Open Comparison and Assessment 2009 – Cardiac Care

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Preface

One of the responsibilities of the National Board of Health and Welfare is to submit periodic reports on the state of Swedish healthcare and medical services, and to chart the progress made towards fulfilling the goal of good health and equitable care for all, as defined in the Health and Medical Services Act. This piece of legislation also requires compliance with the requirements of good care. The latter term has now been adopted by the Board as an objective covering six criteria that are detailed below. To discharge this responsibility the Board undertakes independent national assessments of healthcare and medical services, and it also employs its Good Care criteria to produce open comparisons of processes, outcomes and costs in this field. A further aspect of this task involves the development and definition of national indicators of Good Care.

This report takes the form of an open comparison and assessment of cardiac care processes and outcomes, which it aims to highlight and assess by means of indicator-based comparisons of different hospitals and providers. This assessment is based on both the 2008 national cardiac care guidelines published by the Board and its six Good Care criteria. These stipulate that cardiac care should be efficient, safe, patient-centred, effective, equitable and timely. Cardiac care data already available have been used in this assessment, which focuses only on aspects that this data are able to elucidate.

The report is a baseline study in relation to the updated guidelines as the data are from 2007 and earlier. However, the Board does intend to use the report as an important basis for future evaluations of the impact of the guidelines on cardiac care processes and outcomes. Decision-makers in the field of health and medical services at national, regional and local levels and cardiac care professionals comprise the target group for this report.

Report data have been drawn from the Board's health data registers, while six national cardiac care quality registers have also contributed data. Their representatives viewed the draft report and made valuable comments. Without their assistance, this report would not have been possible and, accordingly, we extend to them our sincerest thanks.

The report saw the light of day largely thanks to the work of a working group, whose members were *Helena Brändström, Rosita Claesson Wigand, Kristina Eklund, Mikael Fabel, Max Köster, Marie Lawrence* (project manager) and *Björn Nilsson* as well as *Bertil Lindahl,* (medical expert and head of UCR, Uppsala Clinical Research Center) and *Fredrik Westander* (consultant)

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Appendix 1, 3, 5 and 6 are available in Swedish at www.socialstyrelsen.se

Summary

This report is an open comparison and assessment of cardiac care processes and outcomes. It is the first in a new series of independent national assessments to be published by the National Board of Health and Welfare. The area of cardiac care was chosen following the spring 2008 release of national cardiac care guidelines.

The overall objective of the report is to undertake an indicator-based assessment and comparison of the quality of cardiac care, focusing particularly on:

- whether cardiac care is provided in line with the Board's recommendations as stated in the 2008 national cardiac care guidelines [1],
- whether it is provided in accordance with the six criteria of the Good Care objective [2]. The Board has defined good care as being both efficient and of high quality. Good Care is defined as *effective, safe, patient-centred, timely* and *equitable* care,
- whether the outcomes are as good as could be expected in terms of mortality and disease recurrence.

The report is a baseline study in relation to the updated guidelines as the data are from 2007 and earlier. However, the Board intends to use the report as an important basis for future evaluations of the impact of the guidelines on cardiac care processes and results.

Decision-makers in the government, county councils and regions, both elected representatives and public officials, as well as managers within the healthcare and medical services comprise the target group for this report. The National Board of Health and Welfare presume that the results will lead to improvements in cardiac care.

In total forty-five indicators were used in the assessment of the quality of care at national, county council and hospital levels. The indicators covered the diseases included in the updated national guidelines for cardiac care published in February 2008, namely acute coronary syndrome; arrhythmia and heart failure; as well as valvular heart diseases and congenital heart diseases. National data sources included the Prescribed Drug Register, the Cause of Death Register and the Patient Register, as well as six Health Care Quality Registers.

The outcomes are presented in the report in the form of national trends and county council and hospital comparisons.

Recommendations by the National Board of Health and Welfare

Areas that need improvement

Within certain areas improvements are clearly needed by all or most of the county councils and hospitals, which are recommended to commence this process without delay. The Board expects the majority of them to achieve the following:

- An increase in the percentage of patients with ST-segment elevation infarction receiving reperfusion treatment (restoration of blood flow to the heart)
- A reduction in the time between the first ECG and the start of reperfusion treatment in patients with ST-segment elevation infarction
- An increase in the number of patients treated with lipid-lowering drugs after an infarction
- Greater efforts to reduce the percentage of patients who continue to smoke after an infarction
- A reduction in the length of sick leave after an infarction
- A greater use of anti-coagulant treatment (Warfarin) in patients with atrial fibrillation and at further risk from thrombosis and strokes
- A greater use of implantable defibrillators (ICD) as primary and secondary preventive measures for the appropriate patient groups
- A greater number of pacemakers for cardiac resynchronisation therapy (CRT) in heart failure patients
- Shorter valve surgery waiting times

Reducing mortality after infarction

There is considerable variation in mortality among county councils, which indicates that it is possible to further reduce it during and after an infarction. In the latter case, this can be done by the following measures, among others:

- Further increasing the percentage of ST-segment elevation infarctions treated with reperfusion at the majority of hospitals
- Shortening treatment waiting times
- Further improving diagnostics and drug treatment for infarction patients after discharge

Improving the potential for assessment of cardiac care

- Development of new and existing indicators for cardiac care is needed. This is a joint task for the National Board of Health and Welfare, the quality registers and the Swedish Association of Local Authorities and Regions (SALAR).
- To improve reporting of data to the Patient Register and the quality registers, the county councils and hospitals are urged to take suitable measures to enable them to report complete data to these bodies.

- New sources of data need to be developed for key areas where national data are inadequate. This includes measures relating to primary care prevention, rehabilitation and treatment. It also includes how patients and their next-of-kin perceive care as well as health care costs.

Healthcare, the Good Care objective and national guidelines

A further issue that the National Board of Health and Welfare wished to investigate is whether healthcare is provided in accordance with the six criteria of the Good Care objective, i.e., whether it is *effective, safe, patient-centred, timely, equitable* and *efficient*. The national cardiac care guidelines provide the basis for such an assessment.

The National Board of Health and Welfare however found that it cannot give a complete answer to this question, the reason being that there are no national data that elucidate all six criteria. However, on the basis of the forty-five indications, the Board can draw the following conclusions about Good Care in cardiac care.

Effective healthcare and medical services

The assessment shows that there are areas where all the county councils and hospitals show outcomes that can be evaluated as good. Examples of such areas are treatment with anticoagulant drugs after myocardial infarction, both at the point of discharge and after twelve to eighteen months, and also treatment with beta-blockers after myocardial infarction patients are discharged. At the same time the National Board of Health and Welfare is aware that within many areas there are major variations among both county councils and hospitals. (Please refer to the Recommendations above).

Safe healthcare and medical services

The National Board of Health and Welfare highlights safe healthcare and medical services in the report using a small number of indicators relating to complications and mortality after planned surgery. The indicators studied reveal that in general, the number of serious complications and deaths due to surgery is low.

Patient-centred healthcare and medical services

The report does not contain any indicators that show whether care is patient-centred, the reason for this being that at present there is no national data source that allows a follow-up of patients’ perceptions of cardiac care measures.

Efficient healthcare and medical services

Several county councils should be able to reduce their drug costs by prescribing the cheapest alternative among equivalent pharmaceuticals. Apart from that, on the basis of the data collected, the National Board of Health and Welfare is unable to evaluate cardiac care efficiency.

Equitable healthcare and medical services

In the majority of areas, the description of the data indicates that cardiac care does not show any unjustified differences in the care and treatment of men and women. Within a small number of areas there are gender differences where further studies should be undertaken, for example, implantable defibrillators (ICD) in patients with a heightened risk of sudden death, and also the insertion of pacemakers for cardiac resynchronisation therapy (CRT) in patients with severe heart failure.

Patient mortality in myocardial infarction is considerable lower for those patients registered in the Register of Information and Knowledge about Swedish Intensive Care Admissions (RIKS-HIA) than their counterparts in the Patient Register. This difference may have a natural explanation but further studies should be undertaken.

Timely healthcare and medical services

There are major variations among county councils and hospitals with respect to hospital delays and waiting times for surgery.

Quality of post-infarction treatment

Mortality after myocardial infarction has dropped dramatically in recent decades but there are, however, major differences among the county councils, which indicates that certain councils can reduce mortality even further. This will require both further refinement of the indicators, so that they highlight the outcomes better, and studies of variations in population morbidity.

Introduction

Background

One of the responsibilities of the National Board of Health and Welfare is to submit periodic reports on the state of Swedish healthcare and medical services, and to chart the progress made towards fulfilling the goal of good health and equitable care for all, as defined in the Health and Medical Services Act. This piece of legislation also requires compliance with the requirements of good care.

The National Board of Health and Welfare launched the concept of the Good Care objective to accompany the publication of its regulations for quality and patient safety management systems in healthcare and the medical services (SOSFS 2005:12). The guidance for these regulations states that Good Care means that all healthcare and medical services should be efficient, safe, patient-centred, effective, equitable and timely.

To discharge this responsibility the Board undertakes independent national assessments of healthcare and medical services, and it also employs its Good Care criteria to produce open comparisons of processes, outcomes and costs in this field. A further aspect of this task involves the development and definition of national indicators of Good Care.

The National Board of Health and Welfare also develops indicators for use in the open comparisons of the quality and efficiency of healthcare and medical services that it publishes. These indicators are an important prerequisite for the assessments of different operations within healthcare and medical services, as well as a means of following up the trend over time and openly describing these matters.

The National Board of Health and Welfare also draws up national guidelines for the care and treatment of serious chronic illnesses. These play a key role in determining the significance of Good Care to specific groups of illness, above all with regard to the evidence-based manner in which care and treatment are to be administered.

Purpose and limitations

This report is an open comparison and assessment of cardiac care processes and outcomes. It is the first in a new series of independent national assessments by the National Board of Health and Welfare and contains recommendations on measures to develop and improve cardiac care. This area was chosen for this study in connection with the spring 2008 release by the Board of national guidelines.

The report aims to openly compare and assess cardiac care in Sweden with reference to the following issues:

- whether cardiac care is provided in accordance with the six criteria of the Good Care objective that stipulate that it should be efficient, safe, patient-centred, effective, equitable and timely,
- whether cardiac care is provided in line with the Board's recommendations as contained in its 2008 national cardiac care guidelines,
- whether the outcomes are as good as could be expected in terms of mortality and disease recurrence.

Report methodology involves openly comparing and assessing cardiac care processes and outcomes by comparing different county councils and hospitals using measurable indicators. A total of forty-fives are used that reflect different aspects of cardiac care, and the majority of them refer to coronary artery disease. Not only does this disease have such a major impact on public health, but there is also an ample supply of data, especially in the case of myocardial infarction.

The report is a baseline study in relation to the updated guidelines as the data are from 2007 and earlier. However, the Board does intend to use the report as an important basis for future evaluations of the impact of the guidelines on cardiac care processes and outcomes.

Criteria as to what can be considered satisfactory goal compliance are required in order to assess whether cardiac care meets the requirements for Good Care and is provided in line with the recommendations of the national guidelines. These, however, do not contain any such strict criteria with quantified target levels. On the other hand, they do indicate high-priority treatments and measures.

As there are no nationally set target levels, these assessments are based primarily on the priorities recommended in the guidelines and also on the differences in different parts of the country, as well as the time trend.

In principle, cardiac care costs should also be included in assessments of this kind. In the future, certain cost estimates will be included in projects that will focus on cardiac care as a pilot area and also deal with the links between process, outcomes and costs.

Target group

The target group for this report is decision-makers in the government, county councils and regions; both elected representatives and public officials as well as managers within the healthcare and medical services in both the public and private sectors. In addition, the various stakeholders, such as patient associations, healthcare professionals and the media should be able to benefit from the report, and it will also provide support for the public debate on healthcare and medical services.

Patients seeking care do not comprise a separate group for this assessment, even if their choice of care can be influenced by information. A considerable number of these comparisons refer to cases of acute illnesses, where in practice patients cannot choose care providers in the same way as in planned care.

Collaboration and communication

This report has been prepared by a project group at the National Board of Health and Welfare. Its members worked with the national quality registers, primarily to gain access to their data. Representatives of all these bodies were allowed to present their views on the indicator texts for which they have contributed data.

The contents of the report have been presented in a variety of contexts to a number of stakeholders. These bodies include: the Healthcare and Medical Services Directors' Group, the Swedish Society of Nursing, the Swedish Society of Medicine, the Swedish Disability Federation's collaborative body, Famna – The National Organization of Non-profit Providers Within Health and Social Care, The Swedish Association of Private Healthcare Providers (Vårdföretagarna) and the Swedish Association of Local Authorities and Regions (SALAR). All healthcare and medical services providers have been given an opportunity to acquaint themselves with the indicators, results and conclusions prior to the final publication of the report.

A large number of people took part in this project and made a variety of contributions to it, both at the National Board of Health and Welfare and elsewhere. For further details, please contact the Board.

Future projects

The National Board of Health and Welfare has been given a remit by the government to develop the foundations of suitable compensation systems within healthcare and medical services. Part of this remit is the implementation of an in-depth study of the connections between quality and costs, using cardiac care as a pilot area. This study was published in June 2009 and is now available; at present only in Swedish [3]. It is intended that it will contribute towards a greater knowledge of how to measure the efficiency of cardiac care in Sweden.

For the past three years, the National Board of Health and Welfare has published the annual report *Quality and Efficiency in Swedish Health Care* in collaboration with SALAR. Cardiac care is one of the areas covered and the 2008 report describes eight indicators, all of which are also found here. Future open comparisons will use the indicators in this report as a basis for making any changes to the selection of indicators.

In future years the National Board of Health and Welfare will publish further assessments in a number of areas. The ones that are topical are those where the Board is drawing up national guidelines for care and treatment, and other areas which, for a variety of reasons, it is considered important to highlight in this manner. In the open comparisons, process and outcomes there were areas where wide geographical variations were typically found. In 2009 and 2010, in addition to this report on cardiac care, the Board will publish open comparisons and assessments of primary care, psychiatry and stroke care.

Disposition of the report

The different sections of the report are addressed to different target groups and, to a certain extent, the text in each section is designed for a specific main group, which means that each different target group may perceive the accessibility of the report as variable. The main target groups for each section are shown below and the further disposition of the report is as follows:

The chapter *Recommendations and evaluations* is intended primarily for political and administrative decision-makers at national level, as well as healthcare and medical services providers. It opens with the recommendations of the National Board of Health and Welfare, stated against the background of the various outcomes in the report. Furthermore, the outcomes of the comparisons are summarised, but above all, they are discussed and assessed with regard to the principal issues in the report. These are whether cardiac care complies with the criteria of the Good Care objective, whether it is provided in accordance with the recommendations in the guidelines and whether the outcomes are as good as could be expected in terms of mortality and disease recurrence.

The Chapter *Method* describes the composition of the indicators, sources used and various methodological aspects.

The Chapter *Description of results – trends and comparisons* is the core of the report and is aimed primarily at managers and staff in cardiac care as well as quality managers at the county councils and hospitals. Forty-five indicator-based comparisons are presented here that reflect cardiac care quality and resource use. Diagrams, descriptive texts and evaluations of outcomes are presented for each indicator. Data are shown for county councils and hospitals as well as the national time trend. When there are differences between the sexes that may indicate inequality in care and treatment, these are also shown.

Recommendations and evaluations

In this chapter, the National Board of Health and Welfare makes recommendations on cardiac care based on the evaluation of the results of various comparisons described in the report.

In addition to the evaluations in this chapter, in Appendix 6 the Board presents county council and hospital profiles with comments on each council's strengths and improvements areas.

The names of all the indicators used in the report include both one of the letters A to E and a number that comprise the designations used below. Please refer to the Chapter entitled *Method* for a list of each indicator name in full together with its code designation.

Recommendations

Based on the description of results in the Chapter entitled *Description of results – trends and comparisons* and on the evaluations contained in this chapter, the Board here presents some concise recommendations on how work ought to proceed and the measures that ought to be taken by healthcare and medical services. These recommendations are addressed to the management of healthcare and medical services providers and to those responsible for cardiac care, but in certain instances also to those responsible for the quality register. The Board also singles out some development needs with respect to the supply of data, which will entail commitments on the part of the Board and other actors.

Undertake measures in areas that need improvement

Certain areas are clearly in need of improvement in the case of all or most of the county councils and hospitals, within which the latter are recommended to take suitable measures without delay.

In the case of *acute coronary artery disease*, one such improvement area is the percentage of patients treated with reperfusion therapy (restoration of blood flow to the heart) in ST-segment elevation infarction, and the time until this is given, respectively (B1, B2). Nor does lipid-lowering drug therapy after infarction achieve the desired result for a significant group of patients. The National Board of Health and Welfare expects the county councils and hospitals to follow the recommendations in the national guidelines (B12-B14) in order that they may achieve better results. Other aspects that these two bodies ought to note with regard to myocardial infarctions are that many patients continue to smoke after infarction (B29) and the post-infarction period of sick leave is far too long in the case of certain county councils.

With regard to *arrhythmia*, the county councils and the hospitals are expected to pay particular attention to the low use of anti-coagulant treatment (Warfarin) in atrial fibrillation and another risk factor (C2), as well as the low volume of ICD-implantations (C5) that also varies from one county council to another. A low volume and major differences are also found in the implantation of failure pacemakers in heart failure (D4). The county councils and hospitals should also take note of the differences with regard to waiting times for *valve surgery* (E1).

There are county councils and hospitals that show noticeably divergent and inferior results for indicators that highlight cardiac care processes, even if the results at a national level are good or relatively good. These results require further analysis and all county councils and hospitals are recommended to consider measures in those cases where their own results show a negative divergence.

Reducing post-infarction mortality

Post-infarction mortality has declined over a long time and there is a continuing downward trend in Sweden. However, there is considerable variation in mortality among both county councils and hospitals. The variation at county council level is considerable, which indicates that it is possible to further reduce mortality during and after myocardial infarction. In the latter case, this can be done by the following measures, among others:

- Further increasing the percentage of patients treated with reperfusion in ST-segment elevation myocardial infarction at the majority of hospitals
- Shortening treatment waiting times
- Further improving diagnostics and drug treatment for infarction patients after discharge

To ensure a deeper understanding of the potential for reducing mortality after infarction treated in hospital, the hospital level must receive particular attention, which in turn requires better case-mix description; in other words, the degree of illness of the infarction patients, which may vary among the hospitals.

As a matter of urgency the county councils and the hospitals should undertake local improvement measures using experience-based learning and exchange the knowledge gained. All the county councils and hospitals can find potential cooperation partners in this report.

Improving the potential for assessment of cardiac care processes and results

Developing new indicators

Further development of cardiac care indicators is needed and this should be regarded as a joint task for the National Board of Health and Welfare, the quality registers and the Swedish Association of Local Authorities and Regions (SALAR). Firstly, there is a need for result indicators (for example, mortality, disease recurrence and complications) that take account of how ill the patients are, and thus be more accurate in comparisons between hospitals. Secondly, there should be a facility for adjusting, or in some other way, taking into account, the background morbidity of a population, in comparisons of the number of treatments or diagnostic examinations.

Improving the reporting of data to the Patient Register and the quality registers

There is an uneven supply of data, and the comparisons by the National Board of Health and Welfare in conjunction with this report (see Appendix 5, in Swedish, at www.socialstyrelsen.se) showed, among other things, an underreporting of PCI treatments to the Patient Register, as compared with the SCAAR quality register. Further examples of underreporting are that in principle all clinics report to RIKS-HIA, but despite this the register is missing a large group of infarction patients. A third example is that both the cardiac failure register and the quality register for secondary prevention (SEPHIA) are under construction and considerable efforts will be required to ensure more complete registration of these major patient groups. The county councils and the hospitals are urged to pay attention to their shortcomings in this field and take suitable measures to enable them to report complete data to both the quality registers and the Patient Register.

Developing sources of data for key areas

Within a number of areas it is impossible from a nationwide perspective to follow up healthcare and medical services processes, results and costs on the basis of the entire patient care chain as well as the various Good Care criteria. The data are quite simply missing.

The following areas are to be taken into account in the development of new or existing sources of data:

- prevention
- care and treatment at primary healthcare centres
- nursing care
- rehabilitation
- how patients and their next-of-kin perceive care and treatment
- healthcare and medical services costs.

Activities are in progress at national level within all the above fields that will enhance the potential for follow-up. Examples of national activities are government remits that relate to the feasibility of describing primary care measures and development of both a national patient survey and rehabilitation descriptive systems.

Evaluations on the basis of Good Care and national guidelines

In the following section the National Board of Health and Welfare evaluates the results of the forty-five indicators from a Good Care perspective, i.e., whether it is effective, safe, patient-centred, efficient, equitable and timely. The 2008 national cardiac care guidelines provide the basis for this evaluation. To conclude, there is also a discussion of whether the results of treatment after infarction are good with respect to the basis of mortality and disease recurrence.

Effective healthcare and medical services

Within a number of areas the data shows that cardiac care meets the expectations and recommendations of the national guidelines and that the patients receive the recommended treatment to a considerable degree, irrespective of the hospital or county council that provides this.

The data at the same time shows that there are several treatments that are used to an inadequate extent. In certain cases there is a major gap between actual use and the expected level, while in other cases it is smaller or somewhat uncertain. There are some indicators where no county councils or only some of them perform in accordance with the recommendations of the guidelines. Examples of such areas are reperfusion treatment in ST-segment elevation myocardial infarction (restoration of the blood flow to the heart), smoking cessation after myocardial infarction and treatments for arrhythmia.

Areas of good compliance with national guidelines

Anti-coagulant treatment (B8, B9) and treatment with beta-blockers (B10, B11) are established treatments used as secondary preventive measures after myocardial infarction. Anti-coagulant treatment was administered to over 98% of the patients upon discharge and to around 93% after twelve to eighteen months, while there is a somewhat wider variation among the hospitals with respect to beta-blockers.

In addition, the percentage of patients treated with RAAS-inhibitors twelve to eighteen months after infarction (B17) is considered as being approximately in line with needs, although certain hospitals also treat patients for whom the value of this treatment is lower.

All the above treatments refer to myocardial infarction and drug treatment and have been the subject of several years of follow-up at hospital level by the RIKS-HIA quality register. This has probably contributed to this even and high level, but there are, however, other treatments that have been followed up in the same way but where there is greater variation, which shows that aspects other than the existence of national follow-up play a role.

The drug treatment of heart failure patients has not been followed up regularly by means of comprehensive registers and it is positive that even without such follow-up, there is a relatively high percentage of such patients who are being treated with RAAS-inhibitors or beta-blockers, respectively (D2, D3), even if in the country as a whole there is a certain level of under-treatment. The measure refers to patients treated in hospital who can be expected to be the most seriously ill heart failure patients. By contrast, it is not possible to make any statement about the drug treatment of heart failure patients who did not receive hospital care.

Areas of under-treatment and poor goal compliance

The description of data by the National Board of Health and Welfare also shows several forms of treatment that are under-used by healthcare and medical services. In certain cases there is a major gap between actual use and the expected level, while in other cases it is smaller or more uncertain. This under-treatment may be a consequence of the fact that the treatment in question has recently been introduced and it is in the process of becoming more widely used. Another possibility is that it is a result of combinations of scarce resources, shortages of staff with the right expertise and, quite simply, a lack of attention to the needs of a patient group. The Board's evaluation shows that the variations among county councils and among hospitals are usually considerable in those areas where patients are under-treated.

Acute ST-segment elevation myocardial infarction affects over 6,000 patients annually and here it is important to administer reperfusion treatment promptly, primarily by means of PCI or thrombolysis. In Sweden over 70% of the patients are given reperfusion treatment (B1) but there is considerable variation among different county councils, which indicates that the attitude to these treatments differs. Many county councils ought to be able to noticeably increase the percentage of patients treated.

Patients with severe heart failure can have a failure pacemaker inserted, which improves cardiac pumping capacity and can result in a higher quality of life and an extended life. This is a relatively new treatment and the number of implanted failure pacemakers (D4) is fewer than three hundred per year. According to the evaluation in the national guidelines, some 1,500 operations ought to be performed annually to meet the need, and furthermore the variation among county councils is very great. This is a small patient group and the costs are not exceptionally high, which indicates that healthcare and medical services ought to be able to ensure a rapid improvement within a year or so.

The number of implanted defibrillators (C5) in patients with a risk of serious ventricular arrhythmia is too low, according the recommendations in the national guidelines. Although the annual number of treatments has risen to six hundred, this figure still represents less than half of the 1,500 implantations that are stated as the benchmark figure in the guidelines and there is great variation among the county councils. The unit cost of the treatment has been noticeably high but has fallen as a result of the drop in the price of defibrillators, and this lower cost favours an expansion of this treatment.

In the case of atrial fibrillation and at least one further risk factor, such as advanced age or diabetes, the patient ought to receive anti-coagulant treatment (Warfarin) in order to prevent thrombosis and stroke. The percentage of patients treated with Warfarin is slightly above 40% (C2), which indicates a considerable under-treatment.

Warfarin treatment is for a variety of reasons unsuitable for certain patients, which makes it difficult to state the optimum level.

Beside these four examples, there are further treatments where the national level indicates a certain under-treatment that healthcare and medical services ought therefore to note. As a rule, with regard to these indicators there are hospitals where under-treatment is more considerable, which is the case, for example, in both lipid-lowering and RAAS-inhibiting drug treatments (B12, B13, B16, D2).

The goal for lipid- and blood-pressure lowering treatment is to achieve a certain level for cholesterol and blood pressure. The indicator for goal compliance for LDL-cholesterol (B14) shows that seven out of ten of the myocardial patients followed up achieve the target level for LDL-cholesterol and that there is considerable variation among hospitals. It is probable that the results for all myocardial infarction patients (not just for those followed up) are lower. This raises questions as to treatment intensity, choice of medications and lifestyle changes and also indicates the importance of also following up goal compliance in registers.

Six to ten weeks after myocardial infarction over 40% of the patients are on full-time sick leave (B30). There are considerable variations among county councils and hospitals, which indicates that it ought to be possible to reduce this figure to between 25% and 30%.

More than 35% of myocardial infarction patients who smoked prior to infarction continue to do so afterwards (B29), which is disheartening, especially since this behaviour constitutes a greater risk of another infarction. The differences among the hospitals are considerable, even if there are relatively few cases and thus a degree of statistical uncertainty. As this follow-up continues, it ought to be possible for the hospitals to share experience with each other and thus help more patients to stop smoking.

Safe healthcare and medical services

The National Board of Health and Welfare highlights safe healthcare and medical services in the report using a small number of indicators relating to complications and mortality after planned operations. The indicators studied show that in general the number of complications and deaths due to an operation is low.

Complications and mortality after planned operations

In principle all care should meet high standards of safety but it is especially in the case of planned care that it can be argued that an operation whose outcome is fatal is an avoidable event. Those patients selected for an operation are all considered as having a state of disease and a general condition that justify surgical intervention. Complications after an operation are also often used in a similar manner as an indicator of patient safety.

The thirty-day fatality rate after a coronary artery operation and valve surgery, respectively, (B27, E2), shows a falling national trend in recent years, but in 2007 the fatality rate after valve surgery began to rise again. One aspect of this trend is that an increasing number of elderly patients are undergoing surgery, which tends to increase the risk of death.

Of those patients who undergo valve surgery, 3.5% die. The number of such patients is relatively small, which results in great statistical uncertainty. One hospital shows a marked divergence with a fatality rate after valve surgery in excess of 8%, while this was below 1% at another hospital. Such variation in the recorded fatality rate must be analysed with all due haste.

No such apparently divergent results have been found for the fatality rate after coronary artery surgery and there are smaller differences among the hospitals. In the country as a whole, more than 1% of the patients undergo a second operation during the care session due to a serious sternal complication (B28). One hospital diverges from this with a noticeably higher re-operation rate of over 3%.

With regard to Warfarin treatment of atrial fibrillation patients and one further risk factor, there is under-treatment and the total patient group is very large. Patients can be affected by severe bleeding complications after Warfarin treatment but no data are available on the extent of these problems.

Patient-centred healthcare and medical services

The report does not contain any indicators that reflect whether healthcare and medical services are patient-centred; the reason for this being that at present there is no national data source that allows a follow-up of patients' perceptions of cardiac care measures.

Efficient healthcare and medical services

Several county councils ought to be able to reduce their drug costs by prescribing the cheapest alternative among equivalent pharmaceuticals. Beyond that, on the basis of the data collected, the National Board of Health and Welfare is unable to evaluate cardiac care efficiency.

In this report the National Board of Health and Welfare does not examine cardiac care efficiency. An in-depth study of the connections between quality and costs, using cardiac care as a pilot area was published in June 2009 [3], with the intention to contribute towards a greater knowledge of how to measure the efficiency of cardiac care in Sweden.

However, a number of areas have been described that relate to cost-effective treatment options and possible over-treatment.

Cost-effective treatment options and possible over-treatment

Highlighting under-use of treatment is as important as highlighting over-use, i.e., the use of a treatment to an excessive extent or for patients other than those who clearly benefit from it.

Indicators that highlight over-treatment facilitate the shifting by healthcare and medical services decision-makers, of resources to areas where an expansion is justified. Some, but not sufficiently many, of the indicators studied have this function.

The choice of the cheapest alternative among equivalent drugs is reflected in two indicators: the choice of low-cost statins in lipid-lowering treatment (B15) and that of ARB (angiotension II receptor blockers) as a RAAS-inhibitor after myocardial infarction (B18), respectively. A high percentage of the patients receive low-cost statins, but the variation among the county councils indicates that there is further scope for reducing the cost of this treatment. Barely a quarter of all patients receive the more expensive alternative ARB as a RAAS-inhibitor and among certain county councils this figure is around 16%. If it is assumed that their patients receive good treatment with regard to side effects, then these councils can be seen as a benchmark for the others.

Furthermore, there are several indicators that reflect PCI-use, in general (B4), in main stem stenosis (B5) and also in the use of a drug-eluting stent (B6). General PCI-use varies markedly among the county councils, which can be partly explained by other variations, for example, the background morbidity, access to PCI, the use of thrombolysis instead of PCI and the fact that coronary artery surgery is used instead of PCI in the planned treatment of stenosis.

It is not possible to indicate an optimal level for PCI-use in main stem stenosis or for the use of drug-eluting stents. There are major differences with regard to total PCI-use by the county councils, which may be due to both the background morbidity and differences among the county councils in evaluating which patients who are to receive this treatment. A broad analysis of evaluations and care consumption with regard to angiography and reperfusion treatment is therefore motivated.

Equitable healthcare and medical services

In the majority of areas, the description of the data indicates that cardiac care does not show any unjustified differences in the care and treatment of men and women. Within a small number of areas there are gender differences that should be studied further, for example implantable defibrillators (ICD) in patients with a heightened risk of sudden death and also the insertion of failure pacemakers in patients with severe heart failure.

Patient mortality in myocardial infarction is considerable lower for those patients registered in the Register of Information and Knowledge about Swedish Intensive Care Admissions (RIKS-HIA) than their counterparts in the Patient Register. This difference may have a natural explanation but should be studied further.

Differences in the care and treatment of men and women

The data from RIKS-HIA show few signs of any undesirable differences in the treatment of men and women. There is a slight difference with regard to the number of patients who receive coronary angiography in non-ST segment elevation myocardial infarction. In this instance, the percentage of women is lower, which can probably be explained by the fact that women derive less benefit from PCI and that they are in general older when they suffer infarction and thus more frequently have contraindications for this treatment.

On the other hand, there is a very great gender difference with respect to implantable defibrillators (ICD) in patients with a heightened risk of sudden death caused by serious ventricular arrhythmia due to severely impaired left ventricular function after myocardial infarction or due to a different cause. The same applies to the insertion of failure pacemakers (CRT) in patients with severe heart failure. Both these treatments are much more common for men, and a probable explanation is their higher morbidity, but the causes of these gender differences should be noted and further studies undertaken.

Equitable infarction care – RIKS-HIA infarction patients and all infarction patients

An important aspect of Good Care is that healthcare is equitable and provided according to need. The comparisons of different county councils reveal in certain cases geographical differences with regard to equality. In this respect, the National Board of Health and Welfare discusses equivalence from another perspective, which is whether the care measures are influenced by caring for myocardial infarction patients in an intensive cardiac care ward (and are thus reported to RISK-HIA) compared with care in an ordinary medical ward.

The Board describes data (B24, B25) which in this respect show that a considerably lower proportion of RIKS-HIA infarction patients die than do patients in the Patient Register: 7.4% deaths after twenty-eight days as against 14.9%. Approximately 60% of the patients in the Patient Register are also reported to RIKS-HIA, which means that in reality, the differences are greater. The percentage of deaths among patients in the Patient Register cared for on an ordinary medical ward, and thus excluding those also reported to RIKS-HIA, is decidedly greater than the 14.9% shown.

It is necessary to consider how the lower mortality among infarction patients cared for in an intensive cardiac care ward is to be interpreted and there are two alternatives, that need not be mutually exclusive. One possibility is that this is a selection or case-mix effect, that is to say, those infarction patients cared for on an ordinary medical ward are more often so seriously ill or in such a poor general condition that it is considered that the benefit of more specialised cardiac care expertise and active treatment would be limited. This group of patients shows a higher fatality rate that thus adversely affects the survival statistics but the care measure is still equitable.

Another possibility is that the care measures vary indeed depending on the form of care. The patients have the same needs and benefit equally from the treatment but the care given on the specialised cardiac ward is more active or in some other way superior. In this case, the care measures are not equitable, not even within the same hospital. An in-depth analysis is required to determine which one of these explanations carries the most weight and cardiac care managers ought to be aware of this aspect.

Some indicators provide a certain degree of guidance with regard to equality in terms of drug treatment after infarction. In the report the National Board of Health and Welfare describes four drug treatments that include both the extent to which infarction patients registered in RIKS-HIA are treated upon discharge, and the extent to which such patients registered in the Patient Register are treated twelve to eighteen months after having been discharged from hospital. The fact that the duration of the follow-up period varies means that the percentage treated according to the Patient Register and the Swedish Prescribed Drugs Register ought to be somewhat lower.

In all four treatments, the degree of treatment in the country as a whole is higher for RIKS-HIA infarction patients. The difference in the degree of treatment is over five percentage points for anti-coagulant treatment (B8, B9), eight for beta-blockers (B10, B11), twelve for lipid-lowering drug treatment (B12, B13) and over thirteen for treatment with RAAS-inhibitors

(B16, B17). If RIKS-HIA patients had been excluded from this account based on the Patient Register, these differences would have been greater.

One explanation for the lower degree of treatment of infarction patients in the Patient Register may be that a patient starts treatment but after due consideration abandons it. In other respects, this issue is the same as with respect to the variation in the fatality rate.

As a matter of urgency managers at both county council and hospital level should examine the issue of equitable care. It is equally urgent that the hospitals begin to report all cases of infarctions to RIKS-HIA, irrespective of the organisational unit at which care is provided. The degree of illness and not organisational conditions, should govern the selection of patients to be reported to national registers.

Timely healthcare and medical services

There are major variations among county councils and hospitals with respect to hospital delays and waiting times for surgery.

Varying waiting times for acute and planned interventions

Care within a reasonable time may relate to both acute and planned care, even if discussions of waiting time usually involve planned care. In the report, the National Board of Health and Welfare describes three indicators that directly measure the delay before treatment is given and one that indirectly reflects a time aspect.

Time until reperfusion (restoration of the blood flow to the heart by means of thrombolysis or PCI) in ST-segment elevation infarction (B2) shows that healthcare and medical services treat over 65% of patients within the target time. This is a poor result, and in addition the differences among the county councils are very great. There is much to suggest that the delay in the treatment of ST-segment elevation infarction can be considerable shortened, thus further improving the results of infarction care.

There is also a time aspect to the percentage of patients receiving coronary angiography in non-ST-segment elevation infarction (B3), since this diagnostic method should take place in the days immediately following an attack. The measure states the percentage of patients who underwent angiography or who were scheduled to do so. On the other hand, the number of days that actually elapsed before the X-rays were taken is not measured. These data are available and can be used in the future to enhance or complement this indicator so that it includes a time limit.

The median waiting time between a decision and an operation is indicated for coronary artery surgery (B7) and heart valve surgery (E1). The median waiting time for all patients who underwent surgery is a coarse measure, and those patients evaluated as being at a greater risk of acute deterioration should be operated on sooner. Valve surgery waiting times are notably longer than in the case of coronary artery surgery, i.e., fifty-four days as against fourteen days, and there is considerable variation among the county councils with regard to both types of procedure. The operations are performed at a small number of hospitals to which all the county councils refer patients, which makes it essential to ensure that the county where they live does not have any influence on waiting times.

Quality of post-infarction treatment

Mortality after myocardial infarction has dropped dramatically in recent decades but there are, however, major differences among the county councils which indicate that certain councils can reduce mortality even further. This will require both further refinements of the indicators, so that they highlight the results even better, and studies of variations in population morbidity.

In the report, the National Board of Health and Welfare describes three indicators that state fatality rates after myocardial infarction as a sole outcome or in combination with the outcome measures of a second infarction or re-admission for cardiovascular disease (B20-B26). Both short-term (28 days) and long-term outcome (365 days) are shown. All hospital-level comparisons are shown unranked, as there is probably a great difference among the hospitals with respect to the degree of illness and general condition of the patients after myocardial infarction, even after age adjustment. At county council level this difference is minor, and consequently the following discussion refers to differences in fatality rates after myocardial infarction solely at that level.

The various result measures have different advantages and disadvantages: a 28-day case fatality rate identifies to a greater extent a fatality rate that is related to the infarctions, compared to fatality rate or re-admission after 365 days. The more time that has elapsed since the original event, the greater the possibility that health factors other than infarction result in death or a new cardiovascular event.

The widest result measure shows the percentage of myocardial infarction patients treated in hospital who die within one year or are re-admitted with a diagnosis of cardiovascular disease (B22). The measure is intended to identify the effects of both the acute care measure and the secondary preventive treatment measure. Nationwide over 40% are affected by one of these outcomes, and the long-term trend is clearly declining. The question as to whether these results are good enough can be answered most easily by pointing to the variation which ranges from barely 37% to over 51%, and it should be possible for more county councils to achieve a level below 40%.

Furthermore, in-depth analyses of the entire patient population should be able to provide guidance as to what distinguishes those patients who survive and do not receive hospital care within one year, from the others in terms of treatment or any other affectable factor. Such an analysis of optimally treated patients can provide further guidance, and it is most probable that also those county councils that show the best results can achieve improvements. Besides drug treatment (to a large extent under the control of the healthcare services) lifestyle and eating habits play a major role in the outcome.

Those indicators that refer to a fatality rare or a second infarction (B20, B23-B26) are targeted at the most serious outcomes, either in the acute stage or after the patient has been discharged. Fatality rate after infarction is a much-used indicator of cardiac care results. If one includes those patients who die of myocardial infarction without having been treated in hospital, the national 28-day case fatality rate is just over 30% (B23). The myocardial infarction fatality rate has been steadily declining during a number of years, above all for those patients who were treated in hospital.

More than half of those who die do so without having been treated in hospital when they suffered an attack. These patients were never admitted and the diagnosis of myocardial infarction was made post mortem. The variation among county councils with regard to this fatality rate is greater than in the case of those who receive hospital treatment. This raises the question as to how this fatality rate can be reduced. Key factors are how quickly the patient or next-of-kin recognise the symptoms of myocardial infarction and seeks medical help and also how the helpline, emergency alarm and ambulance services work. There is a geographical or distance factor, but the county council results indicate that this factor is not predominant and several county councils in sparsely populated areas show a comparatively low fatality rate for patients not treated in hospital.

The 28-day case fatality rate after hospital care with regard to myocardial infarction (B24) varies among the county councils between barely 13% and more than 17%, based on the myocardial infarctions in the Patient Register.

The description of the results of the following indicators from the RIKS-HIA quality register indicates that healthcare and medical services can further reduce both 28-day and one-year case fatality rates by means of the following measures:

- An increase in the percentage of patients treated with reperfusion for ST-segment elevation infarction at the majority of hospitals.
- A reduction in treatment waiting times, which vary greatly.
- Further improvements to continuing diagnostics and drug treatment upon discharge after infarction.

In order to achieve a deeper understanding of the potential for lowering the fatality rate after infarctions treated in hospital, the focus must be on the hospital (and the individual) level. This demands in turn a better description of case mix, i.e., the degree of illness of the infarction patients, which can vary among the hospitals.

Method

The method in this report employs measurable indicators and comparisons among county councils and among hospitals to describe and evaluate cardiac care processes and results. No aspects of cardiac care other than those reflected by the indicators are addressed in this report, which makes the selection of indicators an important issue.

Only currently available sources of data have been used, primarily health data and national quality registers. One limitation is that the present sources of data lack information on several aspects of cardiac care processes and results, for example, information is entirely or largely lacking with regard to prevention, primary level care and treatment, nursing care, rehabilitation and the patients' own perceptions of care.

Different aspects of the set of indicators are dealt with here, after which the sources used and several general aspects of the method are described.

Indicators – composition and motivation

There is a comparatively large number of indicators, forty-five in all, but despite this there are several areas that are not adequately covered. The majority of indicators relate to coronary artery disease, as apart from the fact that this disease has such a major impact on public health, there is also an ample supply of data, especially in the case of myocardial infarction. In addition, a secondary purpose has been to describe myocardial infarction care by means of the sources that comprises RIKS-HIA, the Patient Register and the Swedish Prescribed Drugs Register, respectively, even if this implies that indicators with similar content are described. The two registers contain different infarction populations and comparisons between the sources allow one aspect relating to the question of equitable care to be highlighted. The indicators used can be seen from the table below, which states both the indicator name in full and the code designation used in the report.

Selection of indicators

The basis for selecting indicators was the set of indicators for following up cardiac care that are found in the national guidelines. For further details please refer to Appendix 3 for a description of these indicators, in comparison with those published in the report. There are forty-one indicators in the national guidelines, nine of which have been put on what is termed a development list (as data is not currently available). Of the thirty-two indicators where there is data, all except four are to be found in this report, in identical or similar wording. One indicator from the development list is also described, with the aid of combined sources of data (Warfarin treatment in atrial defibrillation) and one indicator is described only by means of national data (Heart disease mortality for children).

The reason for removing four indicators contained in the guidelines from the description was that the supply of data was deficient (mortality following cardiac arrest in hospital or echocardiography in heart failure), that the indicator was found to apply to a comparatively limited problem (incidence of complications after PCI) or that a new indicator provided a better view of the issue (incidence of patients with simultaneous stroke and atrial fibrillation).

Fourteen new indicators have been added in addition to those derived from the national guidelines, of which the majority refer to drug treatment in conjunction with myocardial infarction. A number of these indicators show treatment both upon discharge and twelve to eighteen months later. Several result measures in infarction have been added, for example, the incidence of a second infarction and the combined measure, death and re-admission after one year, as a complement to the most frequently cited 28-day case fatality rate after myocardial infarction.

Each indicator is concisely described in conjunction with the text of the chapter *Description of results – trends and comparisons.* Please refer to Appendix 4, *Description of indicators*, for a more detailed account of how the different indicators are defined.

Nature of the indicators

Even if there may be uncertainties in the data and other interpretation problems, the vast majority of the indications and comparisons do reflect the quality of cardiac care. These are process or result measures where one specific outcome is to be preferred to another.

However, there are also indicators in the report that are purely frequency measures, for example, the number of treatments or care sessions per inhabitant irrespective of the nature of the morbidity of the populations. The ideal approach is to state the percentage of patients suffering from a specific disease who receive a recommended treatment, but sometimes there is no means of pinpointing patient numbers and stating the extent to which treatment was provided.

In areas where there was a limited supply of data relating to quality or these data were too uncertain, such coarser indicators have been incorporated into the report. This applies to the frequency of PCI treatments with different indications, the number of implantations of failure pacemakers and of defibrillators and the number of patients treated in hospital or care sessions for heart failure, atrial defibrillation and several groups of diagnoses.

These indicators also have something to say about the variation in medical practice and resource use besides the information that they contain on morbidity itself, but the results cannot be unambiguously interpreted in terms such as “good” or “bad”.

There are a number of new indicators described in the report that are being published for the first time, which applies to both those whose source is a quality register and those taken from the Patient Register and the Swedish Prescribed Drugs Register. This represents a risk, and a critical examination can be expected to mean revisions and reformulations of indicators till next time that data for comparisons are to be produced.

To sum up, the indicators are a mixed bag. The bulk of them are robust and relatively well tested, some are new and untried, while others are not quality indicators proper but coarse measures that reflect resource use and treatment choice.

Bias and inadequate areas

In an international comparison, this set of indicators would probably hold its own very well in terms of the supply and quality of the data and the breadth of description, although there are obvious shortcomings as a result of the uneven supply of data.

As previously mentioned, the set of indicators has a bias towards the cardiovascular disease myocardial infarction. Drug use is reflected by several indicators, as there is a good supply of data, while there are too few indicators for heart failure in relation to its incidence. A heart failure quality register is under construction and has therefore not been used in this report.

Moreover, it would have been desirable to have broad result indicators for non-acute PCI treatment given that it is implemented to a significant extent. The existence of a quality register for this treatment contributes to the fact that this deficiency can be remedied through modest efforts. It would also have been desirable to be able to describe more result measures with regard to pacemaker insertions apart from the complications.

In general, it would also have been desirable to have indicators that reflect primary prevention measures with regard to cardiovascular disease, even if this perspective is not prominent in the guidelines and is being addressed in a draft guideline that is currently being prepared.

Various shortcomings in this set of indicators in use can be remedied in future descriptions, if and when the supply of data improves and after continued indicator development.

Sources used

A pre-requisite for comparisons of healthcare and medical services processes, results and costs is a supply of data that needs to have good geographical coverage while at the same time possessing adequate validity. The data should also include the civic registration number to allow follow-up at an individual level.

Existing sources of data have been used for comparisons in this report while an ongoing follow-up of healthcare and medical services processes, results and costs requires continuous collection of data and a permanent supply thereof. Data are not available on all conceivable quality aspects, but the publication of what is currently available will highlight needs and initiate a continued development of the existing sources of data.

Data have been obtained from the following national health data registers: the Patient Register, the Swedish Prescribed Drugs Register and the Cause of Death Register at the National Board of Health and Welfare, as well as from several national quality registers. In several cases data collection has been co-ordinated with that undertaken for the report *Quality and Efficiency in Swedish Health Care* that appeared in October 2008.

Reporting to the national registers at the National Board of Health and Welfare is obligatory and regulated in law, although any registration of personal details in the national quality registers is voluntary. Not only do the county councils and hospitals decide whether they wish to be affiliated to these registers, but patients can always also refuse to allow their details to be registered.

To be able to make use of data from these registers, a knowledge of their shortcomings is important, and the following descriptions deal with their content and any shortcomings that have been noted in the case of individual registers and sources of data.

The Patient Register

The Patient Register at the National Board of Health and Welfare comprises all in-patient care and all out-patient medical appointments that are not designated as primary care. It is updated annually, and when this report was compiled, nationwide data was available for the period from 1987 to 2007.

Around 1.5 million in-patient admissions and almost ten million out-patient attendances are recorded annually in the Patient Register, whose data relating to out-patient cases is not used for measuring the indicators in this report. Unlike the quality registers, the Patient Register contains details of comorbidity or other morbidity that affects patient care.

The in-patient section of the Patient Register has good and even data quality over time with regard to central variables such as primary diagnosis, hospital and records of dates.

There is little omission of the primary diagnosis at just over 1%, and in the case of cardiac care, selective omission of action codes occurs in some cases. Comparisons with the Swedish ICD and Pacemaker Register and also the SCAAR and cardiac surgery quality registers have revealed an under-reporting of pacemaker and PCI interventions, respectively, on the part of certain care providers. The reason for this omission requires further analysis but one reason could be that the patients were transferred to another ward for the intervention, and inadequate routines would then have resulted in the intervention not having been registered for the patient’s care episode.

The diagnosis of heart failure in the Patient Register was validated by a medical records study in 1997. The quality of the diagnosis at this time proved to be relatively good. For this report heart failure diagnosis in the RIKS-HIA quality register and corresponding codes in the in-patient section of the Patient Register were compared. A very small proportion of these infarctions were found only in RIKS-HIA, around 1.5%. Around 3.5 % of the infarctions in accordance with the Patient Register comprised cases that matched but which had been evaluated as having a different cardiac diagnosis in RIKS-HIA.

A detailed account of the comparisons of reporting in the Patient Register and the quality registers is described in Appendix 5, *Degree of coverage – quality registers in relation to the Patient Register* (see www.socialstyrelsen.se).

The Cause of Death register

The Cause of Death register of the National Board of Health and Welfare includes all deceased persons officially resident in Sweden at the time of death; it contains data from 1961 and is updated annually. At the time of writing there are details of deaths up to and including 2006.

There is a greater time lag in preparing this Register than the other registers at the National Board of Health and Welfare, and a contributory factor is that the causes of death are reported in plain text, which means that a considerably degree of coding must be undertaken. In recent times, the Board has made great efforts to speed up preparation of the register through the introduction of automated processes, among other measures.

In recent years between 90,000 and 95,000 deaths have been registered annually, and the Register has a very high quality. Today, it includes all deaths, and approximately 0.7% of the entries lack a death certificate, for which reason no cause of death is stated.

The Swedish Prescribed Drugs Register

This register covers all drugs that have been dispensed on prescription with effect from July 2005, but it does not cover drugs administered in hospital. Corresponding data with effect from 1999 is available but without any civic registration numbers. The register is updated monthly with a delay of around two weeks.

Of the ninety million prescriptions that are filled and registered annually, 0.3% lack a civic registration number and 0.6%, a registered address code.

Drugs administered in in-patient care, dispensed from drug cupboards or bought over the counter are not included in the register, nor is the reason for their prescription, i.e., the diagnosis, shown. With regard to the indicators in this report, in-patients whose diagnosis is in the Patient Register have been followed up in this register.

Myocardial infarction statistics from the National Board of Health and Welfare

In following up acute myocardial infarction with regard to mortality, disease recurrence and re-admission, myocardial infarction statistics from the National Board of Health and Welfare have been used. This means that the same method of measurement has been applied as in the official acute myocardial infarction statistics. The data in the statistics comprise a co-processing of data on myocardial infarction in both the Patient Register and the Cause of Death Register. The intention behind the statistics database is to monitor attacks, new cases, mortality and survival over time.

More information about the Patient Register, the Cause of Death Register, the Swedish Prescribed Drugs Register and the myocardial infarction statistics can be found at www.socialstyrelsen.se.

National quality registers

This report has made use of indicators from several national quality registers for heart diseases, which are located at the Uppsala Clinical Research Centre (UCR) at the Uppsala Academic Hospital, apart from the Swedish ICD and Pacemaker Register, which is operated by doctors at the Karolinska University Hospital in Solna.

RIKS-HIA - The Register of Information and Knowledge about Swedish Intensive Care Admissions

This is a quality register that contributes data for most of the quality indicators in this report, and in which all hospitals with an intensive cardiac care unit now participate, as well as hospitals that care for acutely ill cardiac patients outside such units. In 2007, 62,600 care sessions were registered, of which 20,800 related to acute myocardial infarction. Around 60% of the registered patients were treated for myocardial infarction or unstable angina, and thus more than 95% of these diagnoses in acute cardiac care are covered.

One problem on which this register is currently engaged is that certain patients with these diagnoses are not registered in RIKS-HIA, as they are cared for in wards that do not participate in this register, wherefore it has been decided to also include coronary artery patients cared for outside intensive care units. However, a comparison of infarctions recorded in the Patient Register and in RIKS-HIA for the years 2005 and 2006 shows that more than 40% of the infarctions recorded in the former are missing from RIKS-HIA. Some of those that are missing ought perhaps not to be subject to registration in RIKS-HIA; this might involve seriously ill patients whose primary care is not related to infarction. The great variation among the county councils indicates, however, that the register can improve its coverage in comparison with the Patient Register.

SEPHIA – Patients treated for coronary artery disease

The SEPHIA register is a complement to RIKS-HIA and is linked to its registration. It collects data on secondary preventive measures after myocardial infarction and is intended to cover all patients below seventy-five years of age who have had an acute myocardial infarction and who were alive when discharged. In 2007, 4,800 patients were registered at a return visit six to eight weeks after infarction and forty-nine hospitals participated in registration, which corresponds to 45% of the patients in question.

RiksSvikt – the Swedish Heart Failure Register

This register comprises care and treatment of patients with different types of heart failure, and it now has over 16,000 patients registered. In 2006, 64% of the patients were in-patients, 26% were treated at special heart failure clinics, and around 10% were out-patients. According to the Patient Register over 20,000 people with the primary diagnosis of heart failure are cared for annually in hospital. An estimate states that heart failure affects around 200,000 people in Sweden. A difficult task of major proportions that faces the register is thus to increase its level of coverage. Since a large proportion of the patients are not in-patients, registration must be undertaken within large sections of out-patient care.

The Swedish Cardiac Surgery Register – a register for heart surgery on adults and children

This register annually registers almost 8,000 heart operations, over half of which comprise coronary surgery and 15% to 20%, valve surgery. The register has very good coverage in comparison with the Patient Register at the National Board of Health and Welfare.

SCAAR - The Swedish Coronary Angiography and Angioplasty Register

In 2007, SCAAR registered around 37,000 angiographies and almost 20,000 angioplasties (PCI). The register has very good coverage in comparison with the Patient Register at the National Board of Health and Welfare.

The Swedish ICD and Pacemaker Registry

The Swedish ICD (Implantable cardioverter defibrillator) and Pacemaker Register annually register almost 10,000 pacemaker interventions and around 600 ICD implantations. The intention behind the register is that the medical professions should be able to follow up and evaluate different treatment methods with regard to complications, among other matters.

A comparison between pacemaker interventions registered in the Patient Register and those in the ICD and Pacemaker Register showed that the quality register has very good coverage while the Patient Register was missing around 17% of these interventions. With regard to the smaller category of ICD interventions, the quality register had instead poor coverage and was missing 18% of these interventions.

More information about cardiovascular registers can be found at www.ucr.uu. Information about the Swedish ICD and Pacemaker Register can be found at www.pacemakerregistret.se.

Other aspects of the method

Data management

Certain indicators are shown as percentages of the population, which in the case of the country and each county has been calculated as the total of the population at the beginning and end of the year divided by two.

Underlying cause of death has been defined as the illness or injury that initiated the chain of illness events that lead directly to death or those circumstances surrounding the accident or act of violence that resulted in the fatal injury. When the number of deaths in ischemic heart disease related to the population was calculated, account was taken solely of the underlying cause of death. Mortality is then calculated as the number of deaths per 100,000 of the population.

Letality can be defined as the percentage of those who have fallen ill and then die within a certain period. In this report letality within twenty-eight days is described and in one case the percentage that fall ill and die on the same day. For cases from the RIKS-HIA quality register, letality is also shown with a follow-up of 365 days.

When myocardial infarctions have been followed up with regard to letality and disease recurrence, the myocardial infarction statistics from the National Board of Health and Welfare have been used as a basis for several indicators. These statistics include all cases of myocardial infarction that are registered in the Patient Register or the Cause of Death Register. The secondary and primary diagnoses in the Patient Register, and the contributory and underlying causes of death in the Cause of Death Register, can generate cases of acute myocardial infarction. When the diagnoses of acute myocardial infarction and ST-segment elevation infarction in the RIKS-HIA quality register are followed up, the register's own inclusion criteria for myocardial infarction patients applies.

Age standardisation

Many indicators in this report have been age-standardised by means of what is termed direct age standardisation. Age standardisation facilitates comparisons among gender, regions and years by eliminating the differences that are associated with differences in age composition. All age standardisations use the same standard population for men and women. When the calculations relate to percentages of the population, the year 2000 mean national population has been used as a standard population.

In calculating age-standardised letality after infarction using data from the registers at the National Board of Health and Welfare, the total number of cases occurring in the year 2000 has been used as a standard population. When age-standardised letality has been calculated using data from the RIKS-HIA quality register, the national age composition in the analysis in question has provided the standard.

Also in other age standardisations, the standard population has comprised all those in the country who were affected or ill during the period being studied. For example, for the indicator "Re-admission after care for heart failure 2005-2007" the national age distribution has been used for all heart failure in-patients treated between 2005 and 2007.

All calculations of the indicators from RIKS-HIA, SEPHIA, SCAAR and the Swedish Heart Surgery Register have been undertaken at Uppsala Clinical Research Center at Uppsala Academic Hospital. Calculations of the indicators from the ICD and Pacemaker Register have been undertaken by those in charge of that register.

All data handling and analysis of data from the Patient Register, the Swedish Prescribed Drugs Register and the Cause of Death Register have been undertaken at the National Board of Health and Welfare.

Description of results – trends and comparisons

Presentation and interpretation

The following chapter contains the results of the assessment and open comparison of cardiac care, presenting the 45 indicators with trends and analysis per diagnostic group.

In this section various questions are discussed concerning how the comparisons are presented and ought to be interpreted:

- Classifications of the indicators into groups and designations
- Description level, i.e., nationwide, county council and hospital
- Gender-separate or aggregated description
- Hospital classification and name
- Ranking and description by county council, respectively
- Statistical uncertainty, confidence interval and few cases
- Inadequate comparability and other uncertainty

Classifications and designations

Classification is linked to the classification into disease groups used in the National Guidelines for Cardiac Care, 2008. The description opens with two general indicators that refer to more than one of these groups. The coronary artery group has many indicators and is thus presented as a subclassification.

