation is the one registered at the start of the follow-up. In unlinked cross-sectional studies, on the other hand, the occupation of the deceased is registered at the time of death itself.

One consequence is that no occupation would be registered for men who are economically inactive at (and shortly before) the time of dying. This problem is not essentially different from longitudinal studies with a short follow-up. But for cross-sectional studies the problem may be more serious because of lack of any follow-up time. Especially if the registration of the occupation of the deceased does not have a retrospective element, no occupation might be registered for even those men who had become unemployed only a few months before dying.

In some countries, however, the occupational information given at death certificates contains some retrospective element. In these cases, a large part of men who were economically inactive at the time of death have been given their last and longest held occupation, and they can be assigned to specific occupational classes on the basis of that information. However, there may be shortcomings in this retrospective information on the last or longest held occupation of deceased men. First, relatives may report the occupation inaccurately due to recall bias and other types of reporting error. Second, the reference period is not clear and probably highly variable from one case to another. For such reasons, the retrospective measurement may yield less accurate information than in prospective longitudinal studies.

Biases related to the 'unlinked' nature

The validity of data from unlinked cross-sectional data can also be compromised due to poor comparability of the measurement of socio-economic status on the death certificate and its measurement in the population census. This 'numerator/denominator' bias can take various forms.

One example is "promoting the dead" by which is meant the possible propensity among relatives to describe the deceased's occupation in favourable terms, or to report the 'best' occupation that they held during their lives. This propensity results in a shift of deaths from lower to higher occupational classes. If a parallel shift does not occur in the population census, the end result would be to increase the mortality rates of higher occupational classes, to decrease the rate of lower classes, and thus to underestimate the mortality difference between high and low classes.

Another example is the use of vague occupational terms. The frequent use of the term 'labourer' on English death certificates results in large number of deaths with the occupational code 'labourer not elsewhere classified'. Since the registration of occupations at the population census is much more accurate and much less people are classified in that same occupational code, the net result is an overestimate of the mortality level of this occupational code and some overestimate of the mortality level of the corresponding occupational class (i.e. unskilled labourers in the English case). Similarly, the frequent use of the term 'employee' on French death certificates resulted in an overestimation of the mortality level of the corresponding occupational class (i.e. routine non-manual workers).

One way to evaluate the potential effect of these biases is to compare inequality estimates based on cross-sectional studies with estimates based on longitudinal studies. In table 15.3, this evaluation is made for England & Wales and for France, two countries with both cross-sectional and longitudinal data. The rate ratios in this table compare high to low social classes with respect to mortality among middle-age men in about 1980-1984. The cross-sectional estimates slightly differed from the longitudinal estimates: in England & Wales they were 0.14 units too high, and in France they were only 0.06 units too low. Thus, the use of cross-sectional data can result in either an overestimation or an underestimation of the size of mortality differences by occupational class.

Table 15.1 Comparison of estimates from cross-sectional mortality studies to estimates from longitudinal studies

Country	Study	Period	Age group	Social classes compared (in both data sets)	Rate ratio
England & Wales	cross-sectional	1979-82	20-64 years at death	all manual (IIIM to V) vs. upper	1.55
	longitudinal	1981-85	20-64 years at death	non-manual (I,II)	1.38
France	cross-sectional	1981-83	45-59 years at death	semi/unskilled manual vs. upper	1.74
	longitudinal	1980-84	40-59 years in 1980	non-manual	1.80

Source: Kunst & Groenhof (1996b)

Conclusion

Cross-sectional data can be used (if no longitudinal data are available) to obtain approximate estimates of the inequalities in mortality at one moment in time. However, these estimates may be subject to bias, and the size and direction of this bias is difficult to predict a priori and might vary over time. This raises the question whether this source of data can be used to study trends over time. The experience from the United Kingdom is that, when used with caution, cross-sectional data for subsequent population censuses (and published in the " Decennial Supplements") may be used to determine trends over time in class differences in mortality among middle-aged men and women. In remainder of this chapter, we report on an analysis that attempts to use unlinked cross-sectional data to study trends in three other European countries.

15.3 Materials and methods

An overview of the data sources is given in table 15.2. Numbers of death by 5-year age group, and occupational class were obtained from studies that were centred around the population censuses of about 1980 and about 1990. The Irish and Portuguese studies covered the entire national population. The Spanish study is restricted to the eight provinces for which data on mortality by occupational class were available for both about 1980 and about 1990. These provinces together are representative for Spain as a whole in terms of overall mortality trends between 1980 and 1990.

Age was defined in terms of age at death. The data from different periods referred to the same age group, which was 30 to 59 years. Men older than 60 years had to be excluded because of lack of detailed occupational information of retired men. Women had to be excluded for similar reasons.

Table 15.2 Overview of data sources

Country	Period	Number of person-years at risk, men 30-59 years (* 1000)	Number of deaths among men 30-59 years	Restrictions in coverage
Ireland	1980-82	1431	6664	none
	1990-92	1712	5220	none
Spain	1980-82	2117	8370	8 provinces
	1988-90	2196	7411	id.
Portugal	1980-82	4453	22441	none
	1990-92	4718	20433	none

The measurement of occupational class

Three broad occupational classes were distinguished: non-manual workers, manual workers, and farmers and farm labourers. Details are given in table 15.3. For Ireland, a national social class scheme was used. For Spain and Portugal, we had to use a cruder classification based on the main groups of the International Standard Classification of Occupations (ISCO). In the available data, self employed men could not be distinguished as a separate group, and most of these men had to be combined with non-manual classes.

Table 15.3 Information on measurement of occupational class

Country	Basic data available	Social class scheme used	Changes over time	Classes excluded
Ireland	3 / 4 digit codes	national scheme	none	self employed
Spain	8 main groups of the ISCO	the same 8 groups	none	self employed
Portugal	8 main groups of the ISCO	the same 8 groups	none	self employed

Tables 15.4 and 15.5 present the distribution of (living and decreased) men by occupational class in the three periods. In all three countries, the non-manual and manual classes are the largest two classes. Farmers and farm labourers form a substantial part of the population as well. The share of the agricultural classes decreases over time. The proportion of manual classes decreases in Ireland and Spain, but seemed to increase in Portugal.

Table 15.4 Population distribution by occupational class: men 30-59 years

Country	Occupational class	Proportion (%) of the total population	
		1980-84	1990-94
Ireland	Non-manual	39.5	48.8
	Agricultural	22.5	15.6
	Manual	38.1	35.6
Spain	Non-manual	27.4	33.8
	Agricultural	25.8	19.3
	Manual	46.8	46.8
Portugal	Non-manual	36.9	37.2
	Agricultural	18.9	7.9
	Manual	44.2	54.8

Table 15.5 The total number of deaths according to occupational class: men 30-59 years

Country	Occupational class	Number of deaths	
		1980-84	1990-94
Ireland	Non-manual	2288	2153
	Agricultural	1602	1059
	Manual	2774	2008
Spain	Non-manual	1965	1549
	Agricultural	2058	1880
	Manual	4347	3982
Portugal	Non-manual	6088	6614
	Agricultural	7091	3610
	Manual	9262	10209

For some men, information was lacking on their current occupation. This especially applies to men who were economically inactive at the time of death or census. In these cases, their occupational class was, as far as possible, determined on the basis of their last occupation. Despite this, the proportion of men with unknown class was considerable in some countries. Table 15.6 gives detailed information on these men. As explained in chapter 13, their exclusion from analysis is likely to lead to an underestimation of the magnitude of mortality differences between occupational classes. However, an adjustment procedure was developed to correct for this underestimation (see also chapter 13). Table 15.6 shows one of correction factors that were used to adjust the summary indices presented below.

Table 15.6 Information on men with occupation unknown

Country	Period	Proportion (%) of all person-years at risk	Proportion (%) of total number of deaths	Relative risk of mortality unknown vs. known	Correction factor to RR manual vs. nonmanual
Ireland	1980-82	5.2	14.1	2,96	1.067
	1990-92	5.3	19.0	4.17	1.105
Spain	1980-82	1.7	11.1	7.22	1.069
	1988-90	0.6	11.9	21.13	1.082
Portugal	1980-82	9.8	24.6	3.01	1.121
	1990-92	13.4	26.1	2.28	1.107

Methods

The mortality level per occupational class was measured by means of directly standardised mortality rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation procedure, control was made for differences in age structure between occupational classes and, in addition, between countries and periods.

The time/place comparability of absolute mortality levels was affected, however, because of, among other factors, the restriction of the Spanish data to eight provinces. However, national mortality registrations with a complete coverage of every country's population could be used as an alternative source (WHO). For further details we refer to chapter 13.

The magnitude of mortality differences by occupational class was measured by means of two complementary inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the age-standardised mortality rates that were observed for non-manual and for the manual classes.
2. Rate ratios. These were calculated by means of Poisson regression analysis. The regression model included a series of terms representing 5-year age groups, and a term that represented the contrast between the non-manual and manual class.

In addition, two indices were calculated that explicitly take into account the distribution of the population over occupational classes. The first is the Population Attributable Risk (PAR), in which the class of non-manual workers was the reference group. The second is the Index of Dissimilarity (ID), based on a distinction between the three broad occupational classes. For further details we refer to chapter 13.

15.4 Results

Death rates according to occupational class are presented in table 15.7. In each country and period, manual classes have higher mortality rates than non-manual classes. The mortality rates of agricultural men are relatively low in Ireland and Spain, but high in Portugal. Mortality trends between the 1980s and 1990s are summarised in the last columns of table 15.7. National mortality rates have declined in all countries and especially in Ireland. The largest mortality declines were enjoyed by non-manual classes in Spain, manual classes in Portugal and both classes in Ireland. In each country, mortality trends were least favourable among farmers.

Table 15.7 Death rate according to occupational class: men 30-59 years

Country	Occupational class	Death rate (per 1000 person years)		Change	
		1980-84	1990-94	Absolute ('90 - '80)	Relative (%) (absolute/'80)
Ireland	Non-manual	4.7	3.2	-1.5	-32
	Agricultural	4.3	3.9	-0.4	-9
	Manual	6.2	4.6	-1.7	-27
	Total	**5.2**	**3.8**	**-1.4**	**-27**
Spain	Non-manual	3.8	2.6	-1.1	-29
	Agricultural	3.5	4.3	0.8	23
	Manual	5.4	5.1	-0.4	-7
	Total	**4.5**	**4.1**	**-0.4**	**-9**
Portugal	Non-manual	4.4	5.0	0.6	14
	Agricultural	7.6	9.9	2.3	30
	Manual	6.1	5.2	-0.9	-15
	Total	**5.8**	**5.5**	**-0.3**	**-5**

Table 15.8 presents estimates of the magnitude of the mortality difference between manual and non-manual classes. In both absolute terms (rate differences) and relative terms (rate ratios), class differences in mortality increased slightly in Ireland, increased strongly in Spain, and diminished in Portugal. The increase in Ireland is as large as in most other northern European countries, while the increase in Spain is even larger than was observed in Finland (see chapter 13). In Portugal, mortality differences between manual and non-manual groups seem to have almost disappeared by the early 1990s.

Similar changes are observed in table 15.9, which presents measures that take into account changes in the occupational composition of the male working population. Both in terms of the PAR and the ID, changes in Ireland are fairly small. Both measures showed large increases for Spain, and substantial decreases for Portugal. In Portugal, however, the two measures did not reach the value of zero (which would have implied no class differences in mortality) because they also take into account the high mortality of farmers.

Table 15.8 The magnitude of mortality differences by occupational class: men 30-59 years

Country	Inequality index	1980-84	1990-94	Change ('80 to '90)
Ireland	Rate difference	1.56	1.41	-0.14
	Rate ratio	1.35	1.45	0.10
	(95 % C.I.)	(1.28-1.43)	(1.36-1.54)	
Spain	Rate difference	1.66	2.45	0.78
	Rate ratio	1.43	1.95	0.52
	(95 % C.I.)	(1.36-1.51)	(1.84-2.07)	
Portugal	Rate difference	1.70	0.22	-1.49
	Rate ratio	1.45	1.04	-0.41
	(95 % C.I.)	(1.40-1.45)		

Table 15.9 The magnitude of class differences in mortality expressed by indices that take into account population distributions: men 30-59 years

Country	Inequality index	1980-84	1990-94	Change ('80 to '90)
Ireland	ID	7.76	7.86	0.10
	PAR	0.10	0.16	0.06
Spain	ID	9.99	12.05	2.07
	PAR	0.16	0.36	0.20
Portugal	ID	8.72	6.38	-2.33
	PAR	0.24	0.09	-0.15

A distinction by age group is made in table 15.10. Class differences in mortality are expressed in these age groups by means of the rate ratios that compare manual to non-manual classes. Among men in Spain and Portugal, the rate ratios show the well-known pattern of larger relative inequalities for younger age groups. For Ireland, however, no marked age pattern is observed (just like for England & Wales, see table 13.7). In Ireland, a small but non-significant increase is observed for both age groups. Large and significant increases are observed in Spain. In Portugal, the surprising narrowing of inequalities is observed for the younger as well as the older age group.

A distinction by cause of death is made in table 15.11. The modest widening of class differences in all-cause mortality in Ireland seems to be due mainly to an increase in inequalities in cardiovascular disease mortality. The large increases in Spain seemed to have occurred for all causes of death, and in particular for injury mortality. In Portugal, a reduction in rate ratios is observed for all causes of death. This reduction has resulted in rate ratios far below 1 for neoplasms and circulatory disease, suggesting higher mortality rates in non-manual classes.

Table 15.10 The magnitude of class differences in mortality among men in specific age groups

Country	Age group	Rate Ratio (plus 95% Confidence Intervals)		
		1980-84	1990-94	Change ('80 to '90)
Ireland	30-44	1.26 (0.99-1.60)	1.43 (1.26-1.62)	0.17
	45-59	1.41 (1.27-1.56)	1.44 (1.35-1.55)	0.04
Spain	30-44	1.48 (1.27-1.74)	2.48 (2.15-2.86)	1.00
	45-59	1.32 (1.22-1.42)	1.88 (1.73-2.04)	0.56
Portugal	30-44	1.51 (1.42-1.60)	1.09 (1.04-1.15)	-0.42
	45-59	1.38 (1.33-1.44)	1.02 (1.01-1.10)	-0.33

Table 15.11 The magnitude of manual vs. non-manual differences in mortality from specific causes of death. Men 30-59 years.

Country	Cause of death	Manual vs. non-manual rate ratio (95 % confidence interval)				
		1980-84		1990-94		Change ('80 to '90)
Ireland	All neoplasms	1.34	(1.20- 1.50)	1.43	(1.29- 1.60)	0.09
	All circulatory d.	1.28	(1.18- 1.39)	1.42	(1.29- 1.56)	0.14
	All other diseases	1.42	(1.21- 1.65)	1.40	(1.18- 1.67)	-0.02
	Injuries	1.55	(1.34- 1.80)	1.61	(1.38- 1.88)	0.06
Spain	All neoplasms	1.39	(1.26- 1.53)	1.67	(1.52- 1.84)	0.28
	All circulatory d.	1.21	(1.10- 1.33)	1.78	(1.58- 2.00)	0.57
	All other diseases	1.58	(1.42- 1.76)	1.94	(1.72- 2.18)	0.36
	Injuries	2.01	(1.71- 2.37)	3.55	(2.99- 4.22)	1.54
Portugal	All neoplasms	1.16	(1.09- 1.24)	0.95	(0.90- 1.01)	-0.21
	All circulatory d.	1.05	(0.98- 1.12)	0.82	(0.77- 0.87)	-0.23
	All other diseases	1.66	(1.57- 1.77)	1.59	(1.46- 1.72)	-0.07
	Injuries	1.98	(1.84- 2.13)	1.38	(1.30- 1.47)	-0.60

15.5 Summary of findings

1. Analysis of cross-sectional unlinked data suggest that substantial class differences in mortality existed in the 1980s in each country.

2. In both absolute and relative terms, these differences seemed to have increased slightly in Ireland and substantially in Spain. The data suggested a strong reduction in Portugal.
3. The same (and often surprising) trends were observed with other summary indices, for specific age groups and for most specific causes of death.

15.6 Evaluation of potential problems

In section 15.2 we discussed the potential problems of cross-sectional 'unlinked' studies. While these studies usually are able to demonstrate the existence of class differences in mortality, much less certain is whether they can be used to detect changes over time in the magnitude of these differences. In this chapter, we made an attempt to use these data to study trends in Ireland, Spain and Portugal.

Unfortunately, nationally representative longitudinal data were not yet available for these countries and therefore there was no yardstick against which to assess the validity of the results. One illustration may however exemplify the main point that we want to make here: the use cross-sectional data can easily lead to biased results. In table 15.12, we present results for Ireland. The first column presents our estimates for 1980-82, while the last column present our final estimates for 1990-92. The middle column presents the estimates that we made for 1990-92 in an initial analysis. In that analysis, data on the population-at-risk (the denominator) were obtained from a source that was restricted to the employed population, thereby excluding those who were seeking for work. The results obtained with these data seemed plausible in many respects. One would have concluded from these results that inequalities in mortality would have increased substantially (i.e. from 1.35 to 1.81).

Table 15.12 Sensitivity of cross-sectional mortality estimates to changes in the denominator data. Ireland, men 30-59 years.

	1980-82	1990-92	
		initial estimate	final estimate
Population distribution (%)			
- non-manual	39.5	52.2	48.8
- agricultural	22.5	17.3	15.6
- manual	38.1	30.5	35.6
Death rate (per 1000 p-years)			
- non-manual	4.7	3.0	3.2
- agricultural	4.3	3.5	3.9
- manual	6.2	5.4	4.6
RR manual vs. non-manual	1.35	1.81	1.45
change compared to 1980-82	--	+0.46	+0.10

After that these estimates were made, however, another and more appropriate source of data was identified, in which data on the population-at-risk was given for the entire economically active population, thus including those who were seeking for work. Their inclusion led to an increase in the population share of manual workers (see row 3, compare last two columns). This resulted in a decrease in the death rates of manual workers (row 6) and a decrease in the mortality rate ratio comparing manual to non-manual workers (row 7). Even though this new and more reliable estimate confirms that mortality differences increased over time, the tempo of increase now appears to be much more modest.

This example illustrates that estimates based on unlinked cross-sectional data can be strongly sensitive to subtle data problems. Results based on such data should therefore be interpreted

with caution. While we were likely to be able to obtain fairly reliable estimates for Ireland, it is less certain whether this also holds for Portugal and Spain. The results for Portugal are highly counter-intuitive. Although the Spanish results seem more plausible, there too are some surprising findings. It is difficult to believe, for example, that inequalities in cancer mortality could almost double in only 8 year time (i.e. the excess of the manual class increased 39 percent in 1980-82 to 67 percent in 1988-90).

Closer inspection of the Spanish and Portuguese data suggest that the results are biased due to subtle differences between the data obtained from the mortality registry (numerator) and the data from the population census or surveys (the denominator). This applies especially to the second period. In Spain, differential non-response in the population survey may have resulted in an under-estimation of the population size of manual workers, and thus in an over-estimation of their mortality rate. In Portugal, biases may have resulted from the fact that slightly different occupational classifications were applied in the mortality registry and in the population census. Unfortunately, because of lack of more detailed information, it was impossible to quantify and remedy these possible biases.

15.7 Conclusion for health monitoring

Cross-sectional unlinked data on mortality by occupational class can be used to monitor inequalities in mortality in some EU member states. However, these data may be subject to major biases that result in an over-estimation or under-estimation of class differences in mortality. Therefore, cross-sectional unlinked data should be used cautiously and the results should be interpreted critically.

Chapter 16.
Changes in educational differences in perceived general health

16.1 Background and purposes

An association between educational level and perceived general health has been observed consistently in a large number of studies. However, there is evidence of strong variability in the size of the effect of educational level on perceived general health. For example, an international overview that we made in 1997 showed that educational differences in general health in Denmark, Sweden and the Netherlands were much larger than in Germany, Switzerland and Spain.

This geographical variability raises the question whether how much variability there is over time. Studies from some countries have observed that educational differences in perceived health changed over time. Unfortunately, changes since the 1980s have been documented for only a few European countries. The studies carried out until now did not consistently observe either increasing or decreasing inequalities in morbidity.

The purpose of this chapter is to determine for a large number of countries whether educational differences in perceived general health increased or decreased between the 1980s and the 1990s. Data will be used from nationally representative interview surveys from eleven European countries. Parallel analyses will be made for men and women in the age group 25 to 69 years.

16.2 Materials and methods

An overview of the data sources is given in tables 16.1 and 16.2. Data were obtained from nationally representative health interview surveys or from multi-purpose surveys with a significant health component. Data were obtained from surveys that were at least 7 years apart, with first survey held in the 1980s and the second survey held in the 1990s. Only the Swiss surveys are both from the 1990s.

Table 16.2 shows that surveys differ with respect to the coverage of institutionalised populations (e.g. those living in nursing homes or homes for the elderly), the inclusion of foreigners, the interview method applied and the non-response rate. In no survey, however, there have been major changes over time in these respects.

The data analysed for this chapter relate to men and women aged 25 to 69 years. Younger respondents were excluded because full-time education was not completed by many of them. Older respondents were excluded because of small sample sizes, and because of the bias that the exclusion of institutionalised population might cause. The number of respondents 25 to 69 years varies between countries (table 16.2). Relatively large are the Austrian and Italian surveys and also the first Spanish survey.

Measurement of educational levels

In each survey, men and women were classified according to their completed educational level into maximally five levels: (1) no education, (2) elementary education, (3) lower secondary education, (4) upper secondary education and (5) tertiary education. Table 16.3 shows which of these 5 categories were distinguished in the data that were supplied, and how we combined these categories into the three levels ‘low’, ‘mid’ and ‘high’. An important guideline was to achieve for each country as much as possible a fairly even distribution of the survey population over the three levels. Due to lack of detail in the available educational data, however, the resulting population distributions were rather skewed for some countries.

Table 16.1 Overview of surveys

Country	Survey year	Survey name
Finland	1986	Finnish Survey on Living Conditions
	1994	Finnish Survey on Living Conditions
Sweden	1988	Swedish Survey on Living Conditions
	1997	Swedish Survey on Living Conditions
Norway	1985	Health Interview Survey
	1995	Health Interview Survey
Denmark	1987	Health and Morbidity Survey
	1994	Health and Morbidity Survey
England	1985	Health and Lifestyle Survey
	1995	Health Survey for England
Netherlands	1989-90	Health Interview Survey
	1997-98	Continuous Quality of Life Survey
W. Germany	1984-86	First National Health Survey
	1990-91	Third National Health Survey
Switzerland	1992	Swiss Health Survey
	1997	Swiss Health Survey
Austria	1983	Mikrozensus 1983 "Questions on Health"
	1991	Mikrozensus 1991 "Questions on Health"
Italy	1986-87	Health Interview Survey
	1994	Health Interview Survey
Spain	1987	National Health Interview Survey
	1997	National Health Interview Survey

Table 16.4 shows the resulting distribution of the respondents according to these levels. As may be expected, in every country the share of the highest educational level is higher among men than among women, and this share increases over time (except Switzerland). The share of the highest educational level is about equally large in most countries, but smaller in Spain and Turin. The educational distributions that are observed for Germany, Austria and Switzerland are somewhat different because of different educational systems in which, among other factors, more emphasis is given to vocational training.

Table 16.2 Characteristics of surveys

Country	Survey year	populations excluded from sample: INS = institutionalised FOR = foreigners	Interview method	Percentage non-response	Total number of respondents 25-69 years	
					Men	Women
Finland	1986	INS	face to face	13	4,115	4,514
	1994	INS	face to face	27	3,518	3,407
Sweden	1988	none	face to face	21	2,112	2,083
	1997	none	face to face	22	2,038	2,143
Norway	1985	INS	face to face	21	2,733	2,859
	1995	INS	face to face & self-adm.	25	2,625	2,719
Denmark	1987	none	face to face	20	1,625	1,643
	1994	none	face to face	22	1,610	1,722
England	1985	INS	face to face	26	2,403	3,252
	1995	INS	face to face	29	5,434	6,302
Netherlands	1989-90	INS	face to face	42	4,553	4,664
	1997-98	INS	face to face & self-adm.	42	5,716	5,922
W. Germany	1984-86	FOR	self-administered	34	2,416	2,370
	1990-91	FOR	self-administered	31	2,590	2,664
Switzerland	1992	INS, FOR	mainly phone	29	5,319	6,325
	1997	INS, FOR	mainly phone	31	4,421	5,312
Austria	1983	none	face to face	12	15,629	16,952
	1991	none	face to face	18	15,780	15,585
Italy	1986-87	INS	face to face	8	21,587	22,632
	1994	INS	face to face	8	18,236	19,118
Spain	1987	INS	face to face	10	9,893	10,695
	1997	INS	face to face	16	2,124	2,260

Table 16.3 Overview of educational classifications

Country	Educational level	Description	Categories
Finland	High	Post-secondary education	5
	Mid	Upper secondary education	4
	Low	Up to lower secondary education	1,2,3
Sweden	High	Upper or post-secondary education	4,5
	Mid	Lower secondary education	3
	Low	No or elementary education	1,2
Norway	High	Post-secondary education	5
	Mid	Upper secondary education	4
	Low	Up to lower secondary education	1,2,3
Denmark	High	Post-secondary education	4,5
	Mid	10 years school	3
	Low	Up to 9 years school	1,2
England	High	"Advanced level" exam (age 18) or NVQ level 3 or higher	5,4
	Mid	Certificate of Secondary Education, "Ordinary level" exam or NVQ level 1 or 2	3,2
	Low	No qualifications	1
Netherlands	High	Post-secondary education	5
	Mid	Upper secondary education	4
	Low	Up to lower secondary education	1,2,3
W. Germany	High	High level (incl. "*Hochschule*")	5
	Mid	Medium level (incl. "*Abitur*")	4
	Low	Basic education (incl. "*Hauptschule*", "*Realschule*")	1,2,3
Switzerland	High	Upper or Post-secondary education	4,5
	Mid	Lower secondary education	3
	Low	No or elementary education	1,2
Austria	High	Upper or post-secondary education	4,5
	Mid	Lower secondary education	3
	Low	No or elementary education	1,2
Italy	High	Post-secondary education	5,
	Mid	Secondary education	3,4
	Low	No or elementary education	1,2
Spain	High	Post-secondary education	5,
	Mid	Secondary education	3,4
	Low	No or elementary education	1,2

Table 16.4 Population distribution by educational level: men and women 25-69 years

Country	Educational	Proportion (%) of the total population

	level	Men		Women	
		1980s	1990s	1980s	1990s
Finland	High	18.2	23.7	14.3	19.8
	Mid	34.2	40.3	36.4	45.2
	Low	47.6	36.1	49.3	35.0
Sweden	High	24.7	29.6	23.6	30.3
	Mid	43.9	48.9	43.4	48.5
	Low	31.4	21.5	33.0	21.2
Norway	High	20.9	28.3	14.7	25.0
	Mid	20.0	33.2	13.0	21.8
	Low	59.1	38.5	72.3	53.1
Denmark	High	12.0	20.6	11.9	20.7
	Mid	31.3	31.0	34.9	36.0
	Low	56.7	48.4	53.2	43.3
England	High	16.6	32.3	14.2	21.4
	Mid	29.3	33.4	27.2	36.2
	Low	54.1	34.3	58.6	42.4
Netherlands	High	22.4	24.6	14.5	17.2
	Mid	37.3	38.1	30.5	31.5
	Low	40.3	37.3	55.1	51.2
W. Germany	High	18.5	25.3	11.3	14.6
	Mid	14.8	16.1	19.7	23.6
	Low	66.7	58.6	69.0	61.8
Switzerland	High	33.4	30.6	16.3	10.9
	Mid	50.9	52.3	53.5	59.3
	Low	15.6	17.0	30.2	29.7
Austria	High	16.3	19.8	10.8	15.2
	Mid	54.1	57.0	34.8	40.2
	Low	29.5	23.2	54.4	44.6
Italy	High	7.4	8.3	5.4	6.5
	Mid	49.8	60.8	42.0	54.5
	Low	42.9	30.9	52.6	39.1
Spain	High	14.1	15.5	8.2	14.2
	Mid	20.3	43.8	14.4	38.8
	Low	65.6	40.7	77.4	47.0

Measurement of perceived general health

The health indicator was quantified as the proportion of respondents that state that their general health is fair or poor. As a general rule, respondents with 'fair/poor' health were counted if they reported 'fair', 'poor' or 'very poor' health instead of 'good' or 'very good' health. In additional analysis, a measure was used on 'poor' health. For this indicator, respondents were counted who reported 'poor' or 'very poor' health instead of 'fair', 'good' or 'very good' health.

In nearly all countries, the same survey question with 5 answer categories was used in the two subsequent surveys. The main exception to this rule is Italy, where the first survey used a dichotomy ('felt good' or 'not good) instead of the 5 standard answer categories that were used in the second survey.

Methods

The prevalence of 'fair/poor' health per educational level was measured by means of directly standardised prevalence rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. By means of this standardisation procedure, control was made for differences in age structure between educational levels and, in addition, between men and women, between countries and between periods.

The magnitude of health differences by educational level was measured by means of three inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the prevalence rates that were observed for the highest and the lowest educational level.
2. Odds ratios. These were estimated by means of logistic regression analysis with the proportion of respondent with 'fair/poor' health as the dependent variable. The independent variables were a series of terms representing 5-year age groups, and a term that represented the contrast between the highest and lowest educational level.
3. The Relative Index of Inequality, in which the 'relative' socio-economic position of each educational group was quantified on the basis its cumulative population share (Mackenbach & Kunst 1997). This quantitative measure was related to the health indicator by means of logistic regression. The same regression model was applied as the one above, except for the revised variable on education.

16.3 Results

Basic information on the prevalence of 'fair/poor' general health by educational level is presented in table 16.5. The overall prevalence of 'fair/poor' health varies considerably between countries, with prevalence rates higher than 50 percent in Germany and lower than 20 percent in Switzerland. It should be stressed that these cross-national differences do not necessarily reflect real differences in the health of national populations. Probably more important are differences in the survey questions on perceived general health. This issue will be illustrated in section 16.5. There it is concluded that the data presented in this chapter should not be considered as evidence on differences in health between national populations.