A	General indicators	2 indicators
B	Coronary artery disease	30 indicators
C	Arrhythmiae	5 indicators
D	Heart failure	5 indicators
E	Heart valve disease, heart disease in children	3 indicators

The reason for the use of this classification in the presentation is primarily because discussion and evaluation of quality is most easily and naturally undertaken by disease group. Medical services measures differ with regard to the various groups, for example, depending on whether this involves caring for chronically ill patients, separate treatments as planned care or whether the major emphasis is on measures in the acute stage of an illness.

This classification also reveals the bias within the composition of the indicators, due to the uneven supply of data. There are many indicators for coronary artery disease but considerably fewer for heart failure, which is also a major patient group, and this gives an indirect indication of areas where the supply of data needs to be improved and quality indicators need to be developed.

The names of all the indicators include the letters A to E and a number, and these designations are used consistently in the headings, the running text, diagrams and references. Since some indicators reflect similar aspects and have similar headings, these designations contribute to greater clarity.

Description level, i.e., nationwide, county council and hospital

A description is provided where it is relevant and data are available in three separate diagrams that refer to the national level over time, county councils and hospitals. Those measures that reflect the number of treatments provided per inhabitant are shown only at national and county council level. Measures that are most obviously relevant at hospital level, such as complications after treatment, are shown at that level only.

In all comparisons at county council level, it is patient affiliation that guides the description, irrespective of whether treatment was provided at a hospital within the county council area or elsewhere. This thus focuses on the role of the county councils as the bodies responsible for the care of their own population. It is to be noted that this differs from the description of county council comparisons usually undertaken by the quality registers. In comparisons among hospitals, all patients are recorded at the hospital where treatment is provided, irrespective of county council affiliation. The focus here is instead on the producer perspective.

One aspect that should be noted is that in hospital descriptions based on data from RIKS-HIA, the patient is recorded at the hospital where the care session commenced. If a patient arrives at the emergency department of one hospital and, after an ECG, is taken to another for PCI treatment, it is the first hospital where the patient is recorded.

In the case of a number of indicators, differences occur between national values in the county and in the hospital diagrams, which are due to the fact that the national value in these diagrams comprises the mean value for those patients who had a valid code for their home county or hospital, respectively. Consequently, the omission group in the two diagrams differs.

In the case of those age-standardised indicators derived from RIKS-HIA (B25 and B26), age standardisation has been undertaken with different age distributions for the county and hospital data. These age distributions differ somewhat since those without any reference to home county do not contribute to the age distribution in the standardisation of the county council values. They also contribute to differences in the national values in the county council and hospital comparisons for these indicators.

Ranking and description by county council, respectively

The description in the diagrams is as a rule ranked, with the county council and hospital with the best or the desired results at the top and vice versa. In hospital descriptions, exceptions are those measures relating to fatality rate or re-admission after infarction (indicators B21, B22, B24, B25 and B26), where the hospitals are described instead in county council order. This is done because no adjustment is made for the varying degree of illness of the patients, apart from an adjustment for their ages. It is especially in the case of the diagnosis of myocardial infarction that a selection of patients is made among different hospitals on account of such factors as whether PCI treatment is given there or not.

This presentation stresses that the hospital-level description in these cases should not be viewed as an actual quality comparison. Nonetheless, a description is important since every hospital can follow its own trend over time. The hospitals' outcome also provides a picture of how the results for a county council have been arrived at.

Hospital classification and name

Classification into hospitals is based on how data are reported to each register, which means that when quality registers are the source, certain hospitals are recorded separately, which, in management terms, are part of the same organisation. However, only one value is recorded in RIKS-HIA for the two hospitals St. Göran and Sahlgrenska, which are described there as having two clinics. When the Patient Register is the source, data is aggregated for the hospitals comprising the hospital groupings in the counties of Västra Götaland and Blekinge, respectively.

- Sahlgrenska – Sahlgrenska, Östra and Mölndal (all in Gothenburg)
- NU-healthcare – Uddevalla, Trollhättan
- Skaraborg Hospital – Lidköping, Skövde
- SÄ-healthcare – Borås, Skene
- Blekinge Hospital – Karlskrona, Karlshamn

The hospitals have varying formal names in different registers. Except for hospital groupings, only the official name of the locality or another name together with the place name is used. Gotland Municipality, Region Skåne, and the Västra Götaland Region are all consistently referred to as county councils.

Gender-separate description

Gender-separate data are shown in the report for those comparisons where there is a gender-specific variation that is separately noted and in the case of those indicators where data is traditionally sorted by gender, i.e., in recording mortality. However, data are also recorded when the values for the two genders are aggregated. In hospital comparisons no separation is made in the majority of cases. Gender-separate data are available at county council level for all indicators (where data are available) at the website of the National Board of Health and Welfare (www.socialstyrelsen.se), however with the limitation that all web information is in the Swedish language.

Statistical uncertainty, confidence interval and few cases

The latest available data have been used in all comparisons but most frequently this still means that data from several years are also used in order to increase the statistical certainty of the description.

The statistical uncertainty (the effect of chance) is illustrated in most cases by stating a confidence interval. Smaller county councils or hospitals with comparatively few cases have a greater uncertainty and thus wider confidence intervals for their results than those with a greater number of cases. As a result of this greater statistical uncertainty, these smaller units tend to be found at the top or bottom of the diagrams, while the opposite applies to larger hospitals and the three large county councils. The results from hospitals with fewer than thirty cases are never shown in the diagrams and the hospital is placed right at the bottom of the diagram.

In gender-separate presentation where each county council is shown by two bars in the same diagram, a confidence interval or the value of the bars in figures are not shown. The reader should then recall that the confidence intervals that are not shown would be larger in gender-separate diagrams than when the genders are recorded together. This is especially true of women, who are generally fewer than men, in the various cardiac care diagnoses.

Inadequate comparability and other uncertainty

Another source of error is found in the fact that age or the degree of illness of the patients can vary among the different county councils and hospitals. Age standardisation has been applied to a large number of indicators, which compensates for the age factor in, for example, comparisons of post-infarction mortality. Sometimes, an age limitation has been used instead so that only patients below a certain age are studied. This applies, for example, to all process measures derived from RIKS-HIA, which also addresses a proportion of the age-dependent differences. On the other hand, no adjustment has been made because the degree of illness of the patients (also known as case mix) can vary among county councils and, above all, among hospitals.

With regard to registered cases in RIKS-HIA, it should be noted that the results for indicators B3, B8, B10, B12, B16 and B19, may differ between data published in the 2007 RIKS-HIA annual report and this report, due to the fact that data were produced at two different times. As RIKS-HIA is continuously updated, the number of cases may differ according to when data were compiled. Another difference is the age limitation. Eighty-year-olds are included here in the comparisons based on RIKS-HIA, while its annual reports include only patients below this age.

General indicators - cardiac care

General indicators reflect more than one of the illness groups subsequently described, and this description contains two such indicators. One of them refers to mortality among the population, and the other, to the incidence of recurrent in-patient care sessions, for different selections of heart disease diagnoses.

Mortality in ischemic heart disease (A1)

Around 18,000 people with the diagnosis of ischemic heart disease die annually in Sweden, which means around 200 per 100,000 inhabitants.

Ischemic heart diseases are those caused by an impaired supply of oxygen to the heart, with acute myocardial infarction as the prevailing cause of death within this category.

In the past ten years this mortality has shown a major decline and, after account is taken of differing age distributions, it fell by 27% between 1997 and 2006. This decline applies to both genders but happened to a somewhat greater extent among men, who, however still have a significantly higher mortality from ischemic heart diseases than women do.

Despite this decline described above, mortality is still considerable, and one fifth of all mortality in Sweden is attributable to ischemic heart disease, while only tumour diseases show a higher proportion.

Within the framework of cause of death statistics, details are published annually relating to the proportion of deaths where the diagnoses given are those that can be influenced by health policy or medical efforts. Two measures that are also used for international comparisons are usually termed mortality amenable to health policies and mortality amenable to medical care, respectively.

No heart diagnoses are included in the definition of avoidable mortality that is used today (please refer, for example, to the report *Quality and Efficiency in Swedish Health Care 2008*). This dramatic decline in mortality from ischemic heart disease shows however that a considerable proportion of this mortality is avoidable, through either medical measures (mortality amenable to healthcare) or changes in lifestyle and living conditions (mortality amenable to health policy). In an international discussion it has also been proposed that at least parts of ischemic heart mortality ought to form a component of one or two of the measures of avoidable mortality.

The comparison and the result

Diagram A1 shows the mortality from ischemic heart disease age-standardised per 100,000 for each county council as well as the national trend. The material includes deaths below the age of eighty from 2005 to 2006. The trend diagram shows that mortality from ischemic heart diseases in those aged below eighty decreased by 38% between 1997 and 2006, and this varied considerably throughout the country during the period from 2005 to 2006. The county of Värmland, which had the highest mortality, is more than 50% above Uppsala, which has the lowest mortality.

It is not possible to determine the proportion of this mortality that is avoidable using stable evidence bases; this is instead largely a question of evaluation and the formulation of goals for healthcare policy. In this respect it is assumed that the non-avoidable mortality was half that of the national level for the period from 2005 to 2006 (please refer to the colour-coding of the bars in the diagram). The excess mortality is assumed to be the avoidable portion that the county councils are considered as being able to influence.

If all the county councils would set themselves the goal of reducing mortality to that level, the various councils would be faced with different demands. In the case of Västernorrland, Kalmar and Värmland, these councils would have a remit to reduce mortality by almost 60% through health policy measures and improved cardiac care. Uppsala would have to reduce its level by 37%, while Värmland would have to so by 35% merely to reach the level of Uppsala during the period from 2005 to 2006.

It can be noted that with respect to female patients, Gotland had an ischemic heart disease mortality that was already at 50% of the national level during the period from 2005 to 2006. However, the absolute figures for Gotland's women are very small and may therefore be partly an effect of random variation.

Figure A1
Sweden

Mortality in ischemic heart disease per 100,000 inhabitants. Age <80 years. Age standardised.

Source: The Cause of Death Register, National Board of Health and Welfare

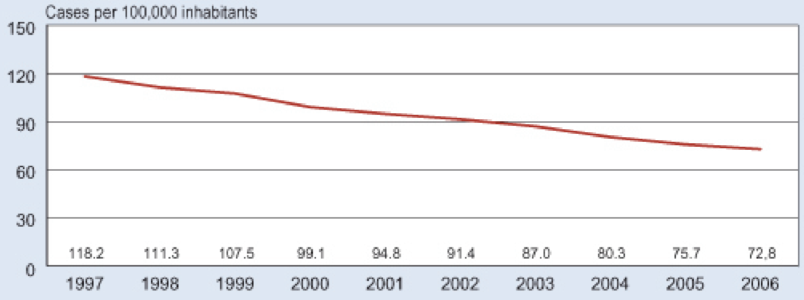


Figure A1
Men

Mortality in ischemic heart disease per 100,000 inhabitants, 2005–2006. Age <80 years. Age standardised.

Source: The Cause of Death Register, National Board of Health and Welfare

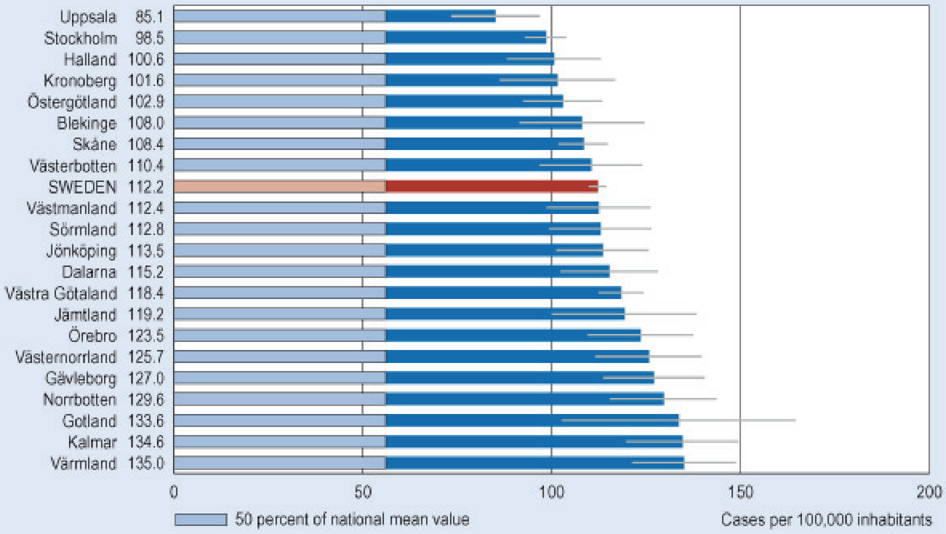


Figure A1
Women

Mortality in ischemic heart disease per 100,000 inhabitants, 2005–2006. Age <80 years. Age standardised.

Source: The Cause of Death Register, National Board of Health and Welfare

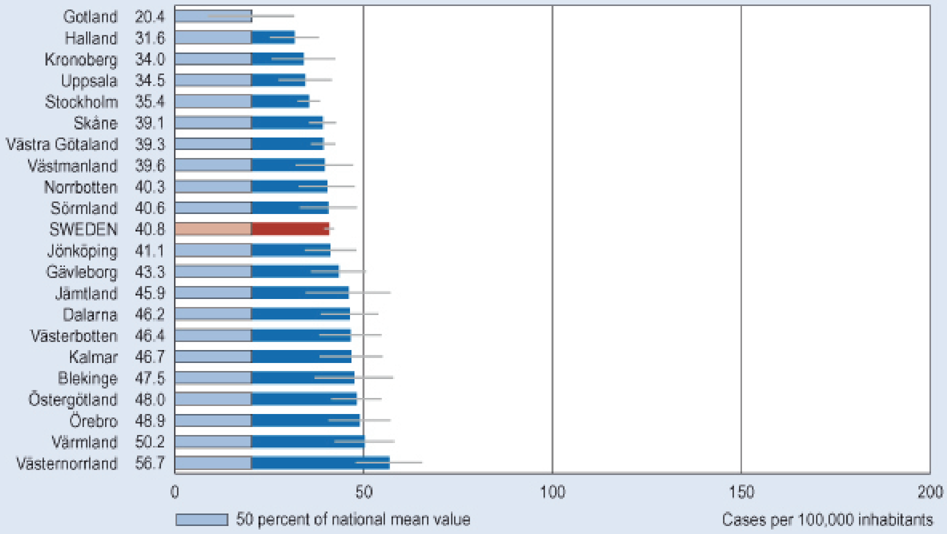
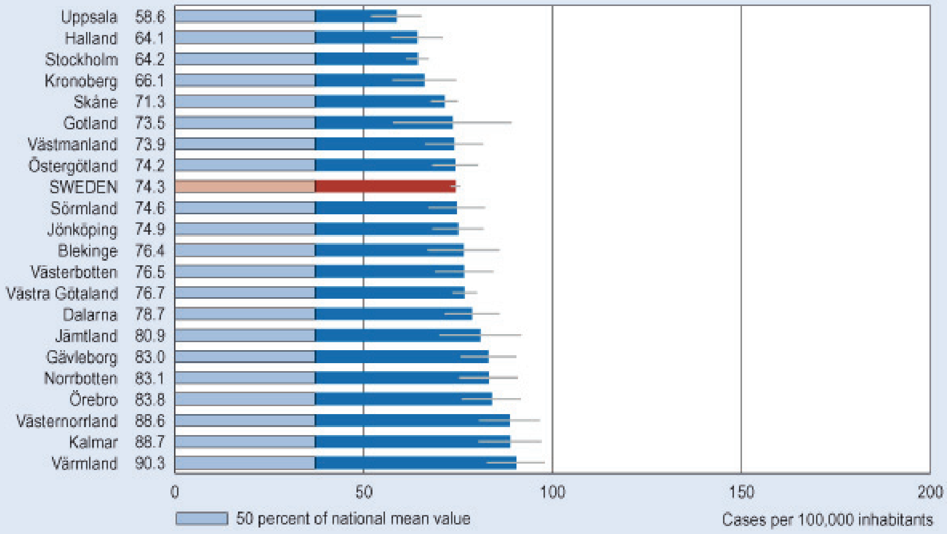


Figure A1
Total

Mortality in ischemic heart disease per 100,000 inhabitants, 2005–2006. Age <80 years. Age standardised.

Source: The Cause of Death Register, National Board of Health and Welfare



Recurrent avoidable hospitalisations for cardiac care (A2)

Between 20,000 and 25,000 people with the diagnosis of heart failure receive in-patient care annually in Sweden, and approximately the same numbers are treated for atrial fibrillation. Patients aged eighty years and above account for over half the heart failure cases treated and around 30% of those treated for atrial fibrillation.

There ought to be few hospital admissions among properly treated heart patients for reasons of both quality and cost, and this indicator measures the percentage of patients with three or more care episodes with the primary diagnosis of heart failure or atrial fibrillation. The indicator is intended to measure the degree of successful healthcare and comprise the effects of care measures in both primary and specialised care.

To ensure good-quality care, different sectors of healthcare and medical services must collaborate, which involves, among other things, a responsibility on the part of primary and out-patient care to ensure that patients do not unnecessarily find themselves in such an acute condition that they must be re-admitted. One reason for re-admission may be premature discharge or other shortcomings of hospital care as well as shortcomings in the secondary preventive drug treatment or other preventive measures outside the hospitals.

Ideally, it should be possible to state the extent and frequency of in-patient care sessions for these patient groups given high-quality measures. All in-patient cases beyond this should then be viewed as avoidable. This cannot be done and results have to be evaluated on the basis of the variation among county councils that can be seen.

The comparison and the result

The comparison shows that the number of people per 100,000 inhabitants who during the period from 2006 to 2007 had at least three in-patient care sessions (aggregated into care episodes) for heart failure or atrial fibrillation. In-patient care, financed by the county councils, at separate geriatric hospitals or units, nursing homes etc. is not included. Age standardisation has been undertaken, but no account could be taken of the background morbidity of the population.

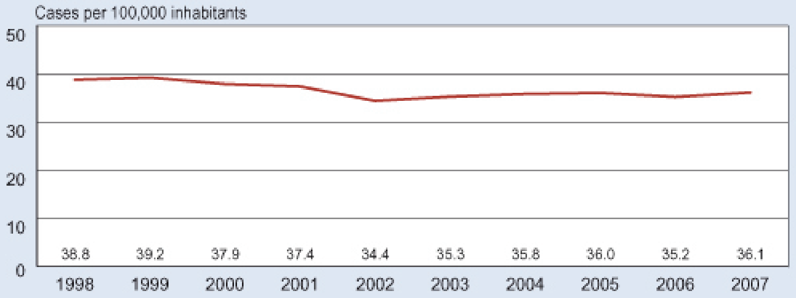
At national level, the number of people who received in-patient care on at least three occasions has been relatively constant over time at between 3,000 and 3,500 annually, and overall men account for around 60% of these patients.

Calculated per 100,000 inhabitants and after age standardisation, there are significant variations among the county councils, as is shown by diagram A2. In this comparison three or more admissions are twice as common in Uppsala and Västerbotten as in Jämtland and Östergötland, where this occurs least of all.

One source of error is that the comparison may be influenced by diagnosis registration, including how the primary and secondary diagnoses are used for different patients; this measurement employs only the primary diagnosis.

Figure A2
Sweden

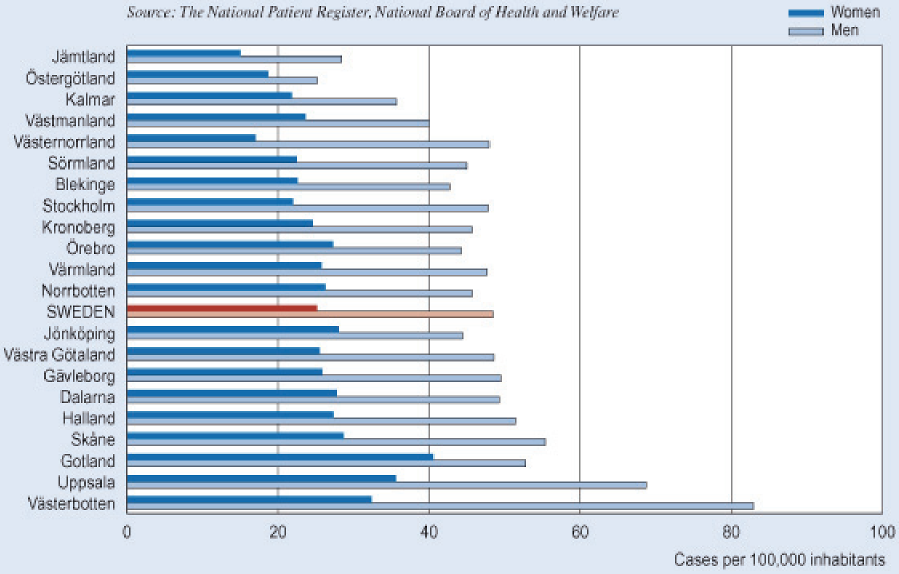
Avoidable hospitalisations for cardiac care. The number of persons per 100,000 inhabitants with at least three hospitalisations. Age standardised.



Source: The National Patient Register, National Board of Health and Welfare

Figure A2
Women
and men

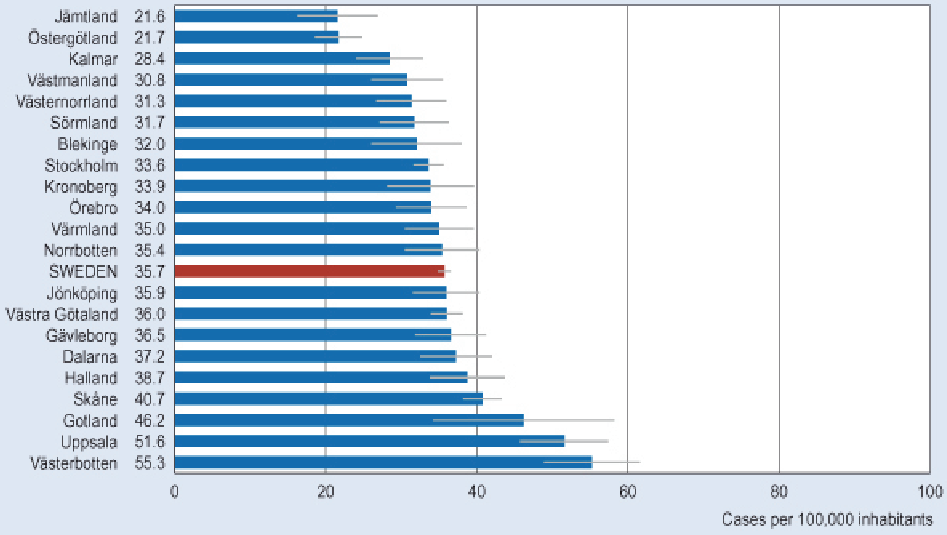
Avoidable hospitalisations for cardiac care. The number of persons per 100,000 inhabitants with at least three hospitalisations, 2006–2007. Age standardised.



Source: The National Patient Register, National Board of Health and Welfare

Figure A2 *Avoidable hospitalisations for cardiac care. The number of persons per 100,000 inhabitants with at least three hospitalisations, 2006–2007. Age standardised.*
Total

Source: The National Patient Register, National Board of Health and Welfare



Coronary artery disease – hospital care and treatment

Reperfusion therapy in ST-segment elevation myocardial infarction (B1)

Barely 30% of all myocardial infarctions in RIKS-HIA belong to the ST-segment elevation category caused by an acute obstructive blood clot in a coronary vessel. The percentage of total infarctions in RIKS-HIA accounted for by ST-segment elevation infarctions has declined over time. Myocardial infarction with simultaneous left bundle branch block on the ECG also means that a blocked coronary vessel is strongly suspected and this condition accounts for 8% of myocardial infarctions. In 2007, the RIKS-HIA database contained over 6,000 cases of ST-segment elevation infarction and over 1,600 cases of left bundle branch block.

These patients require immediate reperfusion of the coronary vessel though PCI treatment (primary PCI) or anti-coagulant drug treatment (thrombolysis) that should start as soon as possible after symptom onset and diagnosis, in order to minimise the damage to the heart and the risk of future heart failure and death. Reperfusion treatment includes primary PCI, thrombolysis and an acute by-pass operation (CABG), as well as acute coronary angiography, which does not result in PCI being implemented.

Primary PCI, as it is termed, is now the predominant treatment in the majority of county councils, and in 2007 it was administered at twenty-eight hospitals. According to the national guidelines primary PCI should be chosen rather than drug treatment (thrombolysis) if this would imply a time delay of no more than ninety minutes. Reperfusion treatment in ST-elevation and left bundle branch block are, irrespective of the method chosen, assigned high priority in the National Guidelines for Cardiac Care, 2008.

The comparison and the result

The indicator refers to patients with myocardial infarction and ST-segment elevation or left bundle branch block on an ECG. The measure shows the percentage of those who received acute reperfusion treatment, separated by the various types of treatment. The indicator is included in the set of indicators for follow-up in the national guidelines and in the 2007 RIKS-HIA quality index for myocardial infarction care.

The results are shown only at county council level on the basis of the patient's home county. The measure functions less well as a quality indicator at hospital level, because patients are selected for treatment at a hospital other than the nearest one, which means that the degree of illness of the patients varies among the hospitals.

In 2007, a total of 5,383 patients were included in the comparison, of whom barely 1,600 were women, and only patients aged eighty or younger were included, as well as only those where the time between symptom onset and ECG was less than twelve hours. Data have been obtained from the RIKS-HIA quality index.

In 2007, 72% of the patients received reperfusion treatment at national level, and there is a relatively wide variation between the percentages of those treated in the various county councils, with values ranging from 54% to 81%. The percentage of men and women treated with reperfusion does not differ to any significant extent. No county council reaches the limit set for top marks in the RIKS-HIA quality index (85% treated). The results for the county of Norrbotten are affected by the fact that two hospitals there are not included in the account.

In the light of the high priority of this measure in the national guidelines, far too few patients are being treated. The reasons for the major variation in the percentage treated have not been elucidated. All hospitals with an internal medicine emergency unit have access to thrombolysis treatment, which means that proximity to a PCI centre is not crucial. A smaller percentage of patients are for medical reasons unsuitable for reperfusion treatment, for example, due to complicating illnesses or a high risk of bleeding. This percentage is somewhat higher for thrombolysis treatment than for primary PCI, but this too should not justify this wide variation. It ought to be possible to increase the percentage of those treated most considerably; alternatively, the arguments for refraining from treatment should be made clear through scientific studies.

One uncertainty is that the degree of coverage by RIKS-HIA of cases of ST-segment elevation myocardial infarction throughout the country has not been studied, and it is probable that this is considerably higher than that relating to all infarction cases.

Figure B1
Sweden

Percentage of patients with ST-segment elevation myocardial infarction given reperfusion therapy. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

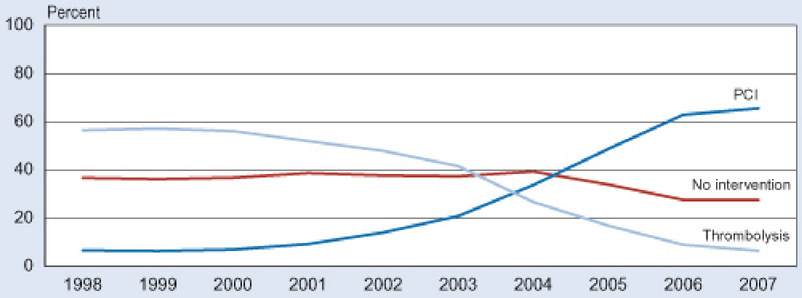


Figure B1
Men

Percentage of patients with ST-segment elevation myocardial infarction given reperfusion therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

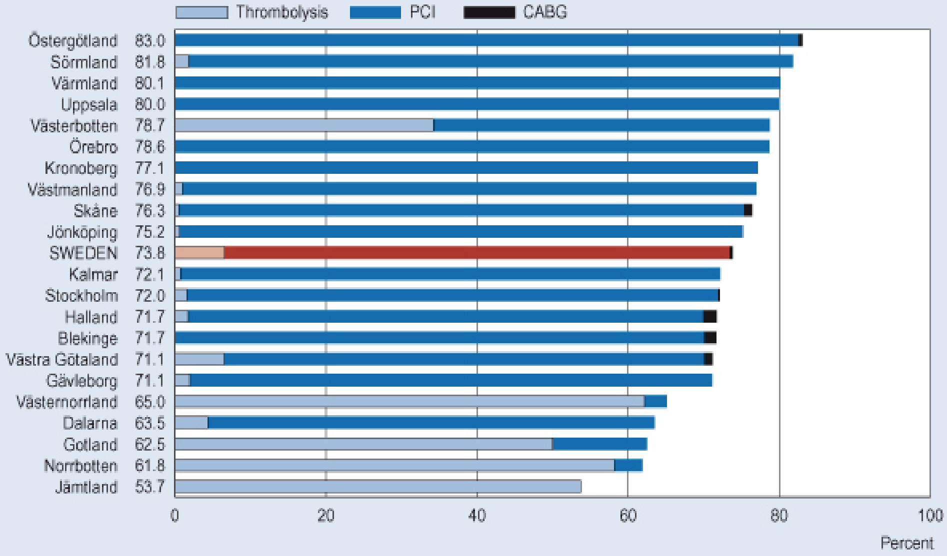


Figure B1
Women

Percentage of patients with ST-segment elevation myocardial infarction given reperfusion therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

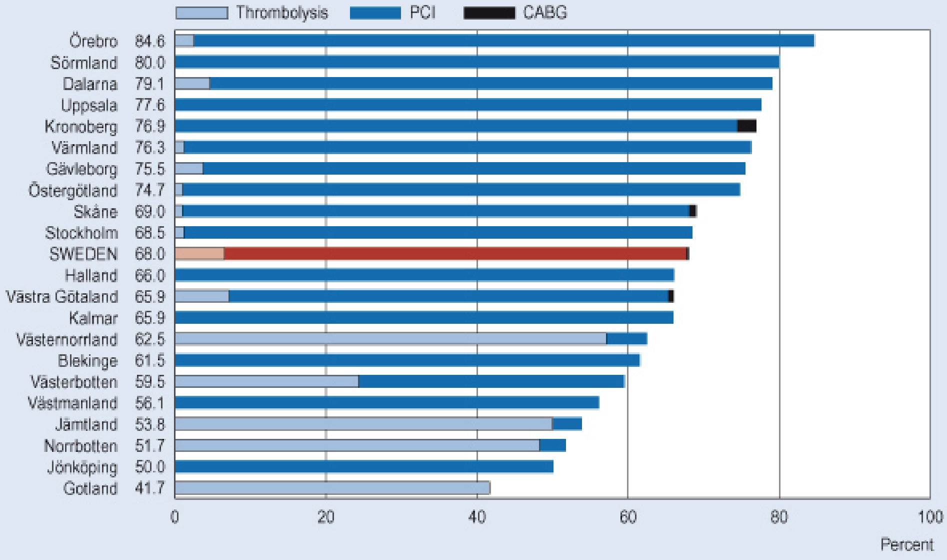
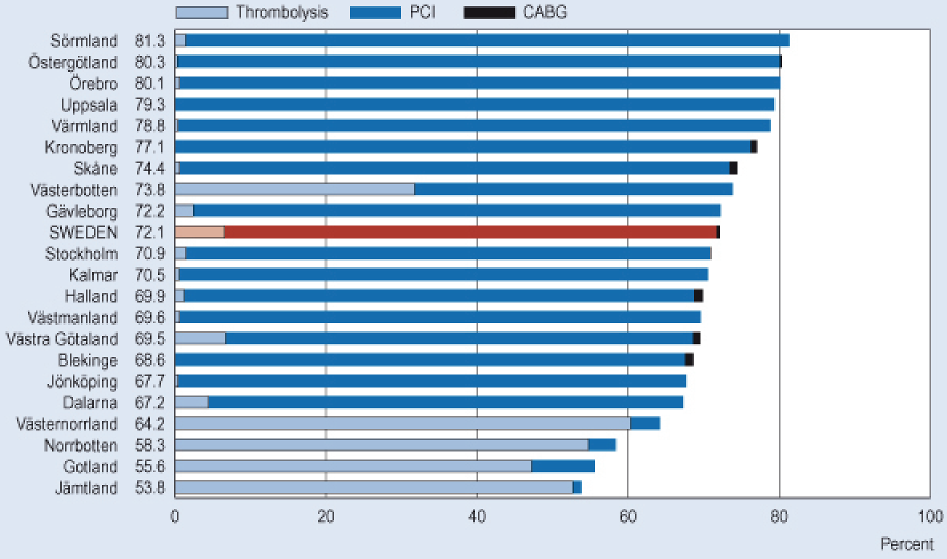


Figure B1
Total

Percentage of patients with ST-segment elevation myocardial infarction given reperfusion therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



Time until reperfusion therapy in ST-segment elevation myocardial infarction (B2)

This indicator relates to the time delay between the first ECG and the start of reperfusion treatment in patients with ST-segment elevation myocardial infarction. The measure shows the percentage treated within the allotted time, which is ninety minutes for PCI and thirty minutes for thrombolysis.

Rapidly implemented reperfusion treatment is an important success factor, and the shorter the time until treatment, the greater the treatment gain. The reason for the internationally applied time limit of thirty minutes for thrombolysis is that this is the time that it is considered practicable to remain within for all the various measures that are needed to initiate thrombolysis treatment. The time limit of ninety minutes for the more complex treatment, PCI, is justified by the fact that PCI gives irrefutable medical gains compared with thrombolysis if the time delay on the grounds of transfer to a PCI centre is less than ninety minutes, or if treatment can commence within ninety minutes of an implemented pre-hospital ECG.

The indicator identifies medical services measures by taking the time of the first ECG as its starting point. The total time from symptom onset to treatment is also affected by how the patient, the next-of-kin, the medical helpline, and the emergency call centre respond to chest pains and other myocardial infarction symptoms as well as by transport times.

The indicator is included in the set of indicators for following up cardiac care, in the national guidelines, and in the 2007 RIKS-HIA quality index. The comparison refers to 2007 and is based on 3,299 patients aged eighty or younger. Data have been obtained from the RIKS-HIA quality index.

At national level 66% of the patients are treated in line with the time goal. There is considerable variation among the county councils, with six of them above the 70% level and four with less than 50% treated within the set time. No county council reaches the limit set for top marks in the RIKS-HIA quality index, 90% treated within the set time.

The percentage of patients treated within the set time limits of ninety and thirty minutes, respectively, rose during the period from 2002 to 2007, from 45% to 65%.

The results can be compared to those in England and Wales, even if the measures are not identical. There, 79% of the patients received PCI treatment within ninety minutes of arrival at the interventional centre, and 85% of the patients are treated with thrombolysis within thirty minutes. For further details, please refer to the report *How the NHS manages heart attacks,* Seventh Public Report 2008, Myocardial Ischaemia National Audit Project, MINAP.

The majority of county councils and hospitals have great potential for reducing the time delays until reperfusion treatment, and if account is taken of supplementary details of the time delay between symptom onset and treatment start, this need for improvement becomes even more pressing. Half the patients treated with PCI experience a time delay of over three hours between symptom onset and treatment. In particular, in the case of those patients who come primarily to their own hospital, which lacks primary PCI facilities, and have to be transferred to a PCI centre, this time delay threatens to become unacceptably long unless well-functioning routines are in place.

One aspect is that the delay time measured is affected if the first ECG is taken in the ambulance instead of upon arrival at the hospital. In county councils where a large percentage of infarction cases are diagnosed in the ambulance, the value of the delay time measure will be impaired due to the time lost during transfer. On the other hand, a pre-hospital ECG means that the preparations for angiography and PCA can start without the patient having arrived at the hospital, and thus the total time from pain onset to implemented reperfusion treatment can be reduced.

Figure B2
Sweden

Percentage of patients with ST-segment elevation myocardial infarction treated with reperfusion therapy within target time. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

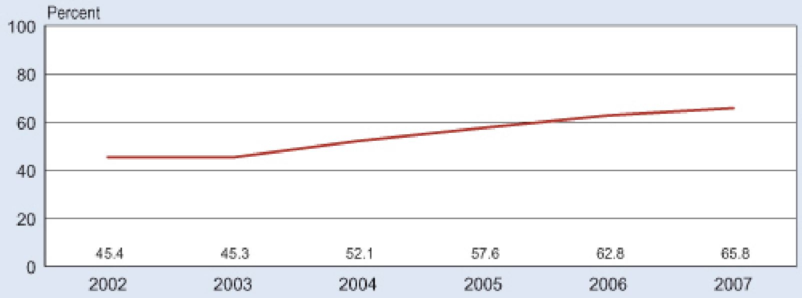


Figure B2
Women
and men

Percentage of patients with ST-segment elevation myocardial infarction treated with reperfusion therapy within target time, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

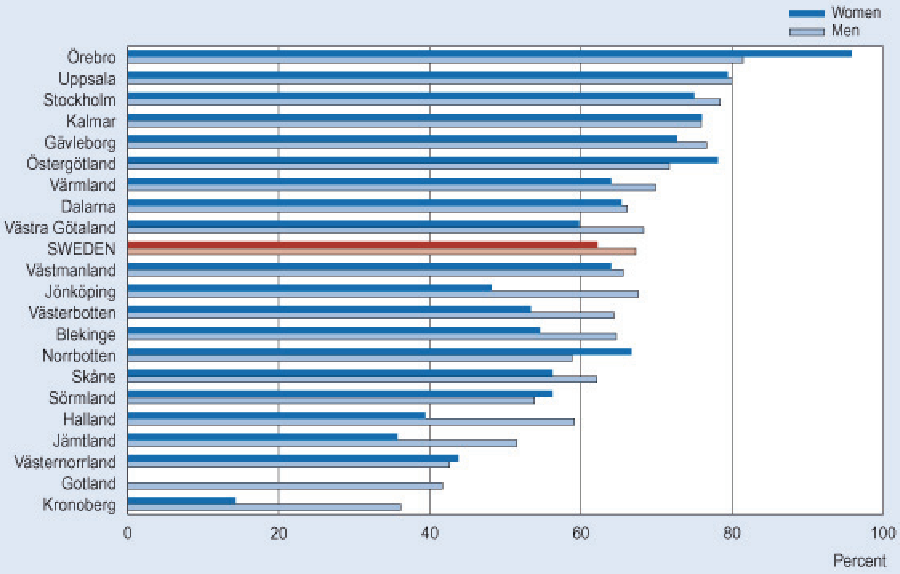


Figure B2
Total

Percentage of patients with ST-segment elevation myocardial infarction treated with reperfusion therapy within target time, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

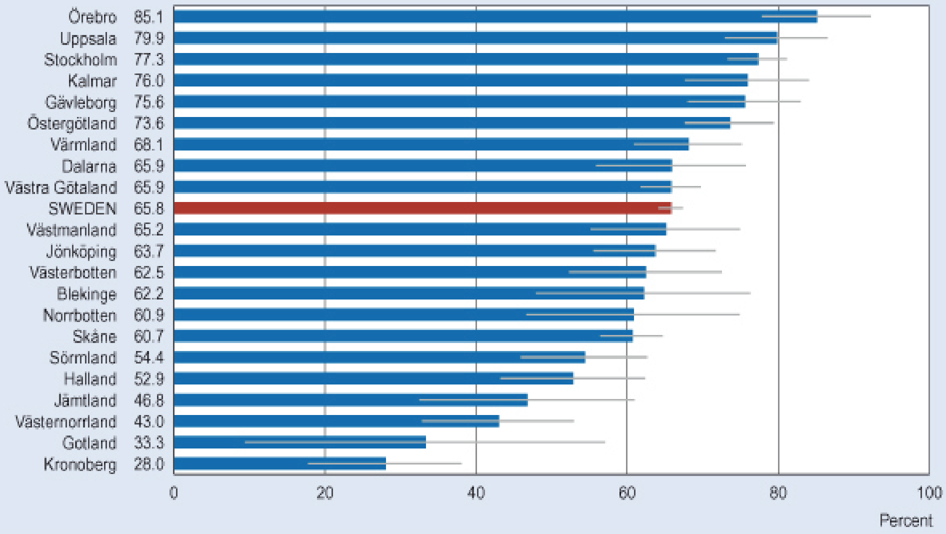
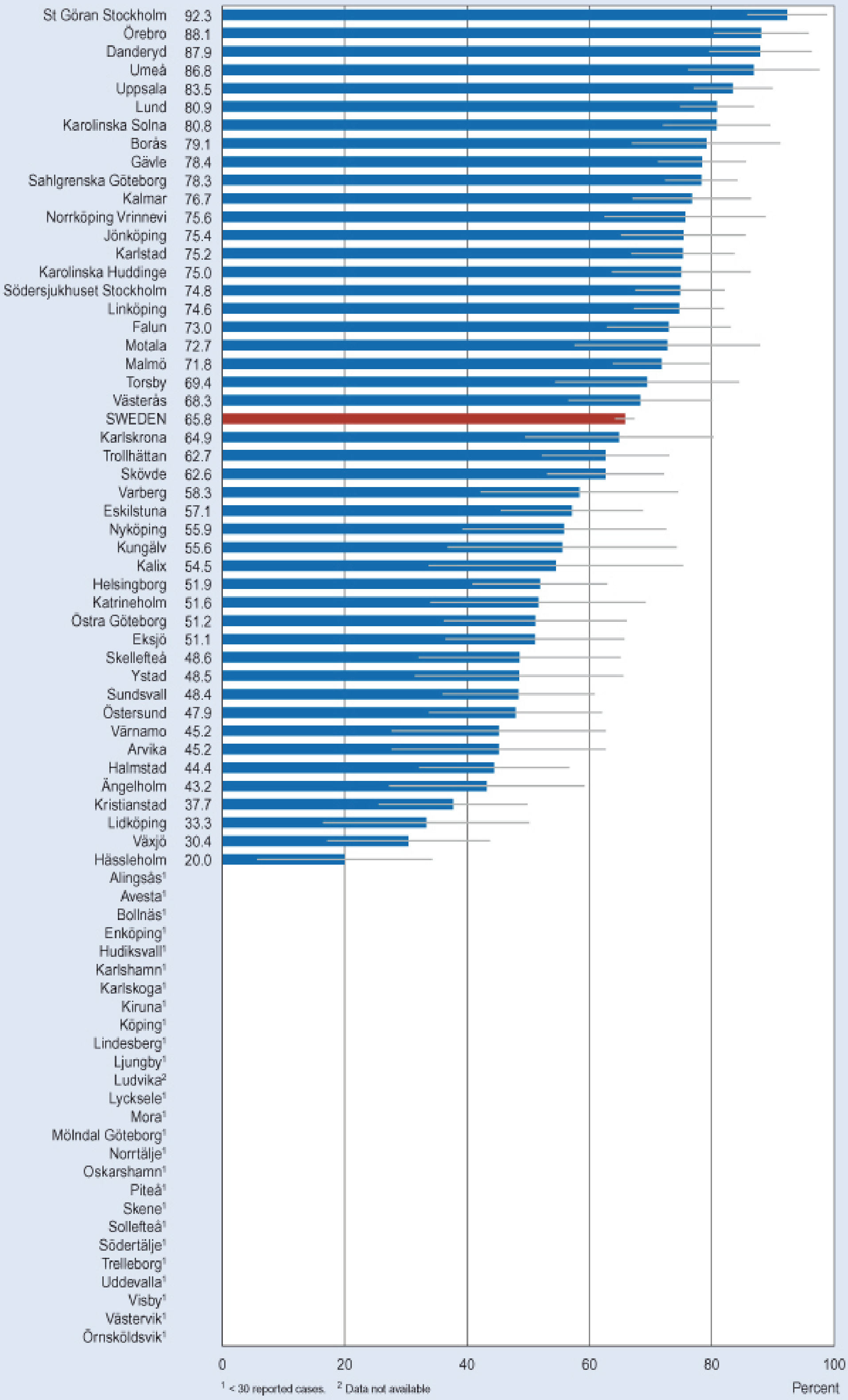


Figure B2
Hospitals

Percentage of patients with ST-segment elevation myocardial infarction treated with reperfusion therapy within target time, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



¹ < 30 reported cases. ² Data not available

Coronary Angiography in patients with non-ST-segment elevation myocardial infarction and an additional risk factor (B3)

Non-ST-segment elevation infarctions constitute just over 60% of the myocardial infarction patient group in RIKS-HIA and this percentage has risen gradually in the past decade.

The patients usually receive intensive anti-coagulant treatment, and those with a moderate or high risk ought to undergo an angiography within a few days in order to clarify the need for a coronary artery intervention. Any intervention in the form of PCI or coronary artery surgery ought to be undertaken within seven to eight days as either procedure reduces the risk of further infarctions. In 2007, a total of thirty hospitals offered coronary angiography.

In accordance with the national guidelines, coronary angiography has a high priority for patients with a moderate or high risk of further heart events, i.e., those who show continuing instability and have at least one further risk factor, for example, diabetes or a previous infarction, or pathological results of a work test. Routine use of angiography for all patients with non-ST-segment elevation infarction has medium-high priority.

Those patients included in the comparison have a moderate or high risk and at least one risk factor besides the infarction itself. In practice, however, there are reasons for certain patients to abstain from angiography. The patient may be multiple-sick or be in too poor a general condition and the expected benefit of the treatment may in this individual case therefore be evaluated as too low. For this reason 100% angiography ought not to be established as an absolute goal.

The comparison and the result

The indicator shows percentage of patients with non-ST-segment elevation myocardial infarction and at least one risk factor who underwent a coronary angiography or where one was planned in conjunction with hospital care. The indicator is included in the set of indicators for following up cardiac care, in the national guidelines and in the 2007 RIKS-HIA quality index for hospitals.

The basis of this comparison comprised in 2007 slightly more than 6,700 patients, of whom over 2,200 were women. Only patients of eighty years or younger were included and data have been obtained from the RIKS-HIA quality index.

The national average was 74% in 2007, which is an increase of around two percentage points compared with 2006. Since 1998 there has been an increase of around forty-five percentage points, in a steadily rising trend.

The differences among the county councils are relatively large, and the percentage of patients undergoing angiography varies from 63% to 86% in the various county councils. Five county councils reach a percentage of 80% or higher while six are below 70%.

The variation among hospitals is larger than that among the county councils. Hospitals of different sizes in different geographical settings show both high and low percentages of patients who underwent angiography, which suggests that proximity to this facility cannot easily account for this variation.

In general, more men than women are treated, and in national terms men show a preponderance of eight percentage points. There may be rational reasons for this variation. Not only are there scientific studies that indicate that women derive less benefit from the treatment (PCI or coronary artery surgery) that motivates the angiography, but also the percentage undergoing angiography decreases with age, which may be due to the greater incidence of different contraindications. Since the women are older than the men, their outcome is affected by this age aspect, although this may also be an expression of age discrimination.

In the light of the recommendation in the guidelines, it may be expected that around 80% of this patient group ought to undergo angiography. A significant number of hospitals do not reach this level, and they and the respective county council management boards have reason to consider the care provided for this patient group.

The RIKS-HIA quality index states an outcome of at least 80% as a requirement for one point, while 0.5 of a point requires 75% of the patients to have undergone angiography.

Figure B3
Sweden

Percentage of patients with non-ST-segment elevation myocardial infarction who underwent coronary angiography. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

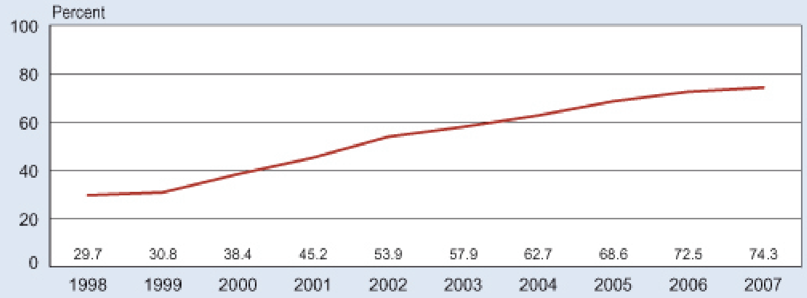


Figure B3
Women
and men

Percentage of patients with non-ST-segment elevation myocardial infarction who underwent coronary angiography, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

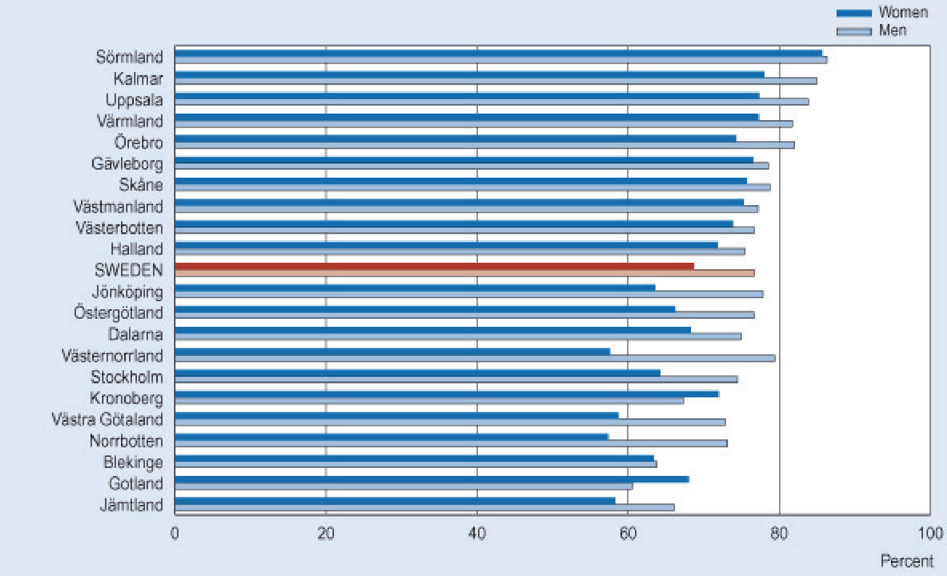


Figure B3
Total

Percentage of patients with non-ST-segment elevation myocardial infarction who underwent coronary angiography, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

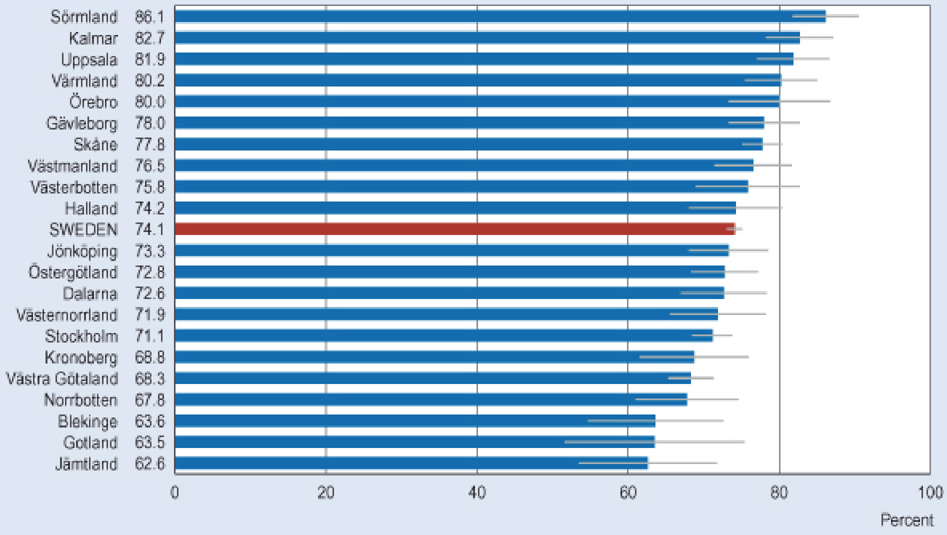
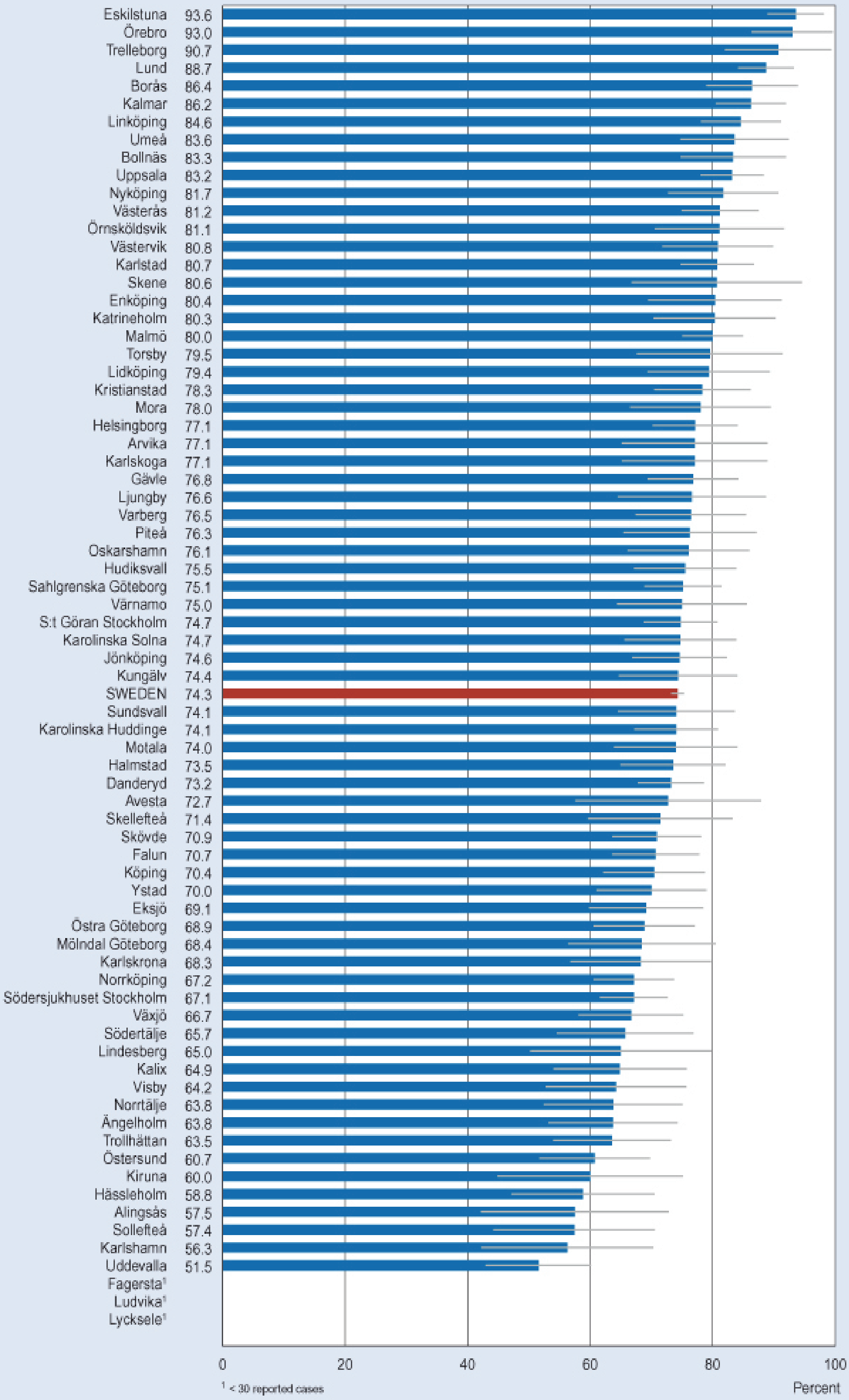


Figure B3
Hospitals

Percentage of patients with non-ST-segment elevation myocardial infarction who underwent coronary angiography, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



[1] < 30 reported cases

PCI frequency with different indications (B4)

The number of PCI treatments in Sweden has increased rapidly since the beginning of the 1990s, as has the number of hospitals that provide PCI. In 2007, there were twenty-eight hospitals that did so among the more than seventy with an emergency internal medicine capability. These twenty-eight are spread throughout the country in such a manner that nearly all the county councils have at least one with this capacity. PCI is always preceded by angiography in order to clarify the need for this intervention. The number of both these measures has risen and thus in 2007 just under 37,000 angiographies and around 19,000 PCI treatments were performed, while this rise levelled out during that year.

PCI is implemented in acute myocardial infarction and also in instable and stable coronary artery disease. In recent years the number and percentage of PCI interventions relating to acute ST-segment elevation myocardial infarction has risen and in 2007 accounted for 25% of the total of such treatments. The expansion in the number of PCI centres can probably be explained to a considerable degree by the ambition of the county councils to have local access to this treatment so that it can be rapidly implemented in the case of ST-segment elevation myocardial infarction. When PCI was growing, this treatment was essentially elective and an alternative to coronary artery surgery.

The comparison in diagram B4 shows the number of annual PCI treatments per 100,000 inhabitants from 2006 to 2007, distributed by treatment indicators. No age standardisation has been performed, nor any adjustment for background morbidity with respect to coronary artery disease in the various county councils. In general, it is neither positive nor negative to have many or few PCI treatments.

Presented in this manner, the indicator is neither a quality indicator nor an actual measure of access. Illustrating access to treatment requires, among other things, taking into account the extent of coronary artery surgery for the inhabitants of the various county councils.

The purpose is to use an approximate description to point out the variation in the use of PCI treatment. The rapid expansion in PCI centres and treatments may cause an uneven development of the use of this treatment and the risk of an over-establishment in certain parts of the country. Previously formulated requirements for minimum treatment volumes at each hospital may also contribute towards an uneven expansion. Once a hospital has adopted this treatment, it becomes important to use its capacity and increase the volume.