The overall prevalence of 'fair/poor' health has decreased over time in most countries. Only in Italy, this prevalence increased among both men and women. This increase is probably due to changes in the survey question. (Recall from section 16.2 that only the Italian survey questions changed substantially over time.)

Table 16.5A Prevalence of 'fair/poor' health by education: men 25-69 yr				
Country	Educational level	Prevalence rate (per 100 respondents)		
		1980s	1990s	Change
Finland	High	25.9	23.9	-2.1
	Mid	40.2	36.9	-3.2
	Low	48.8	45.7	-3.1
	Total	**41.7**	**37.0**	**-4.7**
Sweden	High	12.0	13.1	1.1
	Mid	20.1	19.5	-0.6
	Low	24.7	26.9	2.2
	Total	**19.6**	**19.2**	**-0.4**
Norway	High	10.4	11.8	1.3
	Mid	12.9	14.9	2.0
	Low	26.5	22.1	-4.4
	Total	**20.4**	**16.8**	**-3.6**
Denmark	High	9.8	12.6	2.8
	Mid	12.6	13.9	1.3
	Low	24.9	19.8	-5.2
	Total	**19.2**	**16.5**	**-2.8**
England	High	14.2	12.8	-1.5
	Mid	21.7	12.8	-9.0
	Low	32.7	30.3	-2.4
	Total	**26.4**	**20.7**	**-5.7**
Netherlands	High	10.9	10.3	-0.6
	Mid	17.1	16.9	-0.2
	Low	27.4	25.3	-2.1
	Total	**19.9**	**18.4**	**-1.4**
W. Germany	High	46.4	45.8	-0.6
	Mid	53.8	50.7	-3.1
	Low	56.6	58.3	1.8
	Total	**54.3**	**53.9**	**-0.3**
Switzerland	High	9.3	9.4	0.1
	Mid	15.6	12.5	-3.1
	Low	17.5	21.9	4.3
	Total	**13.8**	**13.2**	**-0.6**
Austria	High	14.8	16.0	1.2
	Mid	27.0	26.1	-0.9
	Low	33.2	35.7	2.4
	Total	**26.8**	**26.3**	**-0.5**
Italy	High	19.5	21.3	1.7
	Mid	25.3	32.0	6.7
	Low	32.5	42.1	9.6
	Total	**27.9**	**34.2**	**6.3**
Spain	High	19.6	18.8	-0.8
	Mid	22.6	23.1	0.6
	Low	30.5	34.8	4.3
	Total	**27.3**	**27.2**	**-0.1**

Table 16.5B Prevalence of 'fair/poor' health by education, women 25-69 yr				
Country	Educational level	Prevalence rate (per 100 respondents) 1980s	1990s	Change
Finland	High	26.9	20.7	-6.2
	Mid	38.3	35.8	-2.5
	Low	48.0	43.3	-4.6
	Total	**41.5**	**35.4**	**-6.0**
Sweden	High	12.0	13.1	1.2
	Mid	24.8	22.3	-2.5
	Low	34.1	31.0	-3.0
	Total	**24.8**	**21.4**	**-3.4**
Norway	High	8.0	10.0	2.0
	Mid	15.7	17.5	1.8
	Low	26.0	24.2	-1.9
	Total	**22.0**	**19.2**	**-2.9**
Denmark	High	5.6	16.6	11.0
	Mid	14.4	15.5	1.2
	Low	29.6	32.3	2.7
	Total	**21.4**	**23.0**	**1.6**
England	High	17.4	14.2	-3.3
	Mid	19.2	17.1	-2.1
	Low	31.4	30.1	-1.3
	Total	**26.1**	**22.0**	**-4.1**
Netherlands	High	13.2	16.2	3.0
	Mid	18.5	19.9	1.4
	Low	26.6	29.6	3.1
	Total	**22.2**	**24.3**	**2.1**
W. Germany	High	45.5	46.1	0.6
	Mid	51.5	45.1	-6.4
	Low	62.1	60.1	-2.1
	Total	**58.2**	**54.5**	**-3.7**
Switzerland	High	14.2	10.7	-3.5
	Mid	14.3	15.8	1.5
	Low	20.3	23.0	2.8
	Total	**16.1**	**17.4**	**1.3**
Austria	High	18.9	19.1	0.3
	Mid	27.2	24.5	-2.7
	Low	36.9	35.4	-1.5
	Total	**31.6**	**28.5**	**-3.0**
Italy	High	25.0	31.8	6.7
	Mid	32.2	38.3	6.2
	Low	39.0	48.8	9.8
	Total	**35.4**	**42.0**	**6.6**
Spain	High	25.1	17.8	-7.3
	Mid	26.9	27.0	0.0
	Low	39.7	41.5	1.8
	Total	**36.7**	**32.5**	**-4.2**

Within each country, lower educated men and women more often reported 'fair/poor' general health. These inequalities persisted over time. It is not clear from the table, however, whether these inequalities increased or decreased between the 1980s and 1990s. Trends in health inequalities can be determined more accurately by using summary indices. Three indices are presented in table 16.6. Rate differences are also presented in figure 16.1.

Figure 16.1. Difference in the prevalence of fair/poor general health by educational level among men (above) and women (below). Source: table 16.6.

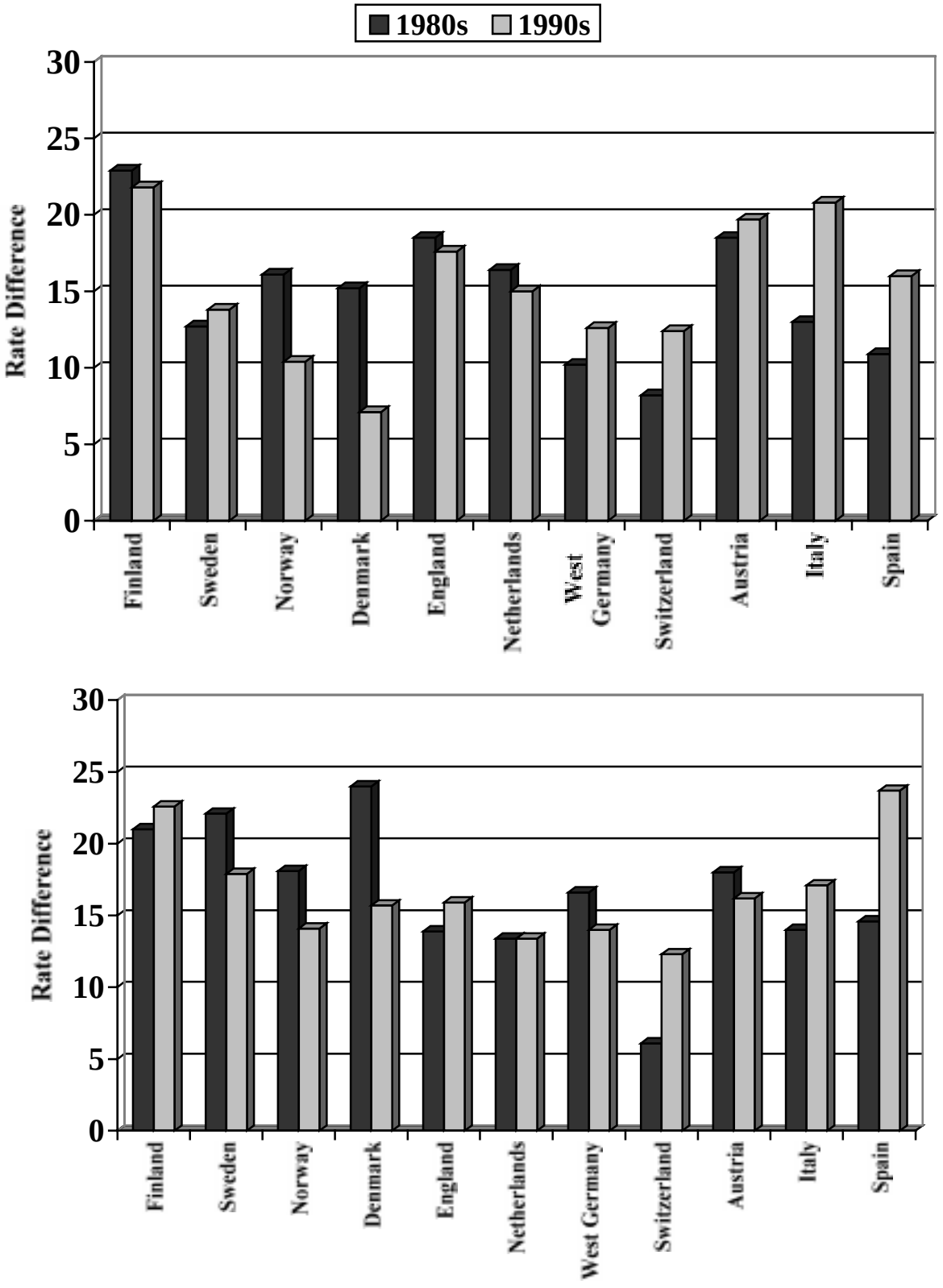


Table 16.6A The magnitude of differences in the prevalence of 'fair/poor' health by educational level: men 25-69 years

Country	Inequality Index	1980s	1990s	Change ('80 to '90)
Finland	Rate Difference	22.9	21.8	-1.0
	Odds Ratio	3.15	2.99	-0.16
	95 % C.I.	(2.55-3.88)	(2.44-3.66)	
	RII	4.40	4.43	0.03
	95 % C.I.	(3.34-5.79)	(3.36-5.85)	
Sweden	Rate Difference	12.7	13.8	1.1
	Odds Ratio	2.37	2.37	0.00
	95 % C.I.	(1.71-3.29)	(1.70-3.30)	
	RII	2.96	3.18	0.22
	95 % C.I.	(1.93-4.55)	(2.04-4.95)	
Norway	Rate Difference	16.1	10.4	-5.7
	Odds Ratio	2.93	2.3	-0.63
	95 % C.I.	(2.16-3.98)	(1.73-3.04)	
	RII	7.24	3.47	-3.77
	95 % C.I.	(4.58-11.46)	(2.32-5.21)	
Denmark	Rate Difference	15.2	7.1	-8.0
	Odds Ratio	2.31	1.66	-0.65
	95 % C.I.	(1.36-3.91)	(1.11-2.48)	
	RII	5.57	2.41	-3.16
	95 % C.I.	(3.01-10.29)	(1.37-4.25)	
England	Rate Difference	18.5	17.6	-0.9
	Odds Ratio	3.11	3.08	-0.03
	95 % C.I.	(2.27-4.25)	(2.57-3.68)	
	RII	4.82	5.64	0.82
	95 % C.I.	(3.26-7.13)	(4.33-7.35)	
Netherlands	Rate Difference	16.4	15.0	-1.4
	Odds Ratio	3.22	2.92	-0.30
	95 % C.I.	(2.53-4.09)	(2.38-3.57)	
	RII	5.39	4.54	-0.85
	95 % C.I.	(3.97-7.33)	(3.47-5.95)	
W. Germany	Rate Difference	10.2	12.6	2.3
	Odds Ratio	1.50	1.76	0.26
	95 % C.I.	(1.20-1.88)	(1.44-2.14)	
	RII	1.85	2.61	0.76
	95 % C.I.	(1.30-2.63)	(1.88-3.62)	

Switzerland	Rate Difference	8.2	12.4	4.2
	Odds Ratio	2.15	2.67	0.52
	95 % C.I.	(1.68-2.75)	(2.07-3.44)	
	RII	2.92	3.61	0.69
	95 % C.I.	(2.14-4.00)	(2.55-5.12)	
Austria	Rate Difference	18.5	19.7	1.2
	Odds Ratio	3.39	3.22	-0.17
	95 % C.I.	(2.92-3.93)	(2.79-3.71)	
	RII	3.68	4.21	0.53
	95 % C.I.	(3.13-4.32)	(3.56-4.99)	
Italy	Rate Difference	13.0	20.8	7.8
	Odds Ratio	2.05	2.94	0.89
	95 % C.I.	(1.79-2.34)	(2.54-3.40)	
	RII	2.46	3.22	0.76
	95 % C.I.	(2.16-2.79)	(2.79-3.72)	
Spain	Rate Difference	10.9	16.0	5.1
	Odds Ratio	1.86	2.59	0.73
	95 % C.I.	(1.58-2.17)	(1.81-3.67)	
	RII	2.65	3.63	0.98
	95 % C.I.	(2.13-3.29)	(2.35-5.63)	

Table 16.6B The magnitude of differences in the prevalence of 'fair/poor' health by educational level: women 25-69 years

Country	Inequality Index	1980s	1990s	Change (‘80 to ‘90)
Finland	Rate Difference	21.0	22.6	1.6
	Odds Ratio	2.86	3.29	0.43
	95 % C.I.	(2.28-3.58)	(2.60-4.18)	
	RII	3.87	4.41	0.54
	95 % C.I.	(2.94-5.09)	(3.26-5.95)	
Sweden	Rate Difference	22.1	17.9	-4.2
	Odds Ratio	3.32	3.06	-0.26
	95 % C.I.	(2.37-4.66)	(2.22-4.23)	
	RII	4.34	4.47	0.13
	95 % C.I.	(2.87-6.65)	(2.91-6.86)	
Norway	Rate Difference	18.1	14.1	-3.9
	Odds Ratio	3.10	2.84	-0.26
	95 % C.I.	(2.13-4.50)	(2.10-3.82)	
	RII	5.85	5.03	-0.82
	95 % C.I.	(3.49-9.80)	(3.22-7.85)	

Denmark	Rate Difference	24.0	15.7	-8.3
	Odds Ratio	4.81	2.33	-2.48
	95 % C.I.	(2.57-9.00)	(1.60-3.39)	
	RII	9.05	4.86	-4.19
	95 % C.I.	(4.92-16.64)	(2.85-8.29)	
England	Rate Difference	13.9	15.9	2.0
	Odds Ratio	2.08	2.66	0.58
	95 % C.I.	(1.59-2.71)	(2.21-3.19)	
	RII	3.95	4.84	0.89
	95 % C.I.	(2.80-5.59)	(3.77-6.20)	
Netherlands	Rate Difference	13.4	13.4	0.1
	Odds Ratio	2.52	2.06	-0.46
	95 % C.I.	(1.93-3.28)	(1.70-2.49)	
	RII	3.76	3.38	-0.38
	95 % C.I.	(2.75-5.14)	(2.62-4.37)	
W. Germany	Rate Difference	16.6	14.0	-2.6
	Odds Ratio	1.89	1.91	0.02
	95 % C.I.	(1.43-2.50)	(1.50-2.44)	
	RII	3.12	3.29	0.17
	95 % C.I.	(2.14-4.53)	(2.33-4.63)	
Switzerland	Rate Difference	6.1	12.3	6.2
	Odds Ratio	1.56	2.52	0.96
	95 % C.I.	(1.26-1.94)	(1.85-3.42)	
	RII	2.06	2.97	0.91
	95 % C.I.	(1.57-2.69)	(2.22-3.98)	
Austria	Rate Difference	18.0	16.2	-1.8
	Odds Ratio	2.75	2.67	-0.08
	95 % C.I.	(2.37-3.19)	(2.31-3.07)	
	RII	3.63	4.03	0.40
	95 % C.I.	(3.12-4.24)	(3.43-4.74)	
Italy	Rate Difference	14.0	17.1	3.1
	Odds Ratio	1.86	2.55	0.69
	95 % C.I.	(1.62-2.15)	(2.20-2.95)	
	RII	2.02	3.24	1.22
	95 % C.I.	(1.79-2.29)	(2.82-3.73)	
Spain	Rate Difference	14.6	23.7	9.1
	Odds Ratio	1.97	3.10	1.24
	95 % C.I.	(1.63-2.37)	(2.18-4.41)	
	RII	3.48	5.15	1.67
	95 % C.I.	(2.73-4.44)	(3.31-8.01)	

Among men, about the same trends are observed irrespective whether one looks at inequalities in absolute terms (rate differences) or relative terms (odds ratios). Inequalities widened in some countries (Germany, Switzerland, Italy and Spain), narrowed in a few other countries (Norway and Netherlands) and hardly changed elsewhere (Finland, Sweden, England and Austria).

In table 16.6, the odds ratio is complemented by the Relative Index of Inequality (RII), which has the advantages to consider all educational levels separately and to take into account changing educational distributions. The RII has a fairly complex interpretation. For example, the RII for Finnish men in the first period is 4.40. This can be interpreted to mean that the least educated man (i.e. the hypothetical man at the bottom of the educational hierarchy) has a prevalence odds that is 4.4 times as high as that of the highest educated man (i.e. the one at the top of the hierarchy). The RII essentially affirms the results that were obtained with the odds ratios. Note that decreases in RII are only observed in Norway and The Netherlands, while all other countries show small or large increases.

Among women, about the same patterns are observed. As among men, the RII declined only in Norway and The Netherlands. Substantial increases in the RII are observed for Switzerland, Italy and Spain. In all other countries, the increase in RII is small and accompanied by a decrease of inequalities in absolute terms (i.e. in rate differences).

The confidence intervals presented together with the RII and odds ratios give an idea of the statistical significance of the changes that are observed. An example are the RII for women, which showed large increases for Switzerland, Italy and Spain. For Italy, the confidence intervals do not overlap, implying that the changes in RII are statistically significant. For Switzerland and Spain, the confidence interval overlap marginally, implying borderline significance. In general, however, confidence intervals are large, also as compared to the trends that are observed. This implies that the observed trends in inequalities may to a large extent, or often even completely, be explained by chance fluctuations in the observed number of respondents with ‘fair/poor’ health.

The same calculations were made with respect to ‘poor’ general health. Data on this health indicator were available for eight countries. Table 16.7 shows that in all countries and both periods, ‘poor’ health is reported more often by persons with lower education. Table 16.8 presents a few indices of the magnitude of educational differences in ‘poor’ general health. In absolute terms, the differences between lower and higher educated people in ‘poor’ health were not as large as the differences in ‘fair/poor’ health. In relative terms (odds ratios), however, inequalities are generally larger. Thus, ‘poor’ general health has fairly low prevalence rates, but highly unequal distributions.

Inequalities in ‘poor’ health do not show the same trends over time as inequalities in ‘fair/poor’ health. Whereas the latter inequalities tended to increase in most countries, for ‘poor’ health decreases are observed as much as increases. In some of the cases where inequalities in ‘fair/poor’ health seemed to have increased (e.g. Finland and Spain) inequalities in ‘poor’ health show an opposite trend. It should however be noted that, because of low prevalence rates, chance fluctuations are large and they can easily obscure any real change in inequalities in ‘poor’ health. None of the changes in odds ratios in table 16.8 reach (not even by approximation) statistically significance.

Table 16.7A Prevalence of 'poor' health according to educational level: men 25-69 years

Country	Educational level	Prevalence rate (per 100 respondents)		
		1980s	1990s	Change ('80 to '90)
Finland	High	1.3	2.7	1.4
	Mid	8.4	6.8	-1.5
	Low	9.5	8.5	-1.0
	Total	7.6	6.4	-1.2
Sweden	High	1.8	2.7	0.8
	Mid	3.5	4.7	1.2
	Low	3.3	6.0	2.7
	Total	3.0	4.4	1.3
Norway	High	1.6	2.7	1.1
	Mid	2.4	5.3	2.9
	Low	6.7	7.6	1.0
	Total	4.7	5.5	0.7
England	High	2.4	2.7	0.3
	Mid	2.9	2.7	-0.2
	Low	7.0	8.1	1.2
	Total	5.0	5.1	0.1
W. Germany	High	13.2	9.9	-3.3
	Mid	11.2	10.7	-0.5
	Low	14.0	15.3	1.3
	Total	13.4	13.2	-0.2
Switzerland	High	1.6	2.4	0.7
	Mid	4.5	3.3	-1.2
	Low	4.7	5.4	0.8
	Total	3.6	3.4	-0.2
Austria	High	1.3	3.4	2.1
	Mid	3.9	5.6	1.7
	Low	6.1	7.0	0.8
	Total	4.2	5.5	1.3
Spain	High	4.6	4.6	0.0
	Mid	5.1	5.6	0.5
	Low	8.0	9.7	1.8
	Total	6.9	7.1	0.2

Table 16.7B Prevalence of 'poor' health according to educational level: women 25-69 years

Country	Educational level	Prevalence rate (per 100 respondents)		
		1980s	1990s	Change ('80 to '90)
Finland	High	3.6	2.6	-0.9
	Mid	4.9	5.4	0.4
	Low	7.7	6.9	-0.8
	Total	6.1	5.4	-0.7
Sweden	High	2.9	1.4	-1.5
	Mid	5.0	4.9	0.0
	Low	8.2	8.8	0.6
	Total	5.6	4.7	-0.9
Norway	High	1.6	4.3	2.6
	Mid	1.3	6.9	5.6
	Low	6.3	9.4	3.1
	Total	5.0	7.6	2.6
England	High	2.7	2.3	-0.4
	Mid	2.7	3.1	0.4
	Low	6.7	6.1	-0.7
	Total	5.1	4.2	-0.9
W. Germany	High	8.7	12.6	3.8
	Mid	15.2	10.9	-4.3
	Low	18.9	17.5	-1.4
	Total	17.0	15.3	-1.8
Switzerland	High	3.6	3.1	-0.5
	Mid	3.5	3.7	0.2
	Low	4.8	6.2	1.3
	Total	3.9	4.3	0.4
Austria	High	3.6	3.4	-0.2
	Mid	3.7	3.9	0.3
	Low	5.1	6.0	0.9
	Total	4.4	4.8	0.4
Spain	High	4.9	4.6	-0.3
	Mid	5.0	5.3	0.3
	Low	10.1	10.0	-0.1
	Total	8.9	7.4	-1.5

Table 16.8A The magnitude of differences in the prevalence of 'poor' health by educational level: men 25-69 years

Country	Inequality Index	1980s	1990s	Change (‘80 to ‘90)
Finland	Rate Difference	8.2	5.8	-2.40
	Odds Ratio	6.27	3.21	-3.06
	95 % C.I.	(3.29-11.96)	(2.05-5.04)	
Sweden	Rate Difference	1.5	3.3	1.8
	Odds Ratio	1.97	2.43	0.46
	95 % C.I.	(0.83-4.67)	(1.25-4.72)	
Norway	Rate Difference	5.1	4.9	-0.1
	Odds Ratio	3.99	3.22	-0.77
	95 % C.I.	(1.92-8.31)	(1.91-5.43)	
England	Rate Difference	4.6	5.5	0.9
	Odds Ratio	3.39	3.33	-0.06
	95 % C.I.	(1.62-7.08)	(2.33-4.77)	
W. Germany	Rate Difference	0.7	5.4	4.6
	Odds Ratio	1.22	1.63	0.41
	95 % C.I.	(0.87-1.73)	(1.19-2.24)	
Switzerland	Rate Difference	3.0	3.1	0.1
	Odds Ratio	3.18	2.34	-0.84
	95 % C.I.	(1.91-5.30)	(1.45-3.77)	
Austria	Rate Difference	4.8	3.6	-1.2
	Odds Ratio	5.01	2.30	-2.71
	95 % C.I.	(3.28-7.66)	(1.75-3.04)	
Spain	Rate Difference	3.3	5.1	1.8
	Odds Ratio	1.87	2.31	0.44
	95 % C.I.	(1.38-2.55)	(1.22-4.38)	

Table 16.8B The magnitude of differences in the prevalence of 'poor' health by educational level: women 25-69 years

Country	Inequality Index	1980s	1990s	Change (‘80 to ‘90)
Finland	Rate Difference	4.1	4.3	0.2
	Odds Ratio	2.46	2.70	0.24
	95 % C.I.	(1.43-4.24)	(1.54-4.74)	
Sweden	Rate Difference	5.3	7.4	2.1
	Odds Ratio	2.88	6.02	3.14
	95 % C.I.	(1.49-5.55)	(2.93-12.35)	
Norway	Rate Difference	4.7	5.2	0.5
	Odds Ratio	3.54	3.22	-0.32
	95 % C.I.	(1.42-8.80)	(1.91-5.43)	
England	Rate Difference	4.0	3.7	-0.3
	Odds Ratio	2.36	2.96	0.60
	95 % C.I.	(1.29-4.340	(1.96-4.49)	
W. Germany	Rate Difference	10.1	5.0	-5.1
	Odds Ratio	2.09	1.67	-0.42
	95 % C.I.	(1.32-3.29)	(1.15-2.43)	
Switzerland	Rate Difference	1.3	3.1	1.8
	Odds Ratio	1.37	2.38	1.01
	95 % C.I.	(0.90-2.08)	(1.34-4.24)	
Austria	Rate Difference	1.4	2.6	1.2
	Odds Ratio	1.46	2.10	0.64
	95 % C.I.	(1.06-2.01)	(1.54-2.87)	
Spain	Rate Difference	5.2	5.4	0.2
	Odds Ratio	2.35	2.18	-0.17
	95 % C.I.	(1.57-3.53)	(1.14-4.18)	

16.4 Summary of findings

1. Inequalities in 'fair/poor' and in 'poor' health are observed in all countries.
2. Data from a few countries suggest decreases in inequalities in 'fair/poor' health, but more often the data suggest stable or increasing inequalities.

16.5 Evaluation of potential problems

For most countries it was difficult to demonstrate with statistical significance changes over time in the magnitude of socio-economic inequalities in health. This low statistical power is due to the fairly small numbers of cases in many instances, especially when surveys have less than about 10,000 respondents and/or when an infrequent health indicator such as 'poor' general health is studied. As a general rule, one should be reluctant to attach much importance to changes that are not statistically significant, especially when there is a large overlap between the confidence intervals for two different periods.

Cross-national comparability of overall prevalence rates

Even though the survey questions are comparable over time in most countries, they are less comparable between countries. Due to these cross-national differences in the phrasing of survey questions, national prevalence rates may not be directly comparable. A striking example is the comparison between Germany and Switzerland. Even though these countries are reasonably similar in many respects, the national prevalence of 'fair/poor' health among women was 54 percent in Germany as compared to only 14 percent in Switzerland. Closer inspection of the survey questions used in these two countries revealed important differences in the phrasing of the answer categories (see table below). The higher prevalence of 'fair/poor' health in Germany can probably largely (and perhaps entirely) be explained by the much more positive wording of the 'fair/poor' answer categories.

Swiss survey		German survey	
sehr gut	(very good)	*sehr gut*	(very good)
gut	(good)	*gut*	(good)
mittelmassig	(average, mediocre)	*zufriedenstellend*	(satisfying)
schlecht	(bad)	*weniger gut*	(not so good)
sehr schlecht	(very bad)	*schlecht*	(bad)

Similar although more subtle differences (e.g. related to cultural factors and reporting tendencies) may influence comparisons between other countries. Given these differences, the data presented in this chapter should not be considered as evidence on differences in health between national populations.

Educational classifications

In some countries, more than one half of the population is combined into the lowest educational category (see table 16.4). This category is especially large among women in the 1980s. This skewed distribution has as a consequence that no information is available on health inequalities within the broad lowest category, and that health inequality estimates for these countries are based on the differences that exist between the relatively few people with higher levels of education and the rest of the population. An important question is, therefore, whether other results would have been obtained for these countries when a further distinction could be made within the lowest educational category.

Although this question cannot be answered for each country separately, due to limitations with the available data, an evaluation could be made with the data that were available for a few countries. In table 16.9, the RII is calculated with data that were available for three countries. The first column presents RII estimates based on the basic distinction of three educational levels, while the second and third columns presents RII estimates based on more detailed educational classifications. Comparison between the first and second column shows that about the same RII would be obtained whether or not a further distinction would be made within the broad lower educational group. The RII for Norway and Italy are sensitive, however, to the use of an even more detailed educational classification. These results suggest that our findings for some countries may to some degree, although not strongly, be influenced by the lack of detail in some educational classifications.

Table 16.9 The effect of further distinctions within educational levels on estimates of the size of inequalities in 'fair/poor' health: men and women 25-69 years

Country (year)	Relative index of inequality		
- sex	Distinction of 3 standard levels	Distinction within the lowest level	Further distinctions
Norway (1985)			
- men	6.98	5.85	5.93
- women	4.76	4.70	4.81
Italy (1990/91)			
- men	3.14	3.08	3.50
- women	3.14	3.27	3.74
Spain (1987)			
- men	2.74	2.69	2.75
- women	3.32	3.53	3.40

Source: Cavelaars & Kunst (1997b)

Non response

The non response rate varied from about 10 percent in Austria, Italy and Spain, to about 20 percent in most other countries, and about 40 percent in the Netherlands and West Germany. An important question is whether non response have biased estimates of educational differences in perceived general health. This bias would occur if response rates vary according to educational level and (within an educational group) response rates vary according to the health indicator. There is some evidence that response rates are generally lower among lower socio-economic groups and among less healthy persons. Uncertain is, however, to what extent non response can bias estimates of health inequalities. To our knowledge, this effect has not yet been evaluated in any European country.

An exploratory evaluation is presented in table 16.10. This table presents calculations of the effect of non response on health inequalities under some hypothetical circumstances. In these calculations, we varied three basic variables (1) the overall percentage of non-response, (2) the extent to which non response was higher among lower socio-economic group, and (3) the extent to which non response was higher among people with ‘fair/poor’ health. For each combination of variables, we estimated the odds ratio comparing higher to lower socio-economic groups. We further assumed that these two groups were equally large and that the true odds ratio was 2.0. As shown in table 16.10, this odds ratios is underestimated when non

response is related to low socio-economic status and to ill health. The underestimation is fairly small, even in the worst case of high non-response rates and strong associations with health and socio-economic status. Thus, differential non response may result in some, but probably not a dramatic, underestimation of inequalities in health.

Table 16.10 The potential effect of non-response on estimates of socio-economic inequalities in health.