Diagram B4 shows that PCI use is at its highest level among a number of county councils in central Sweden and in Kalmar. The difference with regard to the county councils in the lower third of the diagram is considerable and can be explained in part by the variations in background morbidity (please refer to Appendix 2, which describes the risk factors for heart disease). The question is to what extent the variations in PCI use, apart from that relating to patients with ST-segment elevation infarction, can be traced back to factors other than population morbidity and patient needs.

This pattern of PCI use and its variations is of interest in discussions of the most suitable treatment of different patient groups. There is both the alternative of coronary artery surgery for certain patient groups, for example, those with trivascular disease and also that of drug treatment for patients with stable coronary artery disease.

The question as to whether the various alternative treatments are used to the desired extent in different county councils demands in-depth descriptions and analyses. The existence of quality registers for both PCI and heart surgery ensures relatively good preconditions for following up how different alternative treatments are used.

Figure B4
Men

Number of PCI treatments in the case of different indications per 100,000 inhabitants, 2006–2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

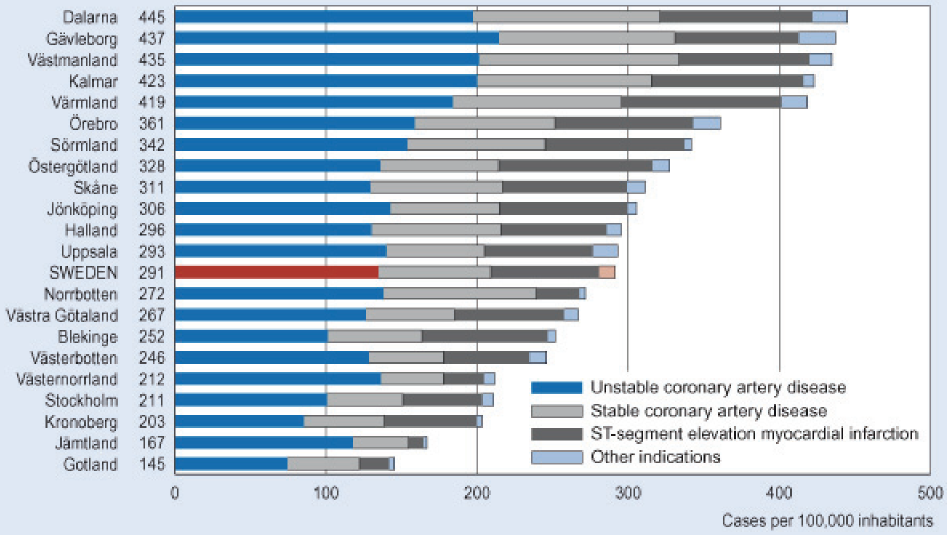


Figure B4
Women

Number of PCI treatments in the case of different indications per 100,000 inhabitants, 2006–2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

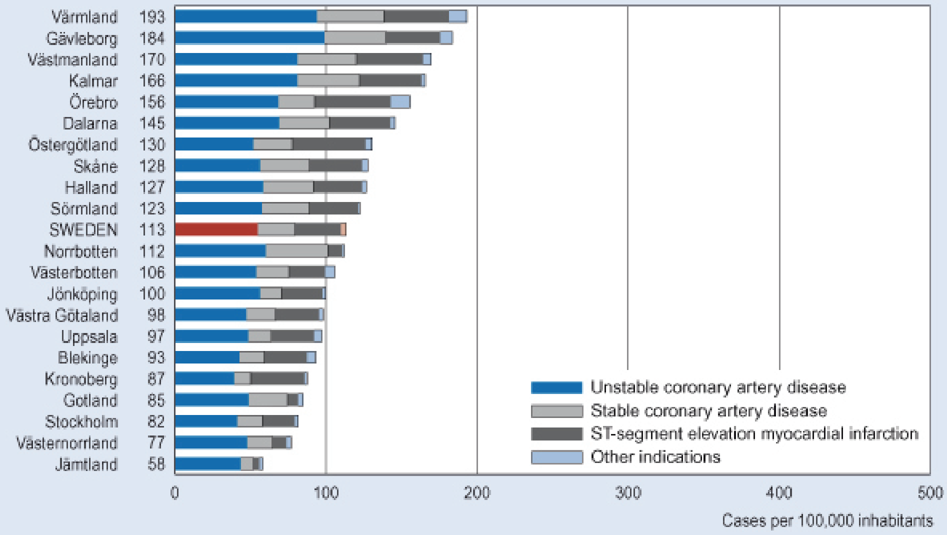
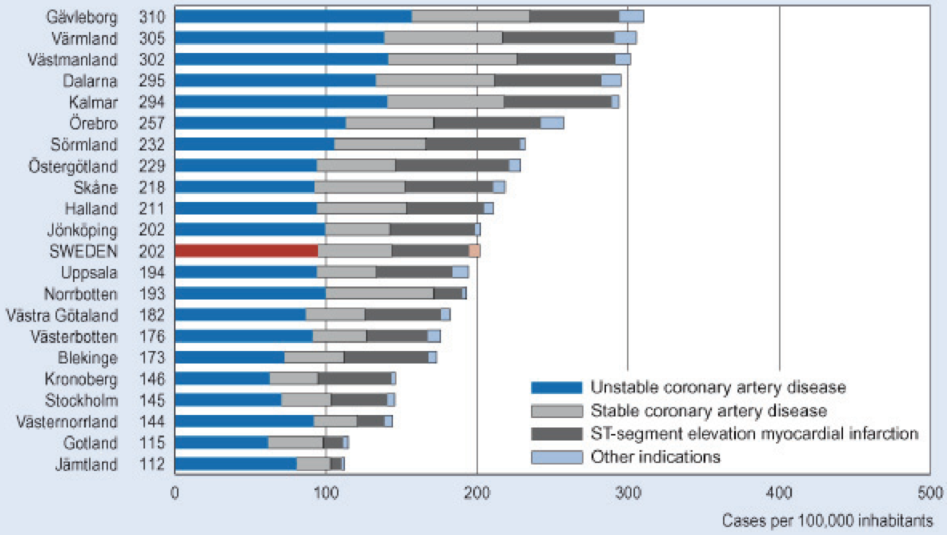


Figure B4
Total

Number of PCI treatments in the case of different indications per 100,000 inhabitants, 2006–2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry



PCI in main stem stenosis (B5)

The indicator refers to patients where the angiography reveals a constriction of that part of the coronary artery of the heart that is called the main stem. This measure shows the percentage of those patients for whom PCI was the treatment adopted. Patients with ST-segment elevation infarction or previous coronary surgery are not included. In main stem stenosis coronary artery surgery ought to be chosen in preference to PCI according to the national guidelines, since earlier studies have shown good results for this treatment, compared with medical treatment, and there are no randomised studies that have compared PCI and coronary artery surgery. PCI has been considered risky in main stem stenosis due to the fact that this vessel supplies the greater part of the heart muscle.

The indicator is included in the set of indicators for following up cardiac care, in the national guidelines, and it also includes the larger group of patients with trivascular disease. According to the guidelines coronary artery surgery is also the first choice for this patient group. Data on this are shown in the annual report from SCAAR, but the lack of any consensus on the definition of trivascular disease, and widely varying registration practices, result in uncertainty in comparisons, and, for these reasons, only patients with main stem stenosis have been included here.

The comparison and the result

The measure shows patients with main stem stenosis that were treated by PCI. The comparison includes 2,801 patients with main stem stenosis during the period from 2006 to 2007 and includes only patients below eighty years of age. Patients with ST-segment elevation myocardial infarction or previous coronary artery surgery have been excluded. Other conceivable contraindications for coronary artery operations have not been assessed. Data have been obtained from the SCAAR quality register.

During 2006 and 2007 11% of the patients with main stem stenosis throughout the country were treated with PCI, which is equivalent to 304 patients. The percentage of those so treated has been constant during a period of years but almost doubled between 2005 and 2007, from 6% to 11%, which corresponds to 135 patients.

The difference in PCI use is very wide, with a variation of between 2% and 31% for different county councils and it was above all the results for Dalarna that are divergent. Some of the county councils with the highest percentage of patients treated with PCI have no access to coronary artery surgery within their own boundaries. The variation at hospital and at county council level is approximately equal in magnitude.

PCI in main stem stenosis ought to be resorted to only when coronary artery surgery is considered unsuitable. No optimum percentage of patients treated with PCI can be indicated but the variation among units and among county councils should be noted.

The growth in 2006 and 2007 to the level of around 11% of patients treated with PCI is possibly a result of the fact that several register studies during this period showed good results for PCI in patients with main stem stenosis. One explanation for this growth may also be that at certain hospitals a major randomised study of PCI treatment versus coronary artery surgery in this patient group was in progress.

The 2007 SCAAR annual report shows results with the same trend for the group of patients with trivascular disease. For this significantly larger patient group, PCI is used to a greater extent in preference to coronary artery surgery.

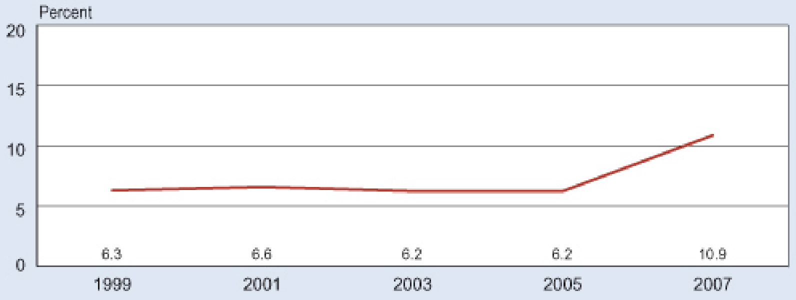


Figure B5
Sweden

Percentage of patients with main stem stenosis treated by means of PCI. Age <80 years.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

Figure B5
Women
and men

Percentage of patients with main stem stenosis treated by means of PCI, 2006–2007. Age <80 years.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

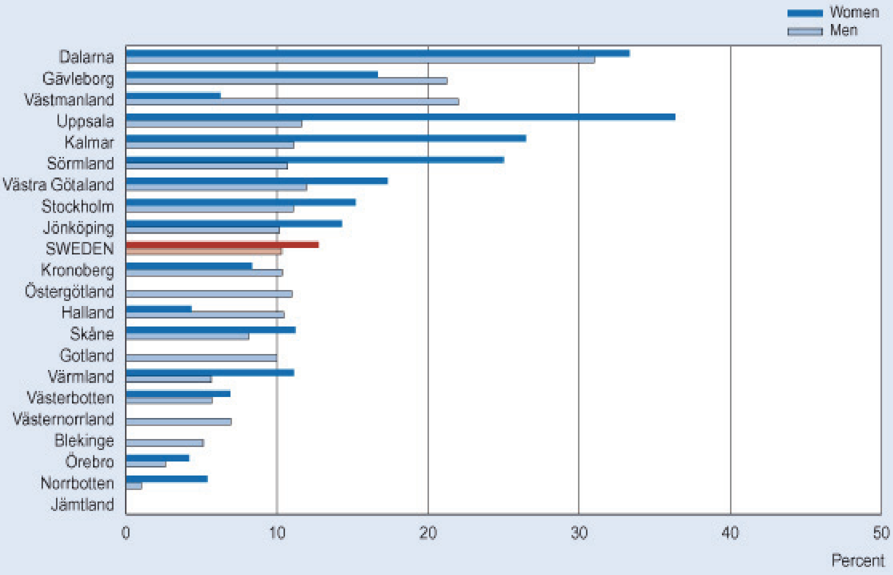


Figure B5
Total

Percentage of patients with main stem stenosis treated by means of PCI, 2006–2007. Age <80 years.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

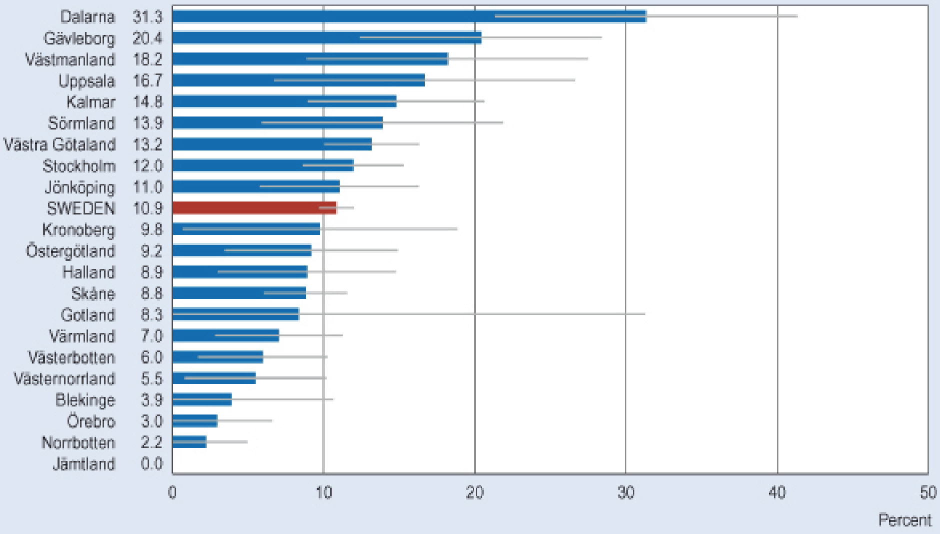
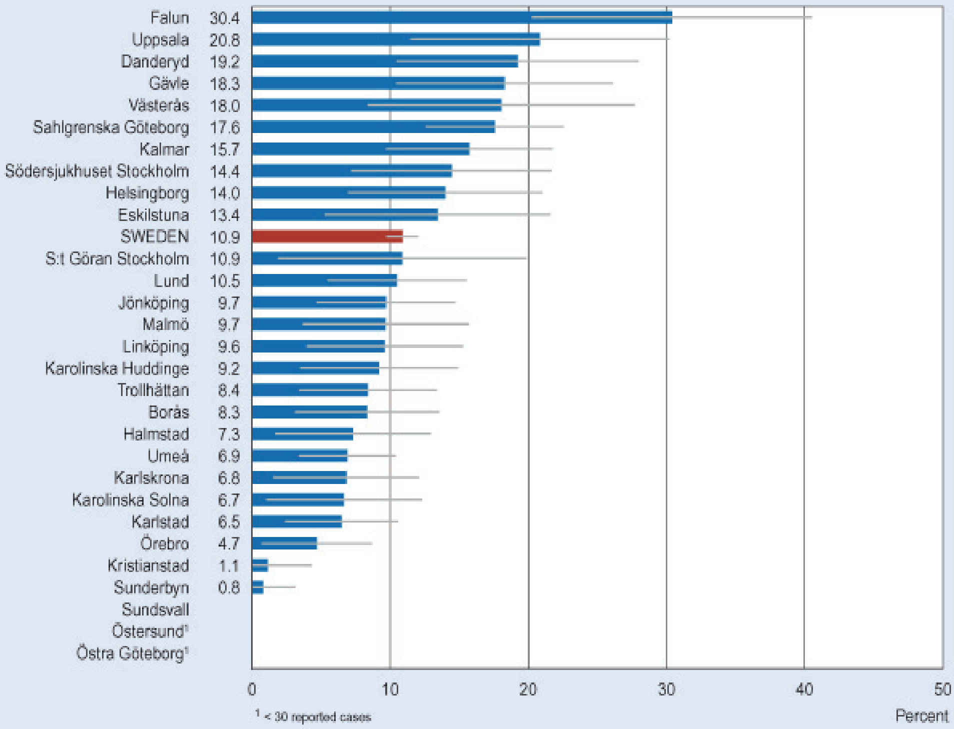


Figure B5
Hospitals

Percentage of patients with main stem stenosis treated by means of PCI, 2006–2007. Age <80 years.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry



¹ < 30 reported cases

Drug-eluting stent in PCI (B6)

Of all the patients treated with PCI, a total of 90% have a stent inserted in the vessel. A stent which is a small cylindrical mesh, usually made of steel, which is put in position at the site of the old constriction, which is first expanded by means of an inflatable balloon, in order to prevent the constriction from recurring. Nowadays, there are stents coated with drugs that further diminish the risk of this happening.

The purpose of a stent is to reduce the risk of a sudden obstruction or re-constriction of a vessel that has been expanded through PCI. Metal stents have been restricted by a risk of nearly 10% to 20% of re-constriction in the stent within a six-month period, and now stents with a medicated surface coating have therefore been developed. Drug-eluting stents reduce cell and connective tissue re-growth and thus the risk of re-constriction. Very positive results relating to a reduced risk of re-constriction have led to a widespread use of drug-eluting stents after they became available in 2003.

Later studies showed that the drug-eluting stent increased the risk of blood clots forming on it, which is a serious complication with a high mortality. Certain studies also suggested that they increased long-term mortality. The use of drug-eluting stents thus declined after 2005. Further follow-up of earlier studies and several new ones have, however, not been able to confirm that there is any heightened risk of myocardial infarction with a drug-eluting stent compared with a bare-metal one. However, there is still proof of a low degree of increased risk of late occurring blood clots in the stents, which requires preventive treatment with blood-clot inhibiting drugs during a lengthy period.

The general use of drug-eluting stents generates a very high cost per additional quality-adjusted year of life. According to the national guidelines drug-eluting stents ought therefore to be given only to patients with a high risk of re-constriction, for example, due to diabetes, small vessel diameter, long stenoses or previous re-constriction. A further condition is that the patients tolerate long-term treatment with anti-coagulant drugs. General use of drug-eluting stents has a very low priority (priority 10).

The comparison and the result

The indicator refers to patients treated with PCI who had a stent inserted. The measure shows the percentage of those who had a drug-eluting stent inserted in the vessel. The indicator is included in the set of indicators for following up cardiac care, in the national guidelines. Data have been obtained from the SCAAR quality register.

In 2007, in total 15,600 patients were treated with PCI and had at least one stent inserted. Of these, 19% received a drug-eluting stent throughout the country, which is equivalent to over 2,900 patients. Viewed over time, use peaked in 2005, when 56% received a drug-eluting stent.

There are major differences among the county councils and eight of them have more than double the percentage of drug-eluting stents than the seven with the lowest percentage. There is also considerable variation among hospitals in the use of drug-eluting stents, with a spread ranging from 4% to 49% of those treated. The gender differences are minor; women receive a drug-eluting stent slightly more often but they also belong to a greater extent to the group with a high risk of re-constriction. In an international perspective, Sweden has a low percentage of drug-eluting stents.

No optimum level for the use of drug-eluting stents can be stated, and the variation suggests that different hospitals interpret the relationship between cost and benefit for this type of treatment differently. Hence, it is important to establish wider agreement so that differences in practice decrease and the use of drug-eluting stents is reserved for patients with a high risk of re-constriction.

Figure B6
Sweden

Percentage of patients given a drug-eluting stent in PCI-treatment.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

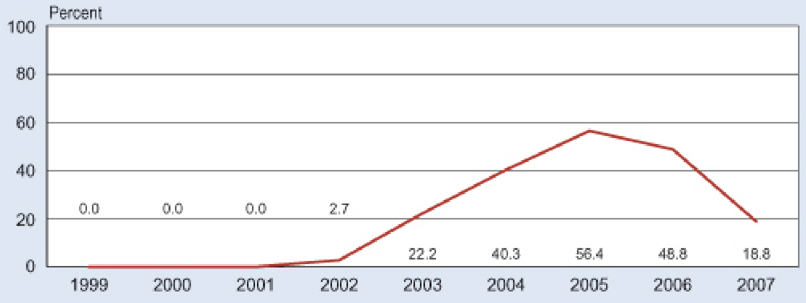


Figure B6
Women
and men

Percentage of patients given a drug-eluting stent in PCI-treatment, 2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

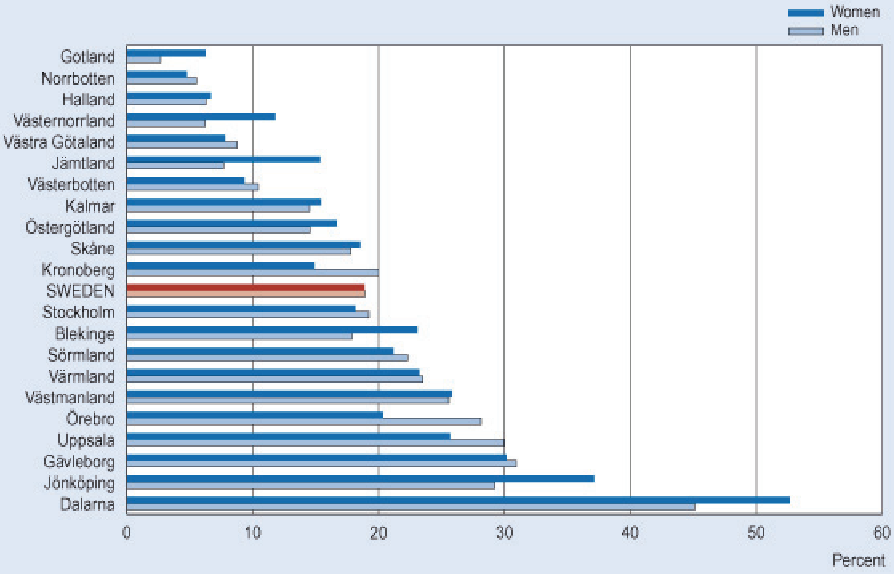


Figure B6
Total

Percentage of patients given a drug-eluting stent in PCI-treatment, 2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

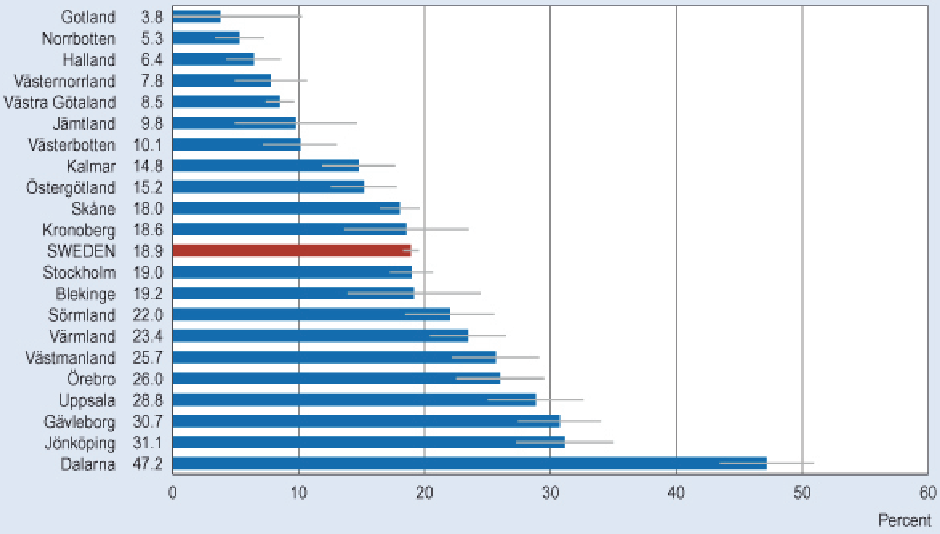
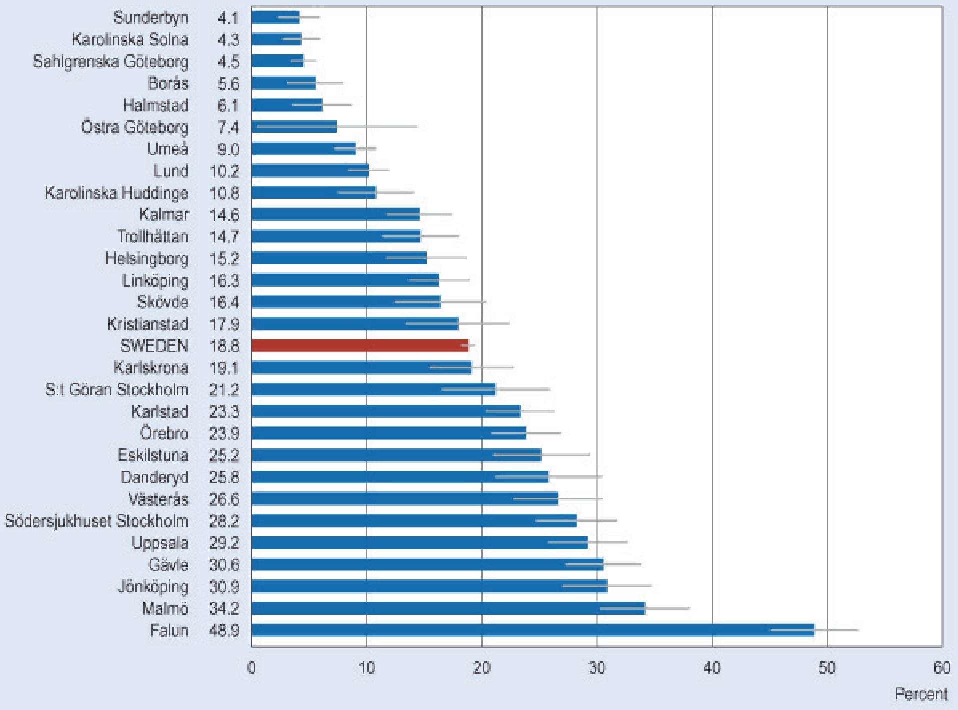


Figure B6 *Hospitals*

Percentage of patients given a drug-eluting stent in PCI-treatment, 2007.

Source: SCAAR – The Swedish Coronary Angiography and Angioplasty Registry



Waiting times for coronary artery surgery (B7)

A coronary artery operation is an alternative treatment for the constriction of coronary arteries, but in both absolute numbers and in relation to PCI, the number of coronary artery operations has dropped in the past fifteen years. An increasing percentage of these operations are performed on patients who have priority on account of instable coronary symptoms and planned interventions are becoming fewer. There are eight hospitals in Sweden that perform this operation, and those performed at St Göran in Stockholm are described under the heading for the Karolinska University Hospital in Solna.

A long waiting time for coronary artery surgery may mean risks of deterioration in the patient’s condition, i.e., that myocardial infarction or death may occur before it can be performed. The maximum waiting-time guarantee applies to this treatment as it does to all planned care, and with it, the requirement that operations take place within ninety days of decision date. Unlike the majority of other planned treatments, there is a medical risk attached to such delays and consequently the time limit in the care guarantee is less relevant.

The national cardiac care guidelines therefore take note of the waiting times for coronary artery surgery by including a measure relating to this in the set of indicators for cardiac care follow-up, but no target expressed in days is given. However, waiting times are to a great degree influenced by medical services routines and priorities.

The comparison and the result

The indicator measures the median waiting time in days from deciding on an operation until it is performed. Patients of all ages are included, and the description at county council level is based on the home county, irrespective of the hospitals where operations are performed.

In 2007, a total of 4,182 operations were performed, of which around 900 were on female patients. The waiting time for coronary artery surgery in the country as a whole was fourteen days. After a decrease between 2003 and 2004, the trend of the last five years shows virtually no change in median waiting time, which for men was somewhat higher than for women, at fourteen days as compared to twelve, which is not stated in the printed report.

A noticeable variation in waiting time was seen across the country. For patients from the counties of Norrbotten and Dalarna it was over thirty days, while it was less than ten days in the case of Blekinge, Örebro, Värmland, Västmanland and Gotland.

Waiting times for coronary artery surgery also varied considerably among the hospitals: in Umeå median waiting time was almost thirty days but less than ten days in Örebro and Karlskrona.

Waiting times reflect several conditions such as the number of individuals requiring surgery, regional operating capacity including intensive care resources, hospital beds and after-care. Northern Sweden had the highest prevalence of ischemic heart disease, which may explain the high patient load there.

Figure B7
Sweden

Waiting times for coronary artery surgery, measured as median time from decision to completed operation.

Source: The Swedish Cardiac Surgery Register

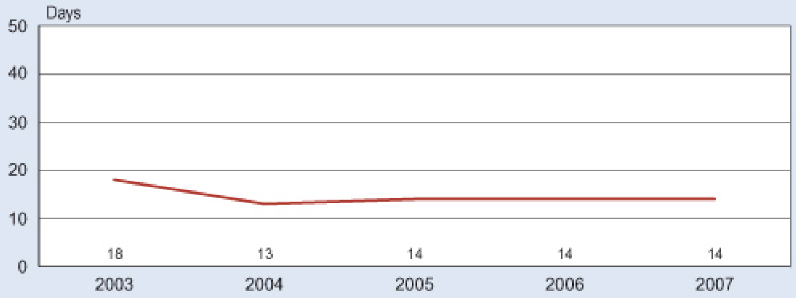


Figure B7
Women
and men

Waiting times for coronary artery surgery, measured as median time from decision to completed operation, 2007.

Source: The Swedish Cardiac Surgery Register

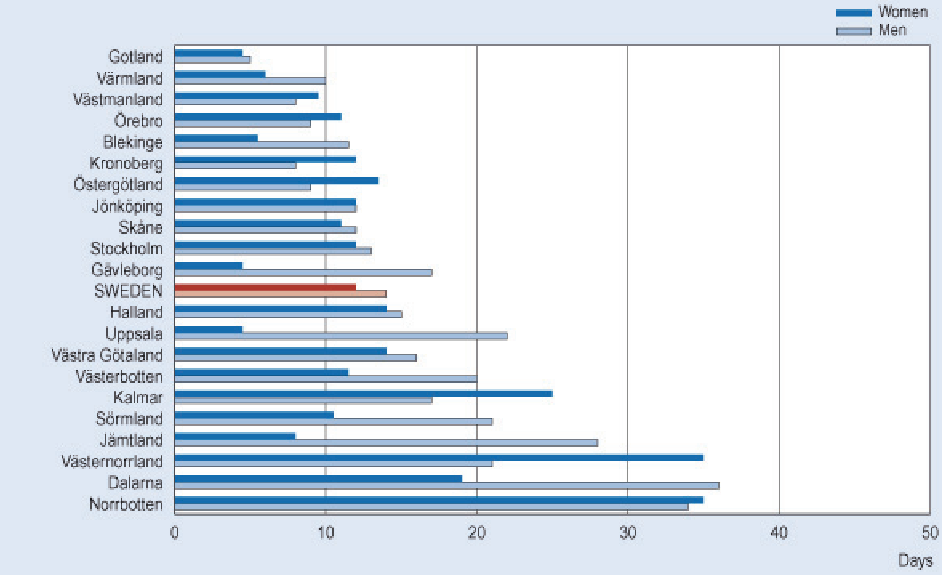


Figure B7
Total

Waiting times for coronary artery surgery, measured as median time from decision to completed operation, 2007.

Source: The Swedish Cardiac Surgery Register

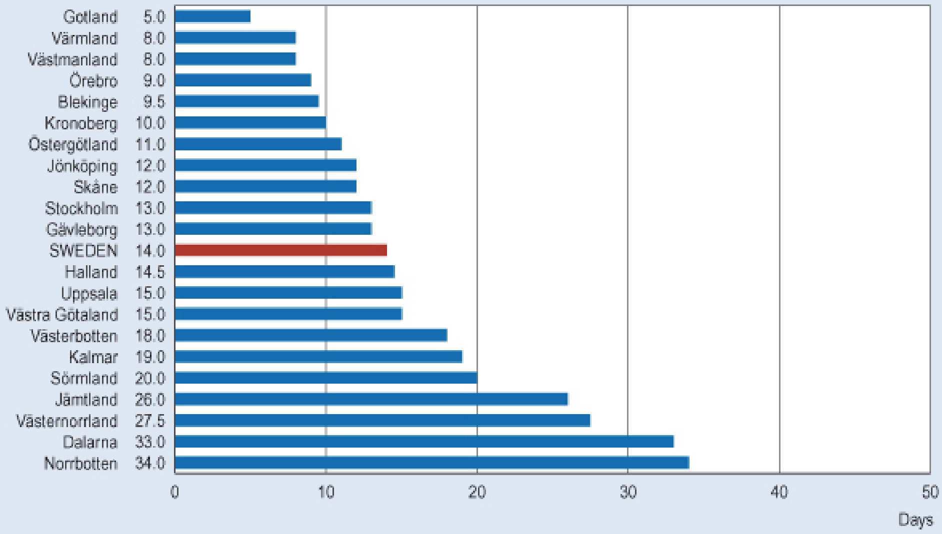
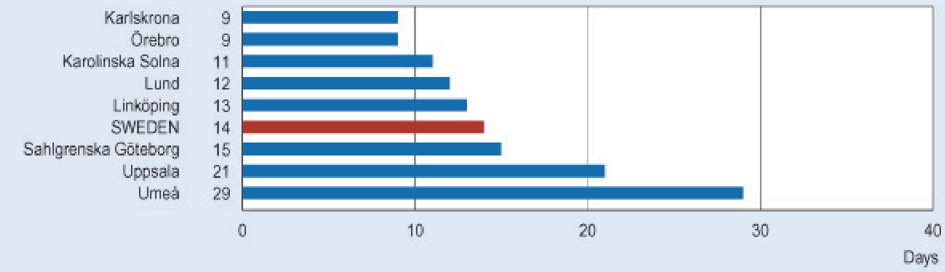


Figure B7 *Waiting times for coronary artery surgery, measured as median time from decision to completed operation, 2007.*
Hospitals

Source: The Swedish Cardiac Surgery Register



Coronary artery disease – drug treatment

Anti-coagulant treatment at discharge after myocardial infarction (B8)

The majority of myocardial infarctions are caused by a blood clot that blocks one of the coronary arteries of the heart. Once an infarction has happened, there is a greater risk of a second clot and infarction, and it is thus important to reduce the risk of new blood clots forming in the coronary arteries of such patients. This is done through anti-coagulant treatment with drugs, which are of two types: those that inhibit the blood platelets (acetyl salicylic acid and clopiodgrel) and those that do the same to the clotting ability of the blood (Warfarin).

In principle all patients who have had a myocardial infarction ought to be treated, with the exception of those with over-sensitivity or other medical contraindication. This treatment has strong evidence support and is evaluated as a cost-effective secondary preventive measure. Treatment with acetyl salicylic acid (ASA) has been assigned priority 1 for this patient group in the national guidelines. As an alternative for those patients who do not tolerate ASA and as a supplementary treatment during a limited time (three to twelve months) Clopidogrel also has high priority, as does Warfarin for patients with concomitant heart infarction and atrial fibrillation.

Any consideration of possible treatment should always be determined after an overall evaluation of the condition of the individual patient, with account taken of, for example, other concomitant illness and other current drug treatment.

The comparison and the result

Two indicators in the report identify the same quality aspect and show the percentage of patients who upon discharge from the hospital are treated with anti-coagulant drugs; these data taken from the RIKS-HIA quality register. Indicator B9 shows instead the percentage of patients who twelve to eighteen months after discharge from the hospital had actually collected equivalent drugs.

Indicator B8 is part of the 2007 RIKS-HIA quality index and is one of the nine measures of quality in the hospital care process. On the other hand, it is not included in the set of indicators for following up cardiac care, in the national guidelines.

In 2007, the basis for this indicator was 13,921 patients, of whom one third were women. Only patients aged eighty or younger are included. Description by county council is based on the patients' home county, irrespective of the hospital where treatment was provided.

In 2007, in total 98% of the patients were treated in the country as a whole, and the differences among the county councils were very small, ranging from 97% to 100% treated. At hospital level, too, there was very little variation, and only two hospitals had a treatment level below 95%. Men and women were not recorded separately, but in principle were treated to the same degree. The trend in the past ten years shows a slowly rising treatment level, which, however, has levelled out at 98% in the past three years. In ten years the use of these drugs within the patient group has risen by five percentage points.

The present treatment is well established as a secondary preventive measure after myocardial infarction. The overwhelming majority of patients receive the care that is recommended by the national guidelines. In addition, please refer to the description of drugs actually collected by patients in the indicator B9 text below, which presents a similar picture.

Figure B8 Sweden *Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin at discharge after AMI. Age ≤80 years.*

Source: RIKS-HIA – Registry on Cardiac Intensive Care

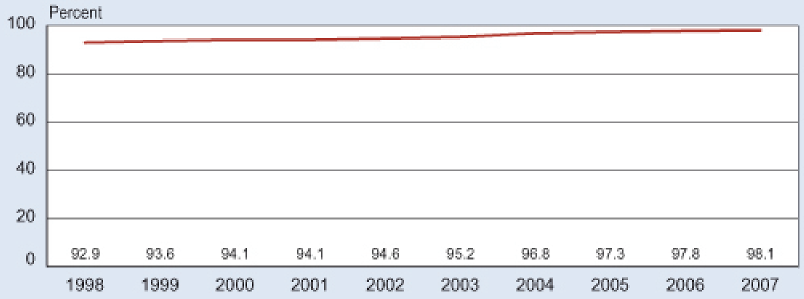


Figure B8
Women
and men

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

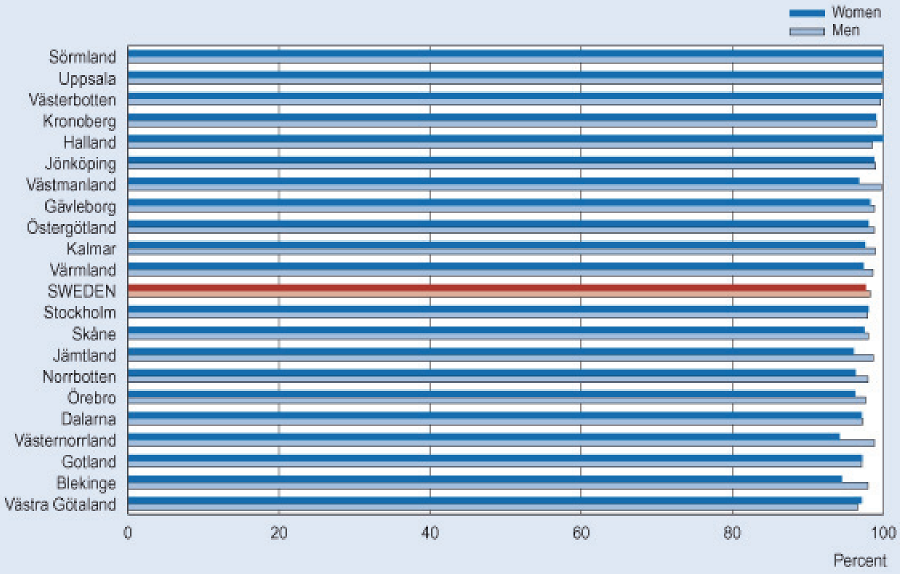


Figure B8
Total

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

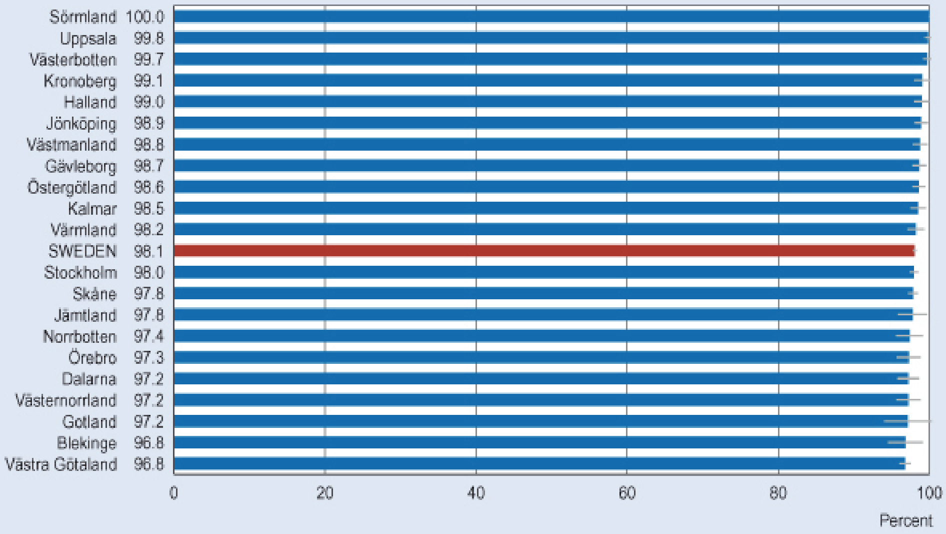
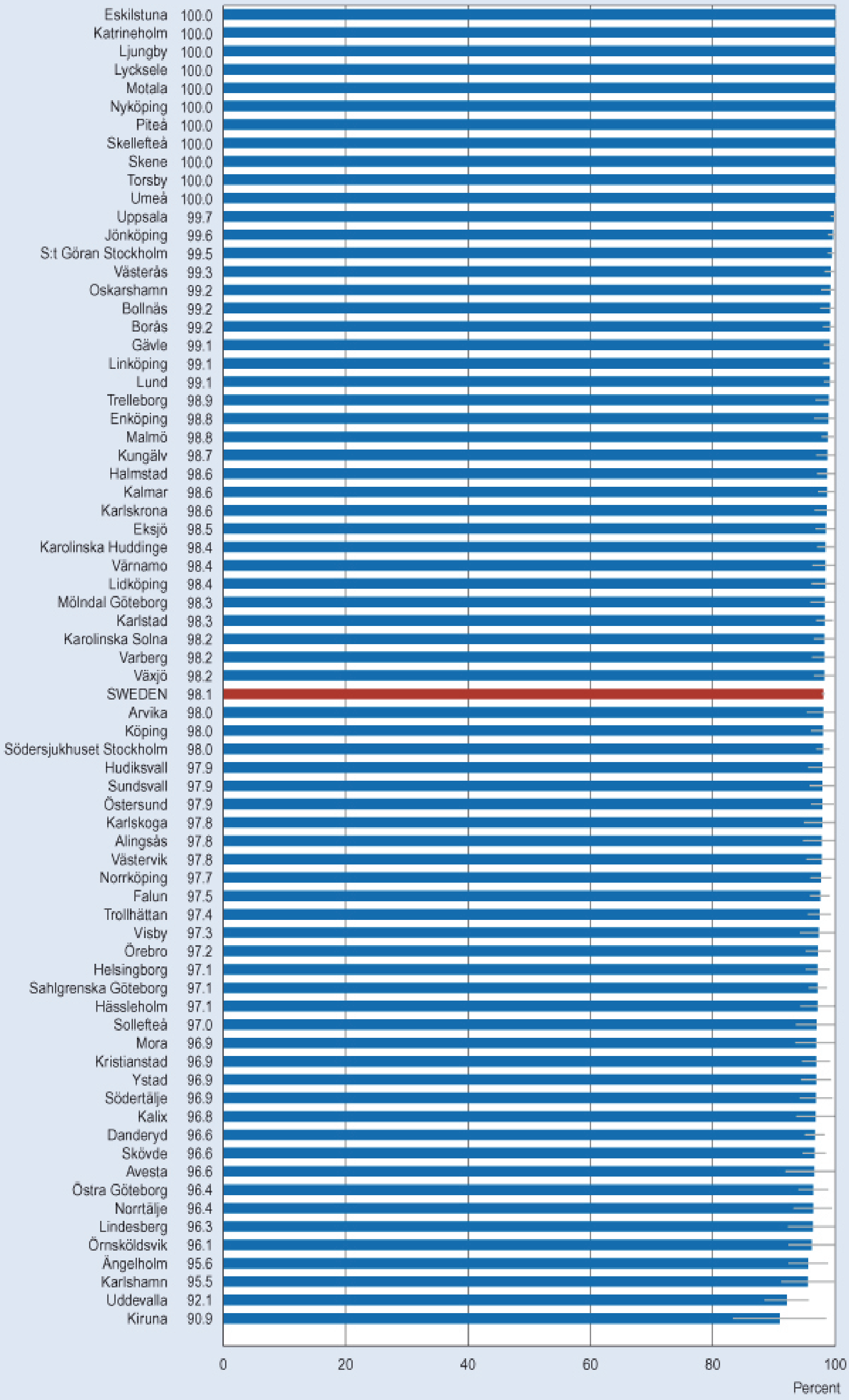


Figure B8
Hospitals

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



Anti-thrombotic treatment 12–18 months after myocardial infarction (B9)

This indicator measures the percentage of patients who receive hospital treatment for myocardial infarction and who twelve to eighteen months after their discharge use anti-coagulant drugs. It reflects the care measures by both hospital and primary care. Indicator B8 measures instead whether the patient was prescribed these drugs upon discharge from hospital.

The comparison includes cases of myocardial infarction for the period from 2005 to 2006 in the Patient Register that relate to patients below the age of eighty. They numbered in total 24,553, of whom just over 30% were women. Details of the patients' drug treatment have been obtained from the Swedish Prescribed Drugs Register and relate to both drugs collected from pharmacies and those provided as dose pouches, which function as single-use dosette boxes containing the quantity of the drug that the patient should have on each occasion (ApoDos).

For the country as a whole, the percentage of patients treated was 93% during the period from 2005 to 2006. A long-term trend is not available as the Swedish Prescribed Drugs Register is much too new.

At county council level the variations in the treatment level were small. Stockholm and Gotland had around 90% of the patients treated, while the counties of Jämtland and Kronoberg treated around 96% of the patients. Among the hospitals the differences were somewhat greater but still modest in comparison with the majority of other indicators described in this report. The lowest treatment level was in Simrishamn at 84% while Ludvika recorded the highest value at 98%. For the country as a whole there are no differences between the sexes. At county council level the variation between the sexes was at most a couple of percentage points.

In comparison with the myocardial infarction patients in RIKS-HIA, a smaller percentage of infarction patients in the Patient Register were treated, that is to say, when all infarction patients are studied. No comparison was undertaken solely of the group of infarction patients that are not registered in RIKS-HIA.

Figure B9
Women
and men

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

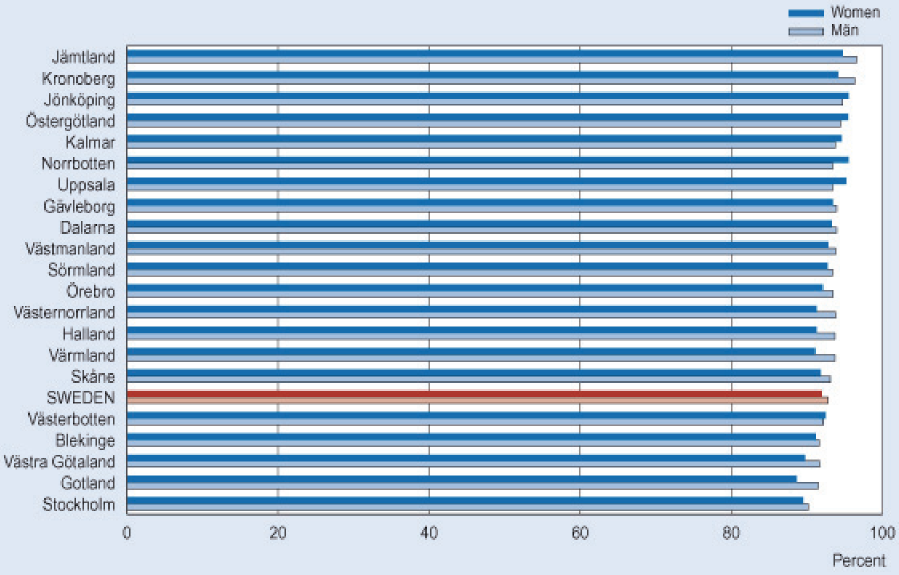


Figure B9
Total

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

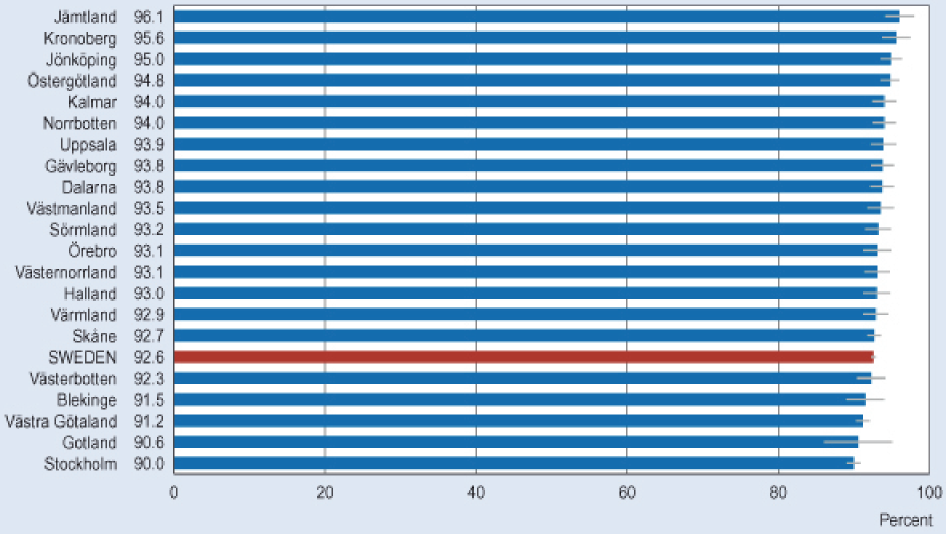
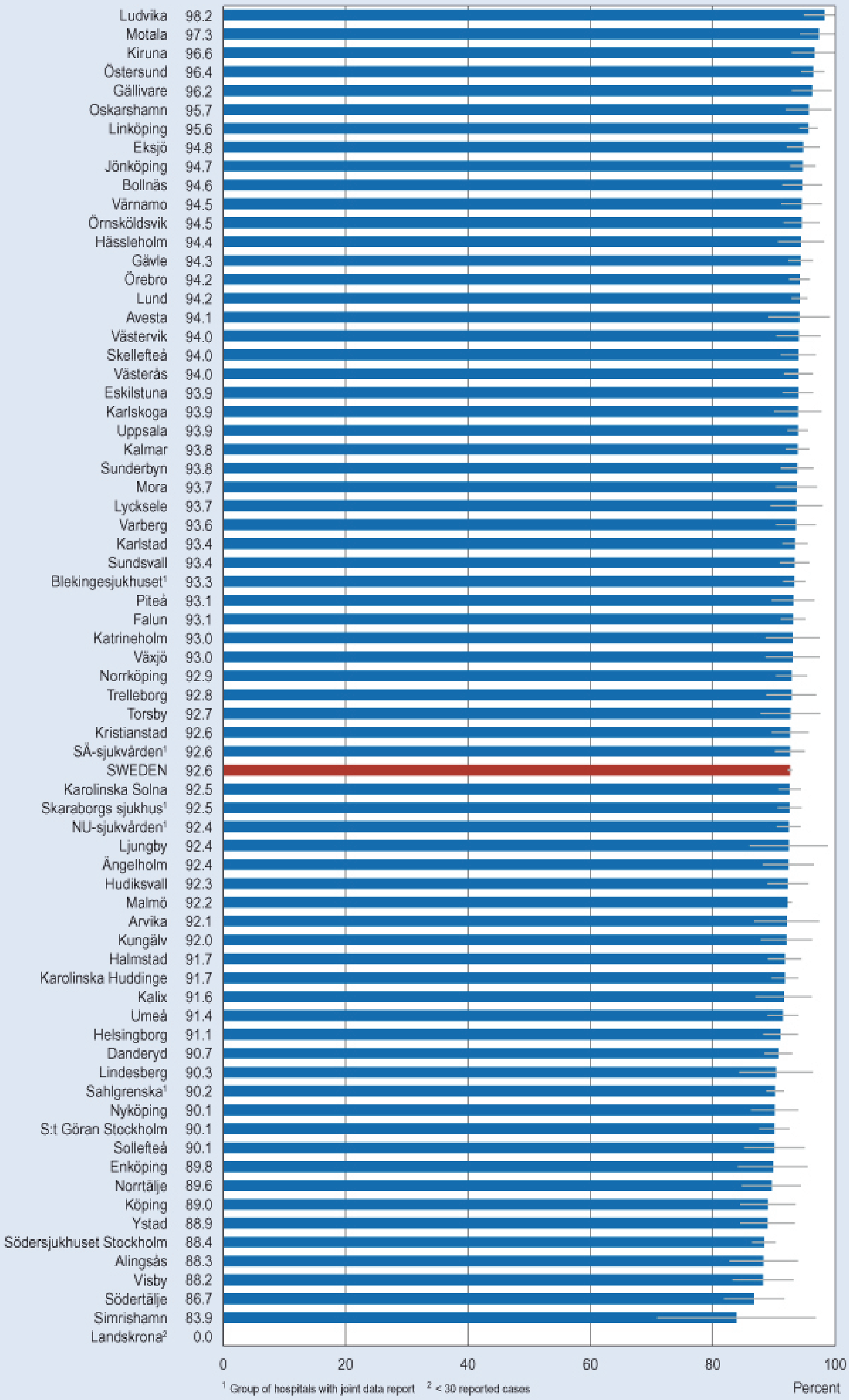


Figure B9
Hospitals

Percentage of patients treated with ASA, another thrombocyte inhibitor or warfarin 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report [2] < 30 reported cases

Beta-blockers at discharge after myocardial infarction (B10)

Beta-blockers are drugs that make the heart work more calmly and efficiently while also lowering blood pressure, and long-term treatment after myocardial infarction lowers the risk of another infarction and death; thus treatment using this drug is a high-priority secondary preventive measure.

In the national guidelines, this measure is assigned priority 2 when used for this patient group. Beta-blockers ought to be prescribed for all patients after myocardial infarction, with the exception of those with over-sensitivity or another medical contraindication, and this is in principle a lifelong treatment.

Any consideration of possible treatment should always be determined after an overall evaluation of the condition of the individual patient, with account taken of, for example, other concomitant illness and other current drug treatment.

The comparison and the result

Two indicators in the report identify this quality aspect, the percentage of patients who upon discharge from the hospital are treated with beta-blockers being described here, while these data are taken from the RIKS-HIA quality register. The second indicator, B11, shows instead the percentage of patients who twelve to eighteen months after discharge from the hospital had actually collected equivalent drugs.

The B10 indicator is part of the 2007 RIKS-HIA quality index and is one of nine measures of quality in of the myocardial infarction care process at various hospitals. On the other hand, it is not included in the set of indicators for following up cardiac care, in the national guidelines.

In 2007, the basis for this indicator was 13,715 patients, of whom one third were women. Only patients aged eighty or younger who do not have AV-block 2 or 3 are included. Description by county council is based on the patients' home county, irrespective of the hospital where care was provided.

For the country as a whole, 91% of the patients were treated in 2007, and the trend over the past ten years points to a greater use of beta-blockers in the post-myocardial infarction process, from an already fairly high level. Between 1998 and 2007, the treatment level rose by nine percentage points, with a year-by-year slight rise in the percentage of those treated.

There are clearly visible differences between the county councils. Norrbotten had a treatment level of 82%, while Östergötland achieved the top level of 95%. At hospital level the variation was more noticeable, with Kiruna lowest at 68% and Västervik highest with 98%. There was little gender variation within the country and 1.4% fewer women than men were treated.

The national guidelines do not stipulate any target level but in the light of their recommendation and the limitation applying to the patients, at least 90% ought to be treated. In the quality index of the RIKS-HIA quality register, this figure is quoted as a limit for the allocation of maximum points, and since the treatment is well established, the differences among county councils and among hospitals ought to be lower.

Figure B10
Sweden

Percentage of patients treated with beta-blockers at discharge after AMI. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

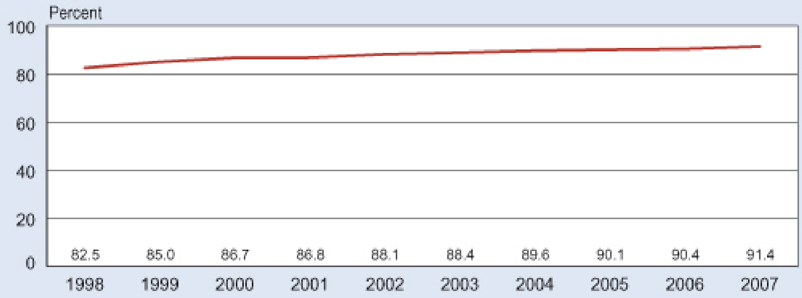


Figure B10
Women and men

Percentage of patients treated with beta-blockers at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

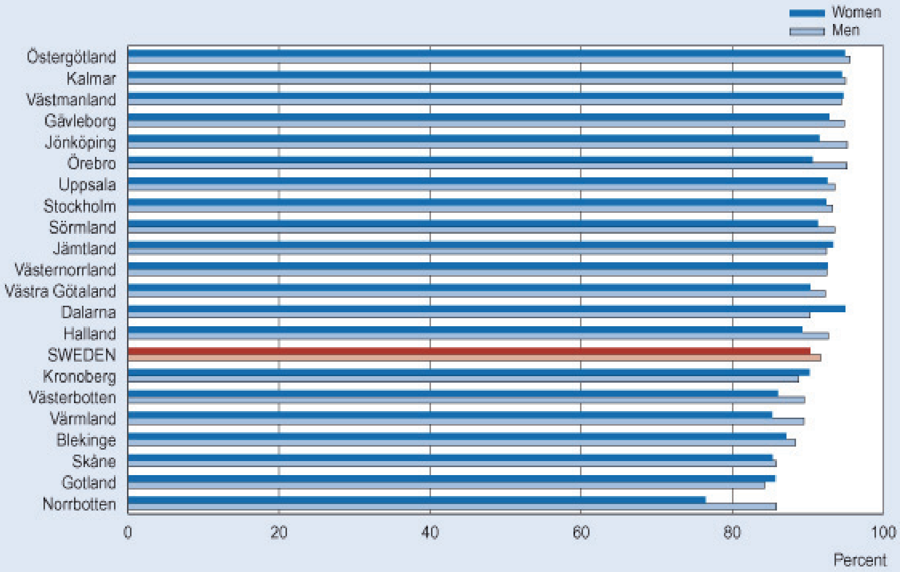


Figure B10
Total

Percentage of patients treated with beta-blockers at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

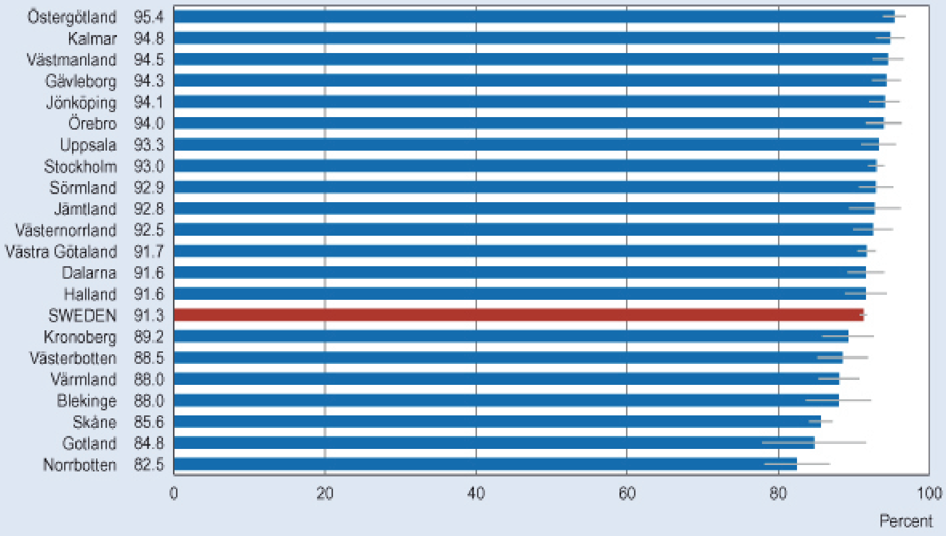
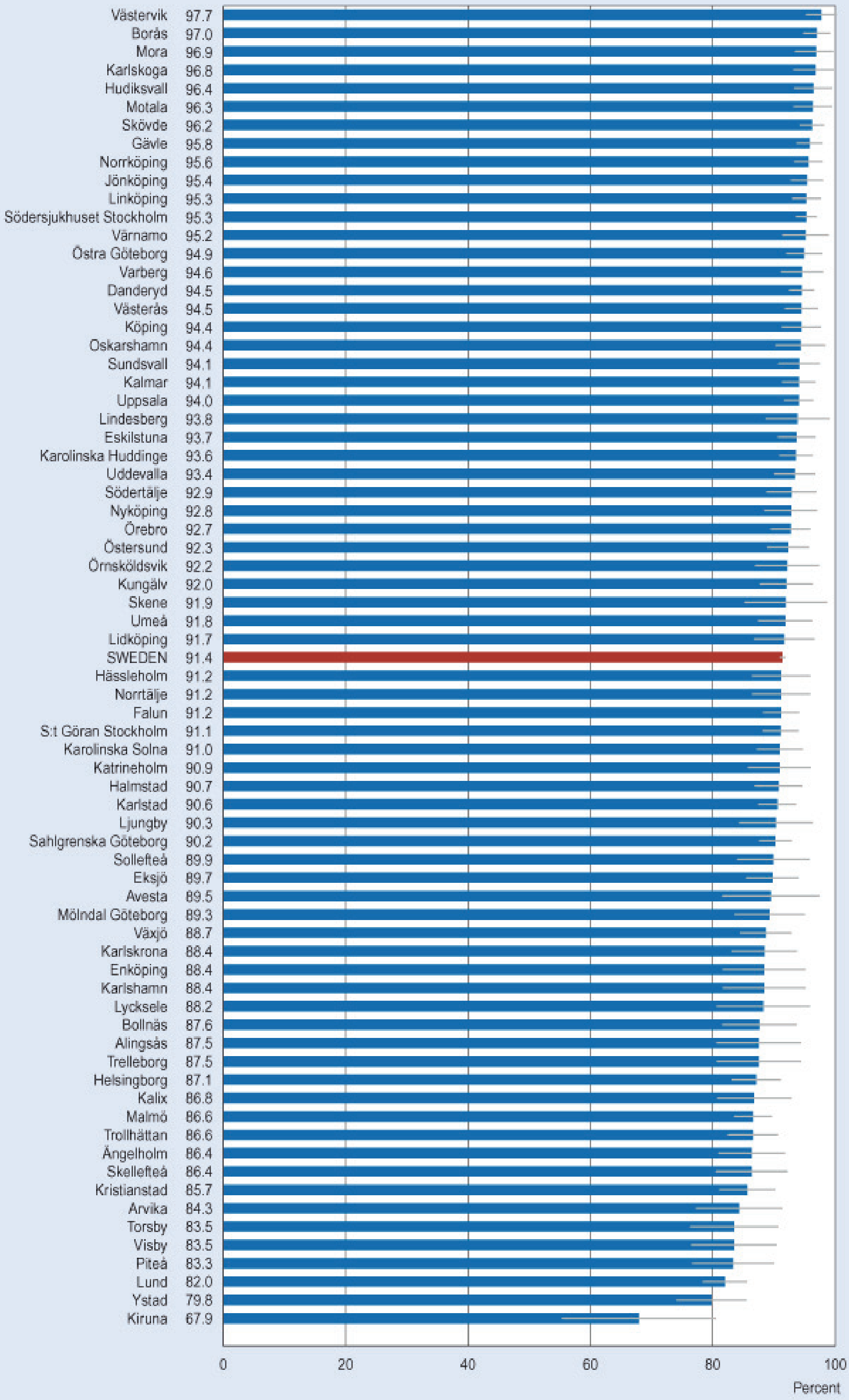


Figure B10 *Hospitals*

Percentage of patients treated with beta-blockers at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



Beta-blockers 12–18 months after myocardial infarction (B11)

Two indicators in the report identify this quality aspect. The first one measures the percentage of patients who twelve to eighteen months after hospital care for myocardial infarction use beta-blockers and it reflects both hospital and primary care measures. The B10 indicator shows instead whether the patient was prescribed these drugs upon discharge from the hospital.

The comparison includes cases of myocardial infarction in the Patient Register for the period from 2005 to 2006 relating to patients below eighty. The total number of patients was 24,553, of whom just over 30% were women. Details of the patients' drug treatment have been obtained from the Swedish Prescribed Drugs Register and refer to both drugs collected from pharmacies and those provided as dose pouches, which function as single-use dosette boxes containing the quantity of the drug that the patient should have on each occasion (ApoDos).

During this period the percentage of patients treated in the country as a whole was 83%. The Swedish Prescribed Drugs Register contains data only from 2005 onwards, and thus a long-term trend is not available. The SEPHIA quality register for 2007 gives a figure of 88% for the percentage treated after twelve to fourteen months. This patient group is somewhat younger and includes only patients below seventy-five.

Differences among the majority of county councils are modest and all except three had a treatment level of over 80%. The highest level of patients treated (almost 89%) was in Jönköping, which was sixteen percentage points higher than on Gotland.

The variation is more pronounced at hospital level where, for example, Torsby, Visby and Helsingborg have values below 75%, while Gällivare and Västervik had a treatment level of over 90%.

In the country as a whole there was no difference between men and women with regard to treatment with beta-blockers twelve to eighteen months after myocardial infarction. There was little variation between the sexes also at county council level, and this was at most the 5.7 percentage points shown by Gotland (these gender differences are not shown in the diagram).

Figure B11
Women
and men

Percentage of patients treated with beta-blockers 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

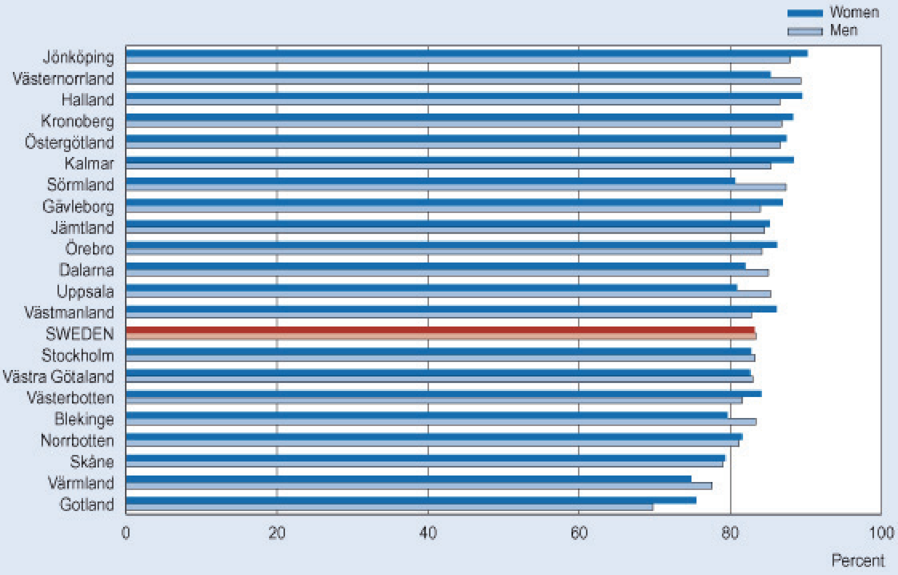


Figure B11
Total

Percentage of patients treated with beta-blockers 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

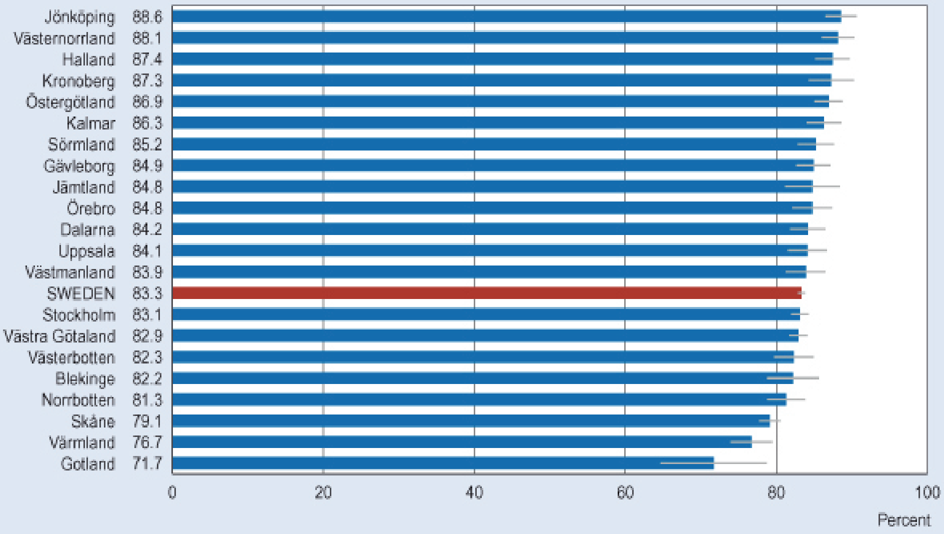
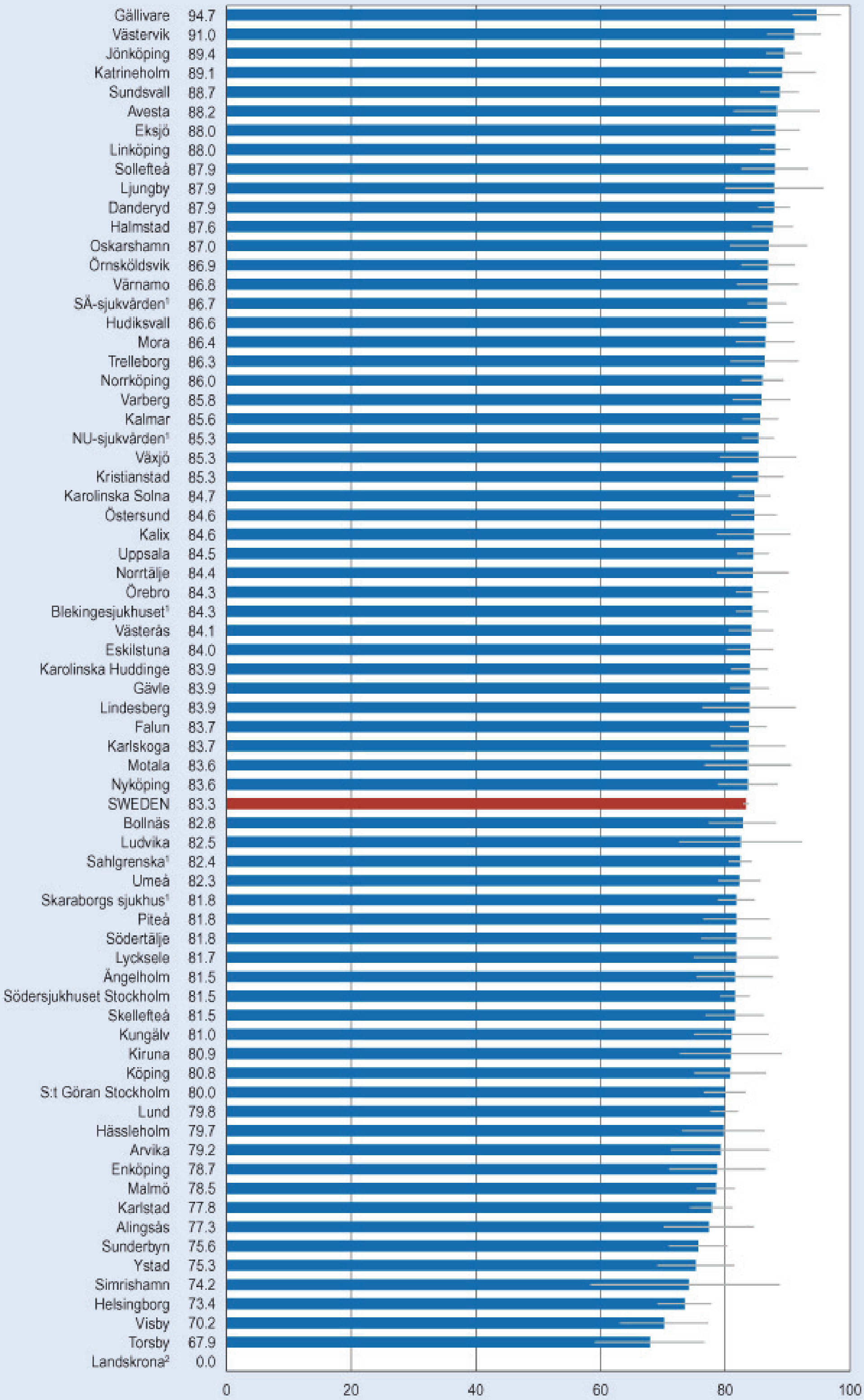


Figure B11
Hospitals

Percentage of patients treated with beta-blockers 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report [2] < 30 reported cases

Percent

Lipid lowering drug therapy upon discharge after myocardial infarction (B12)

The risk of developing coronary artery disease and of myocardial infarction is related to blood cholesterol level, which is in turn related to lifestyle and hereditary factors. Statin treatment lowers this level and reduces the risk of further constrictions of the coronary artery.

Advice on lifestyle changes in conjunction with treatment with low-cost statins is the first-choice treatment for elevated blood fat levels after myocardial infarction. Any consideration of drug treatment should however be based on an overall risk factor assessment and not on the measurement of individual biological risk factors.

Treatment with low-cost statins in coronary artery diseases and elevated blood fat levels is assigned priority 1 in the national cardiac care guidelines from the National Board of Health and Welfare.

Any consideration of possible treatment should always be determined after an overall evaluation of the condition of the individual patient, with account taken of, for example, other concomitant illness and other current drug treatment.

The comparison and the result

Several indicators in the report pinpoint lipid lowering drug treatment after infarction. This indicator shows the percentage of patients who upon discharge from the hospital are given lipid lowering drug treatment, and is part of the 2007 RIKS-HIA quality index.

In 2007, the number of patients was a little over 13,000, of whom approximately one third were women. Only patients aged eighty or younger are included. Description by county council is based on the patients' home county, irrespective of the hospital where care was provided.

The average national treatment level in 2007 was 91%. The last seven years have seen a rapid rise in the percentage of patients treated, by almost twenty percentage points, which has begun to level out in the past three years, even if it has not yet ceased.

There are comparatively modest differences among the county councils. Gotland is at the bottom with 82% and Västmanland at the top with 97%. The variation among the hospitals is fairly modest, and two thirds of them have a treatment level of 90% or more, and only three hospitals treat fewer than 80% of the patients.

On the basis of the recommendation in the national guidelines, it is possible to take the view that in general the percentage treated ought to rise further despite its already high level. RIKS-HIA states 95% as a limit for maximum points in the quality index. Furthermore, the question of goal compliance by individual patients with regard to cholesterol levels ought to be noted; please also refer to indicator B14 in this respect.

Figure B12
Sweden

Percentage of patients treated with lipid lowering drug therapy at discharge after AMI. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

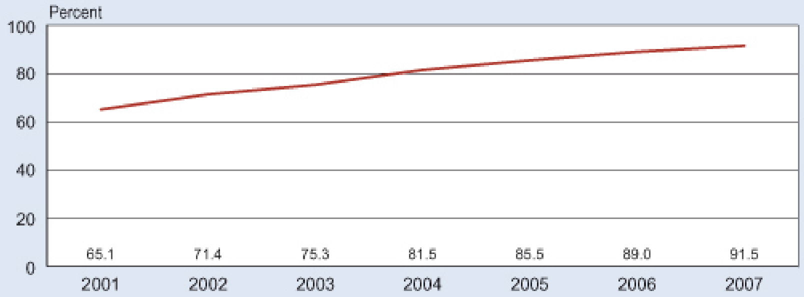


Figure B12
Women
and men

Percentage of patients treated with lipid lowering drug therapy at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

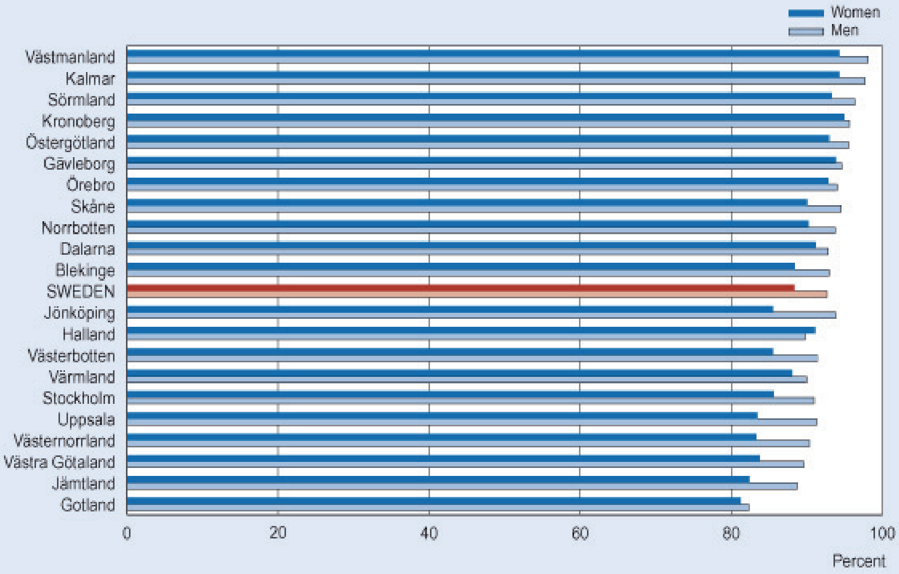


Figure B12 *Percentage of patients treated with lipid lowering drug therapy at discharge after AMI, 2007. Age ≤80 years.*
Total

Source: RIKS-HIA – Registry on Cardiac Intensive Care

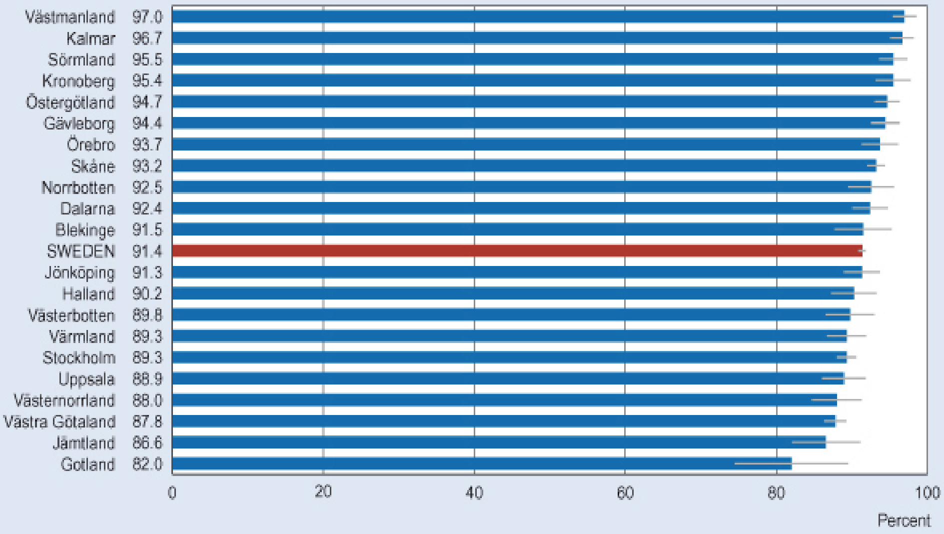
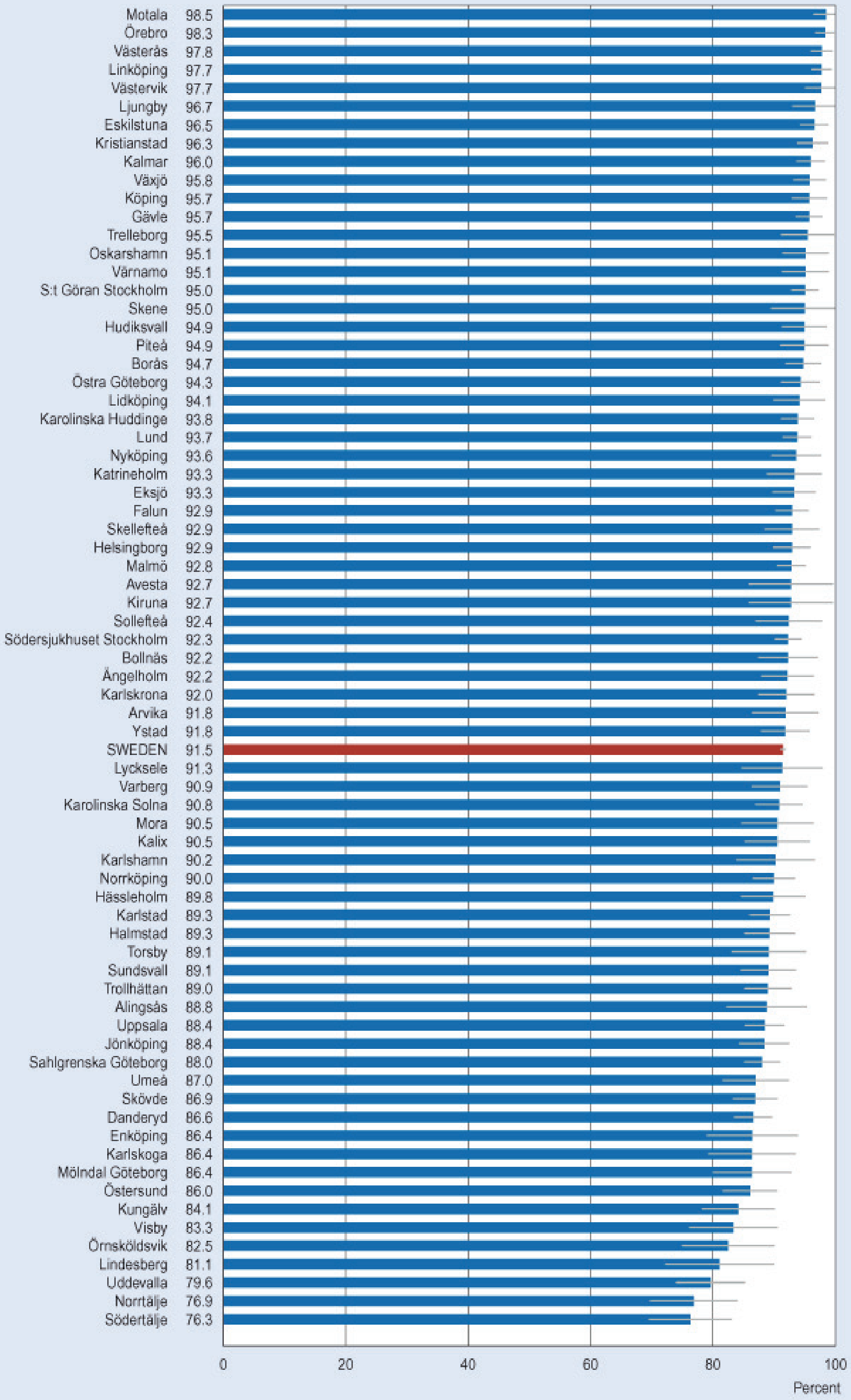


Figure B12
Hospitals

Percentage of patients treated with lipid lowering drug therapy at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



Lipid lowering drug therapy 12–18 months after myocardial infarction (B13)

Indicator B12 shows the percentage of patients receiving lipid lowering drug therapy upon discharge. This particular indicator measures instead the percentage of myocardial infarction patients who receive this therapy twelve to eighteen months after discharge.

The comparison includes 24,533 patients below the age of eighty, who were treated in hospital for myocardial infarction in 2005 and 2006. These data have been obtained from the Patient Register and the Swedish Prescribed Drugs Register and only treatment with statins is included, which, however, are completely predominant in lipid lowering drug therapy. Both prescriptions filled at pharmacies and via the ApoDos system are included, and the latter functions as single-use dosette boxes containing the quantity of the drug that the patient should have on each occasion. The county-council description is based on the patient's home county.

On a national level, 82% of the patients were treated with statins during follow-up twelve to eighteen months after discharge. At county-council level the comparison shows that the difference between the county councils with the highest and lowest treatment levels was just over seventeen percentage points. Västmanland was highest with 89% and Gotland was lowest with 72%. All the county councils except six treat over 80% of the patients.

At hospital level the variation was clearly wider. The lowest percentages of treated patients were found in Södertälje, Visby and Torsby, which were all below 75%. The highest treatment level is found in Kiruna, Västerås and Oskarhamn, with 90% or more. Women are treated to a slightly lower extent, and the percentage of men treated is over four percentage points higher, in the country as a whole.

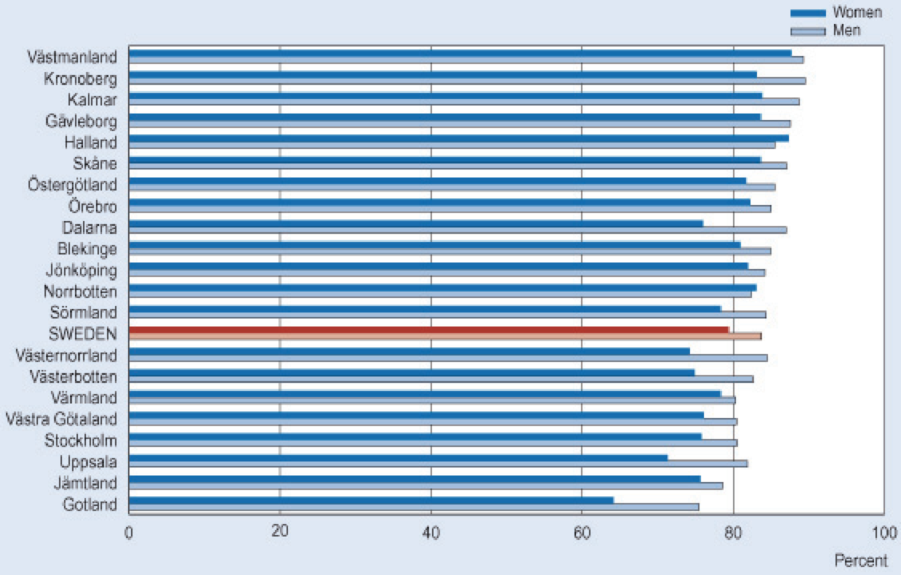
In the country as a whole, the situation is one of under-treatment with regard to the recommendations of the guidelines. A comparison with RIKS-HIA infarction patients (please refer to indicator B12) shows that the percentage treated upon discharge there is more than ten percentage points higher than has been described here. In the follow-up of RIKS-HIA patients < 75 years, 92% had received lipid lowering therapy twelve to fourteen months after being discharged, according to the SEPHIA quality register.

There are fewer RIKS-HIA myocardial infarction patients than those in the Patient Register, and the fact that the percentage treated in RIKS-HIA is higher may be because patients receive care that is more closely based on the guidelines, in the more specialised care form that RIKS-HIA reflects. It may also be the case that those myocardial patients not reported to RIKS-HIA have a worse general condition and more frequently suffer from other concomitant illnesses, which affects the decision to use lipid lower therapy.

Figure B13
Women
and men

Percentage of patients treated with lipid lowering drug therapy 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



Hospitals B13
Total

Percentage of patients treated with lipid lowering drug therapy 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

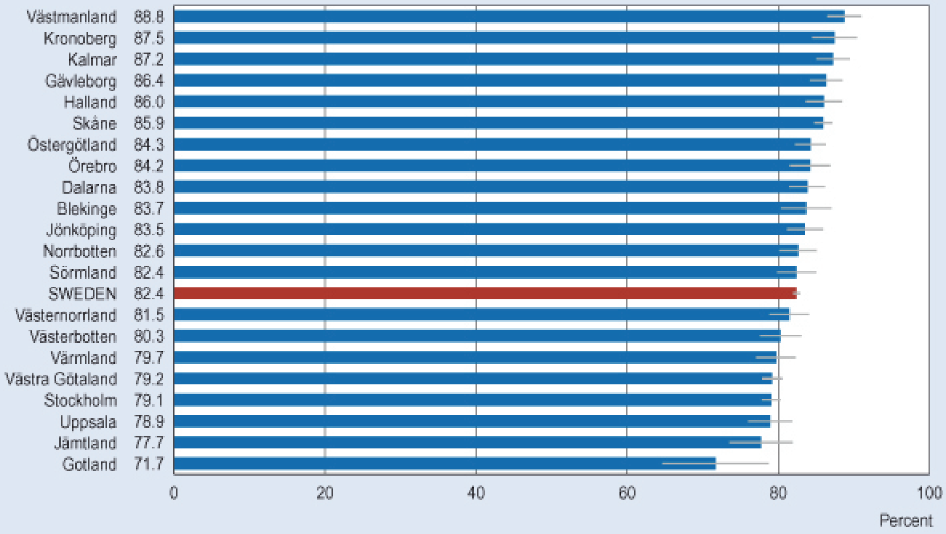
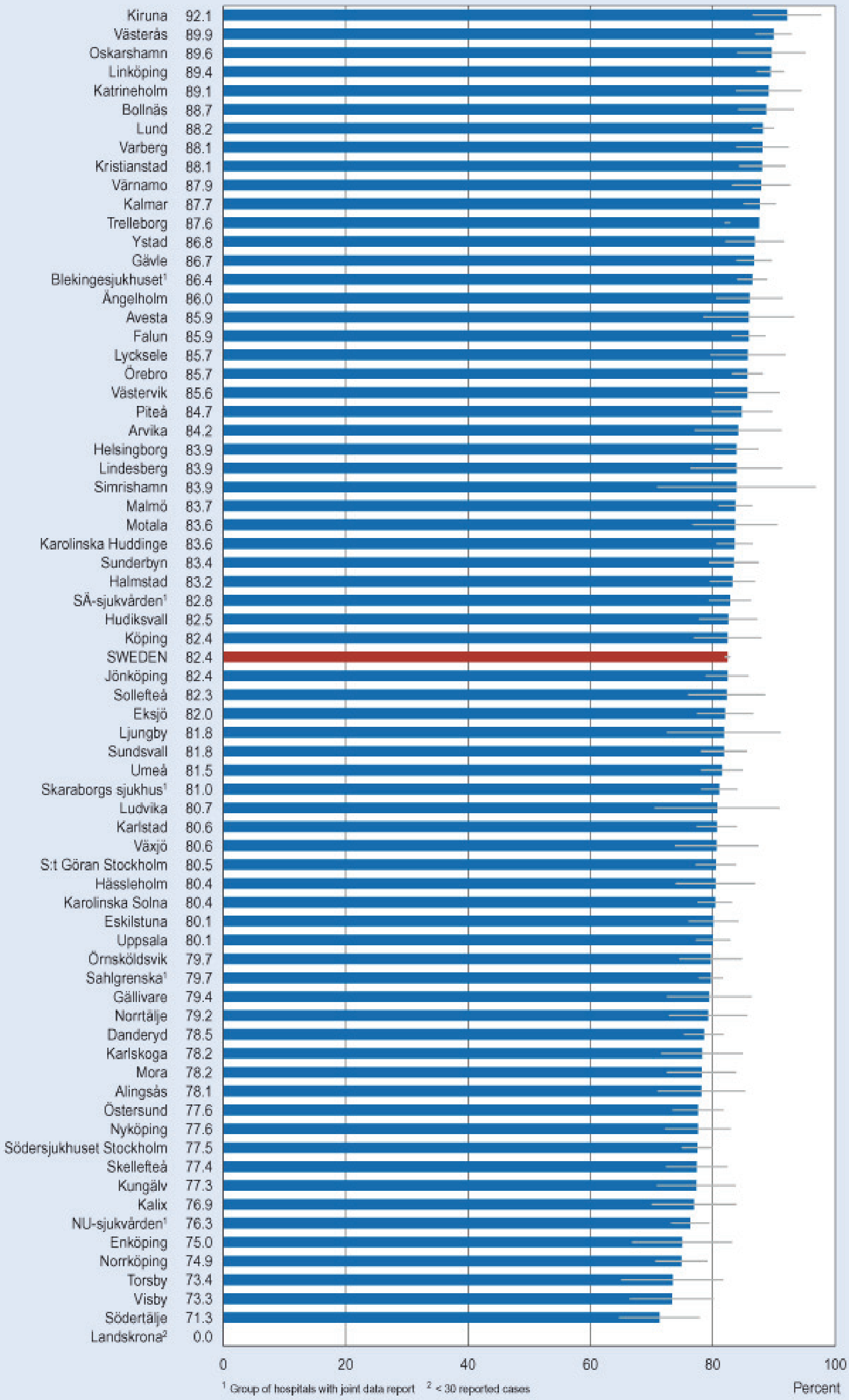


Figure B13
Hospitals

Percentage of patients treated with lipid lowering drug therapy 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



¹ Group of hospitals with joint data report ² < 30 reported cases

Goal compliance for LDL cholesterol after myocardial infarction (B14)

Previously indicators B12 and B13 stated comparisons of the percentage of patients prescribed lipid lowering drug therapy after infarction, which did not take into account how this therapy affected their blood fat levels. The focus here is instead on goal compliance for all patients and thus also on the effects of the therapy on the patients receiving it.

The secondary preventive benefit of reducing the level of LDL cholesterol in patients who have had myocardial infarction is well documented. A reduction of the level to below 2.5 mmol/l ensures a clearly diminished risk of suffering or dying from a second myocardial infarction. According to the national cardiac care guidelines from the National Board of Health and Welfare, it is recommended that treatment start while the patient is still under care for myocardial infarction.

The comparison and the result

The indicator shows the percentage of the patients followed up who one year after their infarction had achieved the target for LDL cholesterol < 2.5 mmol/l irrespective of whether they were treated or not.

The comparison includes 4,890 < 75 years who had an infarction in 2005 or 2006 and who were still alive one year afterwards, of whom just under three quarters were men. The data have been obtained from SEPHIA and thus indirectly also from RIKS-HIA, whose infarction patients are followed up in SEPHIA.

Just under 72% of the patients followed up achieved goal compliance for the LDL cholesterol level during the period in question and no national time trend is available for this matter. In comparison with SEPHIA data for 2006 only, the degree of goal compliance for the LDL cholesterol level rose by 3.6 percentage points for 2006 and 2007 taken together. The percentage of patients who achieved this goal varied among the county councils from 44% to 81% and fewer women than men achieved this treatment objective.

There are major differences among the hospitals that are worth noting, even if SEPHIA at present has a limited degree of coverage. Low goal compliance may be due to both dosage in the drug treatment and the choice of drug, as well as lifestyle factors. Irrespective of this, the degree of goal compliance is too low to be satisfactory and in principle all patients should be able to achieve this goal.

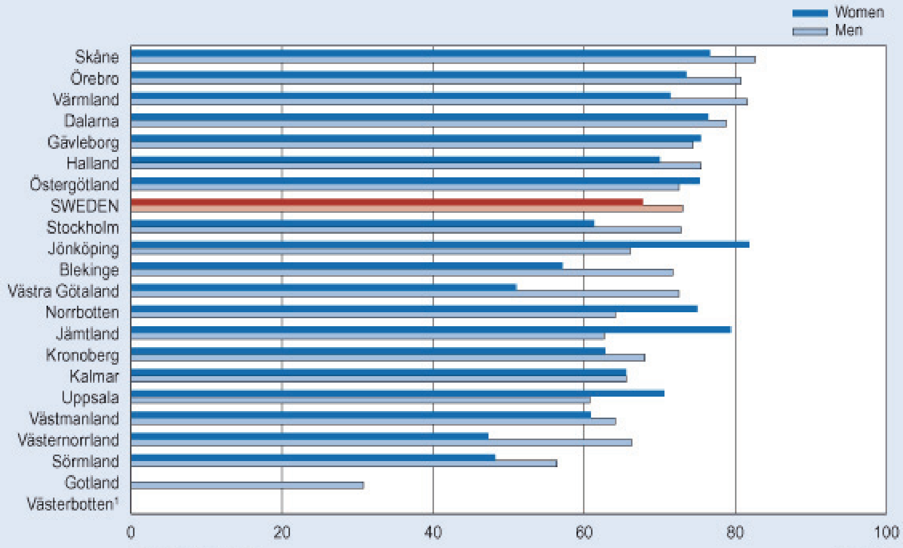
The difference measured reflects goal compliance by patients who one year after the infarction have active contacts with the medical services. There is reason to suspect that patients who were not followed up in SEPHIA have lower goal compliance, and therefore, the percentage of patients who were followed up at each hospital is significant in comparisons between different hospitals.

Another problem of interpretation is that a relatively large number of Swedish hospitals have stopped regular measurement of LDL cholesterol and instead measure apo B (and apo A1) in order to reflect the lipid levels. At present there is no generally accepted target level for apo B that reliably corresponds to the target level for LDL cholesterol.

Figure B14
Women
and men

Percentage of patients who reach target level for LDL cholesterol (<2.5 mmol/l) one year after AMI, 2006–2007. Age <75 years.

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care

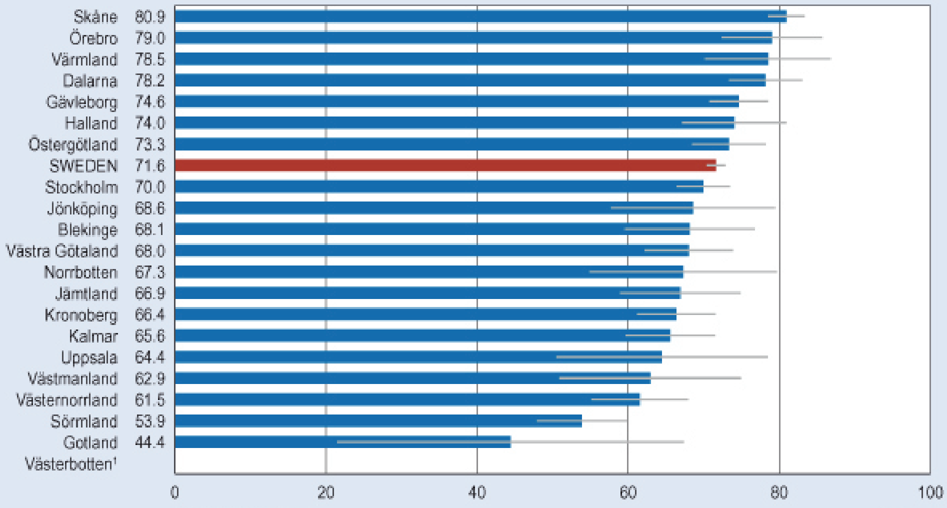


¹ Data not available

Figure B14
Total

Percentage of patients who reach target level for LDL cholesterol (<2.5 mmol/l) one year after AMI, 2006–2007. Age <75 years.

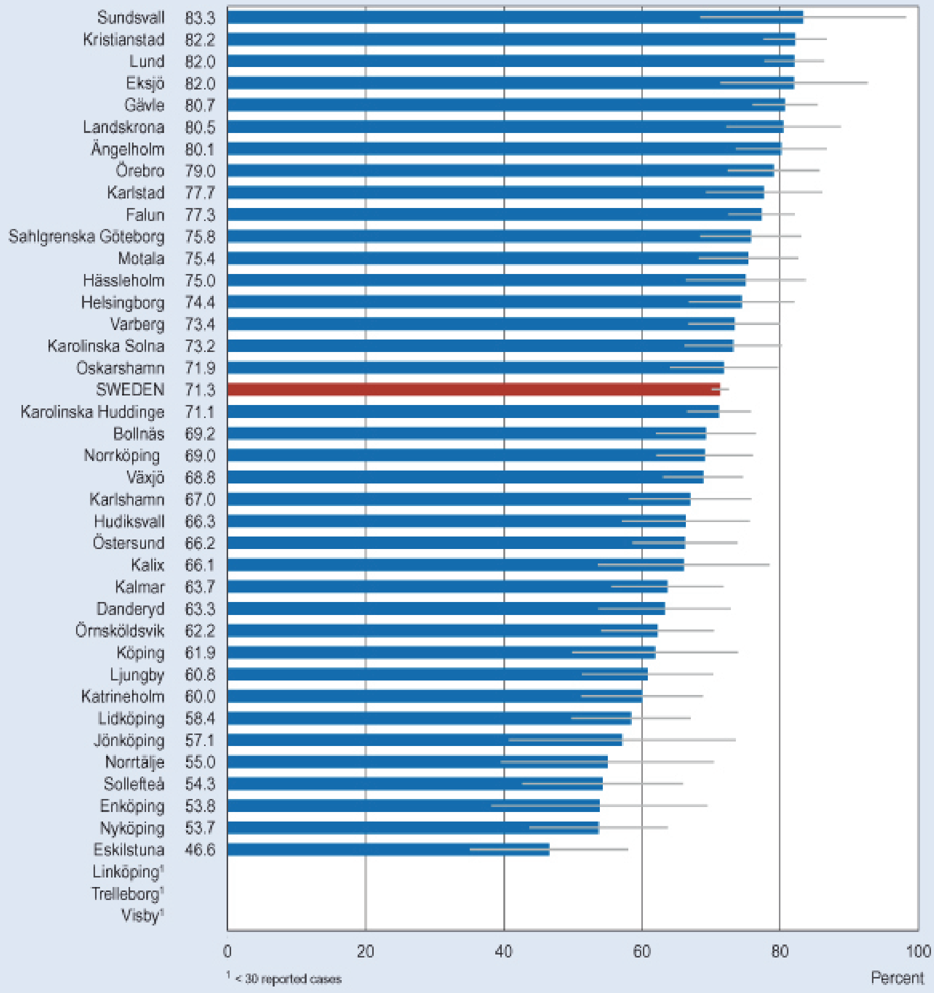
Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care



¹ Data not available

Figure B14 *Percentage of patients who reach target level for LDL cholesterol*
Hospitals *(<2.5 mmol/l) one year after AMI, 2006–2007. Age <75 years.*

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care



Low-cost statins in myocardial infarction (B15)

As previously described, a significant percentage of the myocardial infarction patients can be expected to need lipid lowering drug therapy. Statins lower the cholesterol level and thus reduce the risk of further constrictions of the coronary artery. According to the national guidelines treatment with low-cost statins has high priority; the more expensive ones cost five times as much as the cheapest ones. High-cost statins should be chosen only in the event of intolerance of low-cost statins or their inadequate effect.

The comparison and the result

Previously, it was the percentage of patients receiving treatment with statins after myocardial infarction that was shown but now it is the percentage of patients who were treated with low-cost statins that is shown instead. The indicator reflects economical use of resources, and not treatment quality. The choice of treatment above all in primary care but also in hospital affects the outcome. The comparison is based on around 85,000 patients treated in hospital for myocardial infarction between 1998 and 2007, who during the first half of 2008 were treated with statins, and all ages are included. Both simvastatin and pravastatin are considered low-cost statins. Data have been obtained from the Patient Register and the Swedish Prescribed Drugs Register.

In the country as a whole low-cost statins were used in 85% of all treatments, and this figure tallies well with the result of a similar indicator in the report *Quality and Efficiency in Swedish Health Care*, where 83% of all those who started statin treatment in 2007 received one of the low-cost alternatives, while those who did so most recently were more frequently given a more expensive drug.

In terms of percentage points, the differences among county councils and among hospitals are modest, but, on the other hand, even small variations result in the costs being affected since the volume of patients is so large. It ought to be possible for all county councils and hospitals to ensure that 90% are treated with low-cost statins, without disregarding the needs of individual patients.

Figure B15
Women and men

Percentage of patients prescribed low-cost statins for lipid lowering therapy after AMI, 1998–2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

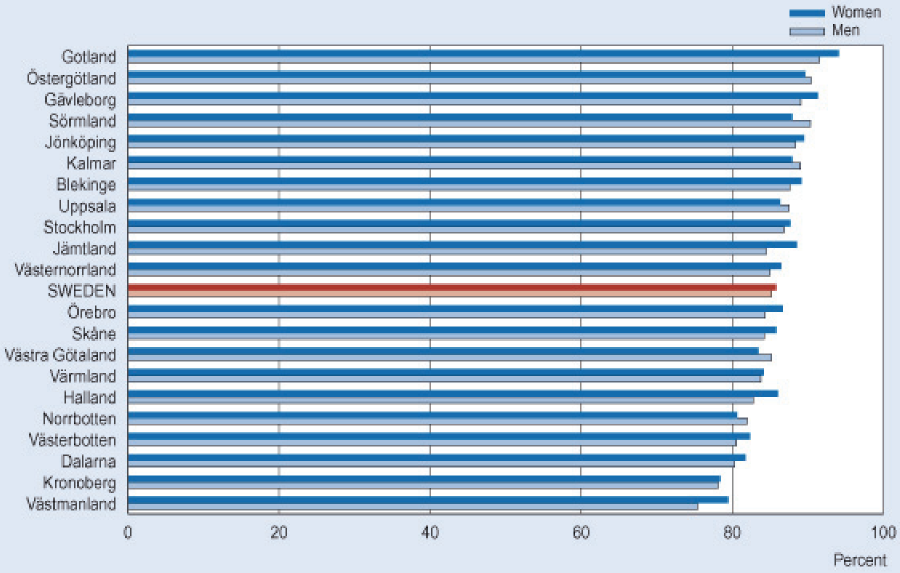


Figure B15
Total

Percentage of patients prescribed low-cost statins for lipid lowering therapy after AMI, 1998–2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

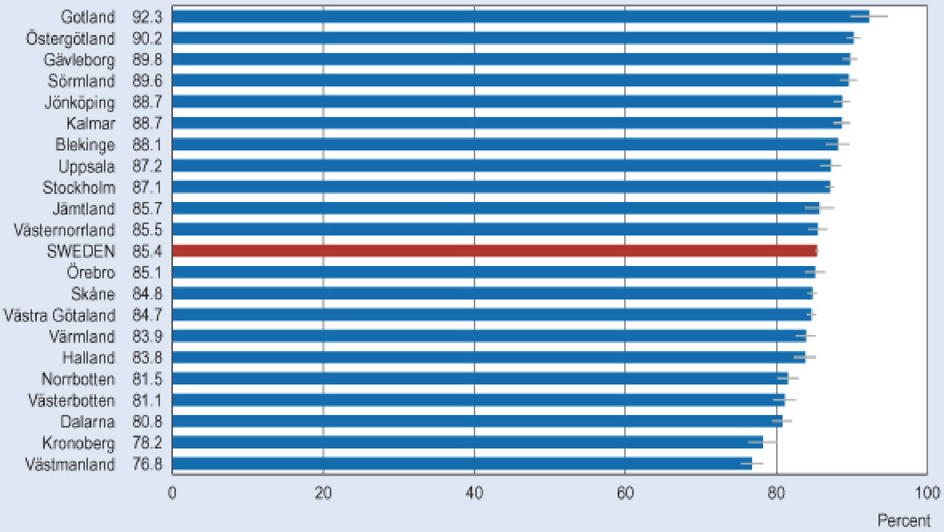
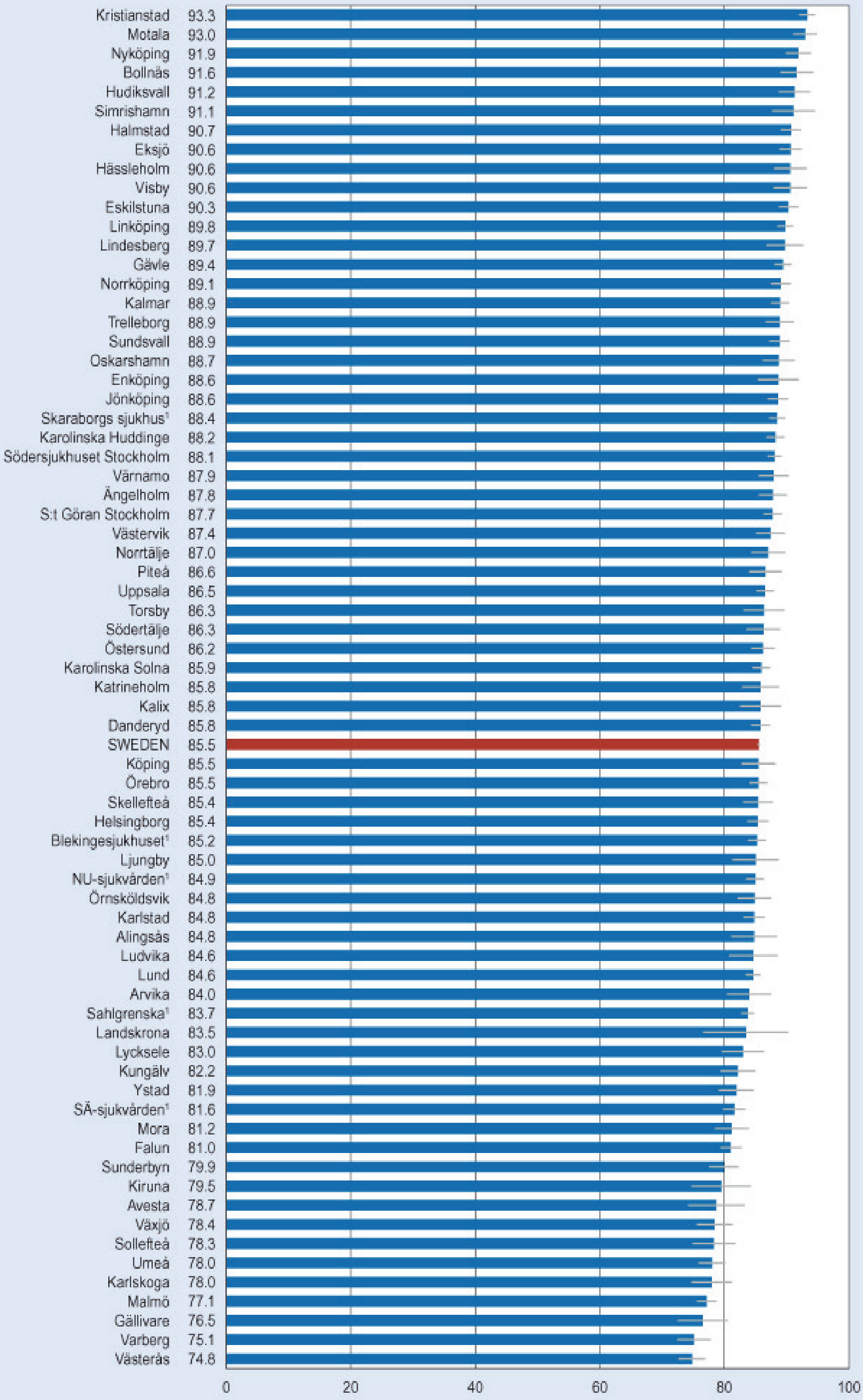


Figure B15
Hospitals

Percentage of patients prescribed low-cost statins for lipid lowering therapy after AMI, 1998–2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report

RAAS inhibitor upon discharge after myocardial infarction (B16)

RAAS inhibitors, which refer to ACE inhibitors and angiotensin II receptor blockers (ARB), have shown good secondary preventive effects on patients who have had myocardial infarction, in particular, those with impaired heart function. Patients with high blood pressure or diabetes also have a greater indication for RAAS inhibitor treatment. These drugs facilitate heart function by both inhibiting activation of hormones that are harmful to the heart in the long term and by widening the blood vessels in the body.

This treatment has high priority in the national cardiac care guidelines. ACE inhibitors are better documented in this patient group than ARB and command a lower price, for which reason ARB ought to be used only in the case of intolerance of ACE inhibitors. The indicator is included in both the 2007 RIKS-HIA quality index for hospitals, and in the set of indicators for following up cardiac care, in the national guidelines.

The comparison and the result

Two indicators in the report reflect this quality aspect. This one refers to myocardial patients with high-risk criteria in the form of impaired heart function, diabetes or high blood pressure. The measure shows the percentage of these patients who upon discharge from the hospital are treated with RAAS inhibitors. The second indicator, B17, shows instead the percentage of patients who twelve to eighteen months after discharge from the hospital used equivalent drugs.

In 2007, the number of patients in the comparison was just over 10,500, one third of whom were women. Apart from infarction, the patient should have one or several other risk factors, for example, diabetes or heart failure. Only patients eighty years old or younger are included but age standardisation has not been performed. Data have been obtained from RIKS-HIA.

The average national treatment level comprised 81% and the fact that RAAS inhibitors have become more common as a secondary preventive measure after myocardial infarction can be clearly seen in the trend over the past ten years. Since 1998 the percentage of patients treated has risen from 52% to 81% and in 2007, it rose by four percentage points in the country as a whole, with men being treated to a slightly greater extent than women.

The differences among the county councils are greater than for several of the other secondary preventive drug treatments. Blekinge with 71% is at the bottom and Västmanland at the top with 91% of patients treated. As expected, the variation at hospital level is even greater. Karlshamn comes last with 58% of patients treated while Västerås has a treatment level of 96%.

In the light of the recommendations of the national guidelines, the situation is one of under-treatment, apart from the fact that there are major differences among the hospitals. Maximum points in the 2007 RIKS-HIA quality index require that 90% of the patients in the high-risk group are treated. However, only two councils and four hospitals reach this level.