Association of non-response to socio-economic status (SES) and general health	Odds ratio		
	10 % overall non-response	20 % overall non-response	40 % overall non-response
No association with SES or general health	2.00	2.00	2.00
Higher non-response with low SES [a]			
- Higher non-response with ill health [b]	1.97	1.96	1.94
- Much higher [b]	1.95	1.93	1.91
Much higher non-response with low SES [a]			
- Higher non-response with ill health [b]	1.94	1.92	1.88
- Much higher [b]	1.89	1.84	1.80

[a] Non-response is 50 % higher among those with lower SES as compared to those with higher SES. "Much" higher: 100%.
[b] Non-response is 50 % higher among respondents with fair/poor health as compared to those with good health. "Much" higher: 100%.

Important for the present chapter is the question whether the effect of non response may have changed over time. In many countries, non response rates have increased by about 5 percent (see table 16.2). Finland was the only country with a much larger increase in non response. Every else being equal, an increase in non response will result in a stronger underestimation of health inequalities in the second period as compared to the first period. In this way, a real narrowing of health inequalities may be overestimated, or a real widening of health inequalities may be underestimated. However, because the increase in non response is small in most countries, these effects are likely to be modest.

Exclusion of specific populations groups

Most surveys exclude people living in institutions like homes for the elderly, nursing homes, institutes for psychiatric patients and for mentally handicapped (table 16.2). Exclusion of these people may bias health inequality estimates if the chance of becoming institutionalised is not only related to physical or mental health, but also related to socio-economic status. There is some evidence for such a relationship. None the less, the potential effect on health inequality estimates is small or even negligible because the estimates presented in this chapter are confined to persons 25-69 years and a very small part of people in this age group lives in institutions. According to data that were available for both Finland, Sweden, Denmark, Norway, the Netherlands, Germany and Switzerland, less than one percent of these people live in institutions.

In most countries, foreigners were included in the survey (table 16.2). Exceptions were Germany and Switzerland. A substantial part of the German and Swiss populations are foreigners (e.g. 7.6 percent of West Germany in 1990). Exclusion of these people might have biased health inequality estimates, because most foreigners have a low socio-economic status and they may have worse health than native people of about the same status. This may also apply to the "*Gastarbeiter*" who were fairly healthy at the moment that they came to Germany and Switzerland, but whose health may have deteriorated since then due to poor living and working conditions. Unfortunately, no reliable estimates are available on the relative health of foreigners as compared to the native German or Swiss population. As a result, it is difficult to estimate to what extent their inclusion would have led to other health inequality estimates.

The latter problem may also be relevant to surveys from countries like Denmark and the Netherlands, where foreigners are formally included in the surveys but where non response rates among these groups are so high that they are seriously underrepresented.

16.6 Conclusion for health monitoring

Survey data on 'fair/poor' general health by educational level can be used to monitor inequalities in morbidity in most EU member states. An important advantage is that data are available on both men and women in a broad age range. However, trend estimates from some countries are surrounded by considerable uncertainty due to, among others factors, high non-response and low statistical power.

In addition, there are a number of problems that are not discussed above, but that will be addressed in sections 17.5 and 18.5 below. Perhaps most important among these problems is confounding by factors that influence the respondents' reporting of health problems.

Chapter 17.
Educational differences in trends in long-standing health problems

17.1 Background and purposes

One of the key issues in public health is whether increases in life expectancy are accompanied by decreases in the prevalence of disability and chronic diseases. Years are added to life, but is also life added to years? The debate about 'compression' or 'expansion' of morbidity has inspired many researchers to use data from subsequent health surveys to determine whether the prevalence of disease and disability have increased or decreased over the past years.

Little attention has been given, however, to the possibility that health trends differ according to socio-economic group. Perhaps constant rates for the population as a whole mask widely different trends for specific groups. It would be especially worrying to observe that health trends are less favourable among lower socio-economic groups, implying a divergence of group-specific prevalence rates. But the opposite may also happen: a convergence of the group-specific rates, with the lower socio-economic groups gradually catching up with the better off.

The purpose of this chapter is to determine whether trends in the prevalence of disease and disability vary according to educational level. More specifically, we will study whether between the 1980s and 1990s group-specific prevalence rates showed a trend towards divergence or convergence. Data will be used from nationally representative interview surveys from eleven European countries. Parallel analyses will be made for men and women in the age group 25 to 69 years.

17.2 Materials and methods

Exactly the same data sources and educational classifications were used as those presented in chapter 16. New in this chapter are the health indicators. Two indicators were used to measure the prevalence of disease and disability on the basis of the available survey data.

The first health indicator is on the presence of any health problem of long-standing nature. This indicator is based on a single question similar to " Do you suffer from any long-standing illness, disease or disability?" . For the present analyses, we measured the proportion of respondents who replied affirmatively.

The second health indicator is on the prevalence of nine groups of chronic conditions: (1) cancer, (2) diabetes mellitus, (3) heart diseases, (4) stroke, (5) chronic bronchitis / emphysema / asthma, (6) stomach / duodenum ulcer, (7) liver / gall bladder disease, (8) kidney / urinary tract disease, and (9) musculo-skeletal disease. For each group of chronic conditions, respondents were asked whether or not they have suffered from that condition during the last 12 months. On the basis of the answers to this series of questions, we measured the proportion of respondents who reported at least one of the above-mentioned conditions.

The nine groups of conditions were selected because they cover a broad spectrum of diseases and because they were included in the surveys from most countries. Note that not all diseases are covered by the aforementioned nine groups. For example, we excluded hypertension and skin diseases because previous analysis showed that some surveys included these conditions while other surveys do not, and that the in- or exclusion of these highly prevalent diseases can strongly influence the health inequality estimates.

In some surveys, changes over time occurred in the questions on which these health indicators are based. This especially applied to the series of questions on the chronic conditions. For example, in Norway, the series of questions included more chronic conditions in the second survey than in the first survey. In Spain, the first survey asked about chronic conditions *that were identified by a physician*, whereas the first survey did not make this restriction. In section 17.4, we will address the question whether such changes may have biased estimates of trends over time.

The prevalence of the health indicators per educational level was measured by means of directly standardised prevalence rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation method, control was made for differences in age structure between educational levels, countries as well as periods.

By dividing the standardised prevalence rates for an educational level by the prevalence rate for the total population (in a specific country and period), we obtained standardised prevalence *ratios*. Since direct standardisation was applied, these ratios are identical to the Comparative Mortality Figures (CMFs). Application of CMFs produces generally the same results as the more usual Standardised Mortality Ratios (SMRs), but CMFs do not have the disadvantage of the SMRs that the latter can produce biased results if age distributions differ strongly.

17.3 Results

Table 17.1 presents prevalence rates of chronic conditions by educational level and period in 11 European countries. The trends for women in selected countries are illustrated graphically in figure 17.1.

In most countries, chronic conditions are more prevalent among lower educated men. However, the differences are fairly small and prevalence rates are not consistently related to educational level among men in Finland, Germany, Switzerland and Spain, and among women in England, The Netherlands, Germany, Switzerland and Austria.

In the right part of table 17.1, we make a first attempt to determine whether trends in the prevalence of chronic conditions vary according to educational level. These trends are expressed both in absolute and relative terms.

What strikes when looking at national trends, is that the relative changes are very large in some countries while small in others. Large increases are observed among for men and women in Norway, England and Switzerland, while large decreases are observed for Spain. These large changes in the overall prevalence of chronic conditions are probably in part due to changes in survey questions and designs, rather than reflecting real changes in the prevalence of chronic conditions. Thus, absolute trends in the prevalence of chronic conditions (either nationally or per educational group) can probably not be assessed accurately with the survey data as they are currently available for some countries.

Figure 17.1. Trends in the prevalence of reported chronic conditions in high and low educational groups among women in selected countries. Source: table 17.1B.

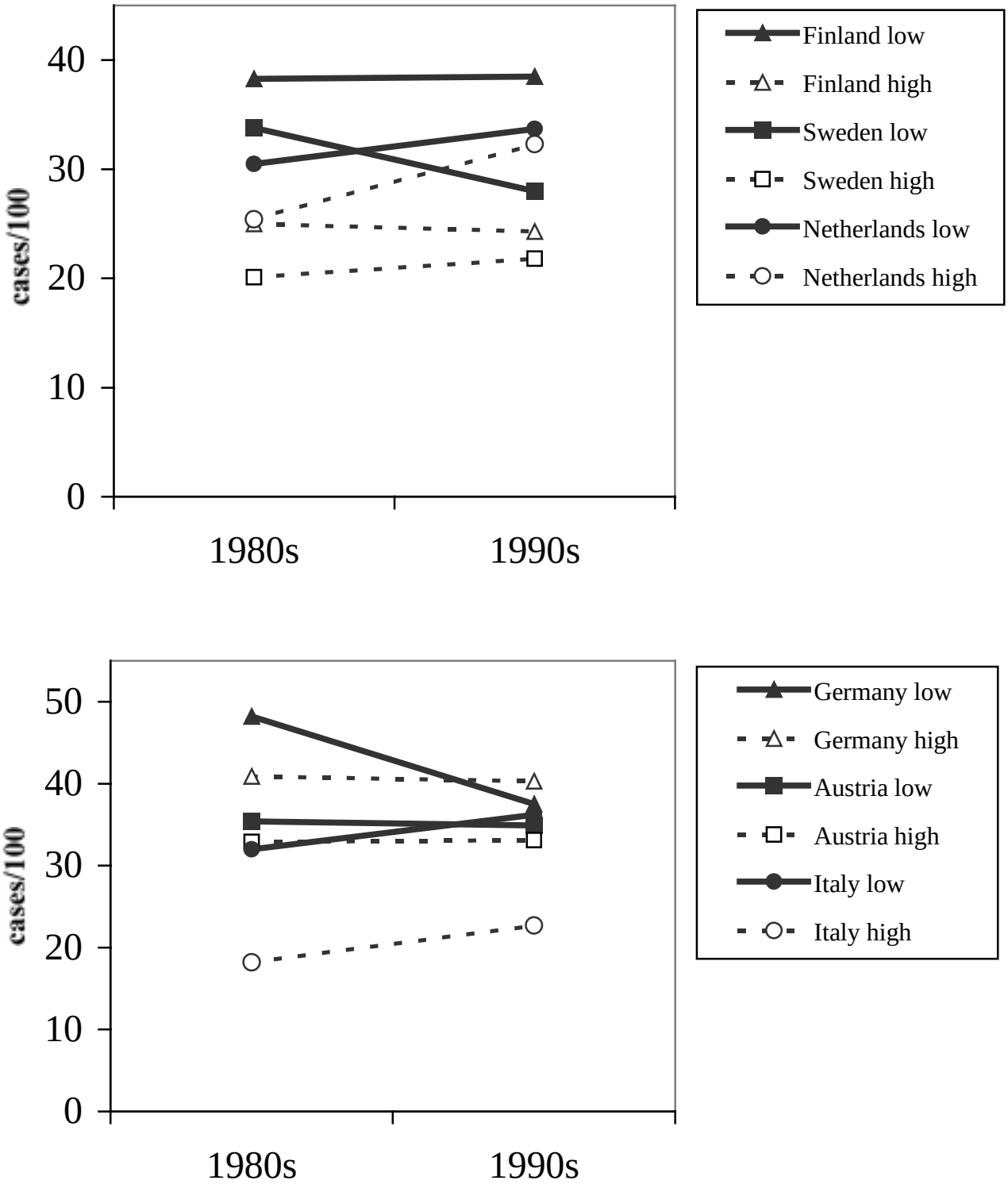


Table 17.1A Prevalence of chronic conditions by educational level: men 25-69 years					
Country	Educational level	Prevalence rate (per 100)		Change	
		1980s	1990s	Absolute ('90- '80)	Relative (%) (absolute/'80)
Finland	High	26.3	28.5	2.2	8
	Mid	35.2	38.6	3.4	10
	Low	38.9	37.9	-1.1	-3
	Total	**35.4**	**35.9**	**0.6**	**2**
Sweden	High	17.8	19.3	1.5	9
	Mid	23.8	25.2	1.5	6
	Low	28.0	27.3	-0.7	-3
	Total	**23.6**	**23.9**	**0.3**	**1**
Norway	High	21.6	34.2	12.6	58
	Mid	24.4	37.1	12.7	52
	Low	26.9	45.5	18.6	69
	Total	**25.3**	**39.5**	**14.2**	**56**
Denmark	High	12.5	17.3	4.8	38
	Mid	17.0	16.4	-0.6	-3
	Low	23.7	24.0	0.3	1
	Total	**20.2**	**20.3**	**0.0**	**0**
England	High	18.2	24.7	6.5	36
	Mid	17.9	27.5	9.6	54
	Low	22.4	31.8	9.4	42
	Total	**20.4**	**28.1**	**7.7**	**38**
Netherlands	High	18.6	21.8	3.1	17
	Mid	25.6	25.3	-0.3	-1
	Low	32.8	30.3	-2.5	-8
	Total	**26.9**	**26.2**	**-0.8**	**-3**
W. Germany	High	30.7	35.1	4.4	14
	Mid	32.4	33.5	1.1	3
	Low	32.4	34.5	2.2	7
	Total	**32.1**	**34.5**	**2.5**	**8**
Switzerland	High	10.5	14.8	4.3	41
	Mid	12.2	14.6	2.4	19
	Low	12.0	15.2	3.1	26
	Total	**11.6**	**14.8**	**3.1**	**27**
Austria	High	30.2	28.1	-2.1	-7
	Mid	36.3	35.9	-0.4	-1
	Low	39.1	38.3	-0.8	-2
	Total	**36.1**	**34.9**	**-1.2**	**-3**
Italy	High	19.1	19.4	0.3	2
	Mid	24.5	27.7	3.2	13
	Low	31.3	34.1	2.8	9
	Total	**27.0**	**29.0**	**2.0**	**7**
Spain	High	17.5	12.0	-5.5	-31
	Mid	22.2	12.0	-10.2	-46
	Low	21.9	16.9	-5.0	-23
	Total	**21.3**	**14.0**	**-7.3**	**-34**

Table 17.1B Prevalence of chronic conditions by educational level: women 25-69 years					
Country	Educational level	Prevalence rate (per 100)		Change	
		1980s	1990s	Absolute ('90- '80)	Relative (%) (absolute/'80)
Finland	High	25.0	24.3	-0.7	-3
	Mid	30.5	34.4	4.0	13
	Low	38.3	38.5	0.2	0
	Total	**33.6**	**33.9**	**0.3**	**1**
Sweden	High	20.1	21.8	1.8	9
	Mid	29.0	31.2	2.2	7
	Low	33.8	28.0	-5.8	-17
	Total	**28.5**	**27.7**	**-0.8**	**-3**
Norway	High	20.5	35.7	15.2	74
	Mid	23.5	43.1	19.7	84
	Low	29.9	44.6	14.7	49
	Total	**27.7**	**42.1**	**14.4**	**52**
Denmark	High	8.7	20.0	11.3	130
	Mid	17.1	17.5	0.4	2
	Low	23.3	22.8	-0.5	-2
	Total	**19.4**	**20.3**	**0.9**	**5**
England	High	20.1	23.4	3.3	17
	Mid	18.1	23.9	5.8	32
	Low	18.7	27.7	9.0	48
	Total	**18.7**	**25.4**	**6.7**	**36**
Netherlands	High	25.4	32.3	6.8	27
	Mid	28.7	29.9	1.2	4
	Low	30.5	33.7	3.3	11
	Total	**29.2**	**32,2**	**3.0**	**10**
W. Germany	High	40.9	40.3	-0.6	-2
	Mid	44.6	37.1	-7.5	-17
	Low	48.2	37.5	-10.7	-22
	Total	**46.7**	**37.8**	**-8.9**	**-19**
Switzerland	High	14.5	21.3	6.8	47
	Mid	12.3	18.9	6.6	53
	Low	13.6	18.7	5.0	37
	Total	**13.1**	**19.1**	**6.0**	**46**
Austria	High	32.9	33.1	0.2	1
	Mid	31.9	31.4	-0.5	-2
	Low	35.4	34.9	-0.4	-1
	Total	**33.9**	**33.2**	**-0.7**	**-2**
Italy	High	18.2	22.7	4.5	24
	Mid	23.9	29.4	5.5	23
	Low	32.0	36.2	4.2	13
	Total	**27.8**	**31.6**	**3.8**	**14**
Spain	High	14.4	6.4	-8.0	-56
	Mid	17.3	8.1	-9.2	-53
	Low	18.4	12.1	-6.3	-34
	Total	**17.9**	**9.7**	**-8.2**	**-46**

Table 17.2 presents an alternative way of looking at inequalities in trends. In this table, the prevalence of chronic conditions is not presented in absolute terms but in relative terms. The rate ratios compare the prevalence rate of each educational group to the national average. The rate ratio for high educated men in Finland in the 1980s of 0.74 implies that the prevalence was 26 percent lower than the national average for that period. This ratio increased to 0.79 in the 1990s, thus implying a convergence towards the national average of 1.00. Similarly, the rate ratio of the lower educated changed from 1.10 to 1.05, which adds to a general convergence of group-specific prevalence rates. Convergence of prevalence rates is also observed among men in Sweden, The Netherlands and Switzerland. An opposite trend of diverging rates is observed among men in England, Austria and Italy. In Norway, Germany and Spain, patterns of change are too haphazard to be described simply in terms of convergence or divergence.

Among women, convergence occurred in Sweden, Norway and The Netherlands, while divergence is observed for Finland and Spain. In other countries, trends cannot be simply be described in these terms, among others because inequalities in health were not large or consistent in the first period.

Table 17.2 Relative prevalence of (rate ratios) of chronic conditions according to educational level: 25-59 years

Country	Educational level	Men			Women		
		1980s	1990s	Change (‘80 to ‘90)	1980s	1990s	Change (‘80 to ‘90)
Finland	High	0.74	0.79	0.05	0.75	0.72	-0.03
	Mid	1.00	1.07	0.08	0.91	1.02	0.11
	Low	1.10	1.05	-0.05	1.14	1.14	-0.00
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Sweden	High	0.75	0.81	0.05	0.70	0.79	0.08
	Mid	1.01	1.06	0.05	1.02	1.13	0.11
	Low	1.19	1.14	-0.05	1.19	1.01	-0.18
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Norway	High						
	Mid	0.97	0.94	-0.03	0.85	1.03	0.18
	Low	1.06	1.15	0.09	1.08	1.06	-0.02
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Denmark	High	0.62	0.85	0.23	0.45	0.99	0.54
	Mid	0.84	0.81	-0.03	0.88	0.86	-0.02
	Low	1.17	1.18	0.01	1.20	1.12	-0.08
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
England	High	0.90	0.88	-0.01	1.07	0.92	-0.15
	Mid	0.88	0.98	0.10	0.97	0.94	-0.03
	Low	1.10	1.13	0.03	1.00	1.09	0.09
	Total	**1.00**	**1.00**		**1.00**	**1.00**	

Country	Educational level	Men			Women		
		1980s	1990s	Change ('80 to '90)	1980s	1990s	Change ('80 to '90)
Netherlands	High	0.69	0.83	0.14	0.87	1.00	0.13
	Mid	0.95	0.97	0.02	0.98	0.93	-0.05
	Low	1.22	1.16	-0.06	1.04	1.05	0.00
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
W. Germany	High	0.96	1.02	0.06	0.88	1.07	0.19
	Mid	1.01	0.97	-0.04	0.96	0.98	0.03
	Low	1.01	1.00	-0.01	1.03	0.99	-0.04
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Switzerland	High	0.90	1.00	0.10	1.11	1.12	0.01
	Mid	1.05	0.99	-0.06	0.94	0.99	0.05
	Low	1.04	1.03	-0.01	1.04	0.98	-0.06
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Austria	High	0.84	0.81	-0.03	0.97	1.00	0.02
	Mid	1.01	1.03	0.02	0.94	0.95	0.00
	Low	1.08	1.10	0.01	1.04	1.05	0.01
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Italy	High	0.71	0.67	-0.04	0.65	0.72	0.06
	Mid	0.91	0.95	0.05	0.86	0.93	0.07
	Low	1.16	1.18	0.02	1.15	1.14	-0.00
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Spain	High	0.82	0.86	0.04	0.80	0.66	-0.15
	Mid	1.04	0.86	-0.18	0.96	0.83	-0.14
	Low	1.03	1.21	0.18	1.03	1.25	0.22
	Total	**1.00**	**1.00**		**1.00**	**1.00**	

Table 17.3 presents estimates of the prevalence of any long standing health problem, as reported by respondents when they are asked for in a single question. In most countries, prevalence rates are higher among lower educational groups. There are a few exceptions to this rule, particularly England and Switzerland. The right part of table 17.3 presents absolute trends. As with the indicator on chronic conditions, the changes over time are unexpectedly large in some countries. Especially the large increase in England is likely to be due to artefacts such as changes in survey questions.

In table 17.4 trends are studied on the basis of rate ratios instead of absolute rates. Here, as in table 17.2, the national average for that period is taken as the reference. The table shows examples of both convergence and divergence of group-specific prevalence rates. Convergence occurred among men in Finland, The Netherlands and Italy, and among

Table 17.3A Prevalence of "any long standing health problem" according to educational level: men 25-69 years

Country	Educational level	Prevalence rate (per 100 respondents		Change	
		1980s	1990s	Absolute ('90 - '80)	Relative (%) (absolute/'80)
Finland	High	33.7	36.0	2.3	7
	Mid	42.6	45.7	3.2	7
	Low	46.4	46.2	-0.1	0
	Total	**42.8**	**43.6**	**0.8**	**2**
Sweden	High	32.1	33.8	1.7	5
	Mid	40.9	39.3	-1.6	-4
	Low	44.0	44.9	0.8	2
	Total	**39.7**	**38.9**	**-0.9**	**-2**
Denmark	High	11.6	13.1	1.5	13
	Mid	14.8	14.1	-0.7	-5
	Low	19.7	19.8	0.1	0
	Total	**17.2**	**16.6**	**-0.6**	**-3**
England	High	31.9	37.7	5.8	18
	Mid	28.2	40.8	12.6	45
	Low	32.9	44.5	11.6	35
	Total	**31.4**	**41.1**	**9.7**	**31**
Netherlands	High	24.6	26.2	1.6	7
	Mid	29.4	31.6	2.2	7
	Low	53.3	48.8	-4.5	-9
	Total	**38.0**	**36.7**	**-1.3**	**-3**
Switzerland	High	10.8	11.6	0.9	8
	Mid	12.0	12.8	0.8	7
	Low	9.8	13.6	3.8	38
	Total	**11.2**	**12.6**	**1.3**	**12**
Austria	High	47.9	41.0	-6.9	-14
	Mid	54.6	48.9	-5.7	-10
	Low	55.9	52.9	-3.0	-5
	Total	**53.9**	**48.2**	**-5.7**	**-10**

Table 17.3B Prevalence of "any long standing health problem" according to educational level: women 25-69 years

Country	Educational level	Prevalence rate		Change	
		1980s	1990s	Absolute (‘90 - ‘80)	Relative (%) (absolute/'80)
Finland	High	34.7	35.6	1.0	3
	Mid	40.6	41.7	1.1	3
	Low	45.5	47.7	2.2	5
	Total	**42.2**	**42.6**	**0.4**	**1**
Sweden	High	33.4	38.3	4.9	15
	Mid	45.6	46.8	1.2	3
	Low	51.0	46.5	-4.5	-9
	Total	**44.5**	**44.1**	**-0.3**	**-1**
Denmark	High	8.2	15.3	7.1	87
	Mid	14.6	14.1	-0.5	-4
	Low	20.3	17.1	-3.2	-16
	Total	**16.9**	**15.7**	**-1.2**	**-7**
England	High	33.2	37.7	4.6	14
	Mid	28.8	37.6	8.8	31
	Low	26.7	41.8	15.2	57
	Total	**28.2**	**39.4**	**11.3**	**40**
Netherlands	High	24.0	35.9	11.9	50
	Mid	31.0	35.9	4.8	16
	Low	45.6	50.7	5.1	11
	Total	**38.1**	**51.9**	**13.8**	**14**
Switzerland	High	15.3	12.4	-3.0	-19
	Mid	14.1	15.5	1.3	9
	Low	13.8	17.7	3.9	28
	Total	**14.2**	**15.8**	**1.5**	**11**
Austria	High	53.3	46.2	-7.0	-13
	Mid	58.2	52.8	-5.4	-9
	Low	60.3	55.8	-4.5	-7
	Total	**58.8**	**53.1**	**-5.7**	**-10**

women in Sweden and The Netherlands. Divergence of trends is observed for men in England and Austria, and for women in Austria and Spain. In many cases, the changes are small, implying a high degree of stability of health inequalities between the 1980s and 1990s.

Table 17.4 Relative prevalence of "any long standing health problem" according to educational level: 25-59 years

Country	Educational level	Prevalence Rate Ratio (national average = 1)					
		Men			Women		
		1980s	1990s	Change (‘80 to ‘90)	1980s	1990s	Change (‘80 to ‘90)
Finland	High	0.79	0.83	0.04	0.82	0.84	0.01
	Mid	1.00	1.05	0.05	0.96	0.98	0.02
	Low	1.08	1.06	-0.02	1.08	1.12	0.04
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Sweden	High	0.81	0.87	0.06	0.75	0.87	0.12
	Mid	1.03	1.01	-0.02	1.02	1.06	0.03
	Low	1.11	1.15	0.05	1.15	1.05	-0.09
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Denmark	High	0.68	0.79	0.11	0.49	0.98	0.49
	Mid	0.86	0.85	-0.02	0.87	0.90	0.03
	Low	1.15	1.19	0.04	1.20	1.09	-0.11
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
England	High	1.02	0.92	-0.10	1.18	0.96	-0.22
	Mid	0.90	0.99	0.09	1.02	0.95	-0.07
	Low	1.05	1.08	0.03	0.95	1.06	0.11
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Netherlands	High	0.65	0.71	0.07	0.63	0.83	0.20
	Mid	0.78	0.86	0.09	0.82	0.82	0.01
	Low	1.40	1.33	-0.07	1.20	1.17	-0.03
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Switzerland	High	0.96	0.92	-0.03	1.08	0.79	-0.29
	Mid	1.07	1.02	-0.05	0.99	0.98	-0.01
	Low	0.88	1.08	0.21	0.97	1.12	0.15
	Total	**1.00**	**1.00**		**1.00**	**1.00**	
Austria	High	0.89	0.85	-0.04	0.91	0.87	-0.03
	Mid	1.01	1.01	0.00	0.99	0.99	0.00
	Low	1.04	1.10	0.06	1.03	1.05	0.03
	Total	**1.00**	**1.00**		**1.00**	**1.00**	

17.4. Summary of findings

1. Inequalities in the self-reported prevalence of chronic conditions and long standing health problems are most (but not all) EU member states.
2. In many countries, the observed inequalities are stable over time, implying a high degree of stability of health inequalities between the 1980s and 1990s.
3. For some countries, however, a convergence or a divergence of group-specific trends is observed.

17.5 Evaluation of potential problems

In some instances, the overall prevalence rates increased or decreased substantially within less than 10 years time. These changes might in part be real. However, it is unlikely that the 'true' prevalence of chronic health problems changes so much in a short period of time. Artefacts are likely to have played a role. We will consider two types of artefacts, and discuss whether their impact may differ according to socio-economic status.

Changes in survey questions

In some cases, changes in prevalence rates may have resulted from changes in the survey questions and the general design of the surveys. An example is Spain, where the observed prevalence of chronic conditions is much lower in the second period than in the first period. A main reason is probably that the second survey asked only for chronic conditions that have been diagnosed by a doctor, whereas this restraint was not made in the first survey. According to the English and Norwegian data, the prevalence of chronic conditions strongly increased over time. In Norway, this may be due to the fact that the series of questions included more chronic conditions in the second survey than in the first survey. In England, the second survey also differed from the first survey in several details.

In many surveys, changes were made in the selection and description of the chronic conditions that respondents could report. Even though these changes did not lead to a notable shift in overall prevalence rates, they may have biased estimates of socio-economic differentials in these rates. An evaluation of this possible bias is given in table 17.5, which looks at the effect of changes in the selection of chronic conditions on estimates of educational differences in having any chronic condition. In general, these estimates appear to be quite robust. However, these estimates are strongly sensitive to whether or not musculo-skeletal diseases are included in the list. Their inclusion generally raises inequality estimates for men, while an opposite effect is observed for women. It should be noted, however, that for each country included in this chapter, musculo-skeletal diseases are included in both surveys. Thus, it is not likely that serious bias has been introduced in this way.

Non-medical determinants of reporting behaviour

The reporting of health problems does not only depend on the presence of 'objective' health problems, but also on the perception of these health problems, the wider consequences of these health problems, and the propensity to report health problems and their consequences. For example, the increase in the overall prevalence of chronic conditions that is observed in the English data might in part be attributable a growing awareness of people of

Table 17.5 The effect of changes in the selection of chronic conditions on estimates of educational differences in having one or more conditions.

Sex - country	Chronic conditions excluded from the list				
	None	Heart diseases	Liver and gall diseases	Kidney and urinary tract diseases	Musculo-skeletal diseases
Men					
- Denmark	1.78	1.79	1.77	1.83	1.36
- West Germany	1.85	1.85	1.89	1.88	1.67
- Italy	1.88	1.93	1.88	1.88	1.68
- Spain	1.38	1.42	1.38	1.34	1.19
- Sweden	1.99	2.12	2.01	2.04	1.75
- Switzerland	1.45	1.44	1.49	1.48	1.41
Women					
- Denmark	1.54	1.57	1.50	1.55	1.46
- West Germany	1.53	1.51	1.56	1.49	1.67
- Italy	1.84	1.79	1.82	1.83	2.08
- Spain	1.56	1.57	1.57	1.56	1.53
- Sweden	2.05	1.98	2.00	2.11	2.13
- Switzerland	2.09	2.04	2.14	2.11	2.22

Source: Cavelaars & Kunst (1997a)

their illnesses, prompted by an increase in health screening by general practitioners in England since the 1980s.