Figure B16
Sweden

Percentage of patients treated with RAAS inhibitor at discharge after AMI. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

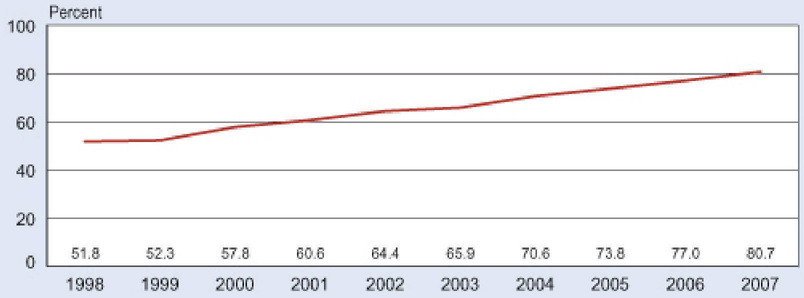


Figure B16
Women and men

Percentage of patients treated with RAAS inhibitor at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

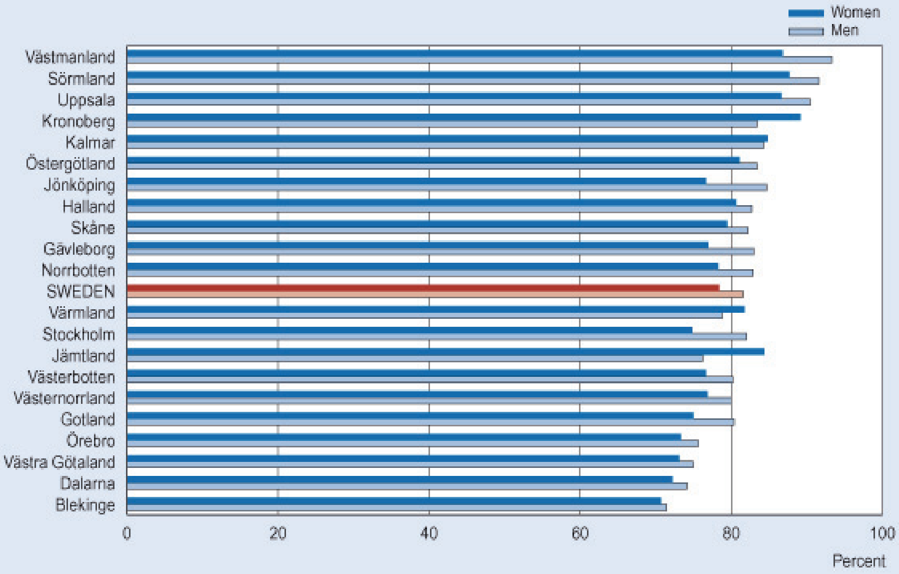


Figure B16
Total

Percentage of patients treated with RAAS inhibitor at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

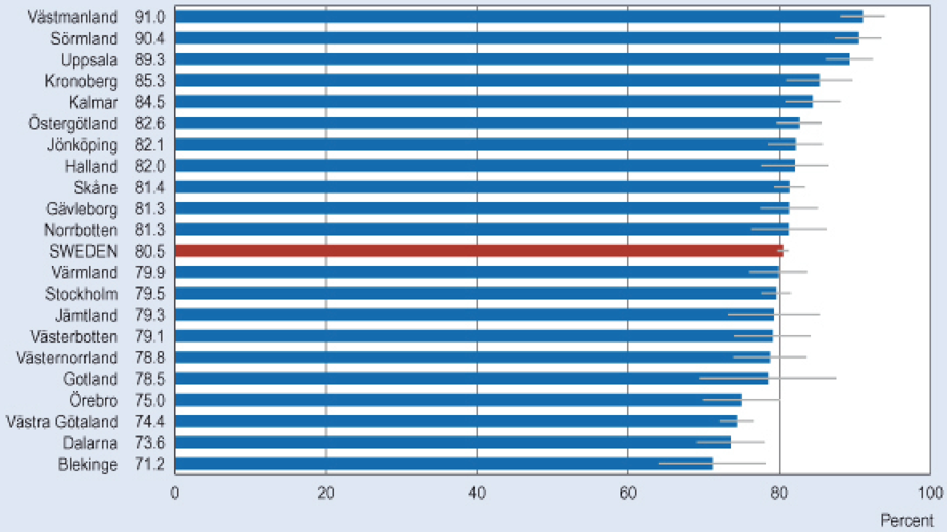
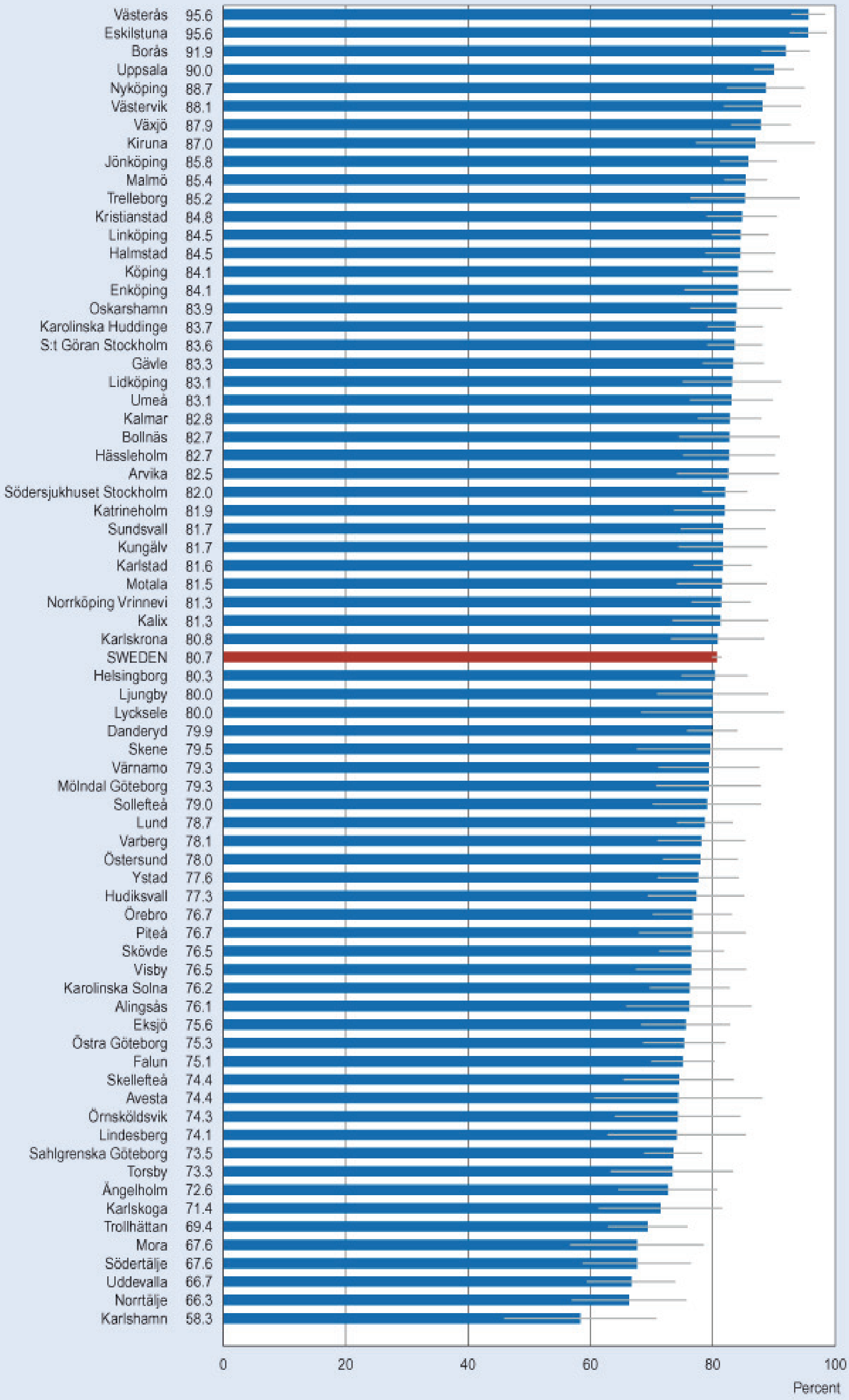


Figure B16
Hospitals

Percentage of patients treated with RAAS inhibitor at discharge after AMI, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



RAAS inhibitor 12–18 months after myocardial infarction (B17)

The indicator shows the percentage of myocardial infarction patients treated in hospital who twelve to eighteen months after discharge receive blood-pressure lowering treatment with RAAS inhibitors. The patient group differs from that in indicator B16 in that it includes all patients with a myocardial infarction diagnosis and not just those who have high-risk criteria in the form of impaired heart function, diabetes or high blood pressure, while all myocardial infarction patients in the Patient Register are also included and these number more than those reported to RIKS-HIA.

The comparison includes 24,553 patients, of whom around 30% were women and comprises patients below eighty, who were treated in hospital for myocardial infarction in 2005 and 2006. These data have been obtained from the Patient Register and the Swedish Prescribed Drugs Register. Both prescriptions filled at pharmacies and via the ApoDos system are included, and the latter functions as single-use dosette boxes containing the quantity of the drug that the patient should have on each occasion.

On a national level, the percentage of patients treated with RAAS inhibitors was 67%, a considerably lower percentage than that shown in indicator B16. The variation among county councils ranges from Gotland with a treatment level of 55%, to Kronoberg, which had the highest percentage of those treated, 83%. At hospital level the variation was greater: eighteen hospitals had fewer than 60% treated, while some twenty hospitals had 70% or more. Men were treated more frequently than women, with national treatment levels of 68% and 65%, respectively.

In medical terms, it is not unsuitable to treat all infarction patients, but the high priority in the guidelines refers to high-risk patients. With the help of data from RIKS-HIA, it is possible to assess that some 50% to 60% of all myocardial infarction meet the high-risk criteria. The percentage treated seems to agree closely with the recommendation in the guidelines, considering the national average and the high-risk patients. Certain county councils and hospitals, on the other hand, tend to treat even low-risk patients.

The difference among the percentage treated in B16 may be due to the fact that the patient population in this indicator is limited to high-risk patients, while all infarction patients are included here. Furthermore, there may be a difference in the general morbidity of the patient group, which means that fewer patients are considered for treatment. It is also probable that a number of patients, who receive RAAS inhibiting treatment upon discharge, discontinued it for some reason.

In the follow-up of RIKS-HIA patients < 75 years, 83% of the high-risk patients were receiving RAAS inhibitor treatment twelve to fourteen months after discharge, according to the SEPHIA quality register.

Figure B17
Women
and men

Percentage of patients treated with RAAS inhibitor
12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

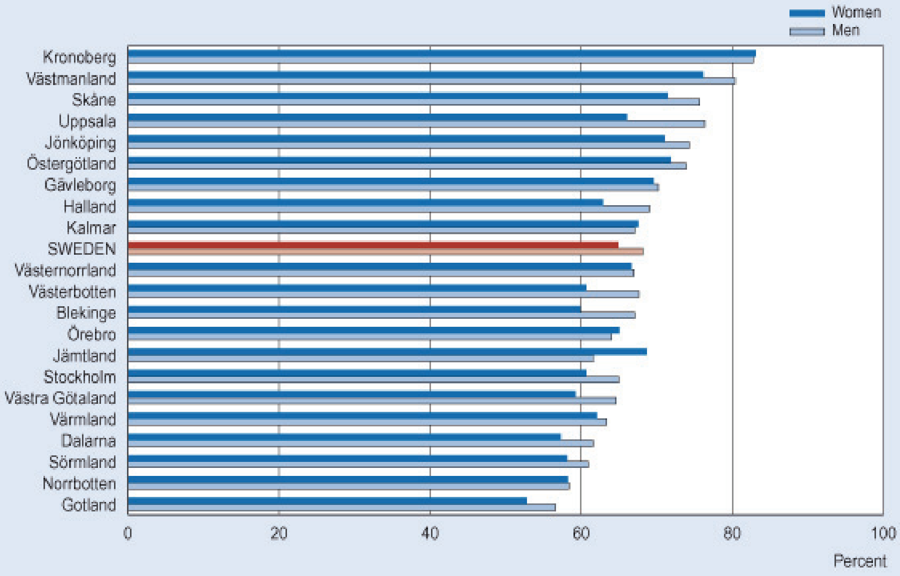


Figure B17
Total

Percentage of patients treated with RAAS inhibitor
12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

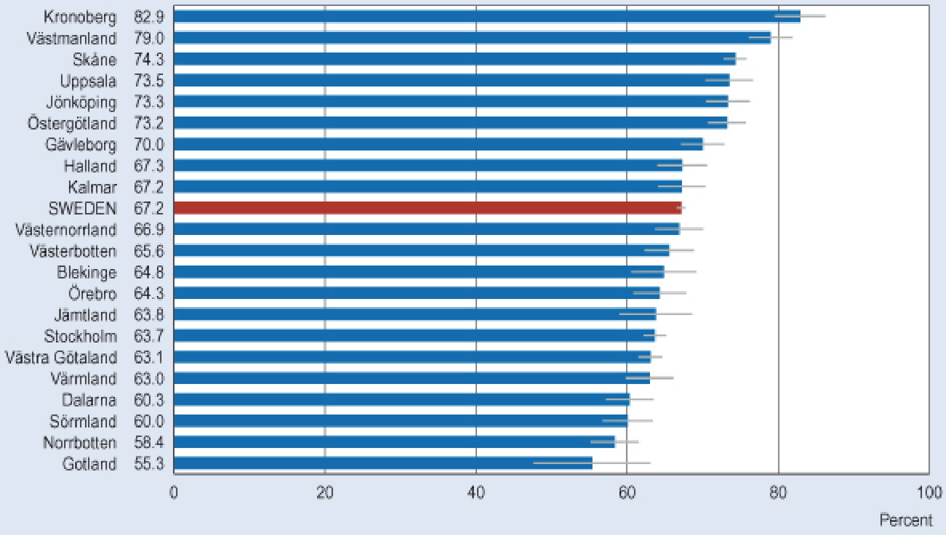
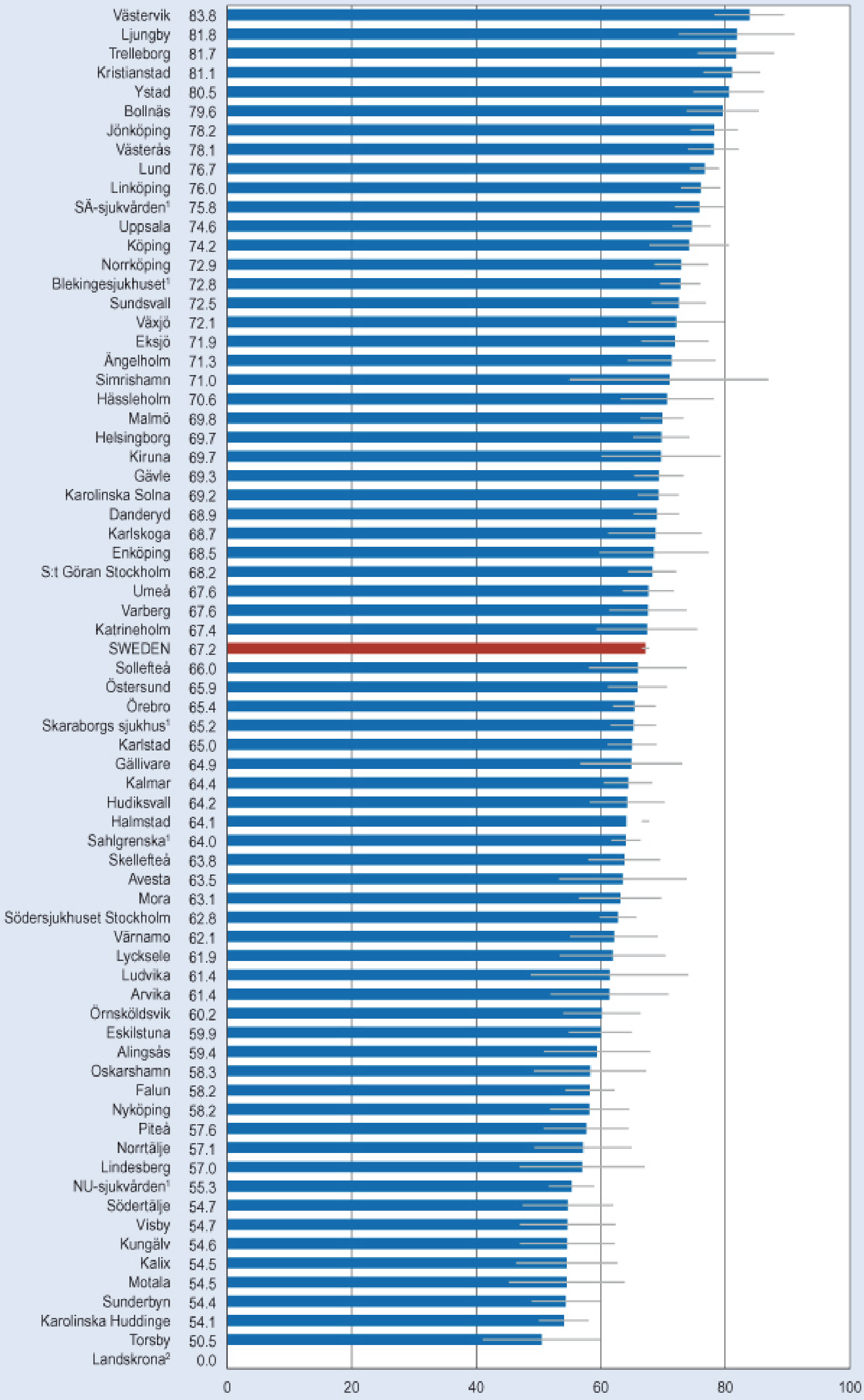


Figure B17
Hospitals

Percentage of patients treated with RAAS inhibitor 12 to 18 months after AMI, 2005–2006. Age <80 years.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report [2] < 30 reported cases

Percent

ARB as an RAAS inhibitor after myocardial infarction (B18)

Long-term treatment with RAAS inhibitors ensures a significant reduction in both morbidity and mortality for patients with heart failure or impaired left ventricular function after myocardial infarction.

ARB and ACE inhibitors are both RAAS inhibitors. ARB does not have a better effect than ACE but it is considerably more expensive and should therefore be used when ACE inhibitors are not tolerated due to side effects. Consequently, ARB as a first-choice drug has low priority in the national cardiac care guidelines.

According to a directive from the Dental and Pharmaceutical Benefits Agency in September 2008, ARB should be subsidised only for patients who have tried to use ACE inhibitors but have not been able to do so, or as a supplement to ACE inhibitors.

The comparison and the result

The indicator illustrates the choice of RAAS inhibitors after myocardial infarction care. The perspective is economical use of resources, not the quality of the treatment administered. The indicator shows the percentage of patients who upon discharge from hospital are treated with ARB, of all those treated with RAAS inhibitors. The indicator is also present in a similar formulation in the national cardiac care guidelines of the National Board of Health and Welfare.

In 2007, according to RIKS-HIA 8,374 patients were treated with RAAS inhibitors after myocardial infarction throughout the country, of whom 1,969 received ARB, i.e., almost 24%, and over time this percentage has increased slightly, as in 2004, it amounted to 19%.

The variation among county councils ranges from Norrbotten at 32% to Gotland at 16%, while Kalmar and Östergötland also show low percentages of patients treated with ARB. At hospital level the variation was more noticeable, and ten hospitals had over 30% treated with ARB, while nineteen had below 20%.

In general, the percentage of women who received ARB was higher than for men, at 28% and 22% respectively. This is probably linked to the fact that women are more frequently affected by a cough when treated with ACE inhibitors and for this reason are given ARB treatment.

Without quantifying the incidence of intolerance for ACE inhibitors, it is probable that ARB percentages upon discharge of 10% to 15% ought to be able to be achieved but with some variation between the sexes. In order to more accurately measure whether ARB is prescribed in accordance with the guidelines, a study ought to be made of ARB use without previous tests with ACE inhibitors. This can be done with the aid of the Swedish Prescribed Drugs Register, but has not been done in this report.

Figure B18
Sweden

Percentage of patients with angiotensin receptor II blockers (ARB) in treatment with RAAS inhibitor after AMI.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

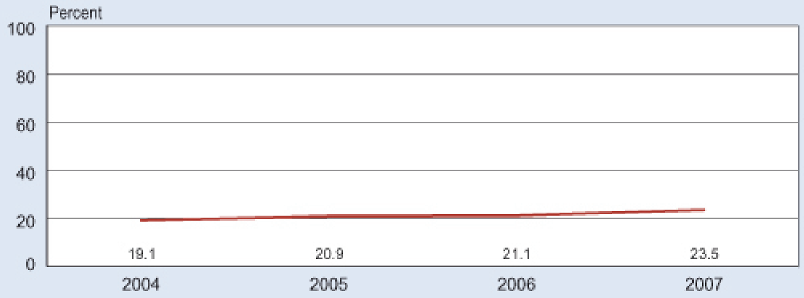


Figure B18
Women
and men

Percentage of patients with angiotensin receptor II blockers (ARB) in treatment with RAAS inhibitor after AMI, 2007.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

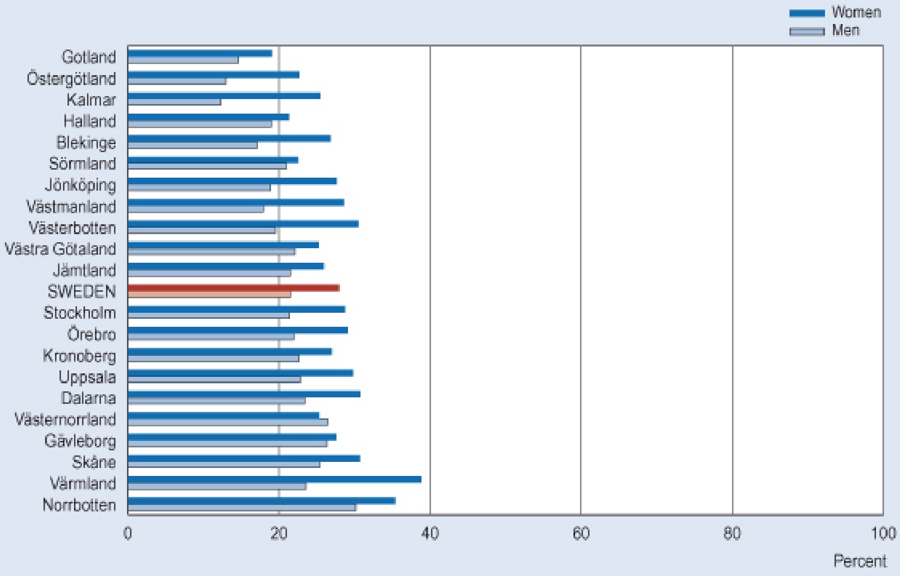


Figure B18 *Percentage of patients with angiotensin receptor II blockers (ARB) in treatment with RAAS inhibitor after AMI, 2007.*
Total

Source: RIKS-HIA – Registry on Cardiac Intensive Care

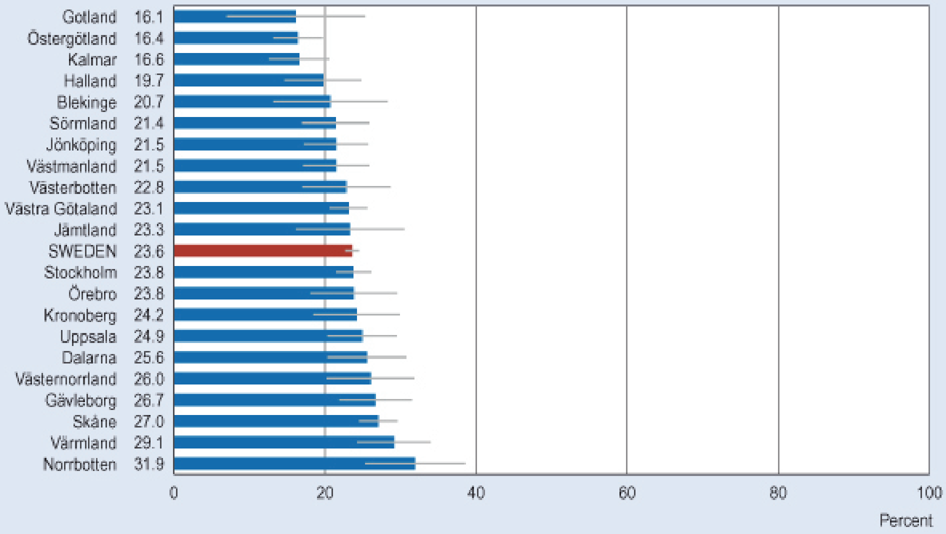
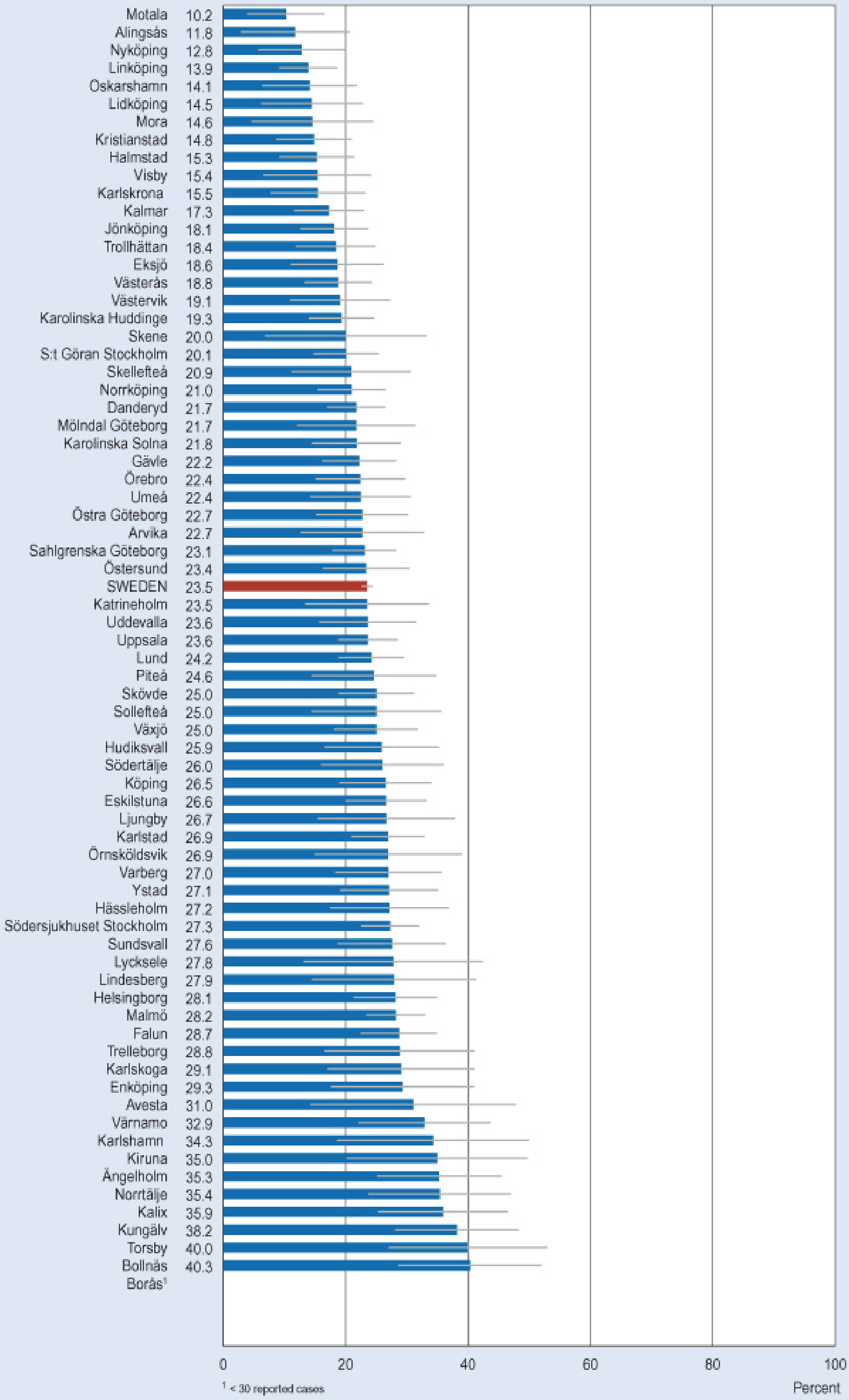


Figure B18
Hospitals

Percentage of patients with angiotensin receptor II blockers (ARB) in treatment with RAAS inhibitor after AMI, 2007.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



¹ < 30 reported cases

Clopidogrel therapy in non-ST-segment elevation myocardial infarction (B19)

In non-ST-segment elevation myocardial infarction patients are treated with acetyl salicylic acid (ASA), clopidogrel or Warfarin in order to prevent blood clots. The addition of clopidogrel to ASA during the first three to twelve months after an episode of instable coronary artery disease has been proven to reduce the risk of myocardial infarction, stroke or death. Treatment during this period has a high priority in the national guidelines. A longer period of treatment, however, is not recommended, as there is a lack of available data to support the thesis that the benefits outweigh the risks (bleeding complications) of long-term use.

In principle all patients with non-ST-segment elevation myocardial infarction patients ought to be treated with clopidogrel unless there are contraindications. Any consideration of drug treatment should always be determined after an individual assessment of the patient, which implies that a 100% treatment level should not be a target.

The comparison and the result

The indicator refers to secondary preventive treatment of patients with non-ST-segment elevation myocardial infarction. The measure shows the percentage of patients who upon discharge from the hospital are treated with clopidogrel, while the indicator is included in the 2007 RISK-HIA quality index.

The basis for this comparison is over 7,500 patients, of whom one third are women and almost 5,000 are men. Only patients eighty years or younger are included and the data have been obtained from RIKS-HIA.

In 2007, the percentage of patients treated with clopidogrel at a national level was 82%, a rise of two percentage points since 2006. There had been a steadily rising trend over a number of years but in recent years it has levelled out slightly. In 2007, in the country as a whole, 78% of women and 85% of men were treated.

The variation among the county councils ranges from 74% to 95% treated. In the case of low-prescribing county councils such as Dalarna and Blekinge, prescribing has risen more than in the country as a whole compared with 2006, but there has been no dramatic decrease in the degree of variation among county councils.

Among the hospitals it can been noted that fourteen reach the RIKS-HIA limit of at least 90% treated for maximum points in the quality index for this indicator, while nine have 70% or fewer treated.

The percentage of those treated ought to increase and the differences among hospitals ought to be able to be drastically reduced. The RIKS-HIA target level of 90% treated is a benchmark that is very much in line with the recommendation in the national guidelines.

An international reference is the percentage of patients in England and Wales who are prescribed clopidogrel after myocardial infarction. In accordance with the national cardiac care follow-up, the national average prescription of clopidogrel was 87% in 2007, which is higher than in Sweden.

Please refer to the report *How the NHS manages heart attacks,* Seventh Public Report 2008, Myocardial Ischaemia National Audit Project, MINAP.

Figure B19
Sweden

Percentage of patients with non ST-segment elevation myocardial infarction receiving clopidogrel therapy. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

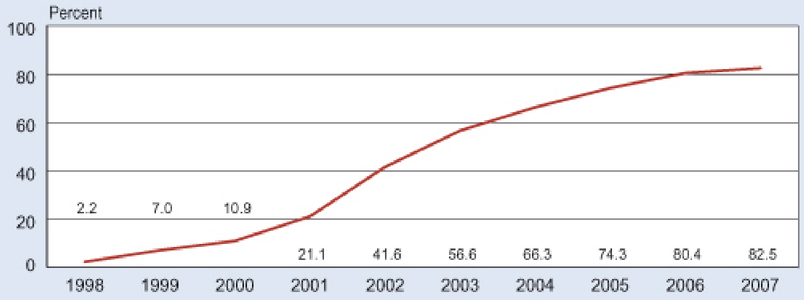


Figure B19
Women
and men

Percentage of patients with non ST-segment elevation myocardial infarction receiving clopidogrel therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

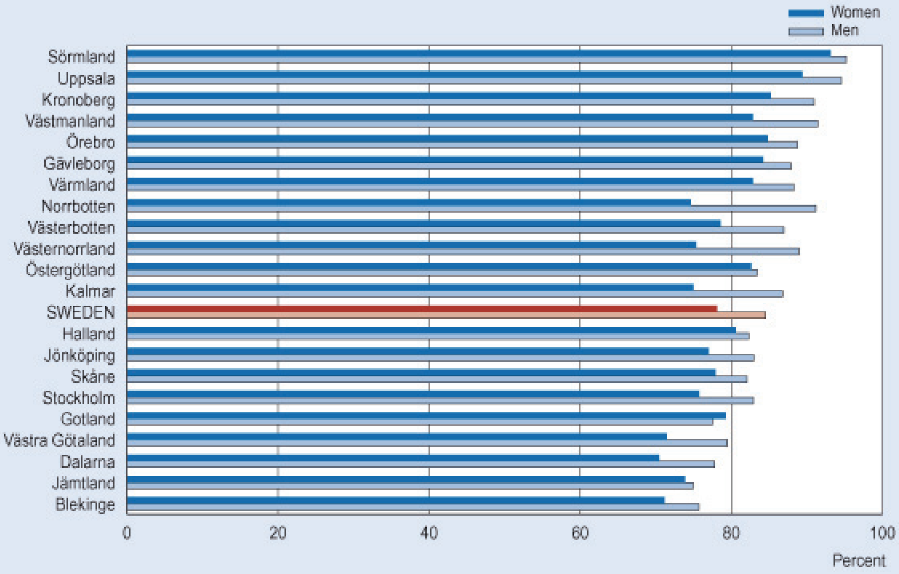


Figure B19
Total

Percentage of patients with non ST-segment elevation myocardial infarction receiving clopidogrel therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

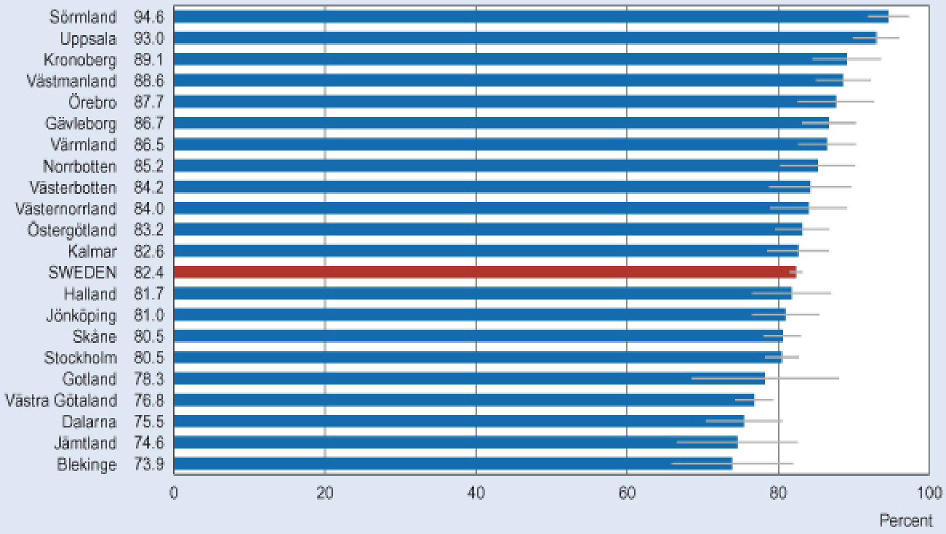
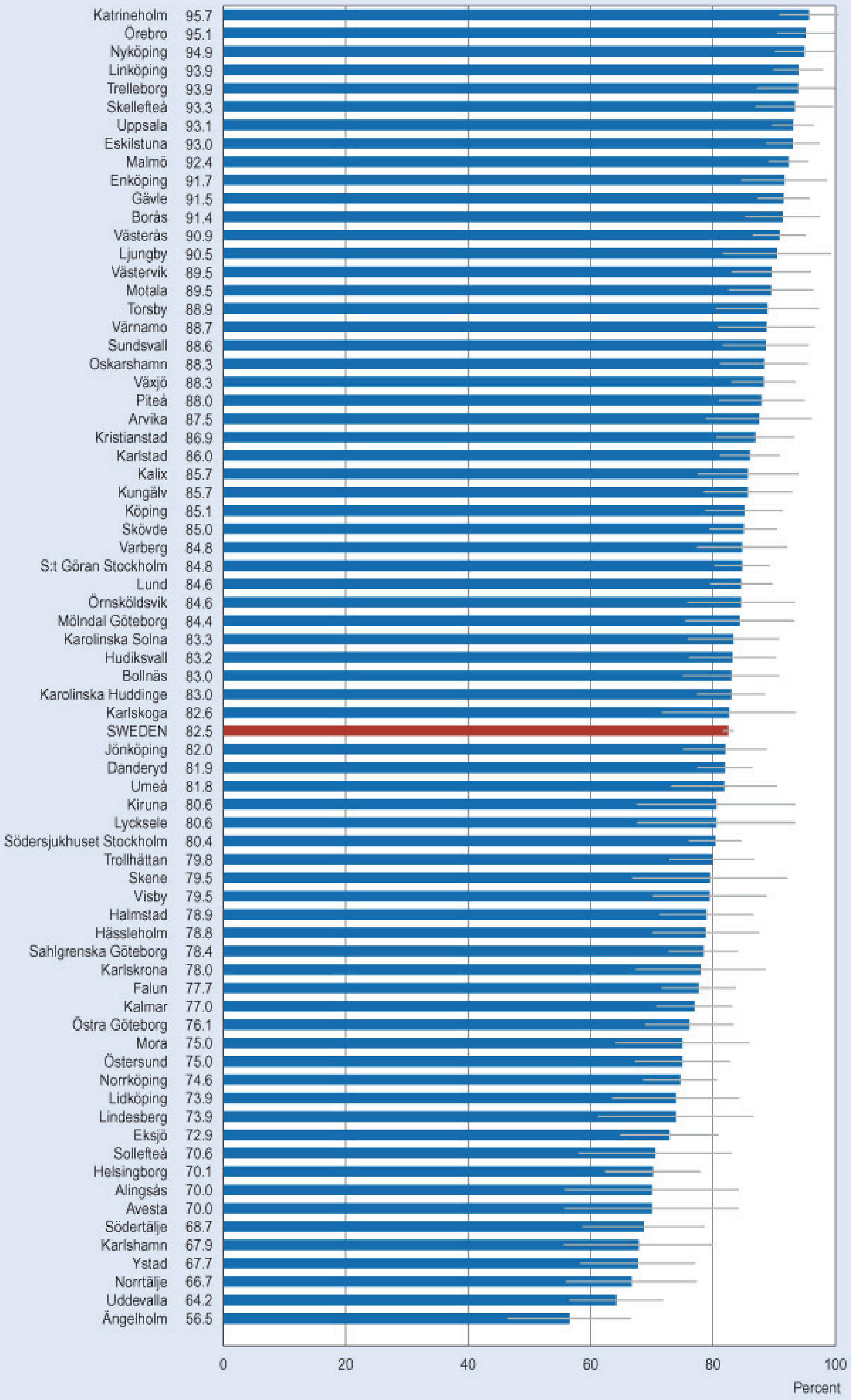


Figure B19
Hospitals

Percentage of patients with non ST-segment elevation myocardial infarction receiving clopidogrel therapy, 2007. Age ≤80 years.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



Coronary artery disease – fatality rate and disease recurrence

Mortality after infarction and recurrence of infarction or ischemic cardiac disease after myocardial infarction are two common result measures. The following section describes several such indicators, both those with death as the only result and those with both death and disease recurrence as a result.

In the pure mortality measures both the Patient Register (PAR) and RIKS-HIA have been used as a source, in similar or identical indicators. One purpose has been to study the differences between the mortality of each infarction population in the two registers. PAR provides the source in all measures that describe disease recurrence.

Mortality after myocardial infarction is dependent on several factors and is affected by the extent of the infarction and the time that elapses until effective treatment is administered. The time factor is affected by both the patient's own decisions and by the medical services organisation throughout the entire chain from the advice helpline and the emergency alarm centre until intervention at the hospital, the distance to which naturally also affects the time factor.

The treatment administered affects the outcome, as a number of treatments in myocardial infarction had been shown to be able to lower mortality. This applies to both treatment during the acute phase and that with a secondary preventive purpose. In addition, mortality is affected by factors not directly related to the infarction, such as the patient's age, general condition and other serious concomitant morbidity.

There are also studies that point to the role played by factors such as income and educational status: patients with a higher income and more extensive education survive to a greater extent than others. Education and income probably coincide with other factors or characteristics of the patients that are the background explanations for this lower mortality.

The indicators are designed so that they reflect different time horizons, different types of infarction and both mortality and heart disease recurrence. The following seven result measures after myocardial infarction are described here:

- A new infarction within 365 days of myocardial infarction (PAR)
- Re-admission within 30 days of discharge after myocardial infarction (PAR)
- Dead and re-admission within 365 days of myocardial infarction (PAR and the Cause of Death Registry)
- Myocardial infarction - 28-day case fatality rate (PAR and the Cause of Death Registry)
- Myocardial infarction - 28-day case fatality rate in hospital care (PAR)
- Myocardial infarction - 30-day case fatality rate (RIKS-HIA)
- Fatality rate within 30 and 365 days in ST-segment elevation myocardial infarction (RIKS-HIA)

A hospital-level description is given but without any ranking or any real claims to explain the results by differences in treatment quality. The reason for this is that no adjustment has been made to take into account the different degree of illness of the patients. Differences can be expected to exist among the hospitals in this respect. In ST-segment elevation myocardial infarction, above all, patients are often brought to hospitals with PCI capacity, which means that they are selected in a manner that would be unfair to an evaluative hospital comparison.

When the description is given at county council level, the patient's home county is used for this purpose, in which case ranking takes place. There may well be differences in background factors among the myocardial patients in different county councils and counties, but these are probably significantly smaller than the differences among different hospitals.

To sum up, two result measures are described in this section with regard to coronary artery surgery; a re-operation after serious sternal complications, and 30-day case fatality rate, respectively.

Reinfarction within 365 days of myocardial infarction (B20)

The indicator measures the percentage of myocardial infarction patients who were discharged from hospital and had a new infarction within 365 days of their discharge. This percentage can be a result of both the care measure in the acute stage and secondary preventive measures. A fundamental factor that affects the outcome is, naturally, the condition of the patient before and after the first infarction.

The comparison comprises 20,786 patients of all ages who were treated in hospital in 2005 with myocardial infarction as the primary diagnosis and then discharged. Only patients with no record of infarction during the preceding seven years are included in these calculations. This thus reflects the care of first-time patients.

Those who had a second infarction consist of both those who died without receiving hospital care in time but where the cause of death was myocardial infarction and those who were treated for infarction in hospital. Age standardisation has been undertaken and the data obtained from the Patient Register and Cause of Death Register.

In the country as a whole, 13% of the patients suffered a second infarction within 365 days. From 1998 to 2005, the percentage of re-infarctions decreased somewhat. The rise in 2001 is probably due to new diagnostic criteria for myocardial infarction that were introduced then. These mean that the definition of infarction was widened and more cardiac patients were given this diagnosis. Percentages at the county council level range from over 10% to around 15%. The difference is small in percentage points but large in terms of the numbers of those who suffered a re-infarction: ten per hundred compared with fifteen per hundred patients. Throughout the country, the outcome for women is somewhat better than for men but the differences are modest.

It is not possible to state a level of a desirable or optimum outcome, although a certain degree of guidance can be gauged from the variation among county councils. There is a significant variation with regard to the number of patients who die without having been treated in hospital (see indicator B23). This means that factors other than the hospital care measures also play a role such as medical advice helplines, emergency alarm centres and ambulance care, for example.

There are sources of errors to be taken into account; the indicator includes as a re-infarction deceased myocardial infarction cases that were not preceded by emergency hospital care. Due to the low percentage of autopsies on elderly deceased patients, there is greater uncertainty in their diagnosis. On the other hand, a follow-up of cases that only received hospital care initially would be affected by the very percentage of infarction cases that never get to a hospital. A large percentage that do not receive hospital care would then seemingly improve the survival rate, and therefore it is important to also include those who died without receiving hospital care.

Figure B20
Sweden

Percentage of patients who suffered a reinfarction within 365 days after the first AMI. Age standardised.

Source: Swedish Statistics of Acute Myocardial Infarction, National Board of Health and Welfare

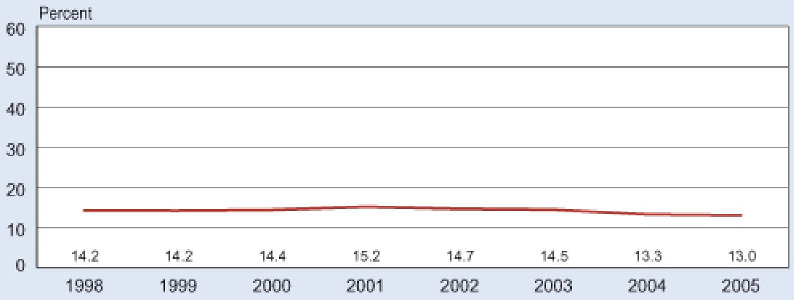


Figure B20
Women
and men

Percentage of patients who suffered a reinfarction within 365 days after the first AMI, 2005. Age standardised.

Source: Swedish Statistics of Acute Myocardial Infarction, National Board of Health and Welfare

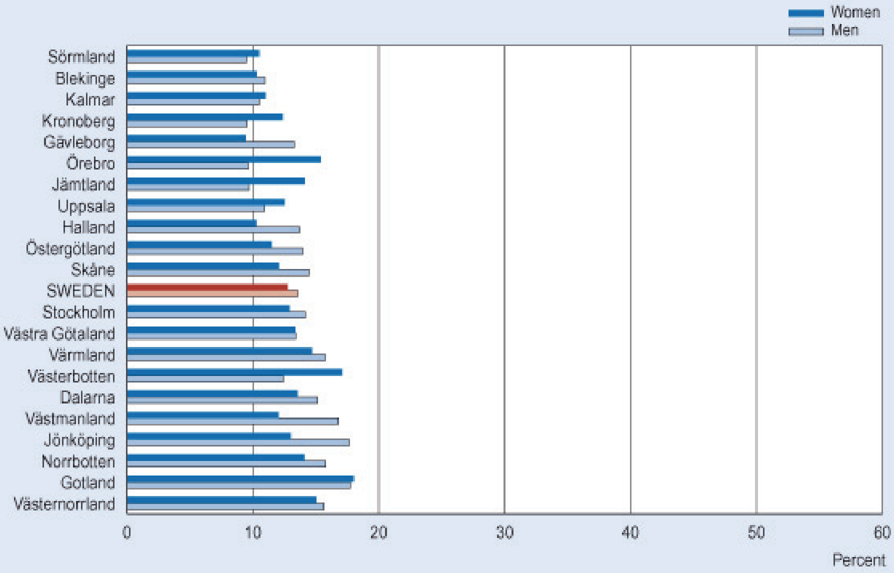
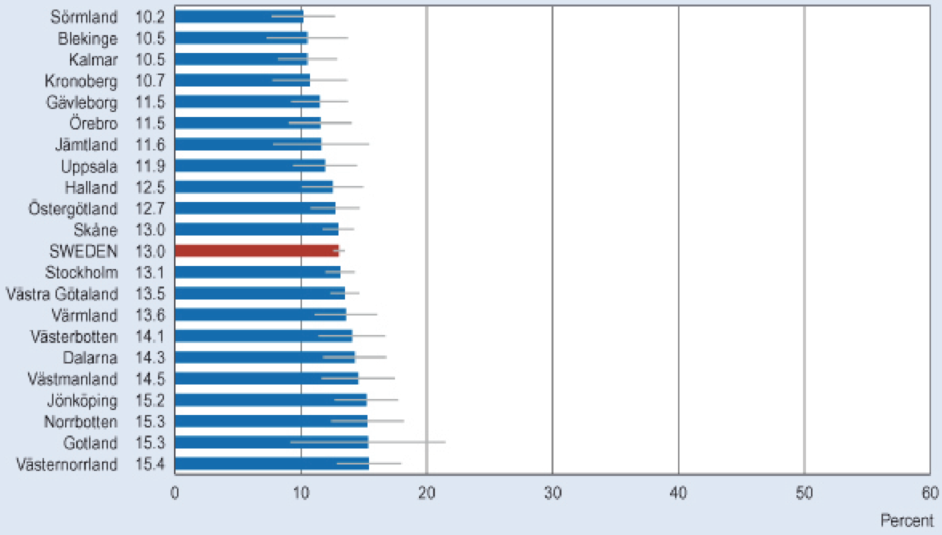


Figure B20 *Total*

Percentage of patients who suffered a reinfarction within 365 days after the first AMI, 2005. Age standardised.

Source: Swedish Statistics of Acute Myocardial Infarction, National Board of Health and Welfare



Re-admission within 30 days of discharge after myocardial infarction (B21)

The indicator measures the percentage of patients treated for myocardial infarction who within thirty days of discharge are re-admitted to hospital as a consequence of cardiovascular disease. Re-admission to hospital a short while after receiving care for myocardial infarction may be a sign of shortcomings in the initial treatment or follow-up. Unplanned and avoidable re-admissions reflect inadequate quality and a greater risk to the patient as well as inefficient utilisation of medical services resources.

The comparison is based on 35,703 patients who were treated in hospital for myocardial infarction during the period from September 2006 up to and including September 2007 and it includes only those who had not had an infarction in the preceding seven years.

Re-admission causes are primary diagnoses of cardiovascular diseases and apart from myocardial infarction and other ischemic heart diseases, and they also include other forms of heart diseases and stroke. This comparison is age standardised.

Re-admission within twenty-eight days with any diagnosis of acute myocardial infarction has not been counted as re-admission in these calculations. These admissions have been viewed as part of the treatment of the acute myocardial infarction. Instead the last care session for myocardial infarction within the twenty-eight day period has been followed up, and the percentage re-admitted within thirty days of the last date of discharge has been calculated. This avoids planned re-admissions for a coronary artery operation or PCI treatment being included in the percentage of re-admitted patients.

Sixty percent of all infarction patients in these calculations were men. In the country as a whole, less than 10% were re-admitted within thirty days of an infarction. During the past ten years, the percentage has dropped steadily from 14% to 9% in 2007 and at a national level the differences between the sexes are small.

There are major differences among groups of county councils. The two or three county councils with the lowest percentage of re-admissions have half the level of those with the highest percentage. Among the hospitals, too, there is great variation, from Motala with 3% to hospitals with 15% re-admissions. The hospitals are arranged by county council affiliation and are not ranked. The reason for this is that the outcome at hospital level is dependent on the degree of illness of the patients, which affects their risk of disease recurrence. Differences in the degree of illness and other morbidity may occur among the patient compositions at the different hospitals. In these calculations it has not been possible to make adjustments for these factors.

It is, of course, desirable that the percentage of re-admissions after treatment for myocardial infarction is as low as possible, but it is hard to state the lowest level that it is reasonable to achieve. One observation is that this percentage has dropped over time despite increasingly shorter infarction care times. A fear that is sometimes expressed is that the scarcity of hospital beds represents a risk that might result in premature discharge.

Figure B21
Sweden

Percentage of patients with AMI readmitted for cardiovascular disease within 30 days of discharge. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

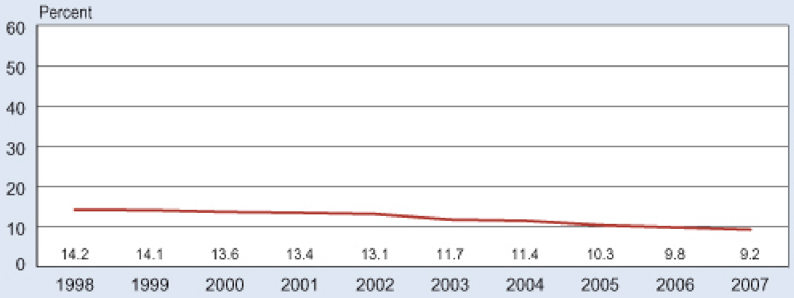


Figure B21
Women
and men

Percentage of patients with AMI readmitted for cardiovascular disease within 30 days of discharge, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

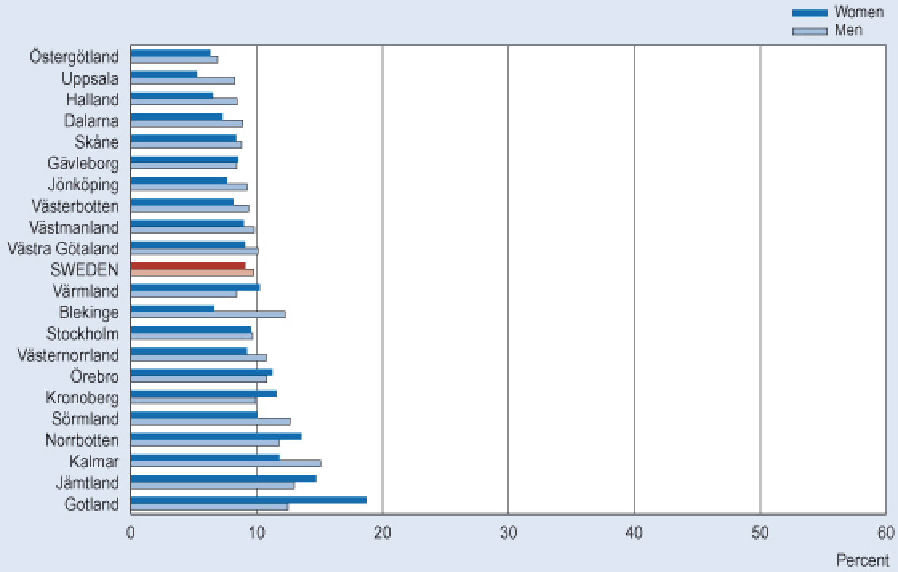


Figure B21
Total

Percentage of patients with AMI readmitted for cardiovascular disease within 30 days of discharge, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

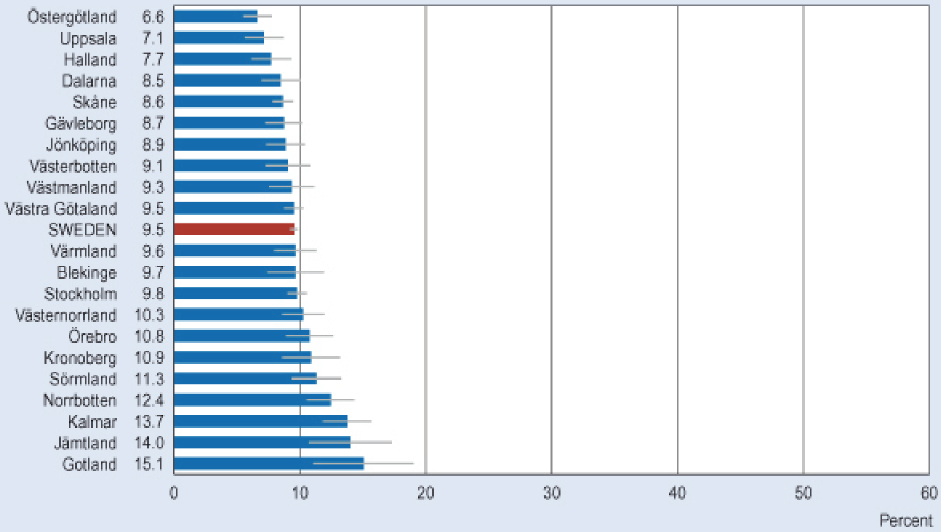
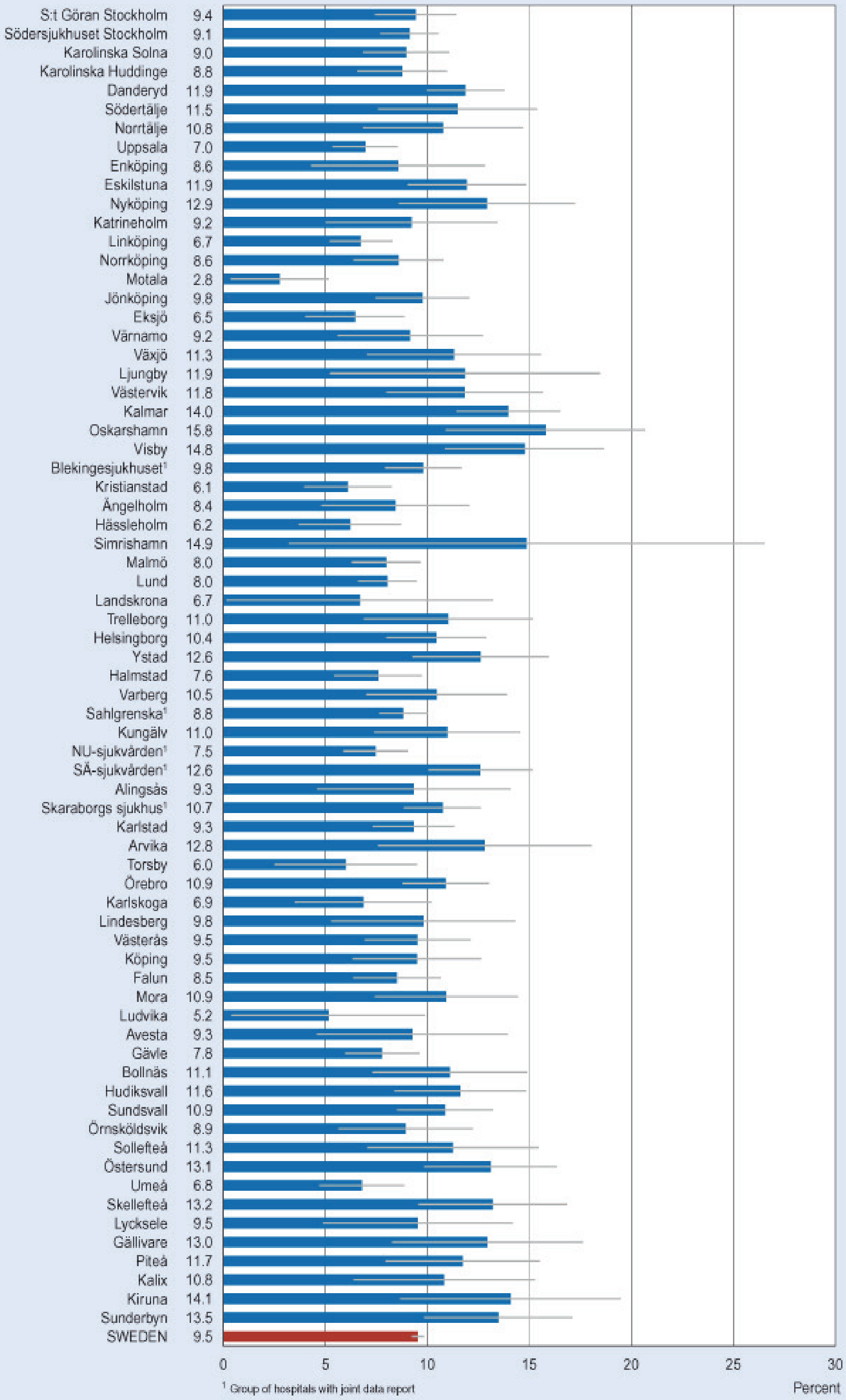


Figure B21
Hospitals

Percentage of patients with AMI readmitted for cardiovascular disease within 30 days of discharge, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare



¹ Group of hospitals with joint data report

Dead or re-admitted within 365 days of myocardial infarction (B22)

The indicator measures the percentage of myocardial infarction patients who died or were re-admitted to hospital for cardiovascular disease within one year of their infarction. This is a result measure that identifies both results, i.e., death and renewed hospital care for cardiovascular disease.

Death and re-admission can be a result of both the care measure in the acute stage and secondary preventive measures. A fundamental factor that affects the outcome is, naturally, the condition of the patient after the first infarction.

The comparison includes 24,177 patients of all ages who were treated in hospital for myocardial infarction in 2006. Dead includes death irrespective of the cause and also during the initial care session, while re-admission applies to in-patient care with a primary diagnosis of myocardial infarction, stroke, heart failure or clots in arms, legs or abdominal arteries. Only patients with no record of myocardial infarction in the seven preceding years are included in the calculations. This thus reflects the care of first-time patients. Age standardisation has been undertaken and data have been obtained from the Patient Register.

In the country as a whole, 42% of the patients died or were re-admitted within 365 days. Since 1998 this percentage has dropped by thirteen percentage points, from 55% to 42% in 2006.

The differences among the county councils are relatively modest. The percentages vary from 37% in Dalarna to 51% in Norrbotten, but the majority of county councils come close to the national level. For women, the outcome at national level is somewhat better than for men but the differences are small.

The results per hospital are stated without ranking, and the reason for this is that the outcome at hospital level depends on the patients' degree of illness, which affects their risk of death and disease recurrence. The patient compositions at the different hospitals may differ with regard to the degree of illness and other morbidity. In these calculations it has not been possible to make adjustments for these factors. Comparisons should be made primarily among hospital with the same roll/remit in acute infarction care.

It is not possible to state a level of a desirable or optimum outcome, although a certain degree of guidance can be gauged from the variation among county councils and also among hospitals, after account is taken of inadequate comparability.

One source of error is that these re-admissions cover several primary diagnoses where the diagnosis criteria may differ among the hospitals, which includes whether a secondary or a primary diagnosis is used.

Figure B22
Sweden

Percentage of patients with AMI dead or readmitted for cardiovascular disease within 365 days of discharge. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

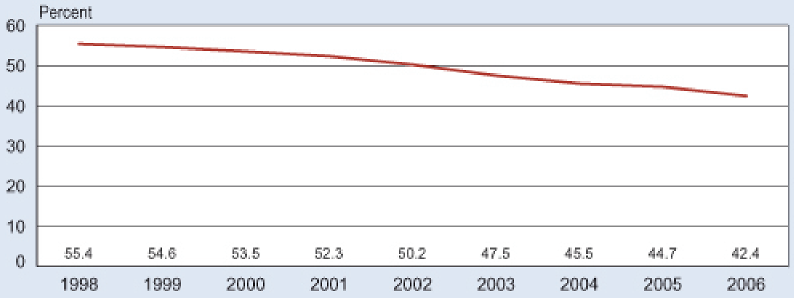


Figure B22
Women
and men

Percentage of patients with AMI dead or readmitted for cardiovascular disease within 365 days of discharge, 2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

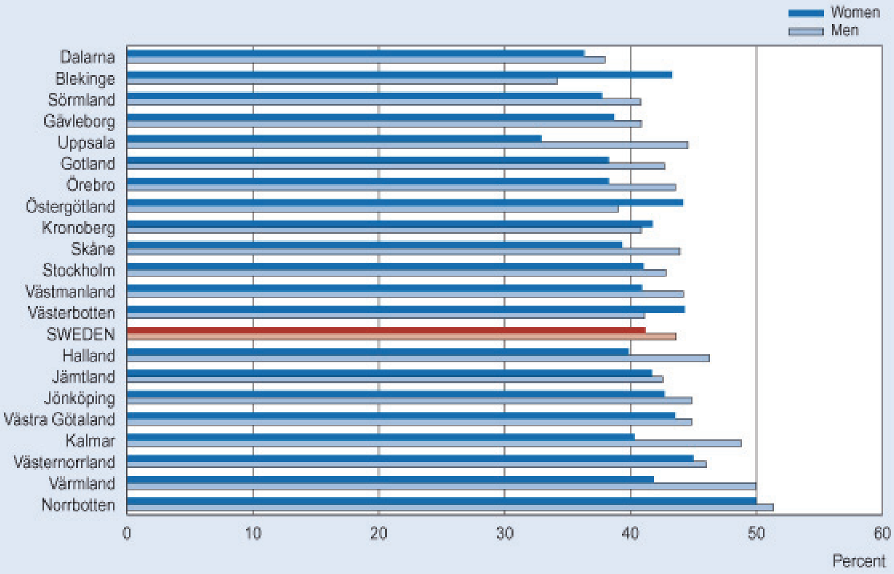


Figure B22
Total

Percentage of patients with AMI dead or readmitted for cardiovascular disease within 365 days of discharge, 2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

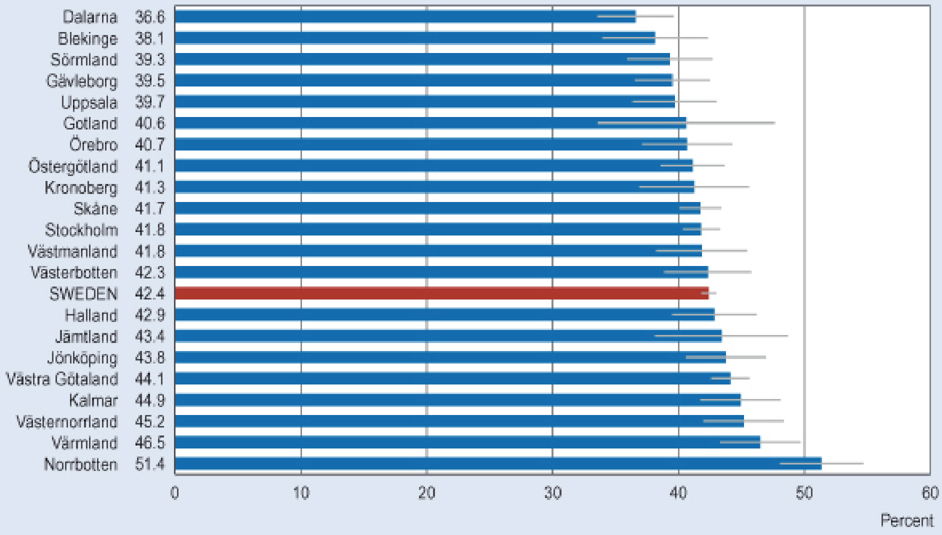
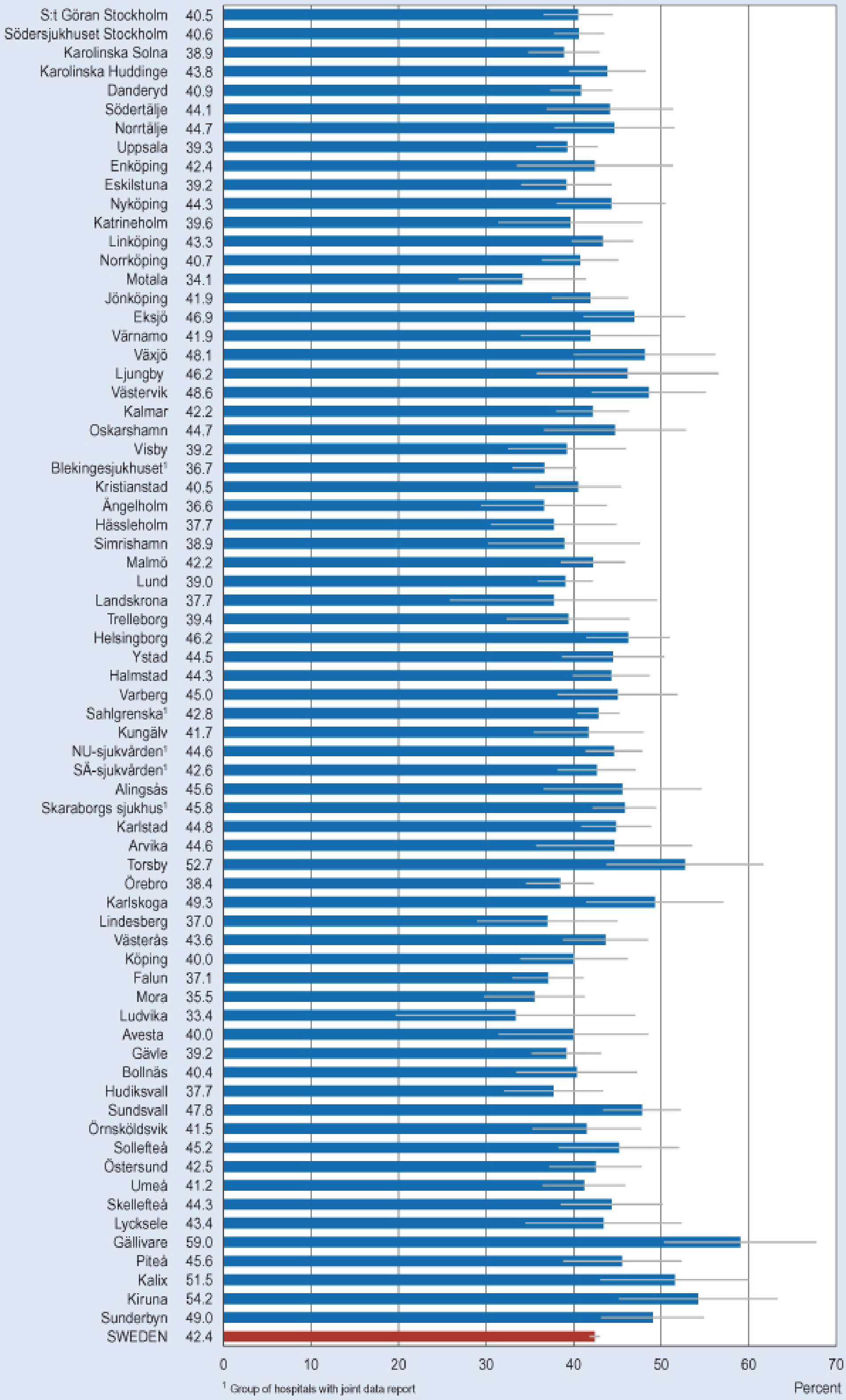


Figure B22
Hospitals

Percentage of patients with AMI dead or readmitted for cardiovascular disease within 365 days of discharge, 2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare



¹ Group of hospitals with joint data report

Myocardial infarction - 28-day case fatality rate (PAR) (B23)

The risk of dying within twenty-eight days of a myocardial infarction is an established international indicator of how well the medical services manage emergency care after a myocardial infarction. This measure is intended to measure the quality of the entire care chain from preventive care to ambulance services, emergency care and subsequent care.

The comparison includes a total of 118,720 infarction cases during the period from 2004 to 2006. Of these, 42% were women. All cases with any diagnosis of myocardial infarction in the Cause of Death Register or the inpatient section of the Patient Register have been counted as myocardial infarction. Thus, this includes both those cases that were treated initially in hospital and those who died without being treated there. This comparison is age standardised.

In the country as a whole, the age-standardised 28-day case fatality rate was between 30% and 31% from 2004 to 2006, which is lower than between 2001 and 2003, when it was almost 33%. Between 1990 and 2000, the age-standardised fatality rate fell by ten percentage points for both men and women, a reduction that thus continued during the 2000s. However, it should be noted that the widened diagnosis criteria for myocardial infarction introduced in 2001 in the national coronary artery disease guidelines from the National Board of Health and Welfare meant that more patients with minor infarctions received this diagnosis and thus the percentage of deaths fell.

The fatality rate varies noticeably among the county councils and there is a difference of over twelve percentage points between the lowest 28-day case fatality rate, found in Uppsala and Västerbotten, and the highest, found in Örebro and Kalmar.

It can be seen from diagram B23 that the fatality rate distribution differs among the county councils. In Uppsala, half of all those who died did so without being treated in hospital, while in, for example, Kalmar and Örebro, this percentage was higher. No data are given for hospitals, as individuals who died without having received initial hospital treatment are also included in the comparison.

In the country as a whole women have a higher fatality rate than men. After account is taken of different age distributions, the results are reversed, and men now show a slightly higher mortality rate than women. This state of affairs occurs in the majority of county councils, even if the differences were often small. One exception, however, is Gotland, where the difference in the 28-day case fatality rate between men and women is over ten percentage points higher for men.

Variations in the fatality measured among the county councils may have several causes. Apart from the fact that diagnostic reliability plays a role, differences in background factors such as other morbidity, social factors, random deviations, and also in the propensity of the population to seek medical attention all have an effect. Direct factors related to medical services may comprise the distance from an acute hospital, the efficiency of the ambulance service and emergency hospital treatment.

No target value can be assigned but it ought to be possible to noticeably reduce the differences among the county councils.

There are sources of errors to be taken into account, and the indicator also includes deceased myocardial infarction cases that were not treated in hospital. Due to the low percentage of autopsies on elderly deceased patients, there is greater uncertainty about the quality of their diagnosis. On the other hand, a follow-up only of cases that initially received hospital care would be affected by the very percentage of infarction cases that never get to a hospital. A large percentage who does not receive hospital care would then seemingly improve the survival rate, and therefore it is relevant to also include those who died without receiving hospital care.

Figure B23
Sweden

28-day case fatality rate of AMI. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

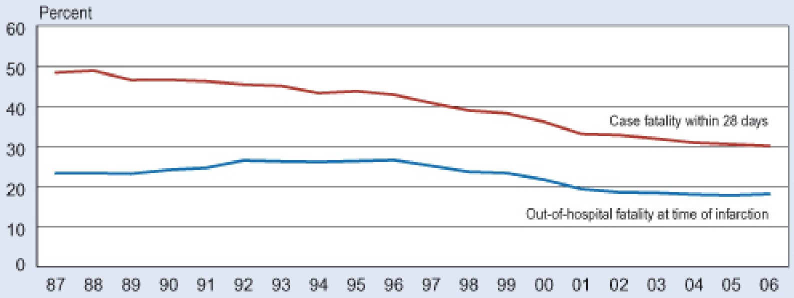


Figure B23
Men

28-day case fatality rate of AMI, 2004–2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

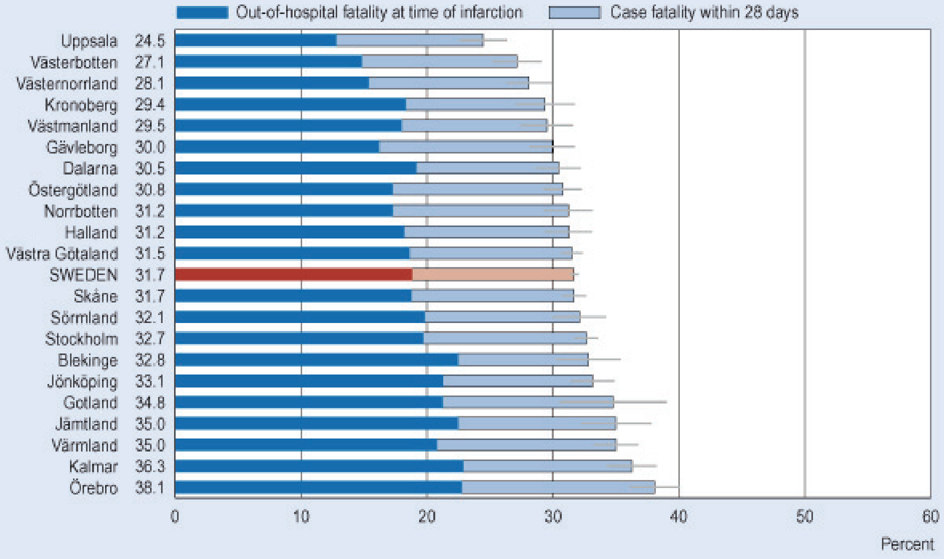


Figure B23
Women

28-day case fatality rate of AMI, 2004–2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

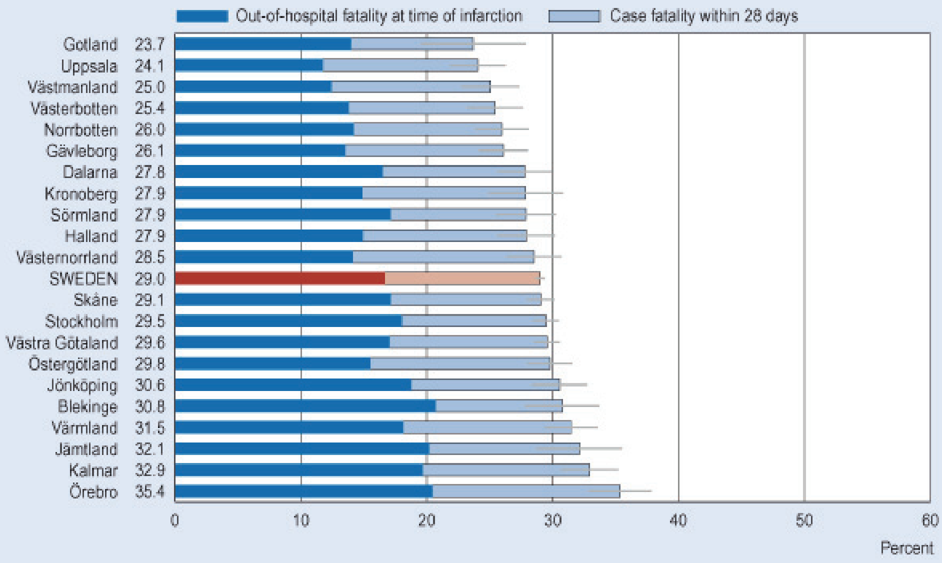
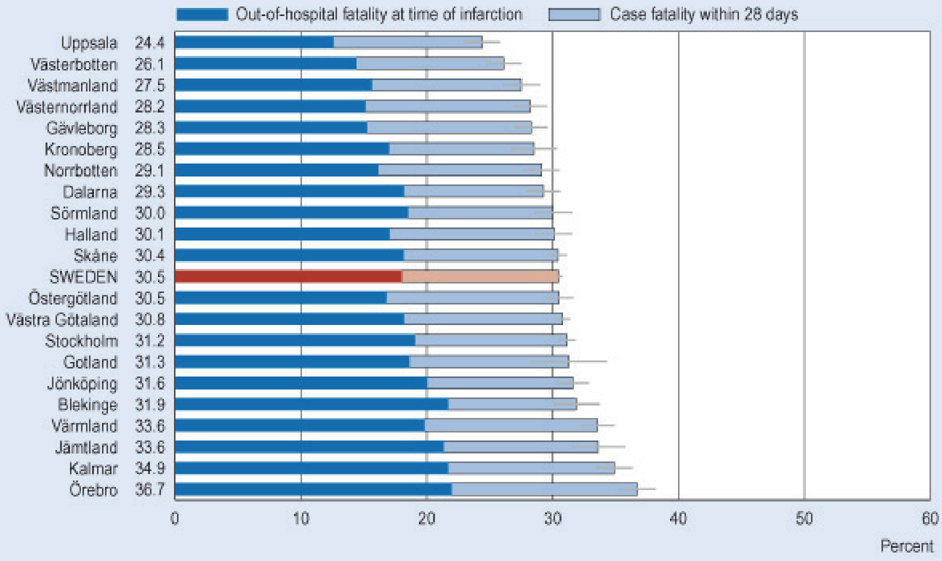


Figure B23
Total

28-day case fatality rate of AMI, 2004–2006. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare



Myocardial infarction - 28-day case fatality rate in hospital care (PAR) (B24)

The indicator measures the fatality rate within twenty-eight days of myocardial infarction for patients treated in hospital. Over 95,700 myocardial infarction cases between 2005 and 2007 are included in this comparison, of which over 40,000 were women, and all cases where the primary or secondary diagnosis was myocardial infarction are included. The data have been obtained from the Patient Register and the comparison is age-standardised.

Over a three-year period around 15% of all patients throughout the country died within twenty-eight days of admission to hospital. Since the end of the 1980s, the 28-day case fatality rate after myocardial infarction for patients treated in hospital has fallen steadily, from 34% in 1988 to 14% in 2007.

Please note the widened diagnostic criteria for myocardial infarction that were introduced in 2001 (see indicator B23).

If no account is taken of age, women have a fatality rate that is three percentage points higher than for men. After age adjustment, men show a somewhat higher 28-day case fatality rate than women during the measurement period in question, 15.5% versus 14.3% for women in the country as a whole.

At county council level the variation for the period from 2005 to 2007 between the highest and lowest fatality rates was four percentage points. Örebro showed the highest fatality rate, at 17%, and Västerbotten, the lowest, at 13%.

The hospital results are not ranked but are shown in county-council order, which is because the patient compositions at the various hospitals can vary with regard to the degree of illness and other morbidity and this may affect the fatality rate figures recorded. The outcome per hospital should thus not be viewed as a result solely of the care quality at each hospital but as also being affected by other factors. On the other hand, it is possible to obtain an approximate estimate of how the various hospitals contribute to the results for the county councils.

The low fatality rate in Västerbotten is seen at all three of the county's hospitals, while the high rate in the case of Örebro can be attributed instead to the results for Karlskoga Hospital, which is, in its turn, so noticeably divergent that in the autumn of 2008, the possible reasons for it were examined, including such matters as how the diagnosis of myocardial infarction was used for patients who died there.

Methods should be devised as a matter of urgency to allow fatality rates among hospitals to be compared, even if there are different degrees of illness among the patients. Such efforts are under way in several countries, and a key issue in Sweden is the possibility of utilising the Patient Register and RIKS-HIA, respectively, for this purpose.

Data at hospital level are nonetheless important as a support for local improvement efforts. All hospitals and clinics can track their own trend over time, and at a local level there is a better knowledge of changes in patient selection, work allocation and collaboration among hospitals.

Figure B24
Sweden

28-day case fatality rate of AMI, hospitalised cases. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

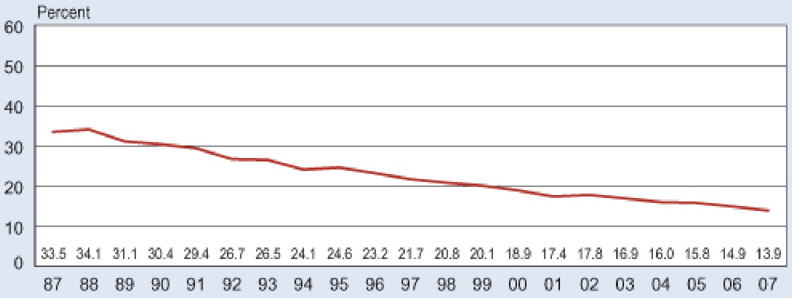


Figure B24
Women
and men

28-day case fatality rate of AMI, hospitalised cases.
2005–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

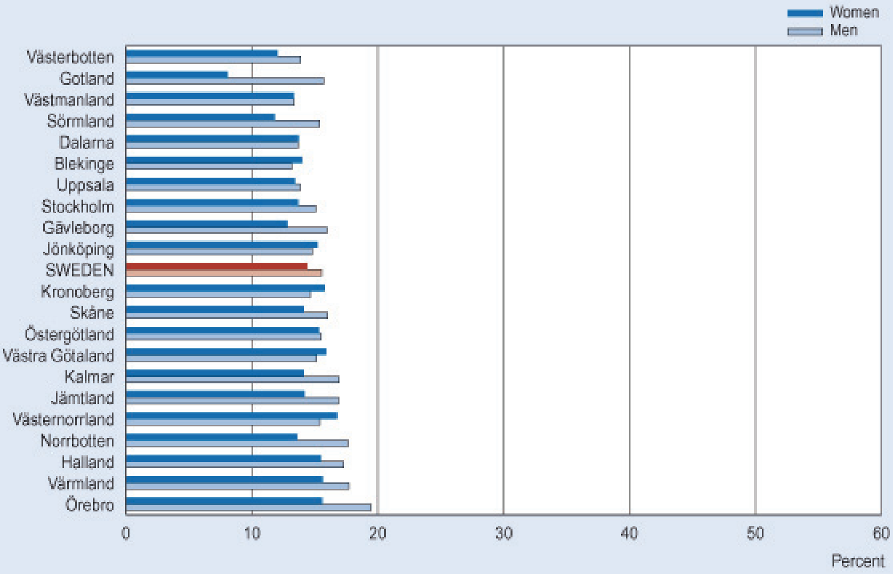


Figure B24 *28-day case fatality rate of AMI, hospitalised cases.*
Total *2005–2007. Age standardised.*

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

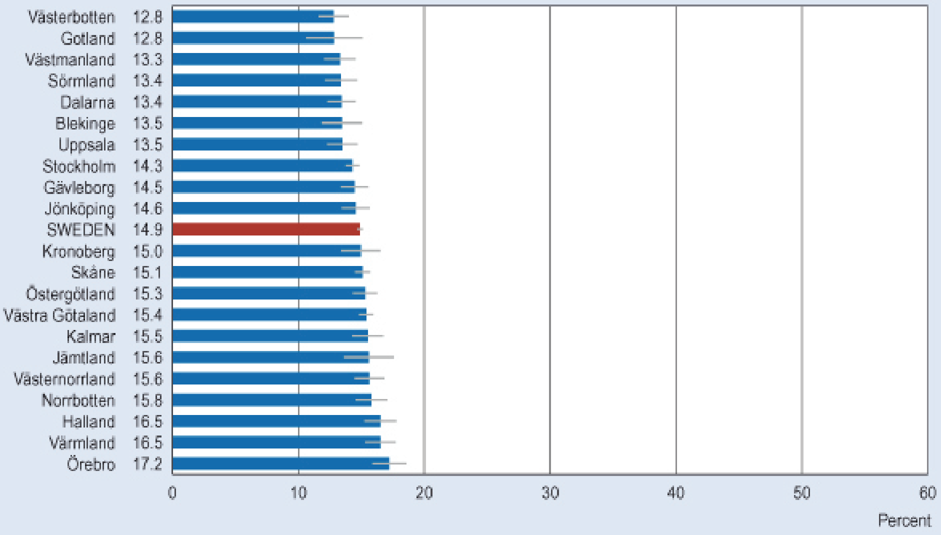
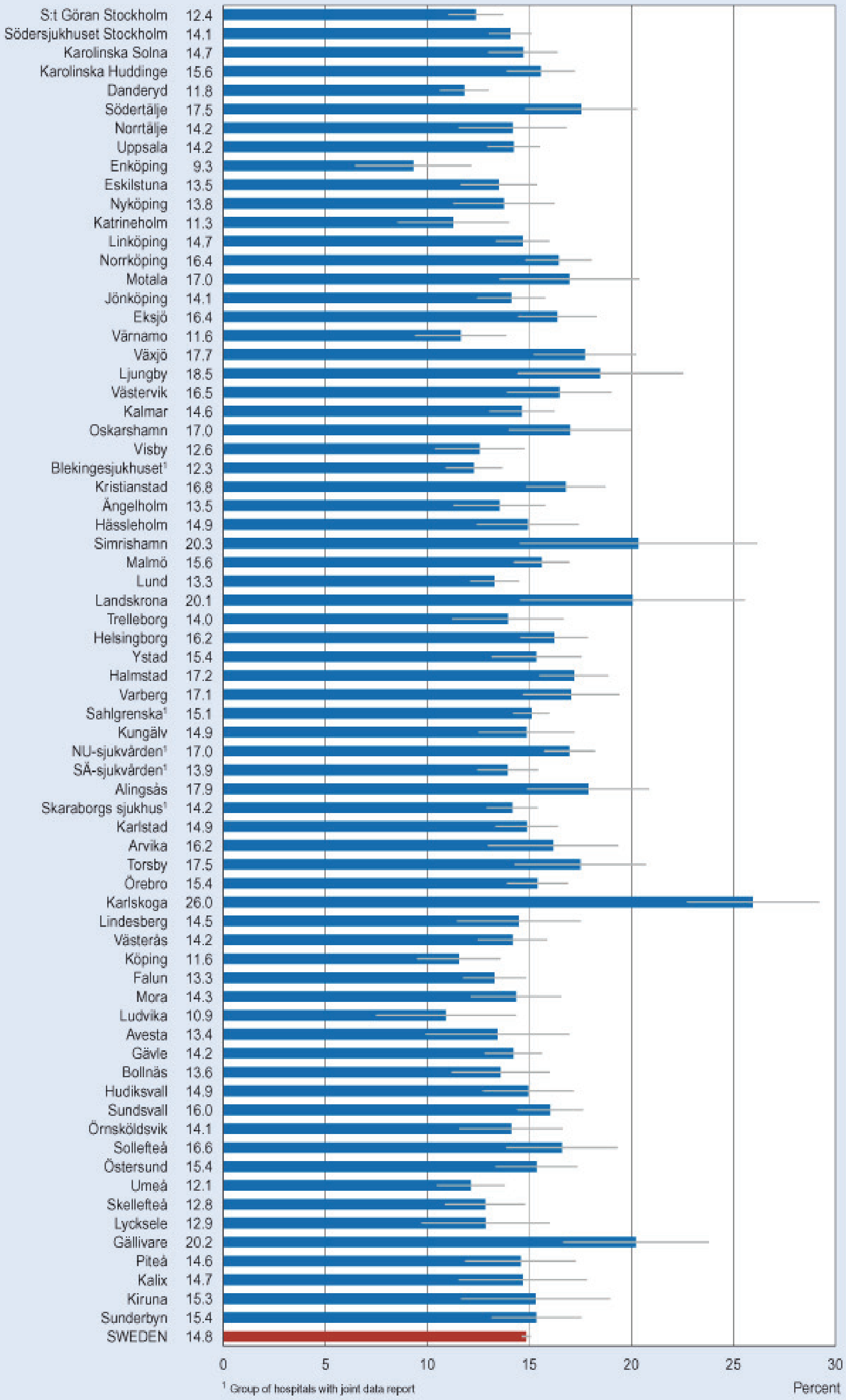


Figure B24
Hospitals

28-day case fatality rate of AMI, hospitalised cases. 2005–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report

Myocardial infarction - 28-day case fatality rate in hospital care (RIKS-HIA) (B25)

The indicator shows the same thing as the previous one, the 28-day case fatality rate in myocardial infarction treated in hospital within twenty-eight days, but with the RIKS-HIA quality register as the source of data and not the Patient Register. Patient selection is thus partly different, and the purpose of describing this indicator for both sources is to throw light on differences and similarities among the various patient groups.

The comparison includes 55,026 patients who were treated for myocardial infarction during the period from 2005 to 2007 and who were reported to RIKS-HIA; 63% of them were men and the comparison has been age-standardised.

The percentage of deaths within twenty-eight days of myocardial infarction was 8% percent in the country as a whole, while, in the Patient Register, almost twice as high a percentage of the patients died. The national time trend shows that a steadily decreasing percentage of the myocardial infarction patients die within twenty-eight days. Between the periods from 1999 to 2001 and 2005 to 2007, this percentage fell by 4.5 percentage points.

A clear variation in fatality rates was seen among the county councils, in a range of between just over five and just over nine percent of deaths, with the exception of Gotland. At national level, a comparison of men and women shows small differences.

The hospitals are not ranked but are shown in county-council order, which is because the patient compositions at the various hospitals can vary with regard to the degree of illness and other morbidity, and this may affect the fatality rate figures recorded. In addition, there is the possibility that the criteria for reporting to RIKS-HIA differ among the hospitals. The outcome should thus not be viewed as a result solely of the care quality at each hospital, as other factors also play a role. On the other hand, it is possible to obtain an approximate estimate of how the various hospitals contribute to the results for the county councils. The smaller hospitals also have fewer patients, which gives a greater statistical uncertainty.

The increasing survival over time, which can be seen in the data of both RIKS-HIA and the Patient Register, is in all probability due to more efficient care during the acute stage of the infarction.

The differences in fatality rate between cases in the Patient Register and those in RIKS-HIA are striking. These differences may be due to the fact that the RIKS-HIA patients are relatively healthier or more amenable to treatment, and also because those treated in intensive cardiac care units may conceivably receive better care than other infarction patients.

The difference between national values for this indicator in the county council and the hospital diagrams is due to the fact that the national value in these diagrams is the mean value for those patients who had a valid code for their home county or hospital, respectively. Hence the omission categories in the two diagrams differ.

In RIKS-HIA the hospital affiliation of almost all patients is stated, for which reason the national value in the hospital presentation is referred to in this text.

The age standardisation has also been undertaken with somewhat differing age distributions for county council and hospital data for this indicator, and the age distribution has also been based on those patients who had a valid code for their home county or hospital, respectively. This also contributes to differences in the national values in the county council and hospital comparisons for this indicator.

Figure B25
Sweden

28-day case fatality rate of AMI, hospitalised cases. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

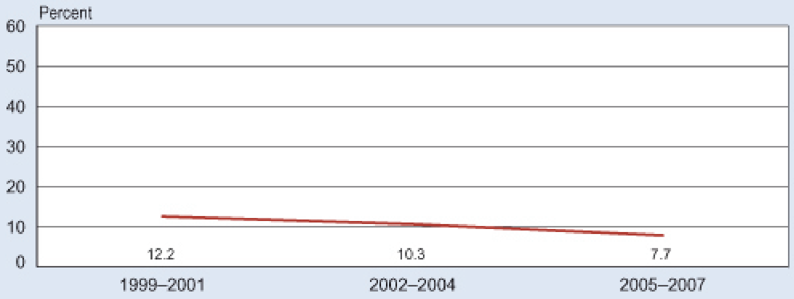


Figure B25
Women
and men

28-day case fatality rate of AMI, hospitalised cases.
2005–2007. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

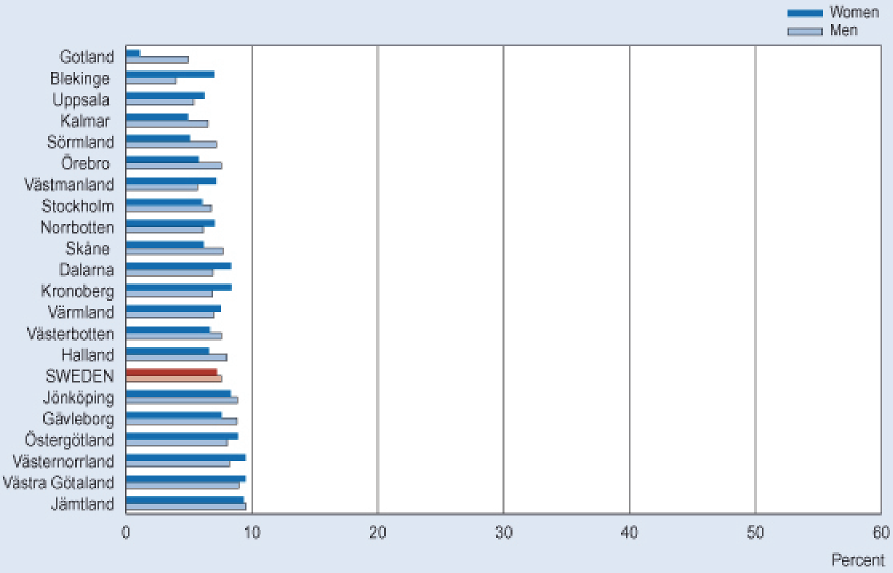


Figure B25 *28-day case fatality rate of AMI, hospitalised cases.*
Total *2005–2007. Age standardised.*

Source: RIKS-HIA – Registry on Cardiac Intensive Care

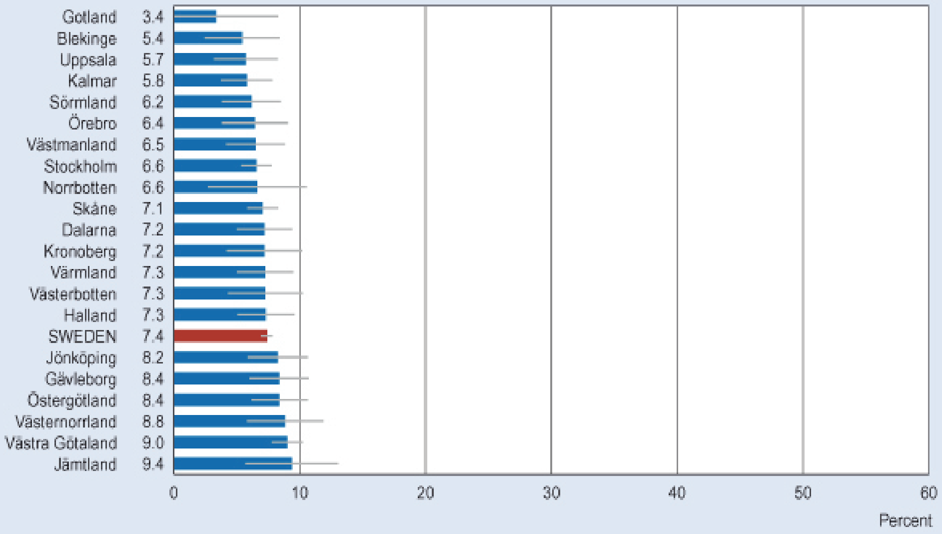
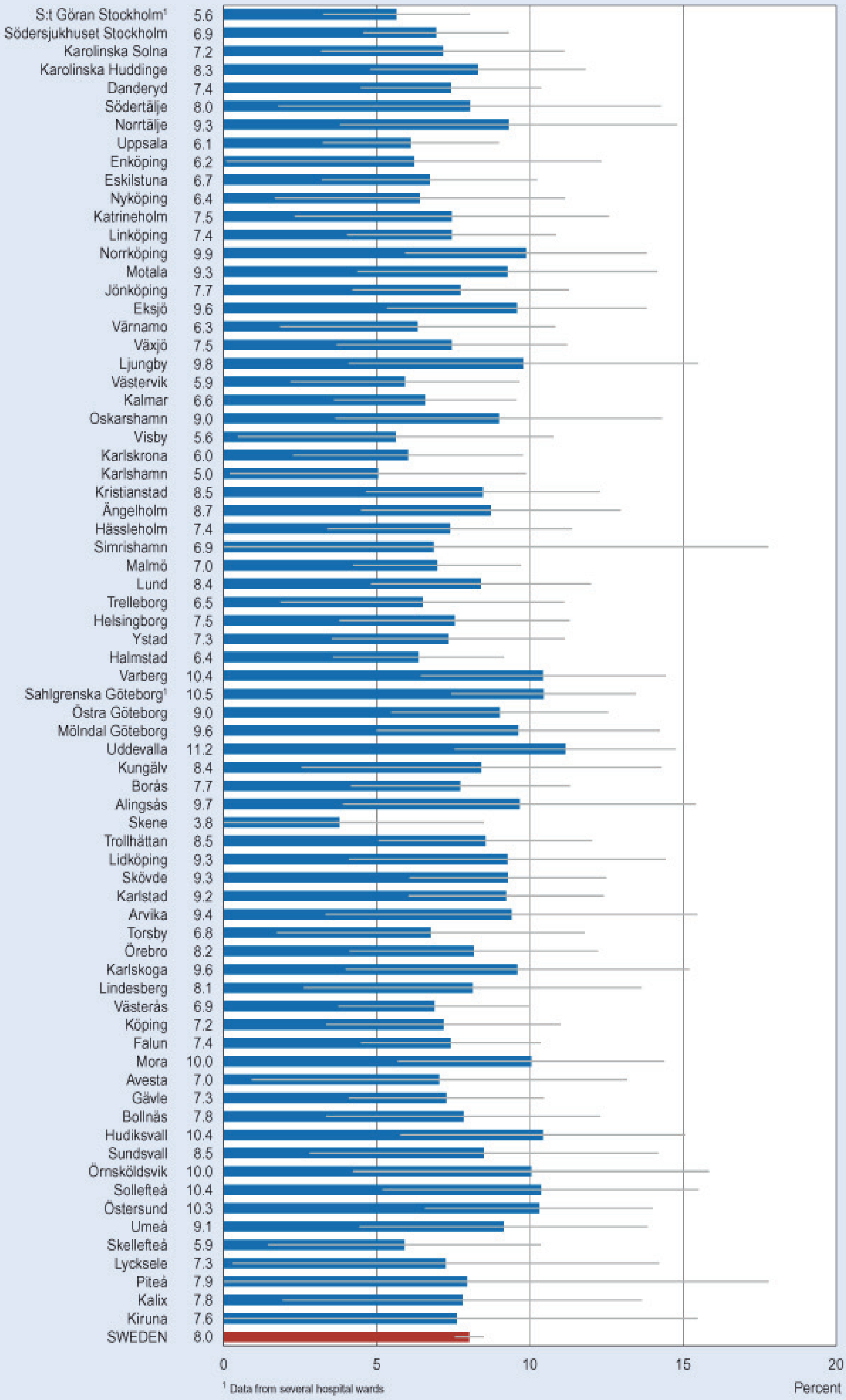


Figure B25 *28-day case fatality rate of AMI, hospitalised cases.*
Hospitals *2005–2007. Age standardised.*

Source: RIKS-HIA – Registry on Cardiac Intensive Care



¹ Data from several hospital wards

Fatality rate within 28 and 365 days in ST-segment elevation myocardial infarction (B26)

In an acute total blockage in a coronary artery, the area of heart muscle that is normally supplied by that artery is at risk of being rapidly damaged by a lack of oxygen. An acute blockage usually manifests itself as an ST-segment elevation on an ECG.

These ST-segment elevation infarctions, as they are called, together with left bundle branch block, comprised 37% of all myocardial infarctions in RIKS-HIA 2007. They often affect a younger patient group and are not associated with previous cardiac and other diseases to the same degree as are non-ST-segment elevation infarctions.

The comparison and the result

The indicator shows the fatality rate within one year among patients with ST-segment elevation infarction and left bundle branch block, divided according to both the percentage of deaths within twenty-eight days (day 0-27) and also the percentage of deaths within the remaining period up to 365 days, the source of these data being RIKS-HIA. In the Patient Register it is not possible to distinguish those infarction patients who had ST-elevation infarctions, which makes it impossible to compare these two registers in respect of this patient group.

Between 2005 and 2006, RIKS-HIA registered 14,500 patients who were treated for ST-segment elevation or left bundle branch block, of whom nearly 66% were men. The comparison includes all ages and is age-standardised. The hospitals are not ranked but are shown in county council order, which is because the patient compositions at the various hospitals can vary with regard to the degree of illness and other morbidity and this may affect the fatality rate figures recorded. In addition, there is the possibility that the criteria for reporting to RIKS-HIA differ among the hospitals. The outcome should thus not be viewed as a result solely of the care quality at each hospital, as other factors also play a role.

At a national level, the age-standardised fatality rate within one year is around 19% and has declined by five percentage points between the years 1999 and 2000 and 2005 and 2006. This decline in the one-year fatality rate may be explained to a considerable extent by more efficient emergency care, improved treatment facilities and also better access to secondary preventive measures.

The 28-day national case fatality rate is around 10%, which can be compared with 8% for all infarction patients in RIKS-HIA (indicator B25) and around 15% for the infarction cases in the Patient Register (indictor B24).

There are considerable differences in one-year fatality rates among the county councils, ranging from 12% in Örebro to 22% in Jämtland.

The degree of coverage of all infarctions in RIKS-HIA is at the national level 60% of the infarctions in the Patient Register and varies among county councils and among hospitals. However, in all probability, it is considerably higher in the case of ST-segment elevation infarctions.

The difference among national values for this indicator in the county council and hospital diagrams is due to the fact that the national value in these diagrams is the mean value for those patients who have a valid code for their home county or hospital, respectively. Hence the omission categories in the two diagrams differ.

In RIKS-HIA the hospital affiliation of almost all patients is stated, and therefore the national value in the hospital presentation is referred to in this text.

The age standardisation has also been undertaken with somewhat differing age distributions for county council and hospital data for this indicator. The age distribution has also been based on those patients who have a valid code for their home county or hospital, respectively. This also contributes to differences in the national values in the county council and hospital comparisons for this indicator.

Figure B26
Sweden

Case fatality rate within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

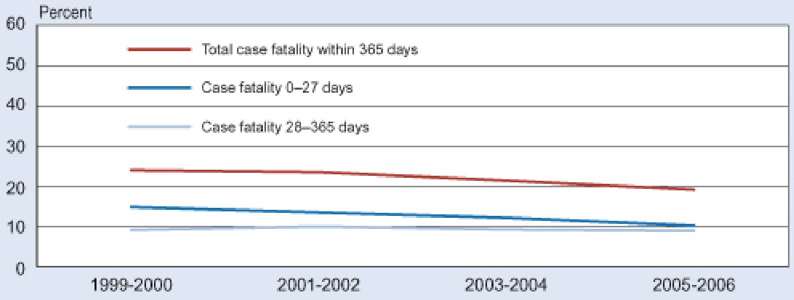


Figure B26
Men

Case fatality rate within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block, 2005–2006. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

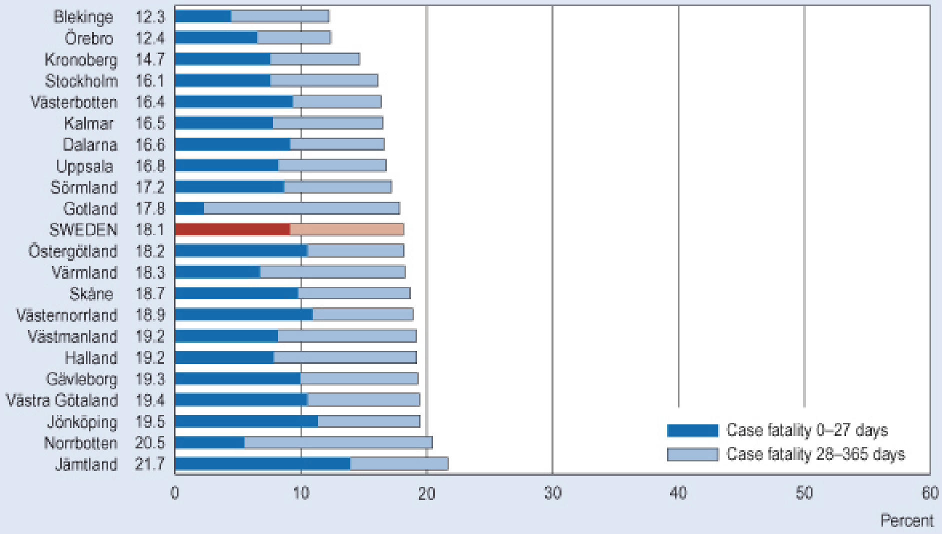


Figure B26
Women

Case fatality rate within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block, 2005–2006. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

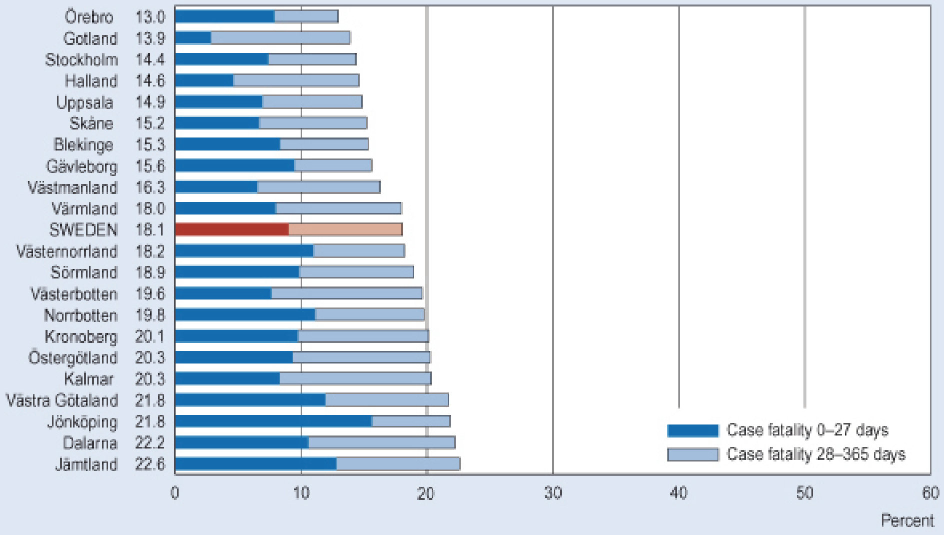


Figure B26
Total

Case fatality rate within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block, 2005–2006. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care

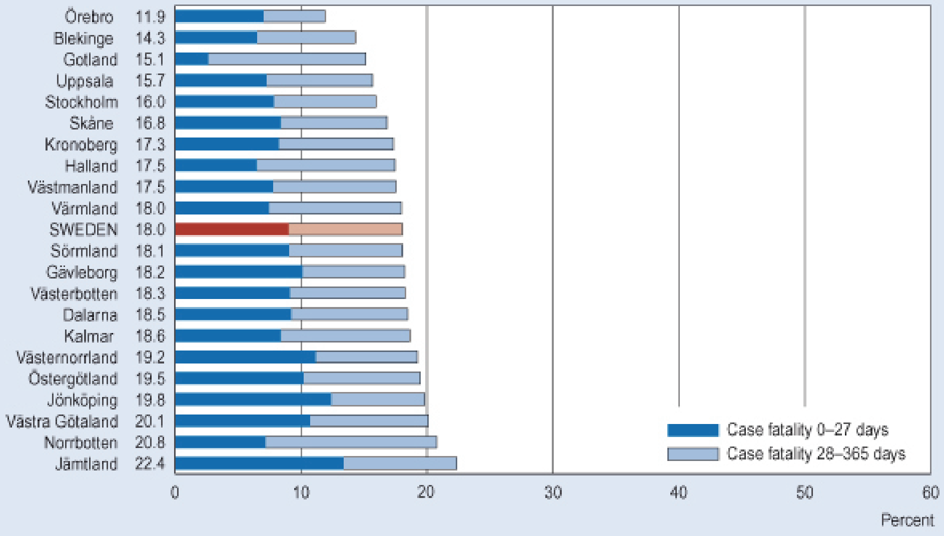
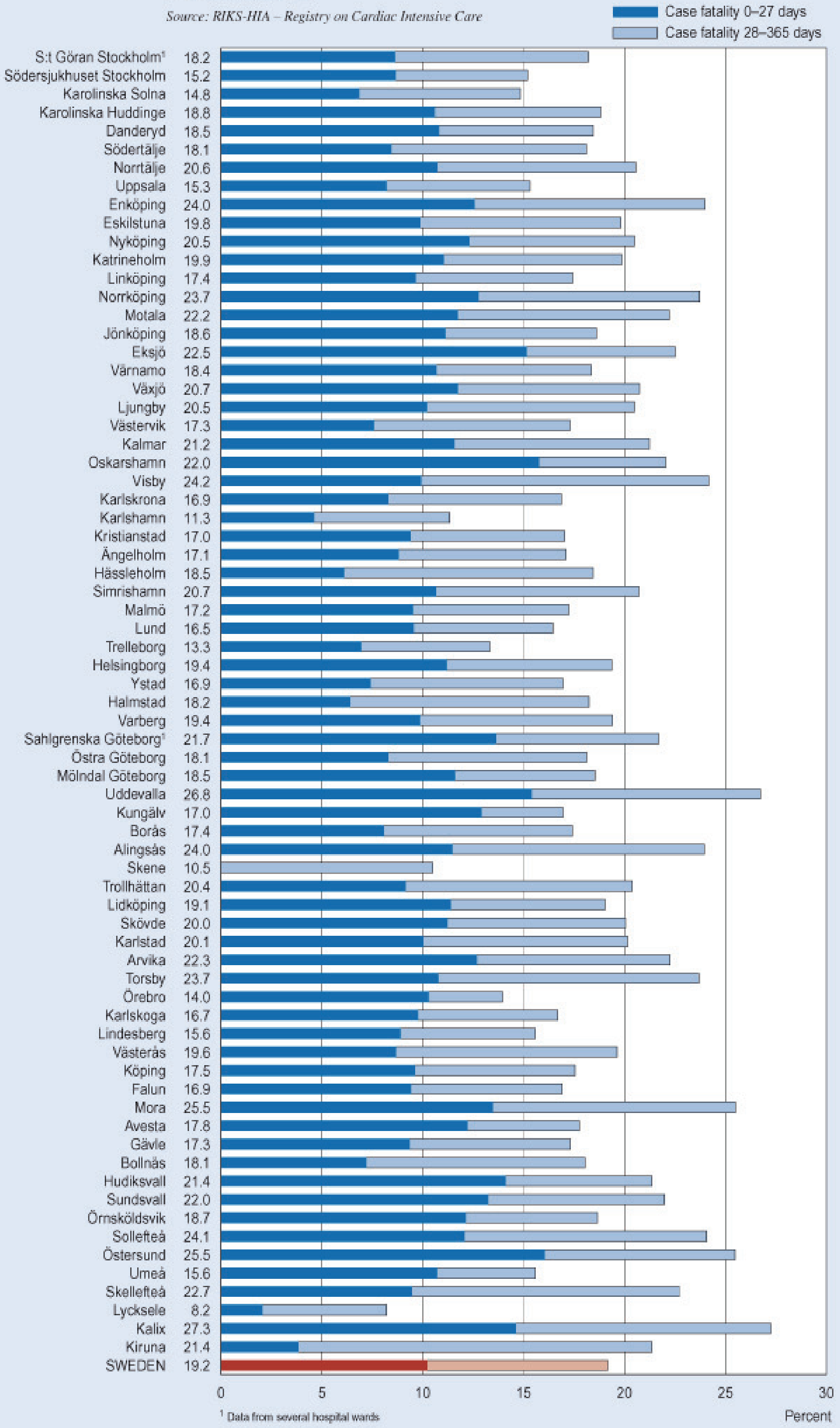


Figure B26
Hospitals

Case fatality rate within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block, 2005–2006. Age standardised.

Source: RIKS-HIA – Registry on Cardiac Intensive Care



¹ Data from several hospital wards

Coronary artery by-pass surgery - 30-day case fatality rate (B27)

One alternative treatment in constriction of a coronary artery in the heart is a coronary artery operation and it is an alternative to PCI for certain patient groups, especially in the case of disease in all three major coronary artery branches and in diabetes. The extent of these operations has diminished in line with the growth in PCI treatment, but it is still a relatively common procedure, and over 4,300 isolated coronary operations are performed annually in Sweden.

The comparison and the result

The indicator shows the percentage of patients who died within thirty days of a coronary artery operation. The 30-day case fatality rate is a measure of the quality of the coronary artery surgery and post-operative care, but age, general condition and the presence of other, concomitant complicating illness also affect the outcome.

During the measurement period from 2006 to 2007 8,385 patients underwent coronary artery surgery according to data from the Swedish Cardiac Surgery Register, and of these, not quite 80% were men. No combined interventions are included, the comparison is not age-standardised, and it refers to patients over eighteen. Since only eight hospitals perform this procedure, the fatality rate is not stated by county council. Operations performed at St. Göran in Stockholm are described under the heading for the Karolinska University Hospital in Solna.

The 30-day case fatality rate was 1.5% during the period from 2005 to 2006. Since the beginning of the 2000s, the fatality rate has remained just below 2%, but a reduction has been taking place since 2005 and by 2007, the level had reached 1.4%. The result is in line with, or better than, the corresponding rate in the USA, where in 2006, the Society of Thoracic Surgeons National Database showed a 30-day case fatality rate of 2.1%. However, various differences among the patient groups undergoing surgery in Sweden and the USA, respectively, may be present.

During the measurement period there was relatively little variation in the fatality rate among the hospitals performing this procedure. The highest rate, 2.3%, was at Karolinska in Solna and the lowest, 1.2%, in Uppsala.

In the country as a whole the rate was of the same magnitude for both genders, but gender differences can be seen at hospital level. In Örebro the 30-day case fatality rate for women after coronary artery surgery was twice as high as for men. The converse applied in both Umeå and Uppsala, where men had a significantly higher fatality rate than women. However, the statistical uncertainty is greater when the results are divided according to gender, which means that they should be interpreted carefully.

The condition of the patients with regard to other diseases at the various units (case mix) affects the fatality rare, which however is generally low.

Figure B27
Sweden

30-day case fatality rate after coronary artery by-pass surgery. Age >18 years.

Source: Swedish Heart Surgery Registry

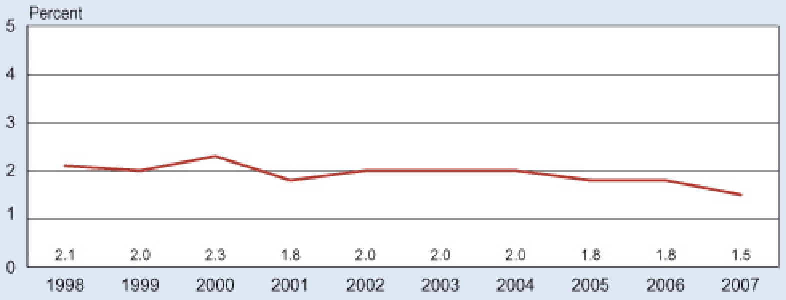
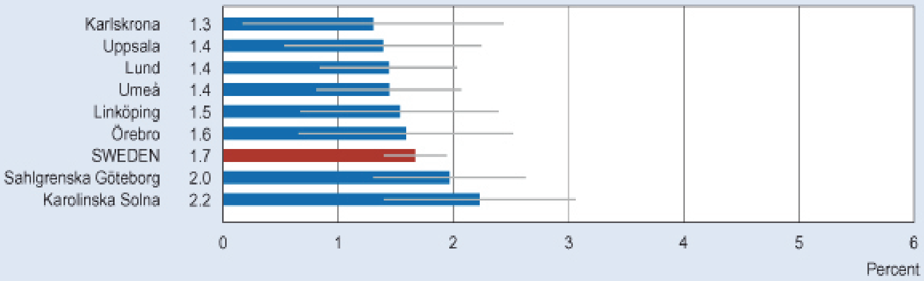


Figure B27
Hospitals

30-day case fatality rate after coronary artery by-pass surgery, 2006–2007. Age >18 years.