Factors like these may not only influence time trends in reported health problems, but also socio-economic differences in these reports. For example, a Dutch study observed that, as compared to higher educated respondents, those with lower education more often failed to report diabetes mellitus, chronic non-specific lung disease and especially heart disease. A Norwegian study showed that people from lower socio-economic groups tended to report less symptoms than people from higher groups with the same disease. These studies suggest that socio-economic inequalities in self reports of health problems may underestimate inequalities in the prevalence of 'objective' health problems.

It is uncertain whether these problems also bias estimates of *changes over time* in the magnitude of health inequalities. Empirical studies on this problem are lacking. However, given the potential for bias, we feel that one should be cautious to interpret changes in inequality estimates, and also consider the role of changing reporting behaviours.

17.6 Conclusion for health monitoring

Survey data on the prevalence of long-standing health problems by educational level can be used to monitor inequalities in morbidity in some EU member states. Data are available on both men and women in broad age range. However, trend estimates can be subject to considerable uncertainty due to, among other factors, changes in survey questions and in reporting behaviour.

Chapter 18.
Changes in income-related differences in perceived general health

18.1 Background and purposes

Studies from several countries observed that people from lower income groups more often report poor health than those with high income. The results of these studies suggested that in the 1980s health differences by income were larger in some countries than in others. For example, two independent studies observed relatively large income-related health differences in England as compared to most other northern European countries. Similar to variations between countries in income-related health differences, variations may also occur over time.

A special reason for interest in changes over time is that income inequalities have increased since the 1980s in some European countries (notably England), but remained about stable in other countries. If income inequalities increase, income-related inequalities in health might also increase. A positive association between income inequalities and income-related health inequalities has been observed in comparisons between countries, but has not yet been studied by means of comparisons over time.

The purpose of this chapter is to determine whether income-related differences in health increased or decreased between the 1980s and the 1990s in six European countries. Data will be used from nationally representative interview surveys on income and perceived general health among men and women 25 to 69 years.

18.2 Materials and methods

The same data sources and health indicator were used as in chapter 16. For England, however, data from the Health Survey of England were obtained from the 1998 (instead of 1995) survey.

New in this chapter is the socio-economic indicator: income. For each respondent, the income level is measured as the household equivalent income (HEI), i.e. the income level that is adjusted for household size. Table 18.1 gives an overview of the data on income that were available in the surveys from the six countries. These data were processed in three steps.

First, basic data on income was obtained from these surveys. Income had to be measured for the entire household (or family) instead of the respondent's individual income. Where necessary, the income of all members with a substantial earning were added. If data were available on different income components, all available income components were included. These may include interests, profits, pension, welfare benefits, property income, alimentation and scholarships. Income is measured as net income, i.e. after deductions of taxes and social security premiums.

Second, the net household income was adjusted for the household size. The household was preferably defined as an economic unity, i.e. as a consumption unit. The size of the household was measured as the total number of members of that household, including children and elderly. The HEI was calculated by dividing the net family income by the root square of the household size. This formula is similar to the one used in a previous comparative project.

Table 18.1 Overview of income data

Country	Survey year	Source of information on income	Data on net household income	Measure of income in basic data	% respondents with income unknown
Finland	1986	tax registry	yes	continuous	0
	1994	tax registry	yes	continuous	0
Sweden	1988	tax registry	yes	continuous	0
	1997	tax registry	yes	continuous	0
England	1985	questions	yes	>10 classes	22
	1997	questions	yes	>10 classes	not available
Netherlands	1989-90	questions	yes	>10 classes	20
	1997-98	questions	yes	continuous	20
W. Germany	1984-86	questions	yes	>10 classes	7
	1990-91	questions	yes	>10 classes	6
Switzerland	1992	questions	yes	5 classes	29
	1997	questions	yes	continuous	31

Finally, respondents were classified on the basis of their HEI into five income quintile groups. Table 18.2 shows the distribution of the population according to these levels. These five groups had to be equally large as measured against the total number of male and female respondents aged 25 to 69 years. However, due to irregularities in income distributions, it was often not possible to construct groups that include exactly 20 percent of the total population.

Table 18.3 gives information on the size of income differences between the quintiles. Inequalities in income in the 1990s were about equally large in most countries except England. These inequalities show a high degree of stability over time.

The prevalence of ‘fair/poor’ general health per income group was measured by means of directly standardised prevalence rates. Standardisation by 5-year age group was done by means of the direct method, with the European standard population of 1987 as the standard. Thanks to this standardisation method, control was made for differences in age structure between income groups, countries, as well as periods.

Table 18.2 Population distribution by income quintile: men and women 25-69 years

Country	Income quintile	Proportion (%) of the total population			
		Men		Women	
		1980s	1990s	1980s	1990s
Finland	1 (highest)	23.1	23.7	20.9	20.1
	2	22.8	21.1	21.3	21.4
	3	22.1	20.1	20.8	22.0
	4	18.0	18.5	20.8	20.5
	5 (lowest)	14.0	16.5	16.2	15.9
Sweden	1 (highest)	28.1	25.1	25.8	23.7
	2	26.6	23.8	23.4	21.9
	3	24.3	22.2	22.8	20.5
	4	13.9	16.4	18.0	20.0
	5 (lowest)	7.0	12.5	10.0	13.9
England	1 (highest)	28.5	23.8	21.6	20.6
	2	22.9	24.3	19.1	22.4
	3	19.9	21.3	20.3	20.4
	4	16.6	17.7	19.7	18.4
	5 (lowest)	12.0	13.0	19.3	18.2
Netherlands	1 (highest)	21.4	24.4	19.4	19.4
	2	22.5	21.4	20.9	20.3
	3	19.9	21.6	19.9	20.2
	4	17.1	18.4	19.0	20.3
	5 (lowest)	19.1	14.3	20.8	20.0
W. Germany	1 (highest)	16.6	20.0	13.9	15.4
	2	25.2	24.5	20.9	20.1
	3	18.9	19.3	18.2	21.6
	4	21.4	19.3	27.1	20.1
	5 (lowest)	17.9	17.0	19.8	22.7
Switzerland	1 (highest)	28.6	27.0	19.1	15.8
	2	18.7	28.1	15.9	25.2
	3	15.8	17.7	20.2	19.8
	4	21.1	11.5	25.2	16.6
	5 (lowest)	15.9	15.8	19.6	22.6

Table 18.3 Relative income levels of the 20th, 40th, 60th and 80th percentiles: men and women (together), 25-69 years

Country (currency)	Percentile	Household equivalent income (yearly)			
		Absolute level (in national currency)		Relative level (to the 20th percentile)	
		1980s	1990s	1980s	1990s
Finland	80 (highest)	75,500	122,700	1.98	1.92
(FIM)	60	61,000	97,700	1.60	1.53
	40	50,200	79,800	1.32	1.25
	20 (lowest)	38,100	63,900	1.00	1.00
Sweden	80 (highest)	122,218	186,535	1.92	1.97
(SKR)	60	92,399	147,628	1.58	1.56
	40	76,599	121,552	1.31	1.28
	20 (lowest)	58,399	94,682	1.00	1.00
England	80 (highest)	not	21,141	not	4.04
(GBP)	60	available	13,787	available	2.64
	40		8,719		1.67
	20 (lowest)		5,232		1.00
Netherlands	80 (highest)	33,501	42,973	2.45	2.34
(DFL)	60	23,689	32,609	1.73	1.78
	40	17,032	25,234	1.25	1.38
	20 (lowest)	13,677	18,339	1.00	1.00
W. Germany	80 (highest)	22,680	27,420	2.02	2.18
(DM)	60	17,500	21,650	1.56	1.72
	40	13,750	17,350	1.22	1.38
	20 (lowest)	11,230	12,600	1.00	1.00
Switzerland	80 (highest)	5,263	5,001	2.39	2.26
(SWF)	60	3,947	3,900	1.79	1.77
	40	3,030	3,035	1.37	1.37
	20 (lowest)	2,206	2,208	1.00	1.00

The magnitude of mortality differences by income group was measured by means of three complementary inequality indices.

1. Rate differences. These were calculated simply as the absolute difference between the prevalence rates that were observed for the lowest quintile group and the highest quintile group.
2. Odds ratios. These were estimated by means of logistic regression analysis with the proportion of respondents with 'fair/poor' health as the dependent variable. The independent variables were a series of terms representing 5-year age groups, and a term that represented the contrast between the highest and lowest quintile group.
3. The Relative Index of Inequality, in which the 'relative' social position of income quintiles was quantified on the basis their cumulative population share. This quantitative measure was related to the health indicator by means of logistic regression. The same regression model as the one above was applied, except for the revised socio-economic variable.

18.3 Results

Table 18.4A presents for men the prevalence of 'fair/poor' general health according to income quintile in six countries and two periods. In each country and period, men with lower income most often say that their general health is fair or poor. The association between income and health among men is generally linear: income and health are correlated both within the lower part and within the upper part of the income hierarchy. The precise form of the association varies between countries and periods. A relatively large health gap between the lowest and next-to-lowest quintile is observed in only a few cases (e.g. The Netherlands in the 1990s). In Sweden and Switzerland, prevalence rates in the lowest income group are not higher, and sometimes even lower, than those in the next-to-lowest income group.

The prevalence of 'fair/poor' health among men generally declined between the 1980s and 1990s. The absolute rate of change is not consistently related to income level in most countries. Exceptions to this rule are England and The Netherlands, where 'fair/poor' health declined in most income groups but increased in the lowest group.

Table 18.4B presents the results for women. As with men, women with lower income more often report fair or poor general health. The association between income and health is generally linear, but the precise form of the association varies between countries and periods. The gradient is least regular in Sweden and Switzerland, where no clear health differences are observed nor at the top nor at the bottom of the income hierarchy.

As among men, the prevalence of 'fair/poor' health among women generally declined between the 1980s and 1990s, and the absolute rate of change is not consistently related to income level in most countries. However, as among men, trends in England and The Netherlands were the least favourable among women in the lowest income group.

Table 18.4A Prevalence of 'fair/poor' health according to income level: men 25-69 years

Country	Income quintile	Prevalence rate (per 100 respondents)		
		1980s	1990s	Change ('80 to '90)
Finland	1 (highest)	34.0	26.7	-7.3
	2	39.7	38.9	-0.8
	3	44.6	41.0	-3.7
	4	50.7	41.6	-9.1
	5 (lowest)	54.5	49.0	-5.6
Sweden	1 (highest)	12.0	11.8	-0.2
	2	20.8	18.0	-2.7
	3	22.2	17.4	-4.8
	4	31.5	30.8	-0.8
	5 (lowest)	31.0	30.0	-1.0
England	1 (highest)	17.9	13.1	-4.8
	2	21.1	15.3	-5.8
	3	29.5	21.5	-8.0
	4	35.2	33.3	-1.9
	5 (lowest)	42.3	49.4	7.1
Netherlands	1 (highest)	11.6	10.8	-0.8
	2	16.9	13.2	-3.7
	3	20.4	18.2	-2.2
	4	25.3	21.5	-3.8
	5 (lowest)	31.8	35.4	3.6
W. Germany	1 (highest)	46.7	46.9	0.1
	2	51.3	53.2	2.0
	3	50.9	55.1	4.2
	4	59.2	55.9	-3.3
	5 (lowest)	59.8	62.5	2.7
Switzerland	1 (highest)	10.9	9.4	-1.5
	2	10.6	12.1	1.5
	3	12.9	16.5	3.5
	4	18.5	19.1	0.6
	5 (lowest)	18.1	14.9	-3.3

Table 18.4B Prevalence of 'fair/poor' health according to income level: women 25-69 years

Country	Income quintile	Prevalence rate (per 100 respondents)		
		1980s	1990s	Change ('80 to '90)
Finland	1 (highest)	32.9	26.9	-6.0
	2	39.5	34.4	-5.0
	3	42.3	37.2	-5.1
	4	49.1	43.1	-6.0
	5 (lowest)	51.4	42.4	-9.1
Sweden	1 (highest)	19.5	18.8	-0.7
	2	32.9	26.9	-6.0
	3	24.4	21.1	-3.4
	4	34.3	29.9	-4.4
	5 (lowest)	31.4	30.0	-1.4
England	1 (highest)	19.3	13.4	-6.0
	2	24.2	15.9	-8.3
	3	25.8	21.5	-4.3
	4	30.9	29.3	-1.6
	5 (lowest)	35.0	39.0	4.0
Netherlands	1 (highest)	15.2	15.3	0.1
	2	20.6	20.0	-0.6
	3	23.3	24.0	0.7
	4	23.9	28.5	4.6
	5 (lowest)	25.1	36.5	11.4
W. Germany	1 (highest)	51.1	43.2	-7.9
	2	53.9	47.6	-6.4
	3	58.1	53.6	-4.4
	4	58.2	58.9	0.7
	5 (lowest)	66.8	63.2	-3.5
Switzerland	1 (highest)	12.6	12.0	-0.6
	2	11.2	15.1	3.9
	3	16.5	18.6	2.1
	4	17.8	24.7	6.9
	5 (lowest)	21.6	19.6	-2.0

Table 18.5A gives a number of summary measures that help to determine whether or not health inequalities among men increased or decreased between the 1980s and 1990s. The first measure is the rate difference, i.e. the absolute difference in the prevalence rates of the highest and the lowest income quintile. Trends in this measure are illustrated in figure 18.1. This measure decreased slightly in Sweden and Switzerland, increased somewhat in Finland, The Netherlands and Germany, and increased substantially in England.

A less favourable picture emerges when inequalities are expressed in relative terms, i.e. by the odds ratio comparing the lowest to the highest income quintile. An increase in relative inequalities is observed in most countries and especially in England, where inequalities doubled. The results obtained with the odds ratio are generally consistent with those obtained with the RII. Also according to this sophisticated measure, income-related inequalities in health have strongly widened in England, and to a lesser extent in The Netherlands. The confidence intervals for the two periods do not overlap in England, implying that the observed trend is statistically significant (i.e. random fluctuations are unlikely to be the sole explanation). For the Netherlands, the overlap between confidence intervals is marginal, thus implying borderline significance. In all other countries, the number of observations appears to be much too small to demonstrate changes with statistical significance.

The same three summary measures are given in table 18.5B and figure 18.1 (below) for women. For each summary measure, a picture emerges that resembles the one for men, with a modest decrease in poor-rich health inequalities in Finland and Switzerland, a modest increase in Germany, and a substantial increase in Sweden, The Netherlands and England. In the latter two countries, the rate differences between the extreme income quintiles more than doubled. The increase in the relative indices is statistically significant for both countries.

Because income-related health inequalities increased in some countries while they decreased in others, the relative position of some countries vis-à-vis others changed. For example, as compared to English women, Finnish women had larger income-related health inequalities in the 1980s, but smaller inequalities in the 1990s. An even larger contrast in trends is observed between Finnish and English men.

Figure 18.1. Poor-rich differences in the less/fair general health among men (above) and women (below) in two periods.