Source: Swedish Heart Surgery Registry



Re-operation after a coronary artery by-pass surgery (B28)

Complications after heart surgery, for example deep sternum infections, are accompanied by higher morbidity, mortality and greater suffering for the patients. Complications are also a drain on healthcare and medical services resources, especially if patients must undergo one or more re-operations. The percentage of re-operated patients is thus an interesting indicator that is commonly found within all surgical procedures.

The comparison and the result

This indicator refers to patients who have undergone coronary artery surgery, which is the most common cardiac surgical procedure. The measure shows the percentage of operations where a re-operation has taken place due to sternum insufficiency or mediastinitis (deep infection) during the same care session, i.e., before the patient has been discharged.

In the national guidelines, the set of indicators for following up cardiac care contains a similar indicator, but in that case it refers to all cardiac surgery. The measure described here includes only isolated coronary artery operations, while combined interventions are excluded, as is other cardiac surgery.

The comparison refers to 8,385 patients who had coronary artery surgery in 2006 and 2007. The comparison is not age-standardised, and no other adjustment has been made in respect of the patients' degree of illness or other morbidity. Operations performed at St. Göran in Stockholm are described under the heading for the Karolinska University Hospital in Solna, and the source of the data is the Swedish Cardiac Surgery Register.

For the country as a whole, the percentage of re-operations was slightly more than 1% although it varied among the hospitals. In the comparison, Gothenburg (Sahlgrenska) shows a low percentage of re-operations while Umeå shows the highest percentage. At national level, women have a slightly higher percentage of re-operations.

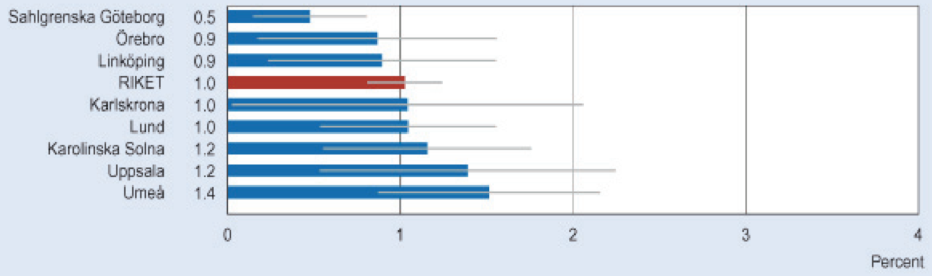
There are sources of error to be taken into account. In calculating the number of re-operations, the total number is often under-estimated because certain complications do not manifest themselves until the patient has been discharged. Thus it happens that a complication is not registered as a re-operation within the same care session but as a new care session. Care time duration may thus have a certain relevance to the number of reported cases.

The measure also includes re-operation for a sternum solution where there may be factors that affect incidence, such as the technique for sealing the sternum after the operation, or an indication to intervene or to wait and see when there are clinical signs of sternum instability.

The quality of the data is not known, and incomplete reporting of complications is a source of error; the registration of sternum insufficiency or mediastinitis has not been validated at the various clinics.

Figure B28 *Percentage of patients reoperated due to sternum complications*
Hospitals *after coronary artery by-pass surgery, 2006–2007. Age >18 years.*

Source: Swedish Heart Surgery Registry



Coronary artery disease – miscellaneous

Smoking cessation after myocardial infarction (B29)

Patients with coronary artery diseases who stop smoking reduce the risk of a second myocardial infarction and mortality, which applies irrespective of age and gender. For this reason smoking cessation after myocardial infarction is a high-priority measure in the national guidelines.

The outcome can be affected to a major extent by the medical services through access to, for example, group therapy, drugs and other tobacco dishabituation methods.

The comparison and the result

The indicator refers to patients who were smokers at the time of their myocardial infarction. The measure shows the percentage of these who had stopped smoking at follow-up six to ten weeks after the infarction. The source of the data is the SEPHIA quality register, which follows up myocardial patients reported to RIKS-HIA. This register is under construction and it has a varying degree of coverage of the various hospitals and county councils.

The comparison refers to 2,660 patients below seventy-five who had myocardial infarction in 2006 or 2007, of whom just over a quarter were women.

In the country as a whole, 63% of the patients followed up who were smokers at the time of their myocardial infarction had stopped smoking. This represents a certain deterioration compared to 2006. There is a major variation among the different county councils. Örebro is at the bottom with 51% who stopped smoking and Gotland is at the top with 83%. Among certain county councils a very small number of patients were followed up, which means that the results ought to be interpreted with caution, while no data can be accounted for with respect to Västerbotten.

At hospital level a clear difference can be seen in terms of the percentage of patients who stop smoking. Danderyd comes last with 46%, while Trollhättan is at the top with 87%. At most hospitals, the number of patients followed up is small, which noticeably increases the statistical uncertainty.

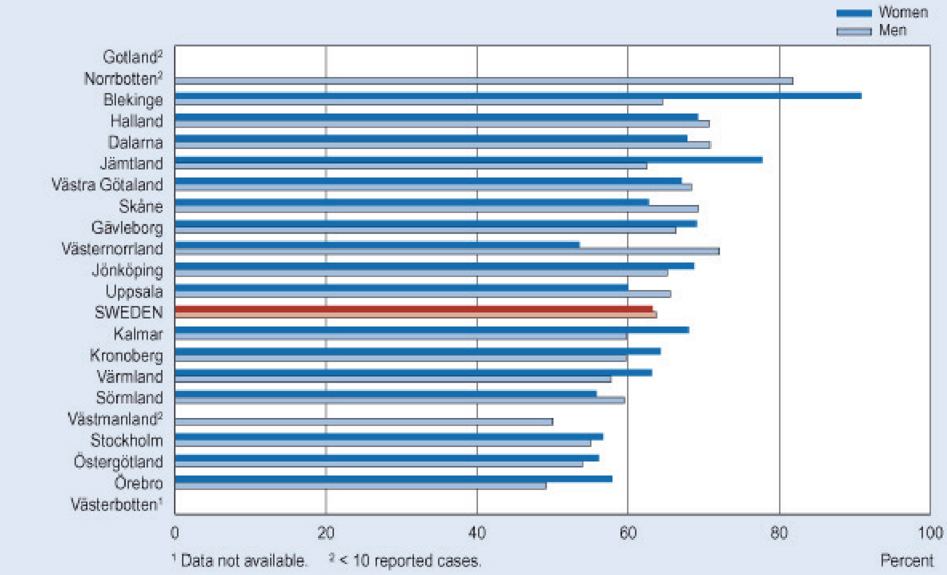
A comparison between men and women does not reveal any great variation among the county councils, with a couple of exceptions. Blekinge and Jämtland have considerably greater success with women than with men when it comes to tobacco dishabituation.

Authoritative target values or evaluations of an expected outcome are not available, but it is disheartening that over 35% of all smokers continue to smoke after their infarction, since the risk to the health of these patients is so great. SEPHIA data and experiences of successful tobacco dishabituation measures for this patient group may in future provide material for the inclusion of target values.

Figure B29
Women
and men

Percentage of smokers who had stopped smoking 6–10 weeks after myocardial infarction, 2006–2007. Age <75 years.

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care

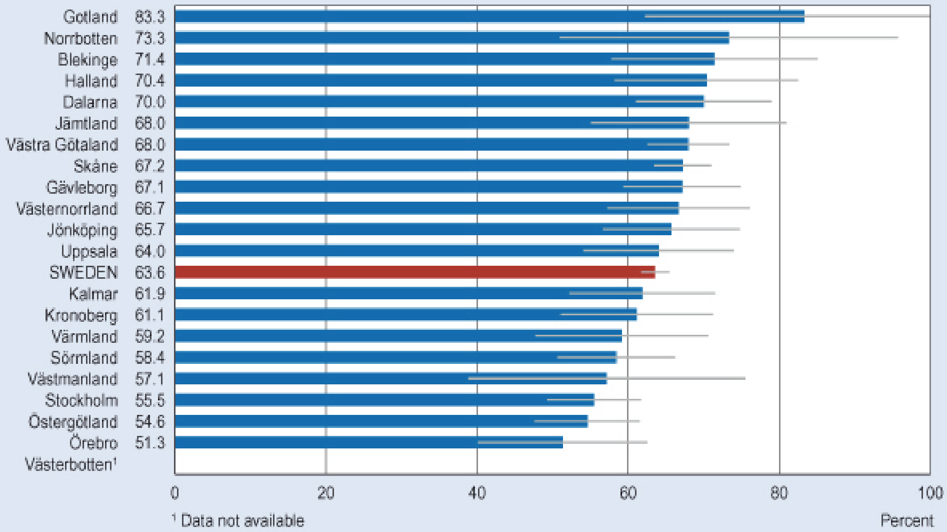


¹ Data not available. ² < 10 reported cases.

Figure B29
Total

Percentage of smokers who had stopped smoking 6–10 weeks after myocardial infarction, 2006–2007. Age <75 years.

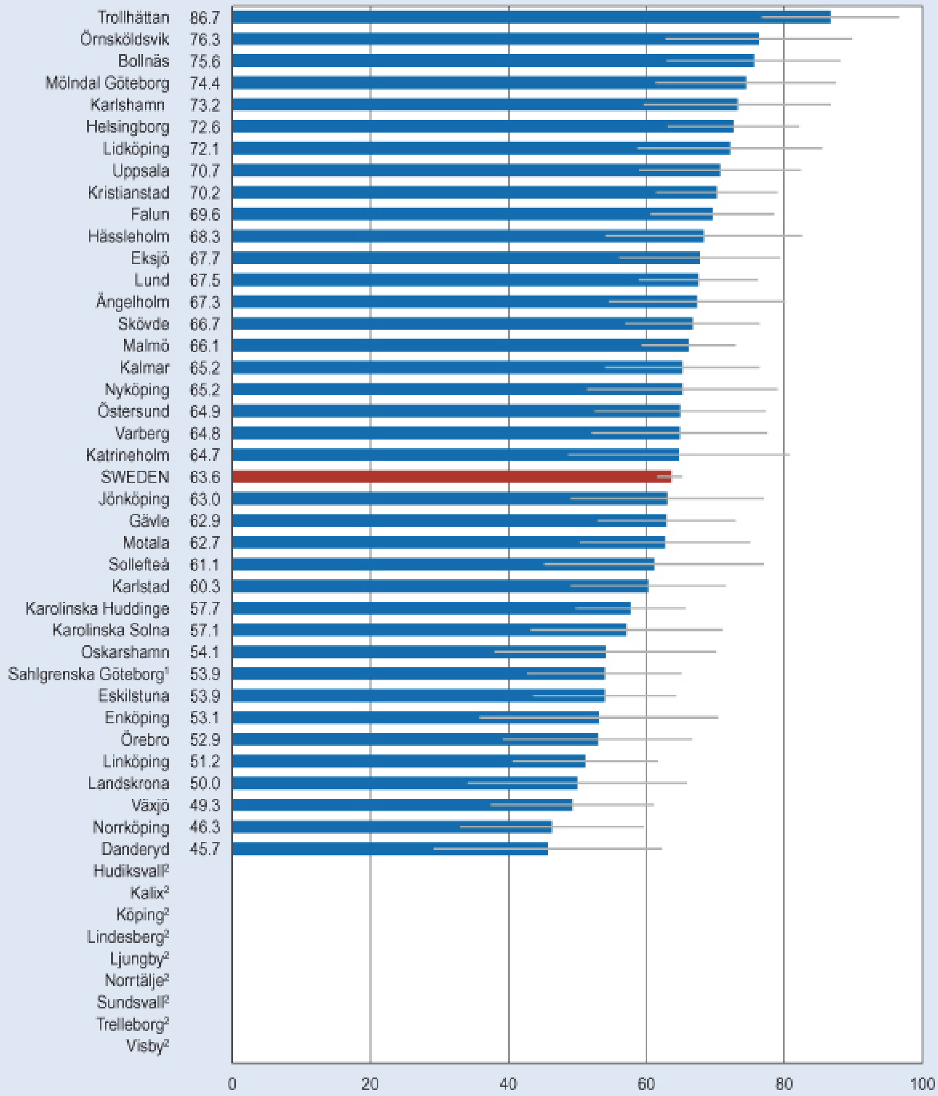
Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care



¹ Data not available

Figure B29 *Percentage of smokers who had stopped smoking 6–10*
Hospitals *weeks after myocardial infarction, 2006–2007. Age <75 years.*

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care



[1] Data from several hospital wards. [2] < 30 reported cases.

Full-time sick leave after myocardial infarction (B30)

The National Board of Health and Welfare has developed an insurance medicine decision-making support with regard to ischemic coronary artery diseases in order to provide assistance in considering whether patients should go on sick leave.

This shows that in the case of acute myocardial infarction without any complications, the patient's fitness for work may be expected to be completely reduced for up to four weeks. Subsequently, there is great variation in working capacity, due, among other things, to the degree of residual physical and mental symptoms. For some of the myocardial infarction patients a further few weeks of part-time sick leave is suitable, while a small group is affected by a permanently reduced working capacity.

This indicator is interesting from both a socio-economic and a health perspective. From a health point of view, it is positive for the patient to return to work as soon as it is medically feasible. The actions by the medical services in conjunction with sick-leave decisions have a great effect on its extent and duration.

The comparison and the result

The indicator refers to myocardial infarction patient who were of able-bodied age and who were gainfully employed at the time of the infarction. The measure shows the percentage of these who were on full-time sick leave six to ten weeks after the infarction, using data obtained from SEPHIA. The indicator is included in the set of indicators for following up cardiac care, in the national guidelines.

Not quite 3,200 patients who had a myocardial infarction between 2006 and 2007 are included in the comparison, of whom 80% were men. No data is available for Västerbotten.

For the country as a whole the percentage of patients who were still on full-time sick leave six to ten weeks after the myocardial infarction was 43% in 2007, which is a reduction of four percentage points since 2006.

There are major differences among the various county councils. In Västernorrland 56% were on sick leave, while in Värmland this was 22%, and a clear difference is also seen at hospital level. Katrineholm had 75% while Uppsala had the lowest percentage, 20%, closely followed by Karlstad and Eskilstuna.

In the country as a whole, there was little difference between the sexes, while this is greater in individual county councils. Especially for women the statistical uncertainty is great in a county council comparison, as the number of patients in the comparison is small.

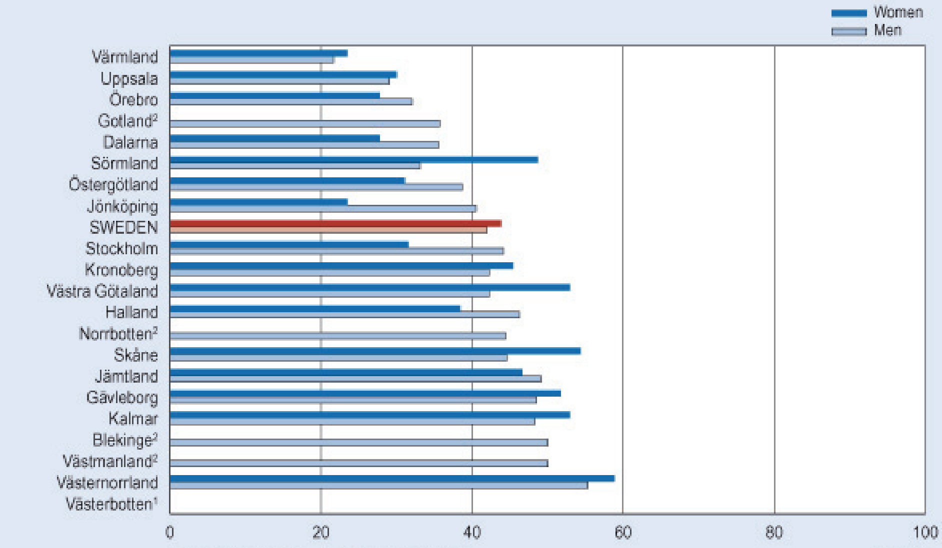
No target level in figures has been stated in the insurance medicine decision-making support or in the guidelines, but the results for certain county councils and hospitals indicate that the percentage of patients on full-time sick leave can be reduced by 25% to 30%. The variations among hospitals cannot be explained by the patients' ability to return to at least part-time work. It ought to be possible for a significant number of county councils and hospitals to noticeably alter their sickness certification practices after myocardial infarction.

SEPHIA at present has a limited degree of coverage, and the patients registered in it from the various hospitals may therefore differ with regard to general condition and working capacity. The application of the criteria as to when a patient was considered as being gainfully employed at the time of the infarction may also differ.

Figure B30
Women
and men

Percentage of patients on full-time sick leave 6 to 10 weeks after myocardial infarction, 2006–2007. Refers to patients previously fit for work.

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care

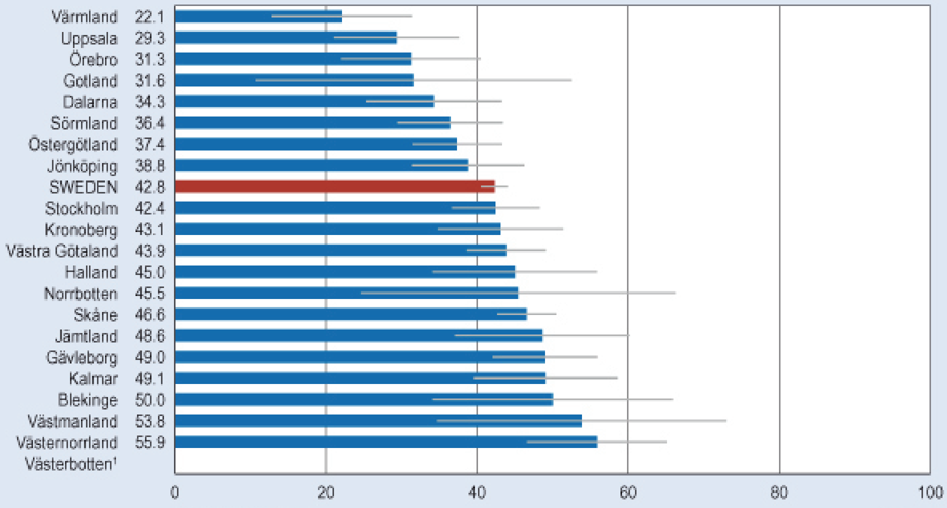


¹ Data not available. ² < 10 reported cases.

Figure B30
Total

Percentage of patients on full-time sick leave 6 to 10 weeks after myocardial infarction, 2006–2007. Refers to patients previously fit for work.

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care

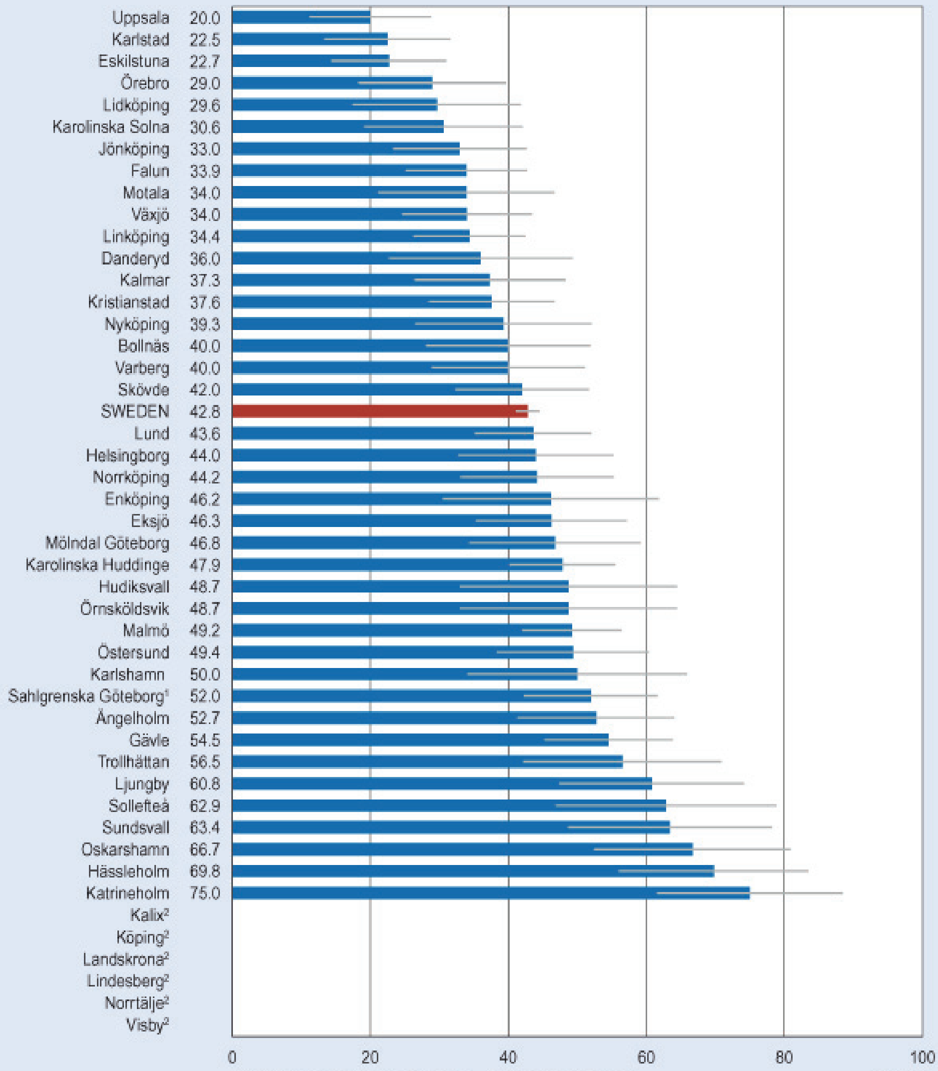


¹ Data not available

Figure B30
Hospitals

Percentage of patients on full-time sick leave 6 to 10 weeks after myocardial infarction, 2006–2007. Refers to patients previously fit for work.

Source: SEPHIA – Registry on Secondary Prevention in Cardiac Intensive Care



[1] Data from several hospital wards. [2] < 30 reported cases.

Arrhythmiae

Five indicators are described here that refer to the treatment of arrhythmiae. The diseases are atrial fibrillation and sick sinus, while the treatments refer to pacemaker insertion, insertion of an implantable defibrillator and drug treatments for atrial fibrillation, where the latter treatment is an important objective in preventing stroke.

Avoidable in-patient care in atrial fibrillation (C1)

Atrial fibrillation is the most common form of cardiac arrhythmia and occurs in around 2% of the age group 60 to 70 years, rising to 8% among the over-eighties. It can occur as attacks or as a chronic condition. A number of the patients can be completely free of symptoms while others have symptoms that require emergency hospital admission. Atrial flutter is a related arrhythmia, which however is less common than atrial fibrillation and it is treated in a similar manner to the latter.

The treatment aims to maintain the normal heart frequency, restore normal heart rhythm where possible and suitable, and prevent recurrence of atrial fibrillation and also the formation of blood clots. Certain treatments can only commence or be administered when the patient has been admitted to hospital, for example, the insertion of certain drugs and other non-pharmacological treatments.

The volume of hospital admissions for the care of atrial fibrillations is dependent on the underlying morbidity and also on the choice of treatment strategies, which can be influenced to some degree. A reasonable goal for the treatment is that the patient should not need to experience symptoms or any recurrence of atrial fibrillation that results in hospital care.

The indicator aims to reflect how successful the medical services are in treating atrial fibrillation patients and it reflects both primary and specialist care measures. The heading “Avoidable in-patient care” underlines that the need for in-patient care can be influenced, but this should not be interpreted as meaning that all in-patient care is avoidable or that it is an expression of inadequate care quality.

The comparison and the result

The comparison shows both the number of people who between 2006 and 2007 were treated in hospital and had a primary diagnosis of atrial fibrillation or flutter, irrespective of the number of care sessions that they had had, and the number of care sessions (merged into care episodes) for this diagnosis. All in-patient care financed by county councils is included, except for that at separate geriatric care units such as nursing homes. Age standardisation has been undertaken but no account has been taken of the background morbidity of the population.

In 2007, nearly 24,000 people with the primary diagnosis of atrial fibrillation were treated. After age standardisation, the proportion of persons treated was 251 per 100,000 inhabitants during that year. The proportion of people with this diagnosis treated in hospital rose by 20% between 1998 and 2007.

In diagram C1 the proportion of patients treated in hospital between 2006 and 2007 has been divided up according to home county council. There is a significant variation among the county councils, which ranges from under 200 to over 300 people treated per 100,000 inhabitants. The proportion of men who are treated in hospital for atrial fibrillation is around 40% higher than the corresponding proportion of women.

The number of care sessions per 100,000 inhabitants is higher than the number of people, as certain patients have more than one in-patient care session per year. The relationship between the number of people and the number of care sessions in the various county councils is not identical. An in-depth scrutiny at hospital level with regard to recurrent in-patient care for individual patients would probably show intriguing variations. In that case, the indicator would need a different design so that the connection to the population of the county councils is discarded.

It is not possible to state the extent of that portion of in-patient care that is avoidable, above all because the background morbidity is not known, which also makes it difficult to interpret the variation among county councils. One council may have few people treated either because there are few atrial fibrillation patients or because they receive good care.

There are different sources of error to take into account. The most common method of restoring a normal heart rhythm is what is termed DC conversion (“electric shock”). This can be registered as out-patient attendance or as an in-patient care session. If registration practices vary among hospitals, this will affect the comparison. Moreover, the diagnosis of atrial fibrillation can be recorded as primary or secondary, with differing degrees of correctness and accuracy.

Figure C1
Sweden

Avoidable hospitalisations for atrial fibrillation. Number of patients and care episodes per 100,000 inhabitants. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

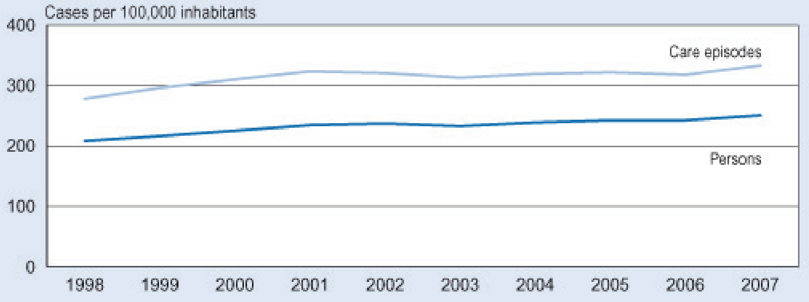


Figure C1
Men

Avoidable hospitalisations for atrial fibrillation. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

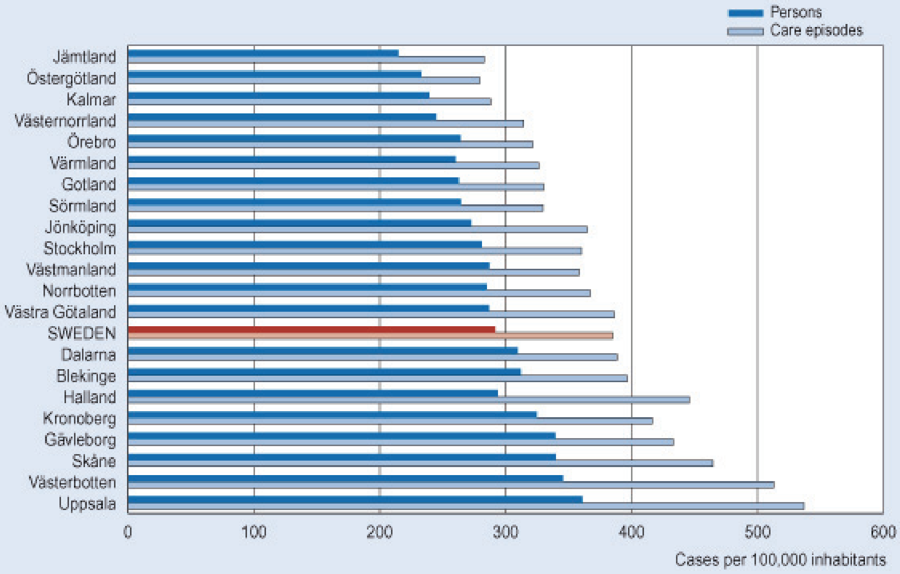


Figure C1 Women

Avoidable hospitalisations for atrial fibrillation. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

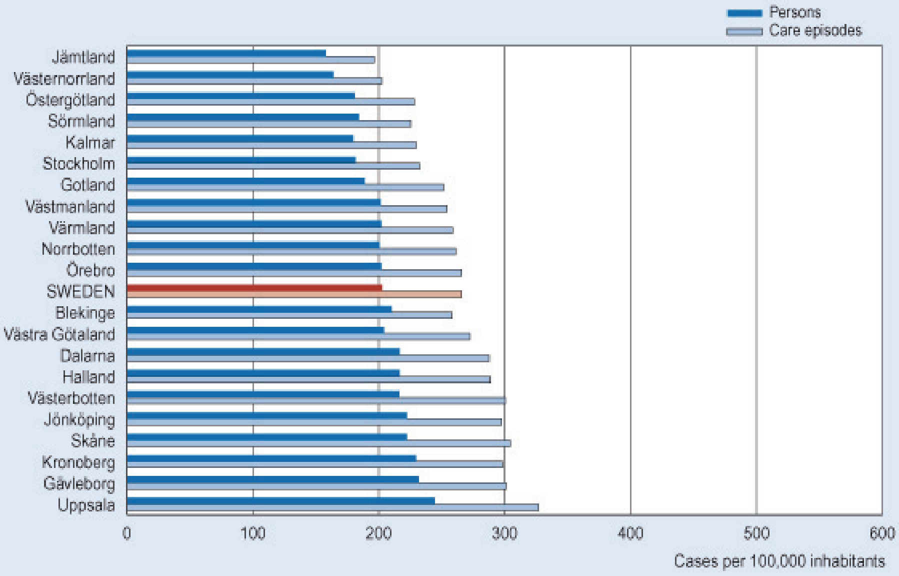
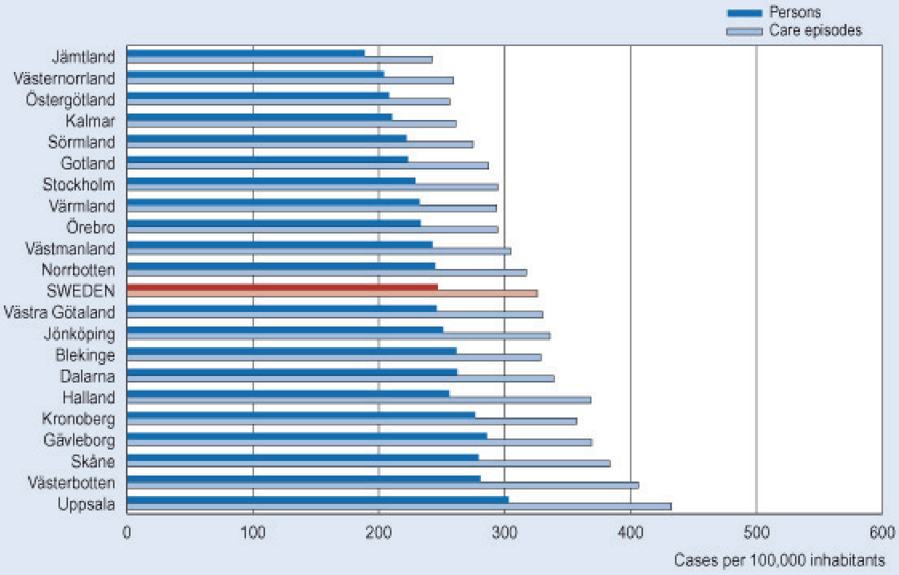


Figure C1 Total

Avoidable hospitalisations for atrial fibrillation. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare



Warfarin treatment in patients with atrial fibrillation and an additional risk factor (C2)

Atrial fibrillation is a chronic disease that increases the risk of blood clots and stroke, which occur if the patient also has one or more further risk factors. In this case, treatment with the anti-coagulant drug Warfarin is applicable.

Warfarin treatment in atrial fibrillation and risk factors for clot formation is a well-documented and efficient but under-utilised treatment to prevent blood clots and stroke. Many stroke cases could be prevented by more extensive Warfarin treatment of persons in the high-risk group. Today, many patients receive no anti-coagulant treatment at all or are treated with the less efficient drug acetyl salicylic acid (ASA).

However, Warfarin treatment requires that the patient is very compliant in this regard, otherwise the risk of bleeding increases. Checks and follow-up are necessary, which demands well-organised medical services.

The risk factors for clotting or stroke are in part the same as in the case of bleeding and in both cases they also increase with age. In order to derive the greatest possible benefit from Warfarin treatment, the risk of bleeding must be weighed against the risk of the patient suffering blood clots or a stroke. As a result, this treatment is not suitable for a percentage of atrial fibrillation patients, and in the national guidelines it is given a high priority.

The comparison and the result

The indicator refers to patients treated in hospital with a primary or secondary diagnosis of atrial fibrillation and who in addition have one or more of the following risk factors: diabetes, previous ischemic stroke or TIA, heart failure treated in hospital or aged over seventy-five. The indicator measures the percentage of these patients treated with Warfarin.

The comparison is based on 89,514 patients treated in hospital for atrial fibrillation between 2005 and 2007 and there were roughly as many men as women. The drug treatment refers to Warfarin dispensed during the first six months of 2008; data are derived from the Patient Register and the Swedish Prescribed Drugs Register.

County-council level accounts are based on the patient’s home county, while in hospital accounts, the patient is assigned to the hospital at which treatment was first given and atrial fibrillation diagnosed. In practice, in certain county councils the responsibility for drug treatment of these patients rests with primary care units and with the hospital in others.

In the country as a whole, 43% of all the patients received Warfarin treatment during the first six months of 2008. In one group of four county councils over 50% of the patients were treated, while in four other county councils this figure was 40% or less. The differences are thus relatively great.

These differences are also found at hospital level. At thirteen hospitals over 50% of the patients were treated with Warfarin, while twenty hospitals were at, or below, the 40% level. A higher percentage of men were treated, and in the country as a whole this amounted to 47% as against 39% for women.

In relation to the recommendation in the guidelines this comparison reveals a noticeable under-treatment. It is not possible to determine the optimum level of people treated with Warfarin, but it can be expected to be noticeably above the levels described here.

This patient group refers to those treated for atrial fibrillation and should also include those patients with this condition who did not require hospital care and are thus not mentioned in the above description. The size of this group is not known, and it is also probable that the number of individuals who have one or more risk factors has been under-assessed. Aspects such as these reinforce the picture of the extent of under-treatment.

Figure C2
Women
and men

Percentage treated with warfarin January to June 2008 among patients with atrial fibrillation and an additional risk factor between 2005 and 2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

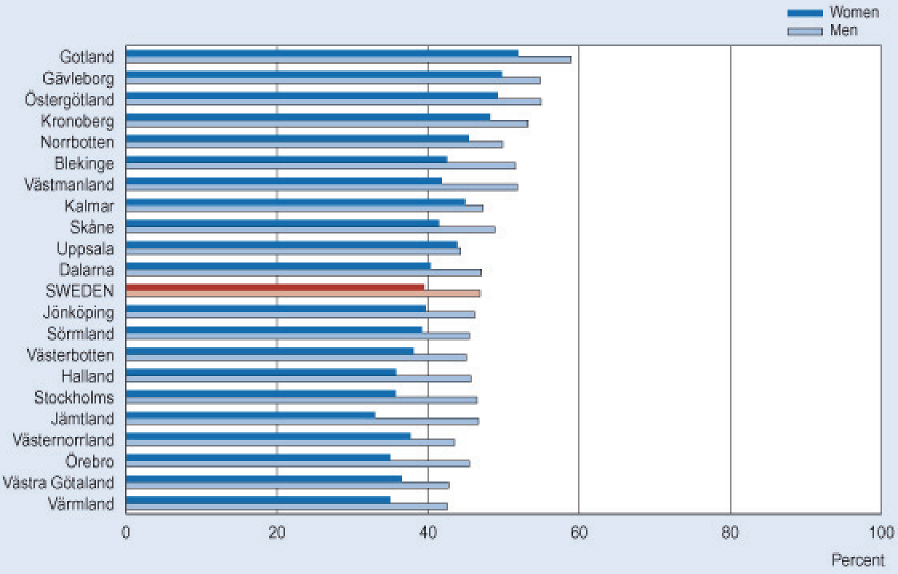


Figure C2
Total

Percentage treated with warfarin January to June 2008 among patients with atrial fibrillation and an additional risk factor between 2005 and 2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

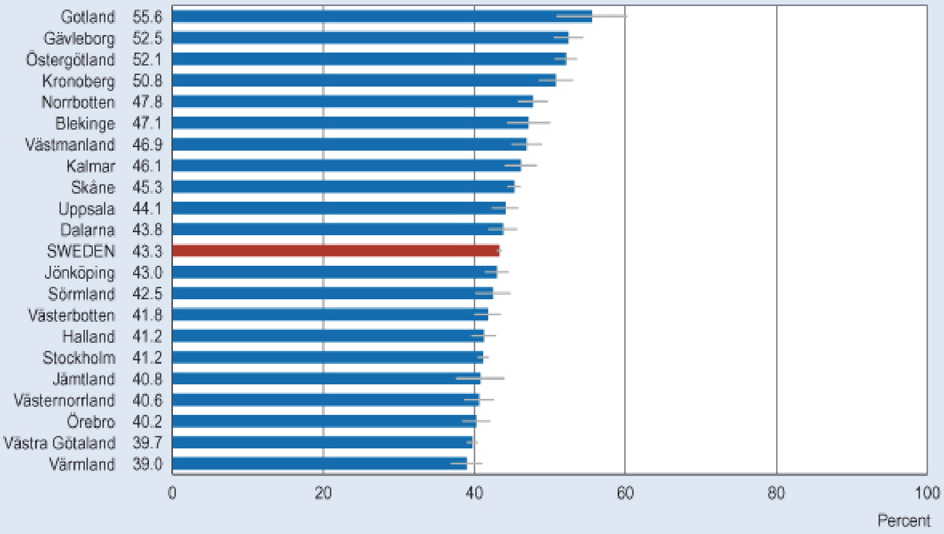
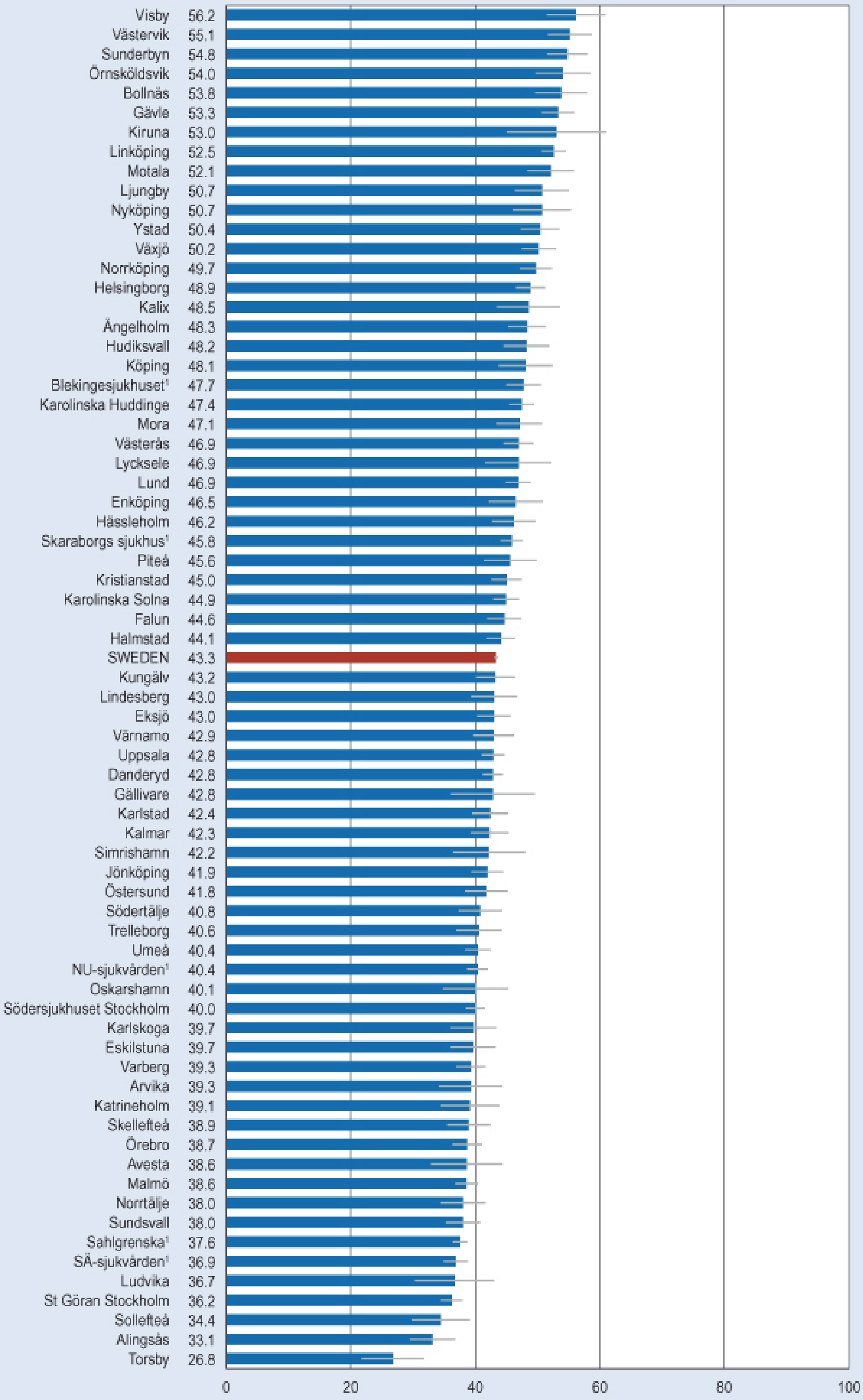


Figure C2
Hospitals

Percentage treated with warfarin January to June 2008 among patients with atrial fibrillation and an additional risk factor between 2005 and 2007.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report

Pacemaker type in sick sinus syndrome (C3)

Sick sinus syndrome is the most common reason for pacemaker treatment and this form of arrhythmia includes, among other things, the inability to increase heart frequency during work and atrial fibrillation attacks.

The symptoms of sick sinus syndrome for the patient may range all the way from minor symptoms to more pronounced ones such as fainting, attacks of dizziness, shortness of breath, chest pains and palpitations, while dementia symptoms may also be present in older patients. The onset of this disease usually occurs between sixty and seventy years of age and is equally common among both men and women. Those symptoms that are caused by a slow heart rhythm are improved by pacemaker treatment, which can also be a pre-condition for adequate medical measures that can slow down attacks of fast rhythm in sick sinus.

In sick sinus syndrome the preference is for atrial stimulation only or AV synchronous pacing (AAI or DDD pacemaker). The alternative of ventricular stimulation only has proved less suitable for treating sick sinus as it carries a greater risk of pacemaker syndrome, atrial fibrillation, thromboembolic complications, heart failure and death. Therefore this is a low-priority measure that ought to be avoided according to the national guidelines.

The comparison and the result

The indicator refers to patients with a sick sinus who have had a pacemaker inserted for the first time. The measure shows the percentage of these patients who received the preferred pacemaker treatment with atrial stimulation, that is to say, implantation of an AAI or DDD pacemaker.

The comparison refers to the period from 2006 to 2007 and covers 5,036 patients with a sick sinus who received a pacemaker. Only patients below ninety are included in the comparison and only first-time insertions. Slightly more than half of them were women. Data have been obtained from the Swedish ICD and Pacemaker Register.

The national trend shows a rapidly rising percentage of patients with AAI or DDD pacemakers, which climbed from 85% in the period from 2002 to 2003 to 88% in the period from 2006 to 2007, and there are very small differences between men and women.

There is very great variation among the county councils, ranging from Jämtland with over 50% to Östergötland, where 96% of all patients received atrial stimulation with an AAI or DDD pacemaker.

The differences among the hospitals are equally great, and the percentage of patients receiving atrial stimulation varies from 48% to 98%. A large number of hospitals still use the non-recommended method of ventricular stimulation to an excessive degree.

There ought to be almost 100% of patients receiving atrial stimulation with an AAI or DDD pacemaker, and thus many of the hospitals have considerable scope for improvement.

Figure C3
Sweden

Percentage of patients with sick sinus syndrome who received an AAI/DDD pacemaker. Refers to patients <90 years treated with a pacemaker.

Source: The Swedish Pacemaker and ICD Registry

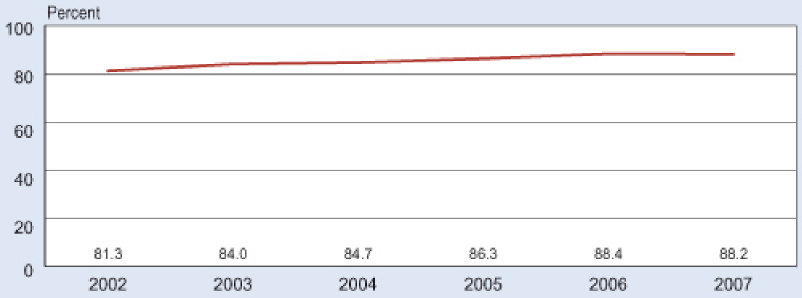


Figure C3
Women
and men

Percentage of patients with sick sinus syndrome who received an AAI/DDD pacemaker, 2006–2007. Refers to patients <90 years treated with a pacemaker.

Source: The Swedish Pacemaker and ICD Registry

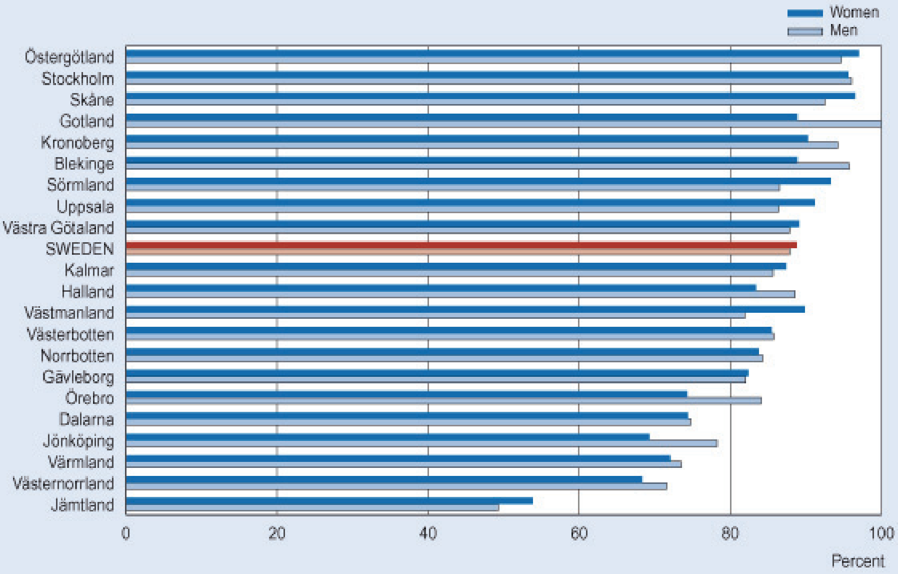


Figure C3
Total

Percentage of patients with sick sinus syndrome who received an AAI/DDD pacemaker, 2006–2007. Refers to patients <90 years treated with a pacemaker.

Source: The Swedish Pacemaker and ICD Registry

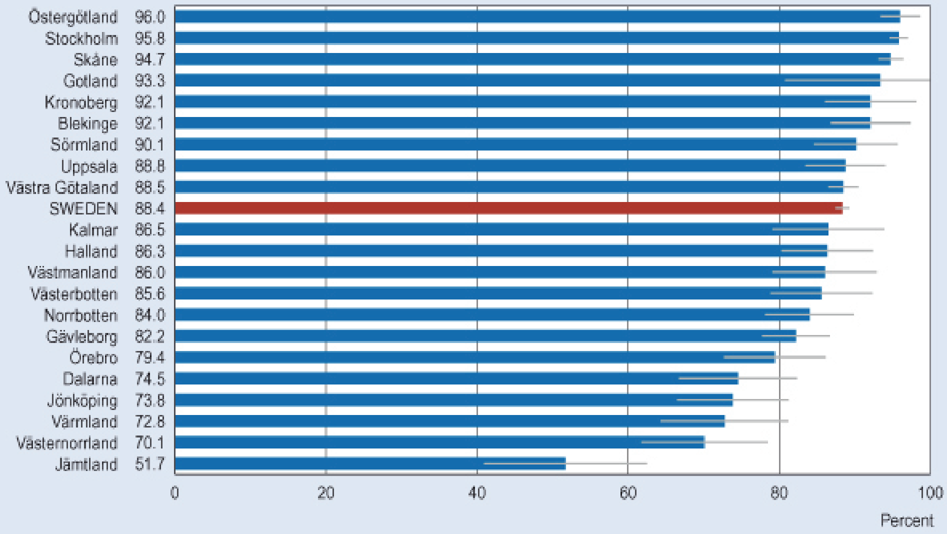
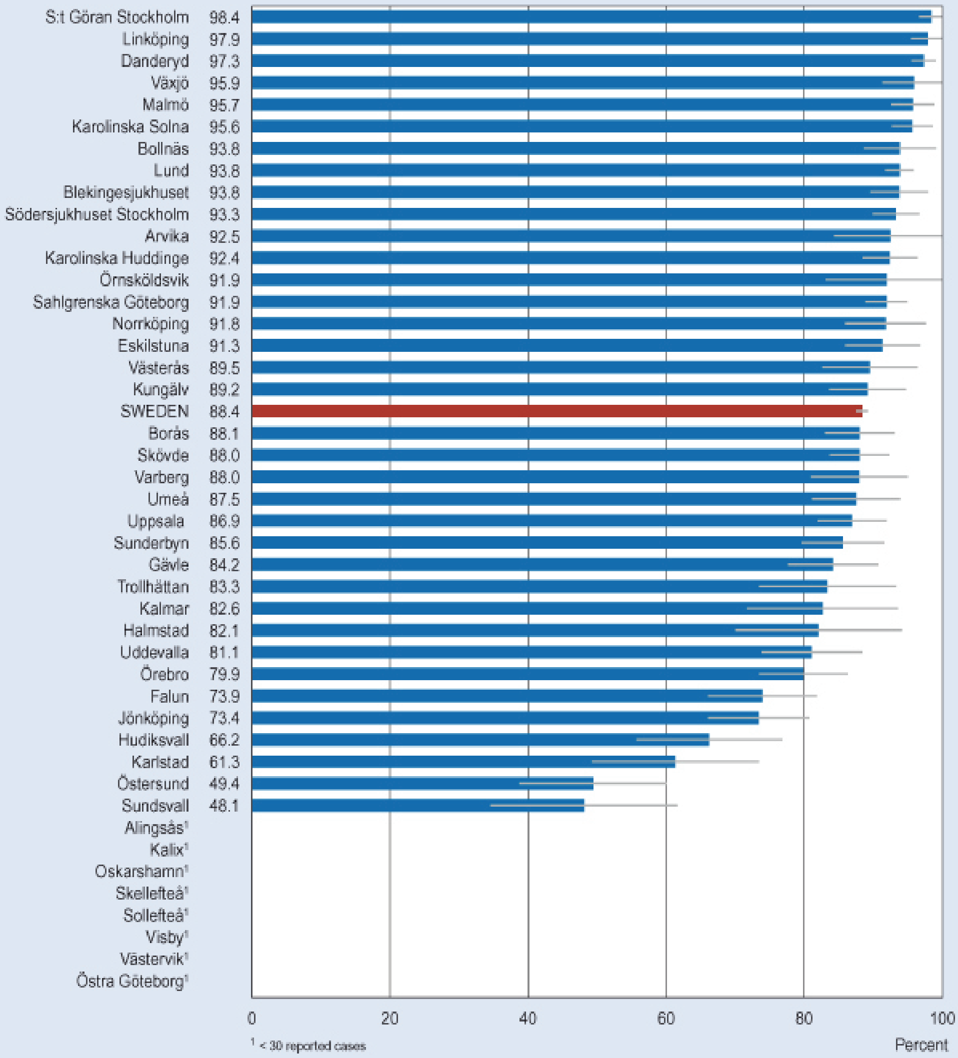


Figure C3
Hospitals

Percentage of patients with sick sinus syndrome who received an AAI/DDD pacemaker, 2006–2007. Refers to patients <90 years treated with a pacemaker.

Source: The Swedish Pacemaker and ICD Registry



¹ < 30 reported cases

Complications in pacemaker and ICD-implantation (C4)

If the heart beats too slowly or irregularly, this may lead to dizziness, fainting spells or sudden death. The background cause of this arrhythmia may, for example, be a sick sinus, atrial fibrillation or a blockage in an AV node. The insertion of a pacemaker is done to help the heart to restore a sufficiently fast pulse or achieve an even rhythm.

An ICD or implantable defibrillator is inserted into patients to prevent serious ventricular arrhythmiae and thus reduce the risk of sudden heart death. A CRT or failure pacemaker is used for severe heart failure and contributes towards optimising the heart’s pumping action, thereby ensuring a higher quality of life and a longer lifespan.

A standard pacemaker operation is normally uncomplicated and takes around one hour and is an in-patient intervention, although in certain cases it is also performed as day surgery. Around 6,000 first-time insertions of pacemakers are undertaken annually. ICD and above all CRT implantations are more complicated interventions with a greater risk of complications. A little over 600 first-time ICD insertions are performed annually, in addition to replacement operations. There are currently over 40,000 individuals with a pacemaker in Sweden according to the Swedish ICD- and Pacemaker Register.

Of those implantations performed in 2006, the percentage of standard pacemakers was over 90% and that of failure pacemakers, 7% to 8%, while the remainder were implantable defibrillators (ICD). Treatment with ICD and CRT is relatively recent and the implantation frequency can thus be expected to rise. The implantation of a pacemaker carries a risk of complications, and the incidence of complications is thus a natural indicator in following up quality.

The comparison and the result

The indicator shows the percentage of patients who are affected by complications within 365 days in the case of first-time implantation, replacement or correction of a standard pacemaker, CRT pacemaker or implantable defibrillator. The complication may refer to both events during the care session and those that occur afterwards. The indicator is included in the set of indicators for following up cardiac care in the national guidelines and has a similar formulation.

The comparison includes almost 18,000 patients who received treatment during the period from 2006 to 2007, a little over 10,000 of whom were men. Data have been obtained from the Swedish ICD- and Pacemaker Register, which states that all care providers in Sweden participate in data collection. Data are described at hospital level only.

A complication is considered to be an unforeseen event involving the malfunction of the pacemaker system or another incident that has serious implications for the patient. In order to be registered as a complication, the degree and nature of the event must be such that either an operative intervention or drug treatment, e.g., antibiotics for an infection, is required.

In the country as a whole, the percentage of complications was 5.9% during the period from 2006 to 2007. The percentage of patients suffering complications has fallen slightly in the past three years from 6.5% to 5.7% in 2007.

Major differences are found among the hospitals, with complication frequencies of a few percent to over 10% for one group of hospitals, and these are so great that they may also be due to discrepancies in the degree of uniformity and completeness of complication registration. Every hospital registers its own complications in conjunction with an operation or follow-up, and data validation is done solely on the basis of removing unreasonable data from the register database. Hospitals that registered fewer than 2% complications are considered to have too high a level of omissions in their register to be regarded as reliable.

Figure C4
Sweden

Percentage of patients who suffered complications from the insertion or replacement of a standard pacemaker, a CRT or an ICD.

Source: The Swedish Pacemaker and ICD Registry

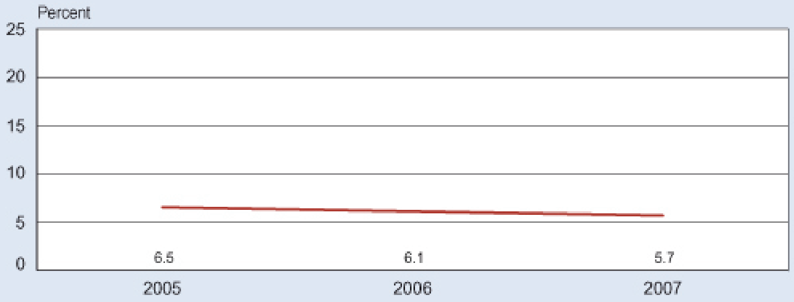


Figure C4
Women
and men

Percentage of patients who suffered complications from the insertion or replacement of a standard pacemaker, a CRT or an ICD, 2006–2007.