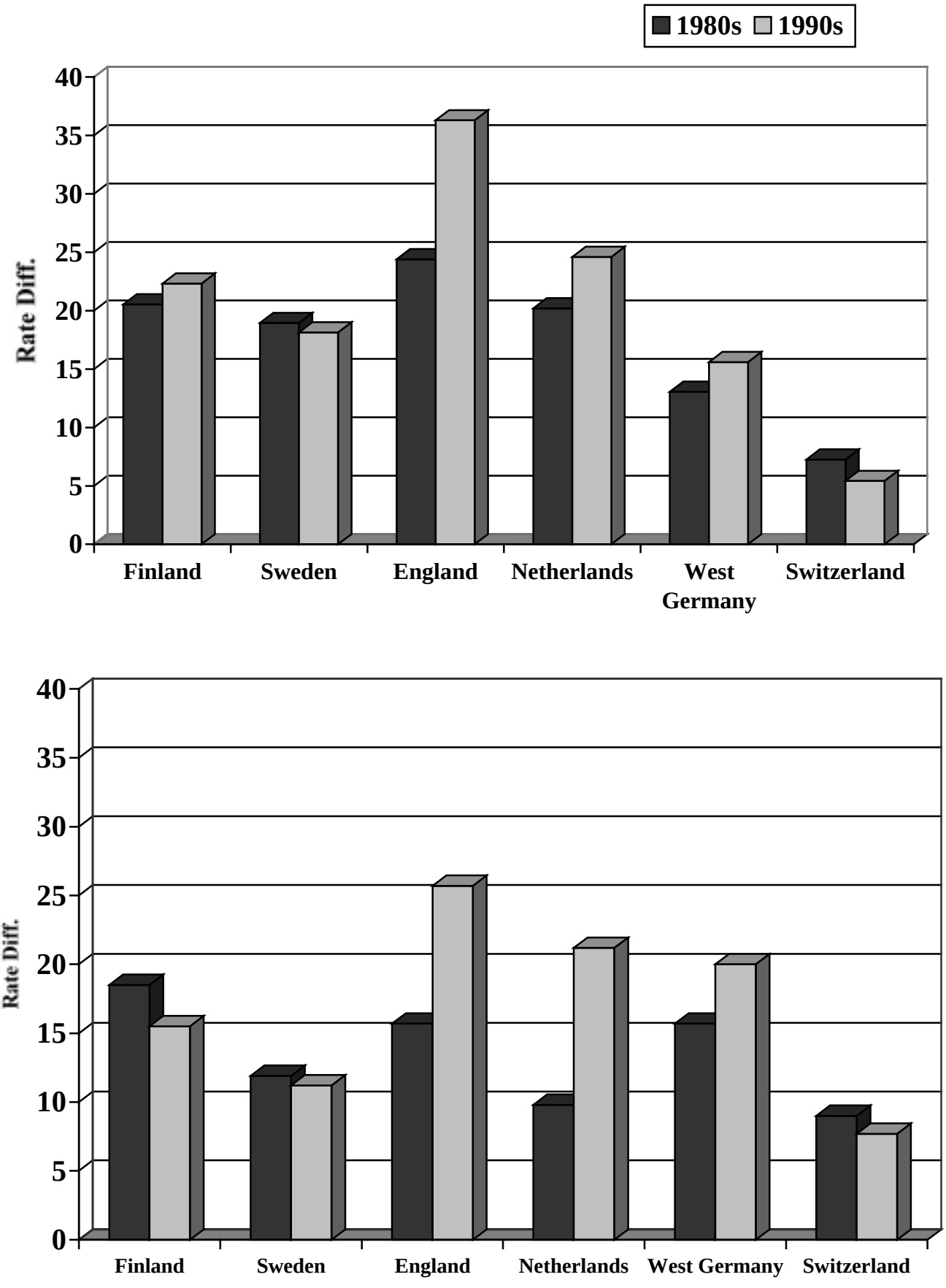


Table 18.5A The magnitude of differences in the prevalence of 'fair/poor' health by income level: men 25-69 years

Country	Inequality index	1980s	1990s	Change ('80 to '90)
Finland	Rate difference	20.5	22.3	1.8
	Odds Ratio	2.92	3.09	0.17
	95% C.I.	(2.29-3.71)	(2.42-3.94)	
	RII	3.71	3.38	-0.33
	95 % C.I.	(2.87-4.79)	(2.58-4.42)	
Sweden	Rate difference	19.0	18.1	-0.8
	Odds Ratio	3.90	4.90	1.00
	95% C.I.	(2.53-6.02)	(3.26-7.36)	
	RII	4.39	3.88	-0.51
	95 % C.I.	(2.91-6.61)	(2.59-5.81)	
England	Rate difference	24.4	36.3	11.9
	Odds Ratio	3.21	6.50	3.29
	95% C.I.	(2.29-4.52)	(5.09-8.30)	
	RII	4.70	10.20	5.50
	95 % C.I.	(3.23-6.83)	(7.76-13.40)	
Netherlands	Rate difference	20.2	24.6	4.4
	Odds Ratio	3.98	4.79	0.81
	95% C.I.	(2.97-5.33)	(3.73-6.15)	
	RII	5.15	6.27	1.12
	95 % C.I.	(3.75-7.07)	(4.72-8.33)	
W. Germany	Rate difference	13.1	15.6	2.5
	Odds Ratio	1.79	2.05	0.26
	95% C.I.	(1.33-2.39)	(1.55-2.72)	
	RII	1.98	2.08	0.10
	95 % C.I.	(1.46-2.68)	(1.54-2.81)	
Switzerland	Rate difference	7.3	5.4	-1.8
	Odds Ratio	1.77	1.60	-0.17
	95% C.I.	(1.39-2.25)	(1.20-2.13)	
	RII	2.46	2.15	-0.31
	95 % C.I.	(1.85-3.28)	(1.57-2.94)	

Table 18.5B The magnitude of differences in the prevalence of 'fair/poor' health by income level: women 25-69 years

Country	Inequality index	1980s	1990s	Change ('80 to '90)
Finland	Rate difference	18.5	15.5	-3.1
	Odds Ratio	2.65	2.43	-0.22
	95% C.I.	(2.09-3.35)	(1.86-3.18)	
	RII	3.38	2.91	-0.47
	95 % C.I.	(2.62-4.35)	(2.20-3.86)	
Sweden	Rate difference	11.9	11.2	-0.7
	Odds Ratio	2.16	2.80	0.64
	95% C.I.	(1.48-3.16)	(1.92-4.09)	
	RII	3.36	3.88	0.52
	95 % C.I.	(2.27-4.97)	(2.59-5.81)	
England	Rate difference	15.7	25.7	10.0
	Odds Ratio	2.09	4.33	2.24
	95% C.I.	(1.56-2.81)	(3.45-5.44)	
	RII	2.52	6.53	4.01
	95 % C.I.	(1.80-3.51)	(5.08-8.39)	
Netherlands	Rate difference	9.8	21.2	11.3
	Odds Ratio	1.99	3.24	1.25
	95% C.I.	(1.51-2.63)	(2.56-4.10)	
	RII	1.94	4.22	2.28
	95 % C.I.	(1.49-2.52)	(3.23-5.45)	
W. Germany	Rate difference	15.7	20.0	4.3
	Odds Ratio	2.11	2.40	0.29
	95% C.I.	(1.53-2.91)	(1.81-3.18)	
	RII	2.21	3.00	0.79
	95 % C.I.	(1.59-3.06)	(2.22-4.07)	
Switzerland	Rate difference	9.0	7.7	-1.3
	Odds Ratio	1.89	1.83	-0.06
	95% C.I.	(1.51-2.35)	(1.41-2.36)	
	RII	2.43	2.10	-0.33
	95 % C.I.	(1.90-3.11)	(1.63-2.72)	

18.4 Summary of findings

1. Large poor-rich differences in health were observed for each country. The association was generally linear, although some irregularities were observed.
2. In most countries, income-related health differences remained about stable both among men and women.
3. In The Netherlands and especially in England, poor-rich differences in health seem to have increased both in absolute and relative terms.

We should warn, however, that the next section (table 18.8) will show that different results would be obtained for England if another series of surveys would be used.

18.5 Evaluation of potential problems

Income unknown

The percentage of respondents with missing information on income varies from close to 0 percent in Sweden and Finland to more than 20 percent in England, The Netherlands and Switzerland (see table 18.1). Persons with income unknown were excluded from the analyses. This raises the question to what extent their exclusion may have biased the results for the three countries mentioned above. This bias would occur if the following conditions are met: (1) non-response is related to income level and (2) for any given income level, non-response is related to health. Both conditions will be discussed separately.

The available evidence suggests that there is no strong association between non-response and income level. A Dutch study among non-respondents to the National Health Interview Survey observed that the income distribution of non-respondents was similar to the income distribution of respondents. The lowest income group was not over-represented among non-respondents, nor was the highest income group (internal report, Statistics Netherlands). In an evaluation of the General Household Survey of England, non-response was studied in relation to a proxy for income and wealth: car ownership. Non-response rates were slightly higher among non-car owners than among car owners (internal report, Office for National Statistics).

Table 18.6 Health of respondents with income unknown in the German surveys

Gender	Survey period	% of respondents with income unknown	Prevalence (in %) of fair/poor health		
			in unknown group	in total population	difference
Men	1984-86	5.1	63.2	53.7	9.5
	1990-91	4.8	59.2	54.4	4.8
Women	1984-86	9.6	65.6	58.0	7.6
	1990-91	6.6	50.9	54.1	-3.2

Table 18.6 gives an illustration of the association between non-response and health. In the first German survey, respondents with unknown income more often report ‘fair/poor’ health than those whose income is known. In the second survey, however, this difference is small for men and even the reverse for women. In other countries too, the available evidence indicate a slightly higher prevalence of ill health among those with income unknown.
If those with income unknown (1) more often come from lower income groups and (2) more often have ill health, the net effect is a underestimation of the health differences between

lower and higher income groups. However, as was demonstrated in table 16.10, this bias would only be substantial if non-response is strongly related to both socio-economic and health indicators. The available evidence suggests that these associations are generally weak. Thus, non-response in income questions may introduce some bias, but this bias is likely to be modest.

Inaccuracies in the reporting of income

When respondents do mention an income, they may not report income accurately or validly. Measuring income accurately requires a large battery of questions, and most health interview and similar surveys have no room for an extensive measurement of income. The result may be a misclassification of respondents according to income, and this misclassification is likely to result in an underestimation of income-related health differences.

Special concern merits the lowest income group. In Sweden and Switzerland, the prevalence of ill health in this group falls below what would be expected given the general income-health relationship. This decrease is unlikely to be a true reflection of the health situation of the poorest. It is more likely to be an artefact, related to specific groups who often report 'zero' or negative income for specific reasons. For example, in the Swedish tax registry (which was linked to the survey to obtain income data) a zero income can be registered in cases of tax avoidance or irregular incomes, or for some specific households such as students living outside their parents' home. Due to these potential problems, not much weight can be attached to deviant results for the poorest, and changes over time in the relative health of this group should be interpreted with much caution.

The choice of equivalence formula

In our recommendation, a simple formula was suggested to adjust the net household income for household size (i.e. divide by the square root of the number of household members). However, more sophisticated formulae are used by most national statistical agencies. This raised the question whether these national formulae are better able to discriminate between poor and rich households and to measure the 'true' size of poor-rich differentials in health. Given this possibility, a comparison is made in table 18.8 using data from England. In this table, the size of health inequalities is estimated using two equivalence formula: our standard formula and the McClemens formula, which takes into account not only the household size, but also its composition by age. A distinction is made between adults and children (by age of the child). The results in table 18.8 show that, as expected, the McClemens formula is able to reveal somewhat larger poor-rich differences in self-reported morbidity. However, these differences are in the same order of magnitude for both equivalence scales, and the McClemens formula does not perform better in all cases.

This example underlines our general experience that the magnitude of poor-rich differences in health does not strongly depend on the precise equivalence formula that is used. Only in more extreme cases (no adjustment for household size or - the other extreme- calculation of *per capita* incomes) can different adjustment formulae produce substantially different results.

Table 18.7 Poor-rich differences in 'fair/poor' according to two different formula for calculating household equivalent income. England, men and women 25-69 years.

Inequality measure	Men		Women	
	Standard formula	McClemens formula	Standard formula	McClemens formula
Rate difference	36.3	31.5	25.7	30.8
Odds Ratio	6.50	6.24	4.33	5.59
95% C.I.	(5.09-8.30)	(4.52-8.60)	(3.45-5.44)	(4.17-7.50)
RII	10.20	10.72	6.53	9.24
95 % C.I.	(7.76-13.40)	(7.42-15.50)	(5.08-8.39)	(6.63-12.88)

Source: data from the Health Survey for England of 1997 (McClemens formula) and 1998 (standard formula)

Different surveys, different results?

A final question that equally applies to income as to other socio-economic indicators is this: would different results have been obtained if data from a different series of surveys would have been used? This question is important, as surveys can differ with regard to sample design, quality control, use of proxy interviews and other factors. All these factors may influence estimates of the magnitude of health inequalities. In addition, as chance fluctuations are largely due to the limited number of respondents per survey, the use of more (and large) surveys increases overall statistical power. Therefore, where possible, results from different surveys should be compared wherever this is possible.

In table 18.8, this kind of comparison is exemplified for England. The two surveys used in this report (the HALS and the HSE) were chosen for practical reasons, and especially because of the inclusion of questions on the prevalence of chronic conditions. However, an alternative exists with the General Household Survey (GHS). In England, this survey has some advantages, such as the larger sample size, its continuous character and its high comparability over time. An obvious question is therefore whether the same results would have been obtained for England when the GHS would have been used.

As shown in table 18.8, analyses of GHS data also reveals an increase over time in the magnitude of poor-rich differences in general health. However, the increase is much more modest than the one observed with HALS/HSE data. It is uncertain why the results differ so much. We tend to attach more confidence to the GHS data, because of its higher comparability over time. In conclusion, the combined evidence for England suggests that poor-rich health differences in England probably increased only moderately. This increase is not clearly larger than elsewhere in Europe.

Table 18.8 Poor-rich differences in 'fair/poor' according to two series of surveys. England, men and women 25-69 years

Sex - inequality measure	Health and Lifestyle Survey 1985, Health Survey England 1998			General Household Survey 1984 and 1996		
	1985	1998	Change	1984	1996	Change
Men						
- Rate difference	24.4	36.3	11.9	19.9	26.2	6.3
- Odds Ratio	3.21	6.50	3.29	3.08	3.27	0.19
95% C.I.	(2.29-4.52)	(5.09-8.30)		(2.44-3.88)	(2.64-4.04)	
- RII	4.70	10.20	5.50	3.60	3.86	0.26
95 % C.I.	(3.23-6.83)	(7.76-13.40)		(2.97-4.64)	(3.05-4.88)	
Women						
- Rate difference	15.7	25.7	10.0	20.9	29.1	8.2
- Odds Ratio	2.09	4.33	2.24	2.97	3.57	0.60
95% C.I.	(1.56-2.81)	(3.45-5.44)		(2.41-3.65)	(2.96-4.31)	
- RII	2.52	6.53	4.01	3.94	4.06	0.12
95 % C.I.	(1.80-3.51)	(5.08-8.39)		(3.11-4.98)	(3.27-5.03)	

18.6 Conclusion for health monitoring

Survey data on ‘fair/poor’ general health by income level can be used to monitor inequalities in morbidity in some EU member states. Data are available on both men and women in broad age range. However, trend estimates are inevitably surrounded by considerable uncertainty due to, among other factors, low statistical power and inaccurate measurement of income.

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