Source: The Swedish Pacemaker and ICD Registry

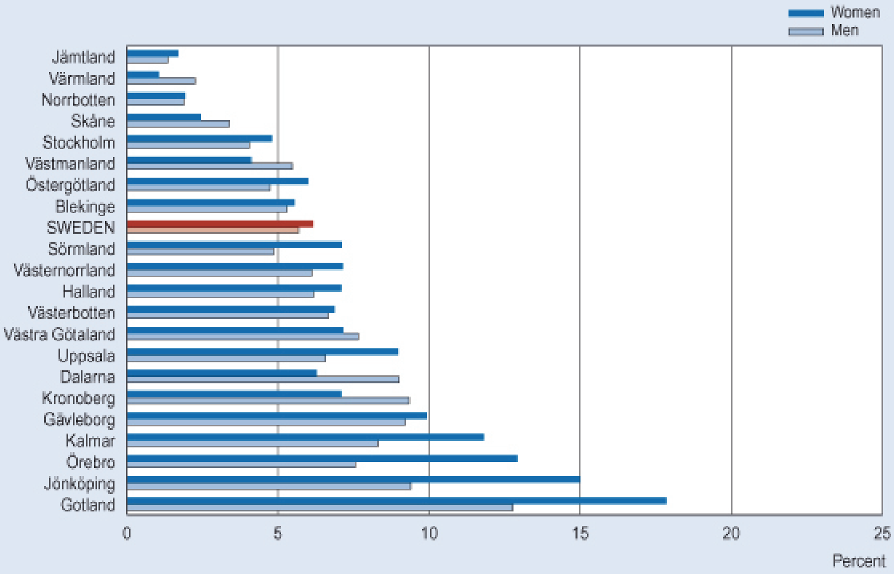


Figure C4 *Percentage of patients who suffered complications from the insertion or*
Total *replacement of a standard pacemaker, a CRT or an ICD, 2006–2007.*

Source: The Swedish Pacemaker and ICD Registry

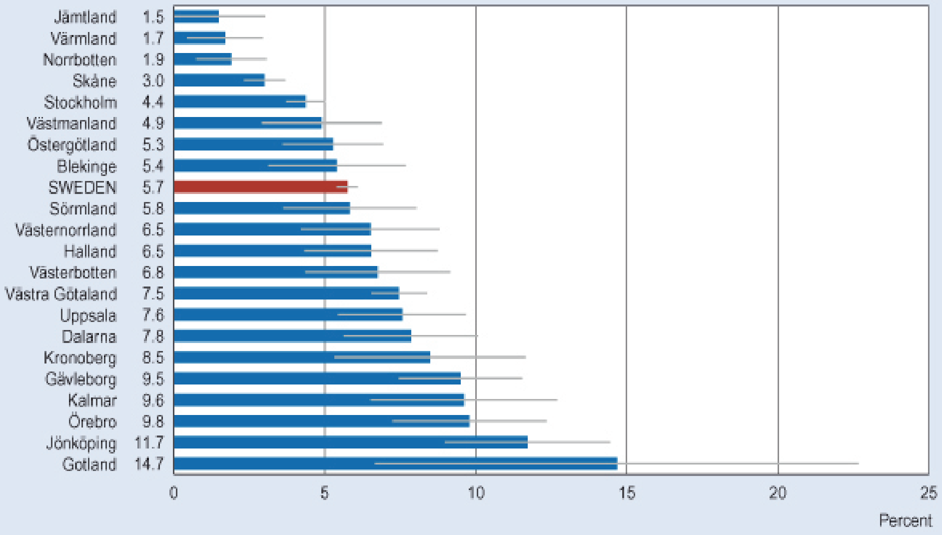
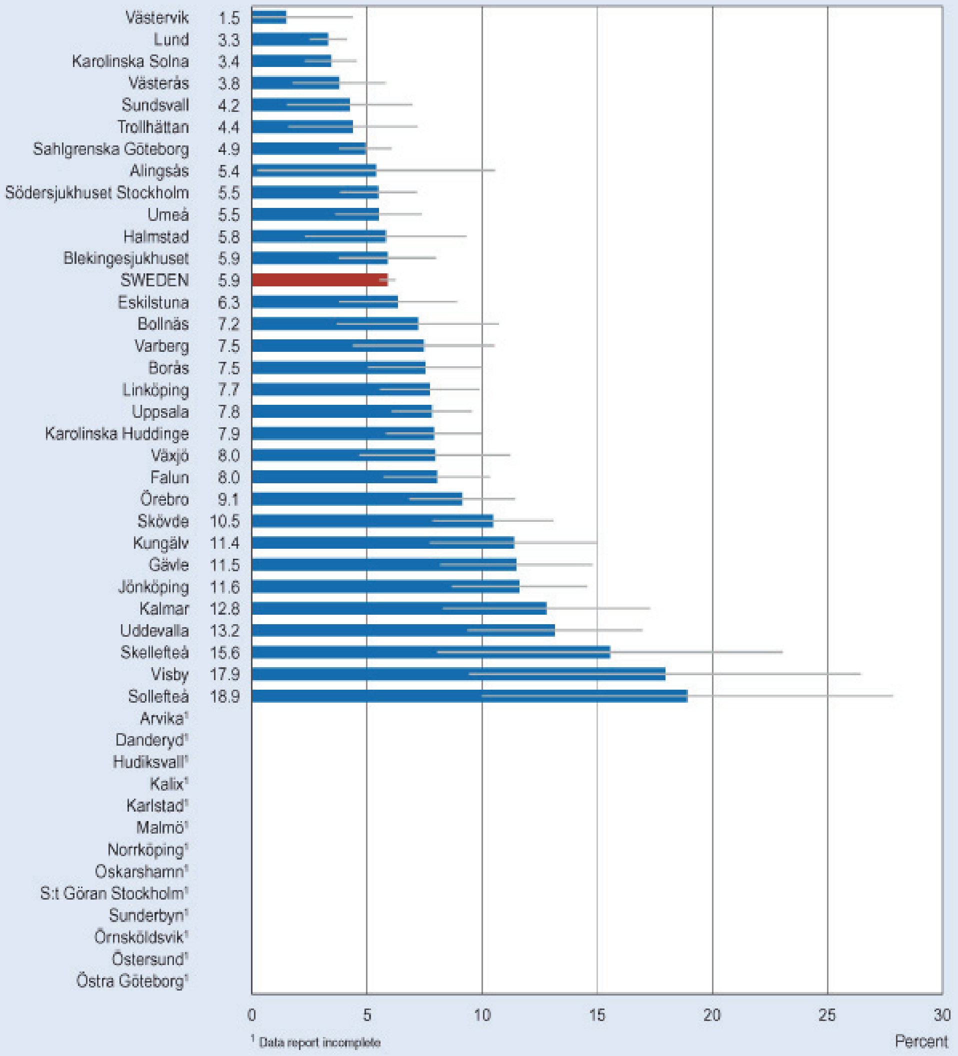


Figure C4
Hospitals

Percentage of patients who suffered complications from the insertion or replacement of a standard pacemaker, a CRT or an ICD, 2006–2007.

Source: The Swedish Pacemaker and ICD Registry



Number of ICD implantations (C5)

Patients with seriously impaired left ventricular function, after myocardial infarction or for other reasons, have a higher risk of sudden death due to serious ventricular arrhythmiae. Primary preventive treatment with an implantable defibrillator (ICD) has been shown to reduce the mortality of these patients.

The same is true of the ICD treatment of patients who suffered cardiac arrest or fainting caused by ventricular tachycardia or fibrillation. The treatment in this instance is given to prevent a further serious event and thus has a secondary preventive purpose.

ICD is a cost-effective treatment but has major budget implications as every insertion costs over 200,000 crowns according to the cost-per-patient database at the Swedish Association of Local Authorities and Regions (SALAR). In 2008, however, successful procurement of equipment in several regions and county councils resulted in reduced costs, although the cost makes it imperative to ensure that the treatment is given for the right indication.

This treatment has relatively high priority in the current guidelines from the National Board of Health and Welfare: priority 4 in primary preventive treatment and priority 2 in secondary preventive treatment. Primary preventive ICD treatment did not have such a high priority in previous guidelines but the treatment is well established for patients who have already suffered a cardiac arrest.

The comparison and the result

The indicator shows the number of insertions of implantable defibrillators per 100,000 inhabitants in the various different county councils. Only first-time implantations are shown but both those undertaken as primary and secondary preventive measures are included. The indicator is included in the set of indicators for following up cardiac care, in the national guidelines, where they are divided into treatment motivated respectively by secondary and primary considerations, which is not done here.

The comparison is age-standardised and refers to the period from 2006 to 2007. Data have been obtained from the Swedish ICD- and Pacemaker Register, which is assessed as having a good degree of coverage for this variable.

In the country as a whole, around 600 ICD implantations were performed annually. Since 2004, the number of annual treatments has doubled from 3.4 to 7.4 per 100,000 inhabitants. There are considerable differences among the county councils, and one group of five councils has more than twice as many ICD treatments as the five that show the lowest level in relation to population size and age.

There are also noticeably large differences between the sexes, as women are treated to a lesser degree than are men, which may be connected to the fact that men show an indication for primary and secondary preventive ICD treatment to a higher degree than women do. However, these differences are so great that they ought to be noted.

In accordance with the national guidelines, the need for ICD treatments can be assessed at 1,500 per annum, which is equivalent to approximately sixteen operations per 100,000 inhabitants.

The current level of around 600 treatments means that there is a major under-treatment in the country as a whole, which is larger in the case of those county councils that provide comparatively few treatments, but no council achieves the expected level that is estimated in the national guidelines.

Figure C5
Sweden

Number of patients who received an implantable defibrillator (ICD) per 100,000 inhabitants. Refers to new insertions. Age standardised.

Source: The Swedish Pacemaker and ICD Registry

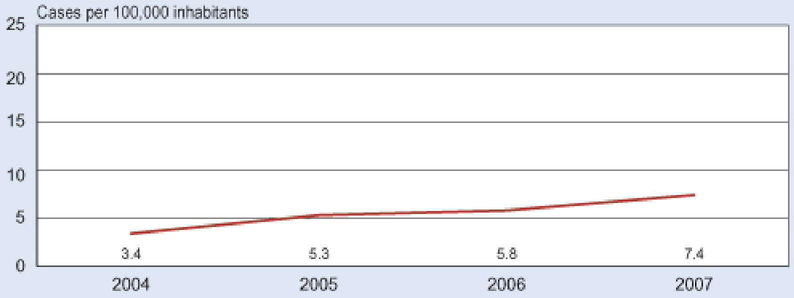


Figure C5
Women
and men

Number of patients who received an implantable defibrillator (ICD) per 100,000 inhabitants, 2006–2007. Refers to new insertions. Age standardised.

Source: The Swedish Pacemaker and ICD Registry

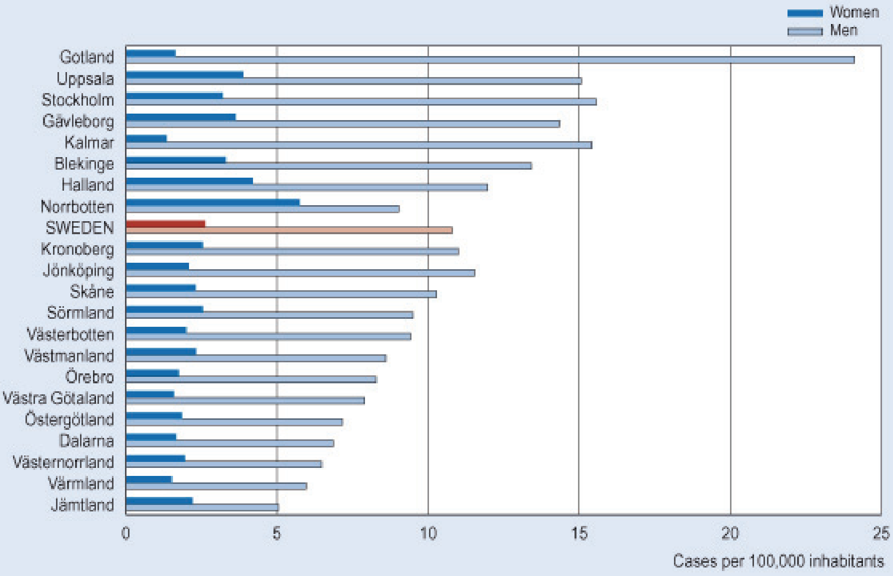
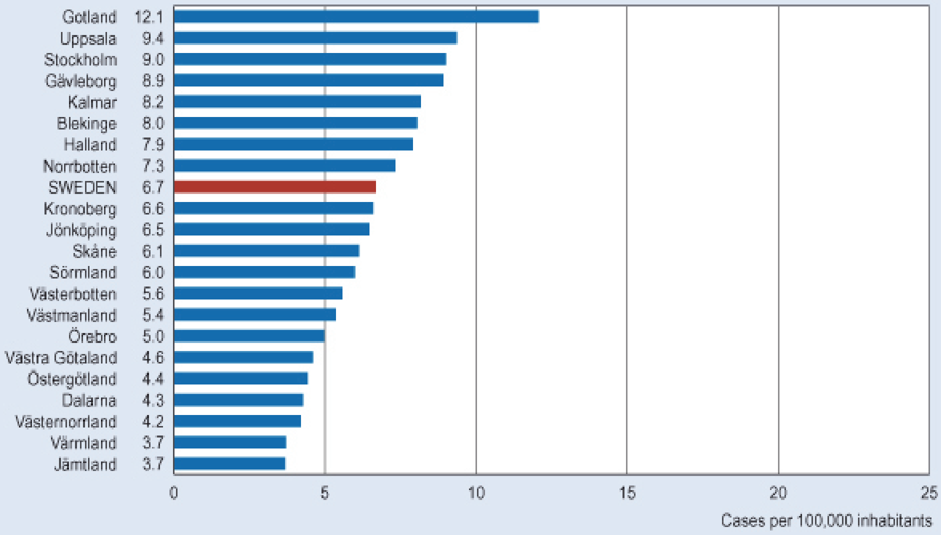


Figure C5 *Number of patients who received an implantable defibrillator (ICD) per*
Total *100,000 inhabitants, 2006–2007. Refers to new insertions. Age standardised.*

Source: The Swedish Pacemaker and ICD Registry



Heart failure

Heart failure is a chronic illness that means that the heart does not have sufficient strength to pump the blood to the various organs and it often develops gradually. The symptoms may include fatigue, shortness of breath during exertion, breathing difficulties, night coughs and swollen legs.

There can be a variety of causes, of which the most common is myocardial infarction. The more patients who survive myocardial infarction, the more common heart failure thus becomes. Furthermore, a long period of high blood pressure may result in the heart becoming fatigued. In addition, diseases of the heart muscle itself or the valve system can cause heart failure.

It is estimated that in Sweden there are around 200,000 people with symptomatic heart failure and as many with latent heart failure. Approximately ten percent of all those over eighty years of age have heart failure, which carries a noticeably greater risk of early death and is also a common reason for hospital care. It is also usual for heart failure patients to be re-admitted a short time after being discharged. The fact that these symptoms are very general makes the illness hard to diagnose, especially when it is mild or moderate.

There is a limited supply of quality and other data on heart failure care, not least in the light of how serious the illness can be, how common it is and the scale of the resources that it requires.

The following account describes five indicators or comparisons that reflect heart failure and, naturally, not all of them pinpoint the quality of the care given to heart failure patients. The inadequate supply of good-quality register data means that most of these indicators contain a large measure of uncertainty and should thus be interpreted carefully.

The supply of data is improving in line with the expansion of reporting to the RiksSvikt quality register. More uniform diagnostics and registration of diagnoses in the Patient Register would permit the development of good quality indicators based on that register as well as the Swedish Prescribed Drugs Register.

Avoidable in-patient care in heart failure (D1)

The need for emergency admissions to hospitals for heart failure can be influenced, and a correctly treated heart failure patient can be expected to require fewer admissions. The indicator aims to reflect how successful the medical services are in treating heart failure patients, and it covers the entire care chain from primary to specialised care.

The indicator is included in the set of indicators for following up cardiac care, in the national guidelines. The word "Avoidable" in the heading has been chosen in order to highlight the fact that the number of admissions can be influenced, but this should not be interpreted as meaning that all in-patient care can be avoided, not even in the case of optimally administered treatment in out-patient care.

The comparison shows two aspects of the use of in-patient care. It shows both the number of persons who, during the period from 2006 to 2007, were treated in hospital with a primary diagnosis of heart failure, irrespective of how many care sessions they had, and also, in a parallel bar, the number of care sessions (care episodes) with the primary diagnosis of heart failure. In-patient care at separate geriatric care units, nursing homes, etc., in those county councils that operate or finance such institutions, has been excluded. Age standardisation has been undertaken but no account could be taken of the background morbidity of the population.

In the country as a whole, the number of persons treated in hospital during the period from 2006 to 2007 was over 44,000 or 234 persons per 100,000 inhabitants. This figure has fallen from a level of 300 in 1999, but has remained unchanged since 2002. The differences among the county councils range from 290 to 166 persons per 100,000 inhabitants.

Diagram D1 shows that the number of care sessions at a national level amounted to 314 per 100,000 inhabitants during the measurement period, which is clearly higher than the number of persons. This difference arises due to the fact that a group of heart failure patients have more than one care session per year. The number of men treated in hospital is considerably higher than the number of women, which ought to reflect the former's higher morbidity, and the same gender pattern applies to the number of care sessions.

It is not possible to state the extent of that part of in-patient care that is avoidable, above all because the background morbidity is not known. This also makes it difficult to interpret the variation among county councils. A county council may have few people being treated either because of a low number of heart failure patients or because they receive good care, and the same comment also applies to the number of care sessions.

Continued indicator development is required. Hospital comparisons relating to repeated care session for heart failure can both show a variation from which conclusions can be drawn, and also support in-depth analyses of what factors ensure successful treatment of this large patient group, in both primary and hospital-based care.

Figure D1
Sweden

Avoidable hospitalisation for heart failure. Number of patients and care episodes per 100,000 inhabitants. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

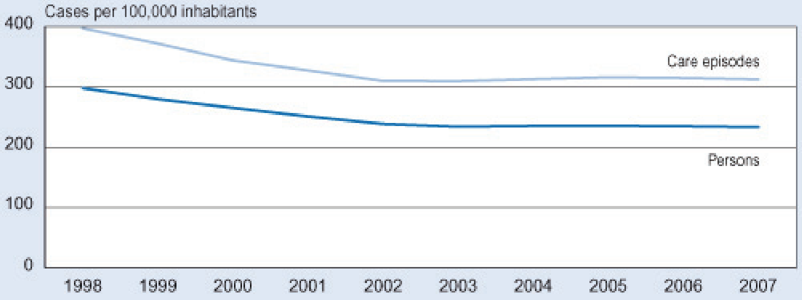


Figure D1
Men

Avoidable hospitalisation for heart failure. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The National Patient Register, National Board of Health and Welfare

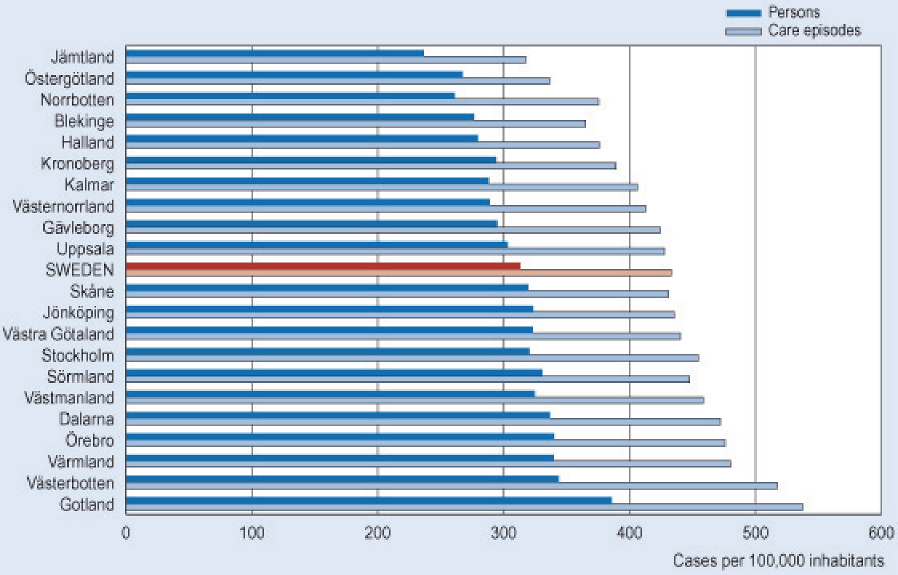


Figure D1 Women *Avoidable hospitalisation for heart failure. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.*

Source: The National Patient Register, National Board of Health and Welfare

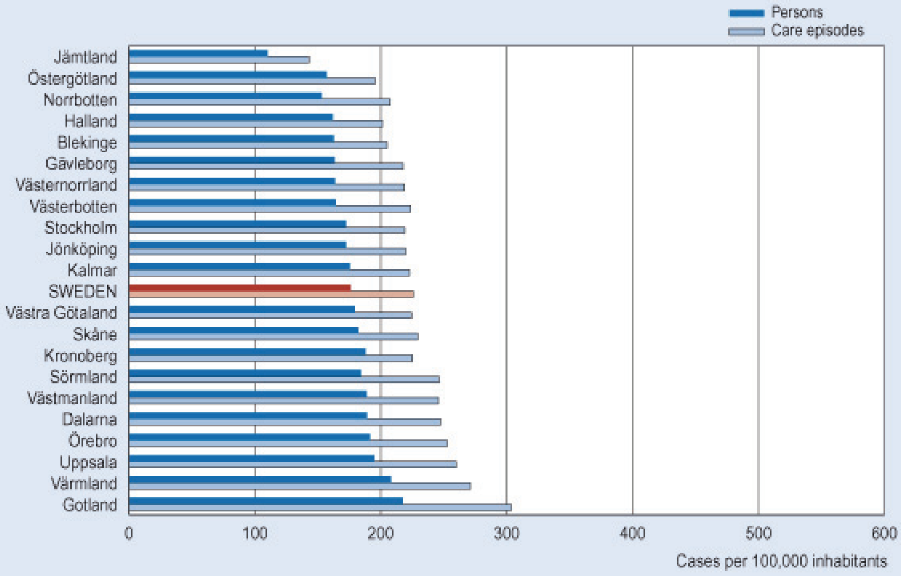
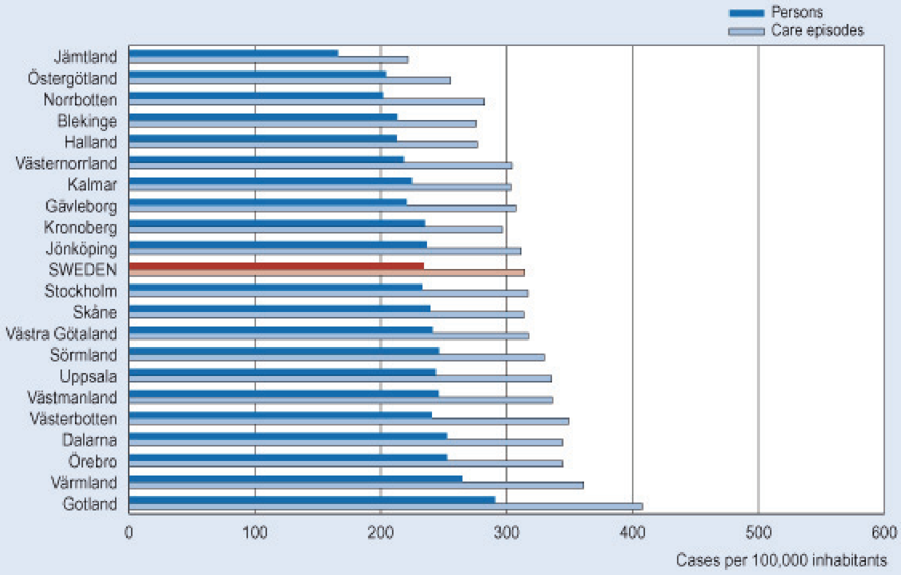


Figure D1 Total *Avoidable hospitalisation for heart failure. Number of patients and care episodes per 100,000 inhabitants, 2006–2007. Age standardised.*

Source: The National Patient Register, National Board of Health and Welfare



RAAS inhibitor in heart failure (D2)

Blood pressure lowering treatment with RAAS inhibitors (ACE inhibitors and angiotensin II receptor blockers, ARB) has shown very good preventive effects on patients with heart failure with varying degrees of severity. The treatment reduces the risk of hospital admission, myocardial infarction and death among heart failure patients.

This treatment has high priority in the national cardiac care guidelines. In principle all heart failure patients should be treated, if there are no medical obstacles. For reasons of cost ACE inhibitors should be used as the first choice, and ARB only in cases of intolerance of ACE inhibitors or when there is an indication for simultaneous treatment with both drugs.

The comparison and the result

The indicator relates to patients with a diagnosis of heart failure who received in-patient care and the percentage of these who were treated with RAAS inhibitors, i.e., ACE inhibitors or ARB. The comparison is based on 8,055 patients below the age of eighty, who in 2007 received in-patient care and were diagnosed as having heart failure, of whom 34% were women. Their drug usage relates to drugs dispensed zero to six months after they were discharged from hospital. The data have been obtained from the Patient Register and the Swedish Prescribed Drugs Register.

In the country as a whole, just over 86% of the patients were treated with RAAS inhibitors. No development trend over time is available, and the differences among the county councils are relatively modest. This variation ranges from Skåne with 82% of patients treated to Västernorrland with 95% and is greater at hospital level. Ten hospitals are below the 80% level, while over twenty treat 90% or more of heart failure patients.

There is a gender difference in that men were treated in 88% of the cases and women in 83%. In Jönköping, Kronberg and Halland, this difference is ten percentage points in favour of the men.

In the light of the recommendation in the national guidelines it can be estimated that at least 90% of the patients ought to be treated with RAAS inhibitors. A certain level of under-treatment exists within the country as a whole and a significant level is found in several county councils and hospitals. A little over a third of the hospitals achieve up to 90% of patients treated.

A source of error and a problem with comparisons are that only heart failure patients who receive in-patient care are included and these are probably patients with more severe heart failure than those treated only as out-patients, which reinforces the notion of under-treatment. The degree of illness of the patients treated as in-patients at the hospitals may vary, which can influence the outcome, even if in principle all heart failure patients should have this treatment.

Figure D2
Women
and men

Percentage of patients treated with RAAS inhibitors after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

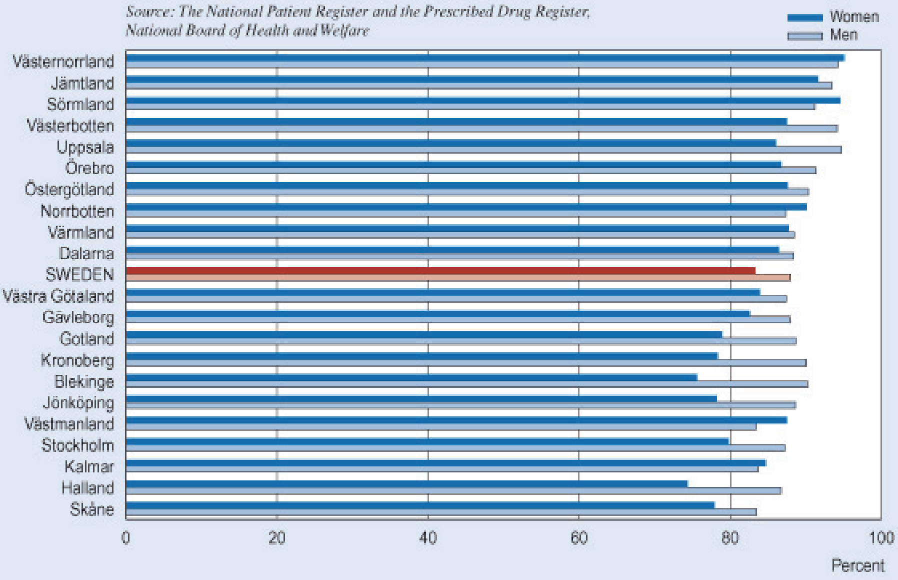


Figure D2
Total

Percentage of patients treated with RAAS inhibitors after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

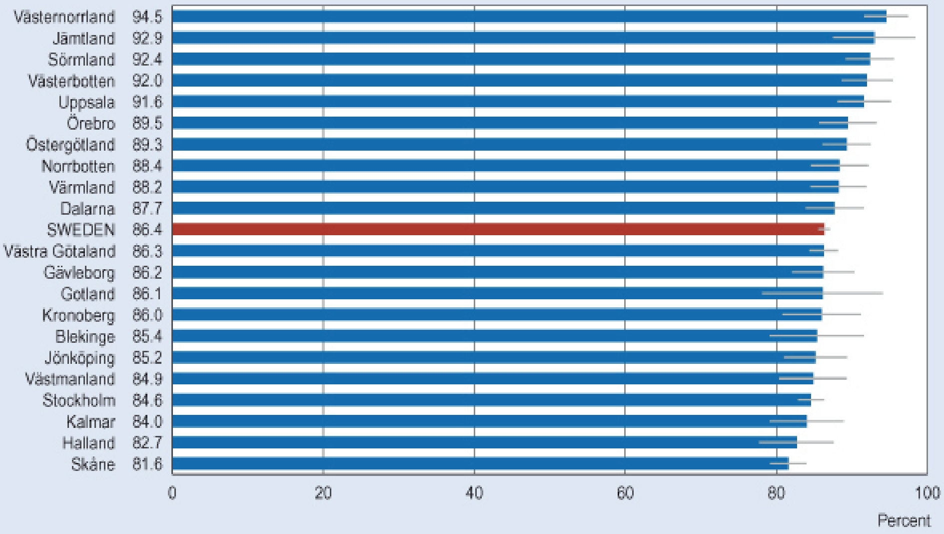
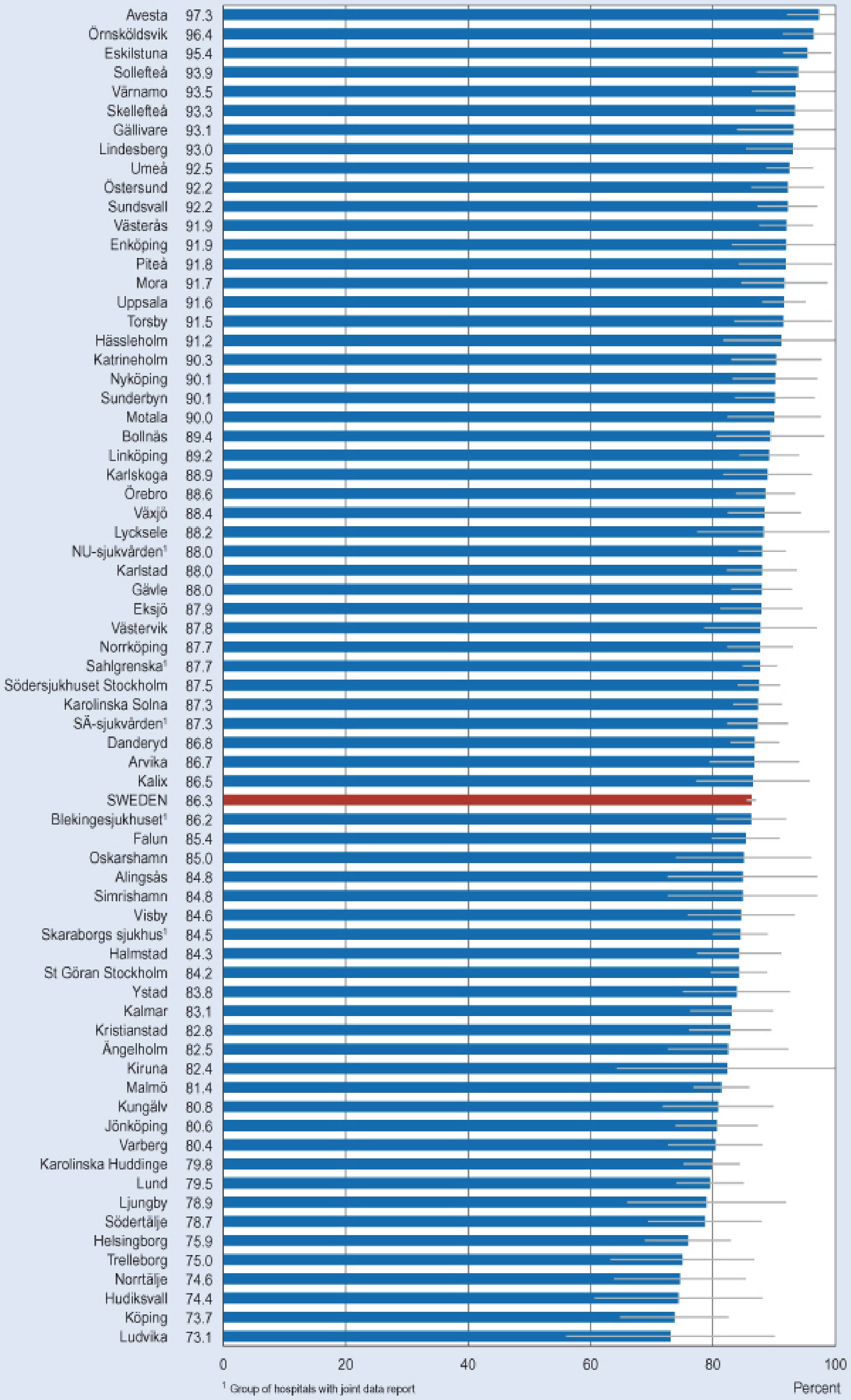


Figure D2
Hospitals

Percentage of patients treated with RAAS inhibitors after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



[1] Group of hospitals with joint data report

Beta-blockers in heart failure (D3)

Beta-blockers lower blood pressure, pulse and heart minute volume, which provides protection against such things as dangerous arrhythmiae and cardiac arrest. In the long term beta-blockers also have a positive effect on the pumping ability of the heart in patients with heart failure. Hence, beta-blockers in heart failure patients have been shown to protect against both sudden death and death caused by the reduced pumping ability of the heart. In addition, this treatment results in less need for hospital care of heart failure patients.

The treatment has a low cost per year of life gained, and long-term treatment with beta-blockers for heart failure patients therefore has a high priority in the national cardiac care guidelines. In principle all patients should be treated, except those for whom there are medical reasons to abstain from such treatment.

The comparison and the result

The indicator relates to heart failure patients treated in hospital and measures the percentage of those treated with beta-blocker drugs. The total number of patients included in this comparison was 8.055, of whom 34% were women. Patients below the age of eighty, who in 2007 received in-patient care, are included. Their drug usage relates to drugs dispensed zero to six months after they were discharged from hospital. The data have been obtained from the Patient Register and the Swedish Prescribed Drugs Register.

In the country as a whole, 85% of all heart failure patients were treated with beta-blockers, which is a slightly higher percentage than that recorded in the data for 2007 in the quality register RiksSvikt. The differences among the county councils are relatively small. The lowest percentage of patients treated was found in Blekinge with 76%, while Örebro had the highest percentage, with 91% of patients treated.

As expected, at hospital level, the differences were greater. Seventeen hospitals of the total of sixty-six compared here treat 80% or fewer, while fourteen hospitals treat 90% or more of the heart failure patients.

The national guidelines do not state any target level for the percentage that ought to be treated, but it is estimated that this ought to be at least 90% of the patients below eighty. There is thus a certain degree of under-treatment in several county councils and at several hospitals, and a considerably higher degree of under-treatment at those hospitals that have the lowest percentages of heart failure patients treated with beta-blockers.

Figure D3
Women
and men

Percentage of patients treated with beta blockers after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

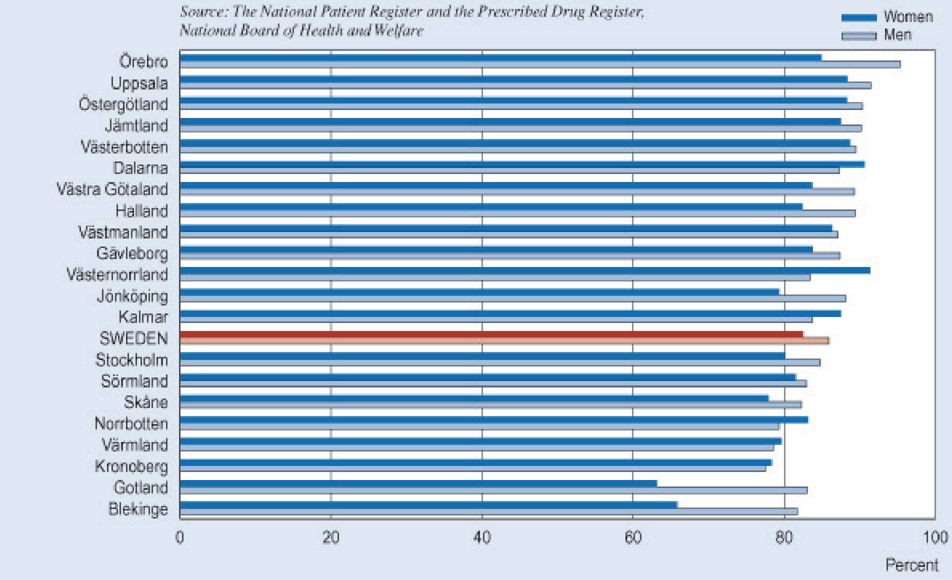
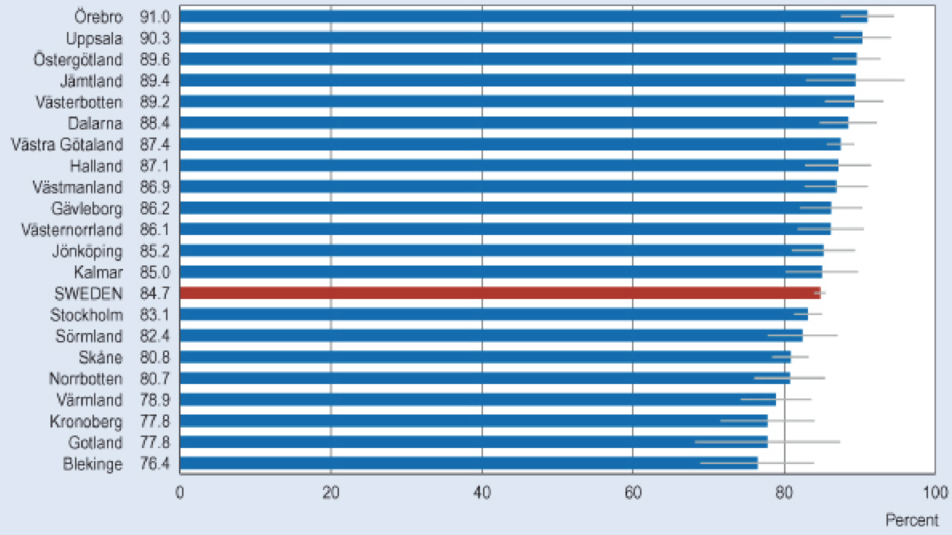


Figure D3
Total

Percentage of patients treated with beta blockers after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare



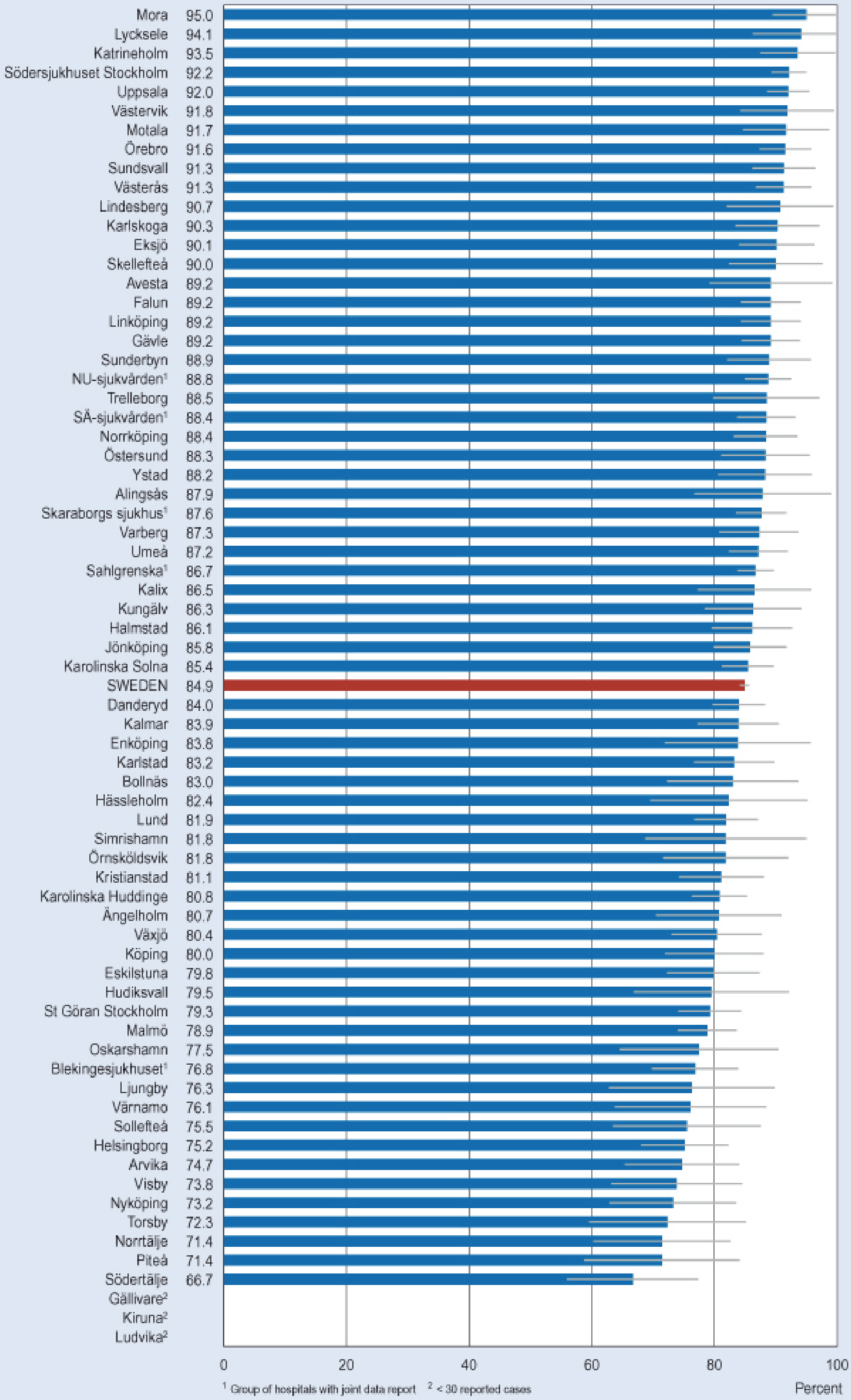


Figure D3 Hospitals *Percentage of patients treated with beta blockers after hospital treatment for heart failure, 2007. Refers to patients <80 years and drug treatment 0–6 months after discharge.*

Source: The National Patient Register and the Prescribed Drug Register, National Board of Health and Welfare

¹ Group of hospitals with joint data report ² < 30 reported cases

The number of implanted pacemakers for cardiac resynchronisation therapy (D4)

Heart failure is treated, above all, with drugs, and the insertion of CRT pacemakers is a relatively new treatment for heart failure patients where there are indications that the heart ventricles are not being activated in a normal manner. CRT stands for *Cardiac Resynchronisation Therapy* and insertion results in both heart ventricles being activated in a manner that optimises the pumping ability of the heart (increased QRS width on an ECG). For many patients with severe heart failure, CRT means a higher quality of life and an extended lifespan. A CRT pacemaker can also reduce the need for drug treatment and hospital admission.

That the treatment is relatively new and there are major differences in practice make it important to monitor the introduction of CRT as a treatment for heart failure. It is cost-effective but the unit cost has a major direct impact on the costs, which vary from around 50,000 crowns (CRT-P) to 175,000 crowns (CRT-D).

In the national guidelines the measure has a relatively high priority (priority 3) for patients with moderate to severe heart failure and an indication for this treatment.

The comparison and the result

The indicator shows the number of heart failure patients per 100,000 who during the period from 2006 to 2007 had a failure pacemaker (CRT-P) or an ICD with CRT function (CRT-D) inserted. The comparison is age-standardised, but no other account has been taken of the background morbidity in the various county councils. The data have been obtained from the Swedish ICD- and Pacemaker Register.

Every year in the country as a whole, around 600 heart failure patients had a CRT or a combined CRT pacemaker and ICD inserted, as an average for the period between 2006 and 2007. This is equivalent to 6.6 insertions per 100,00 inhabitants, and over 70% of these procedures were performed on male patients.

Between 2005 and 2007 the annual number of implantations varied between 430 and 630 and during this period there was no clear indication of any rising trend. There are very great differences among the county councils, and only Västerbotten and Gotland have a treatment frequency higher than ten implantations per 100,000 inhabitants and year.

In the national guidelines the need for annual first-time implantations was estimated at 1,500, which is equivalent to a little over sixteen implantations per 100,000 inhabitants and year. In an international comparison Sweden has a fairly low implantation frequency.

The most important observations are both that there is a noticeable degree of under-treatment, based on the estimated need in the national guidelines, and that noticeably more men than women are treated.

Figure D4
Sweden

Number of implanted pacemakers for cardiac resynchronisation therapy (CRT) per 100,000 inhabitants. Age standardised.

Source: The Swedish Pacemaker and ICD Registry

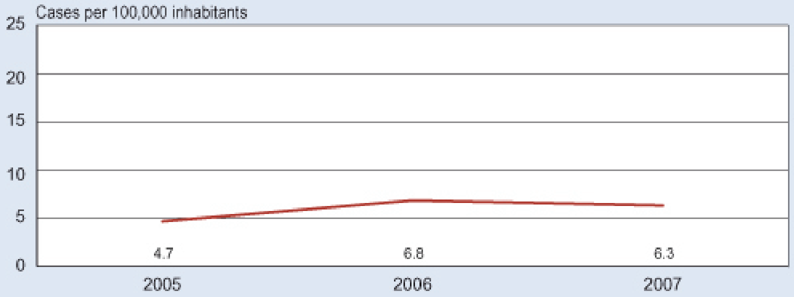


Figure D4
Women
and men

Number of implanted pacemakers for cardiac resynchronisation therapy (CRT) per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The Swedish Pacemaker and ICD Registry

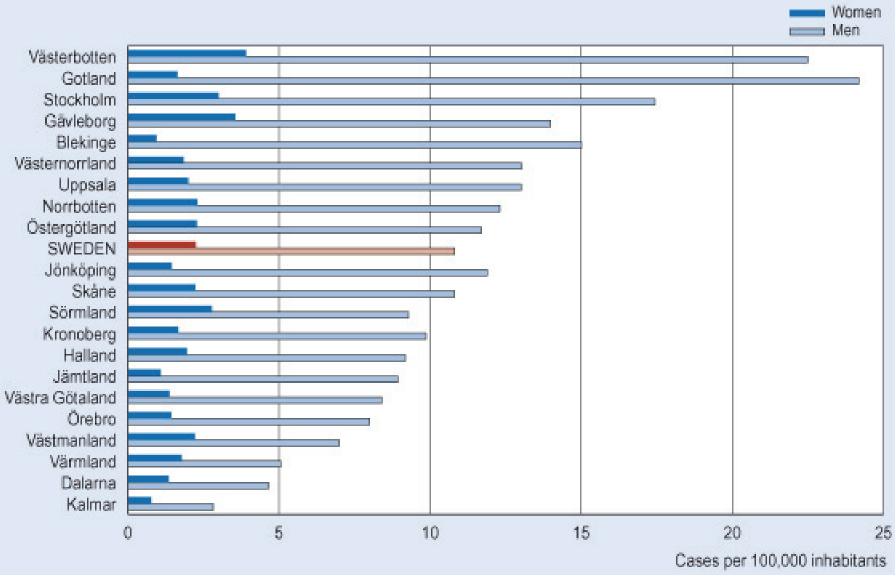
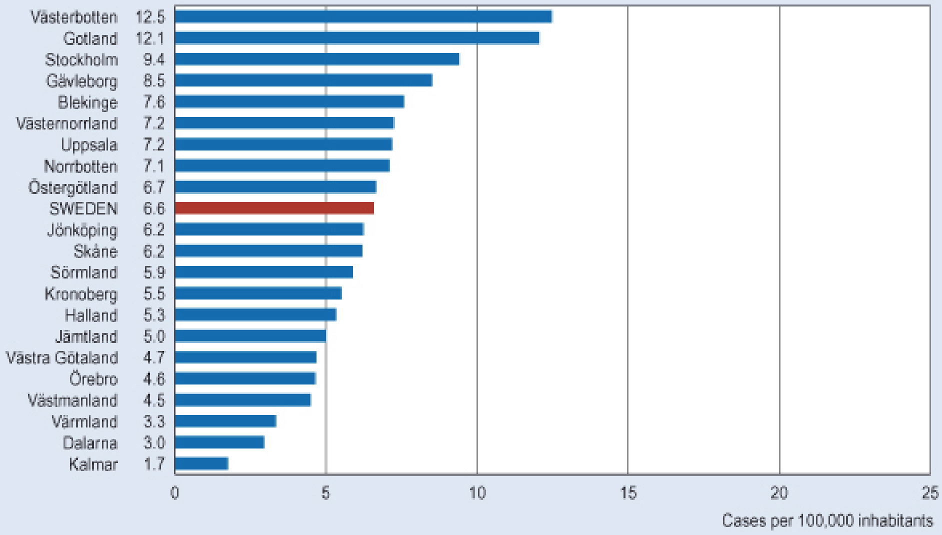


Figure D4
Total

Number of implanted pacemakers for cardiac resynchronisation therapy (CRT) per 100,000 inhabitants, 2006–2007. Age standardised.

Source: The Swedish Pacemaker and ICD Registry



Dead or re-admitted after treatment for heart failure (D5)

It is relatively common for the patients to die or be re-admitted a short time after hospital care for heart failure. Heart failure is a chronic illness, which means that the outcome of death after hospital care is a complicated quality measure, but one that it is still worth focusing on. The cause of this re-admission may include premature discharge of heart failure patients, inadequate drug treatment or patients receiving rather poor information about the disease.

Avoidable re-admissions are a quality defect that cause both greater patient suffering and higher costs for the medical services. According to the 2007 annual report of the quality register RiksSvikt, studies have estimated the annual cost of hospital care for heart failure patients at between two and three billion crowns annually. Heart failure is one of the most common diagnoses in elderly patients receiving hospital care.

The comparison and the result

The indicator refers to patients treated in hospital for heart failure. The measure states the percentage of patients who within thirty days of their discharge have either died or been re-admitted to hospital diagnosed with heart failure. Data have been obtained from the Patient Register, and the comparison refers to all ages, while age standardisation has been performed.

During the measurement period from 2004 and up to and including October 2007, a total of 73,345 care episodes with a primary diagnosis of heart failure were registered. Around 8,700 patients died within thirty days, and among the survivors around 5,700 were re-admitted within 30 days. The percentage of dead or re-admissions in the country as a whole was just below 20%, with a small preponderance among men. Death is a more common outcome than re-admission, and men have a considerably higher percentage of re-admissions than women (not shown).

The time trend shows that the percentage of re-admissions has been constant since the beginning of the 1990s, while mortality has declined slightly. Up to 1992, when nursing homes and other geriatric care units were transferred to the primary municipalities, these institutions also reported to the Patient Register.

The variation among the county councils ranges from 17% in Stockholm to 24% in Värmland, but the results should be interpreted carefully. That over 10% of the patients die within thirty days illustrates their degree of illness and advanced age. The variation among county councils and among hospitals may be influenced to a great degree by something other than the quality of the care measures. If in-patient admission practices differ, then this will affect the outcome. The milder the degree of illness of the patients admitted, the better the outcome that is shown. For this reason, closer notice ought to be paid to case mix in future comparisons.

The same applies to diagnostic practice. If patients with mild heart failure are given this diagnosis more often in one county council or hospital than in another, then the outcome for the former body is improved.

Figure D5
Sweden

Percentage of patients dead or readmitted within 30 days after hospital-treated heart failure. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

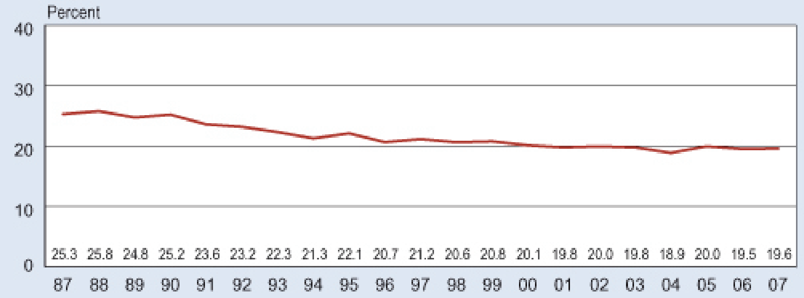


Figure D5
Men

Percentage of patients dead or readmitted within 30 days after hospital-treated heart failure, 2004–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

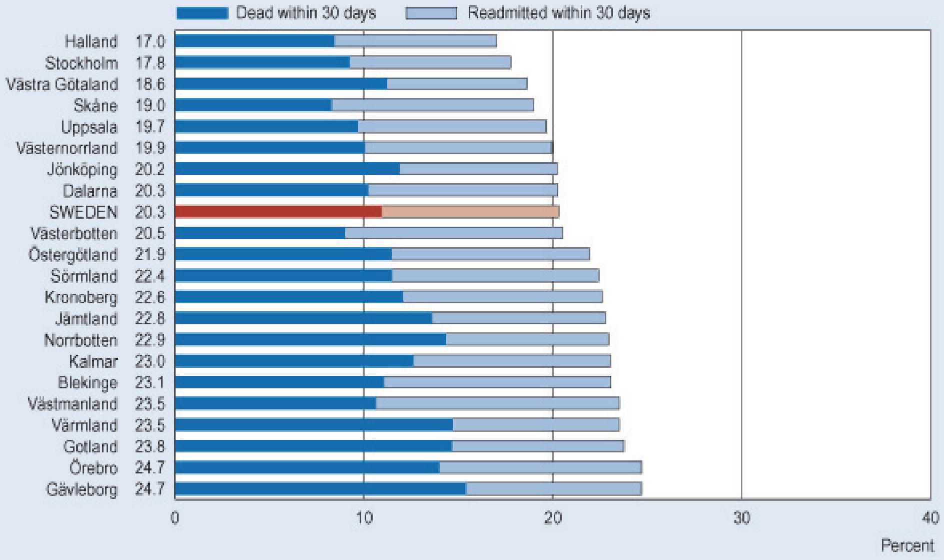


Figure D5
Women

Percentage of patients dead or readmitted within 30 days after hospital-treated heart failure, 2004–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

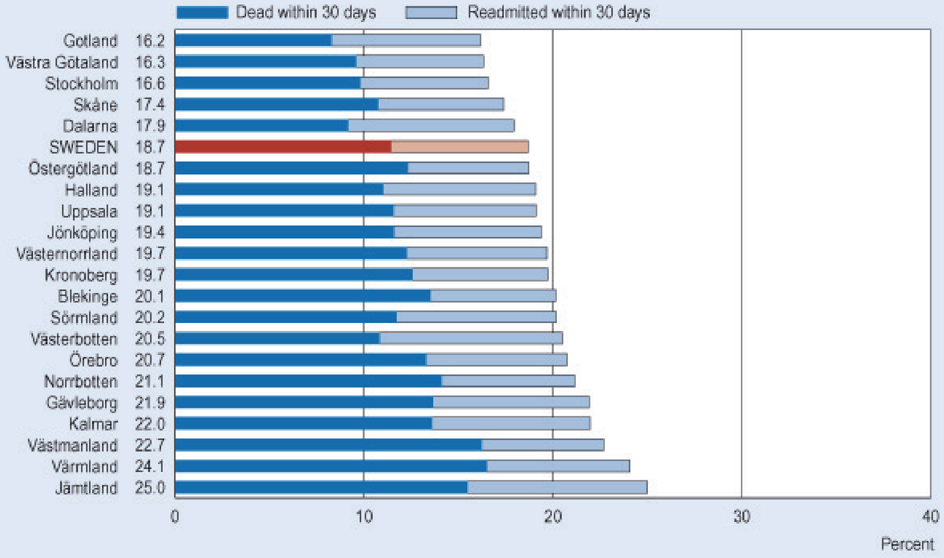


Figure D5
Total

Percentage of patients dead or readmitted within 30 days after hospital-treated heart failure, 2004–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare

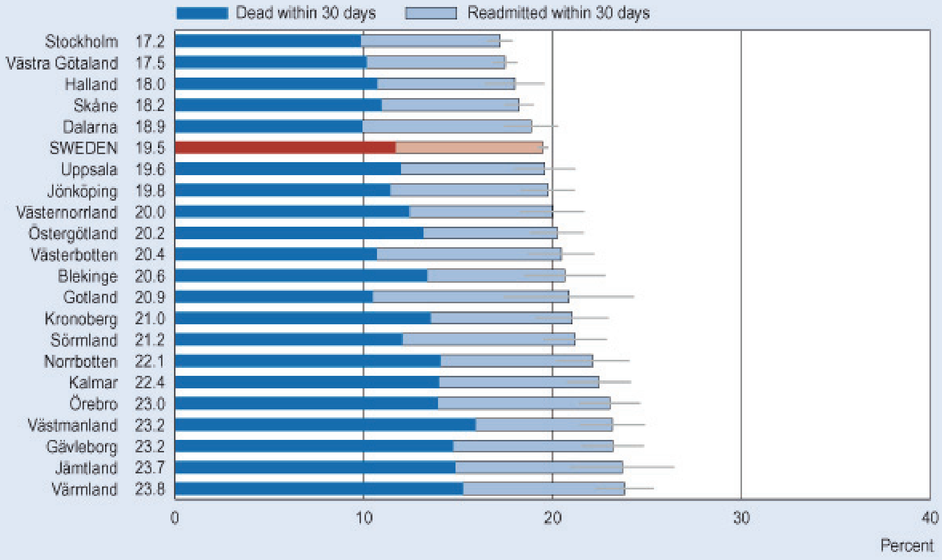
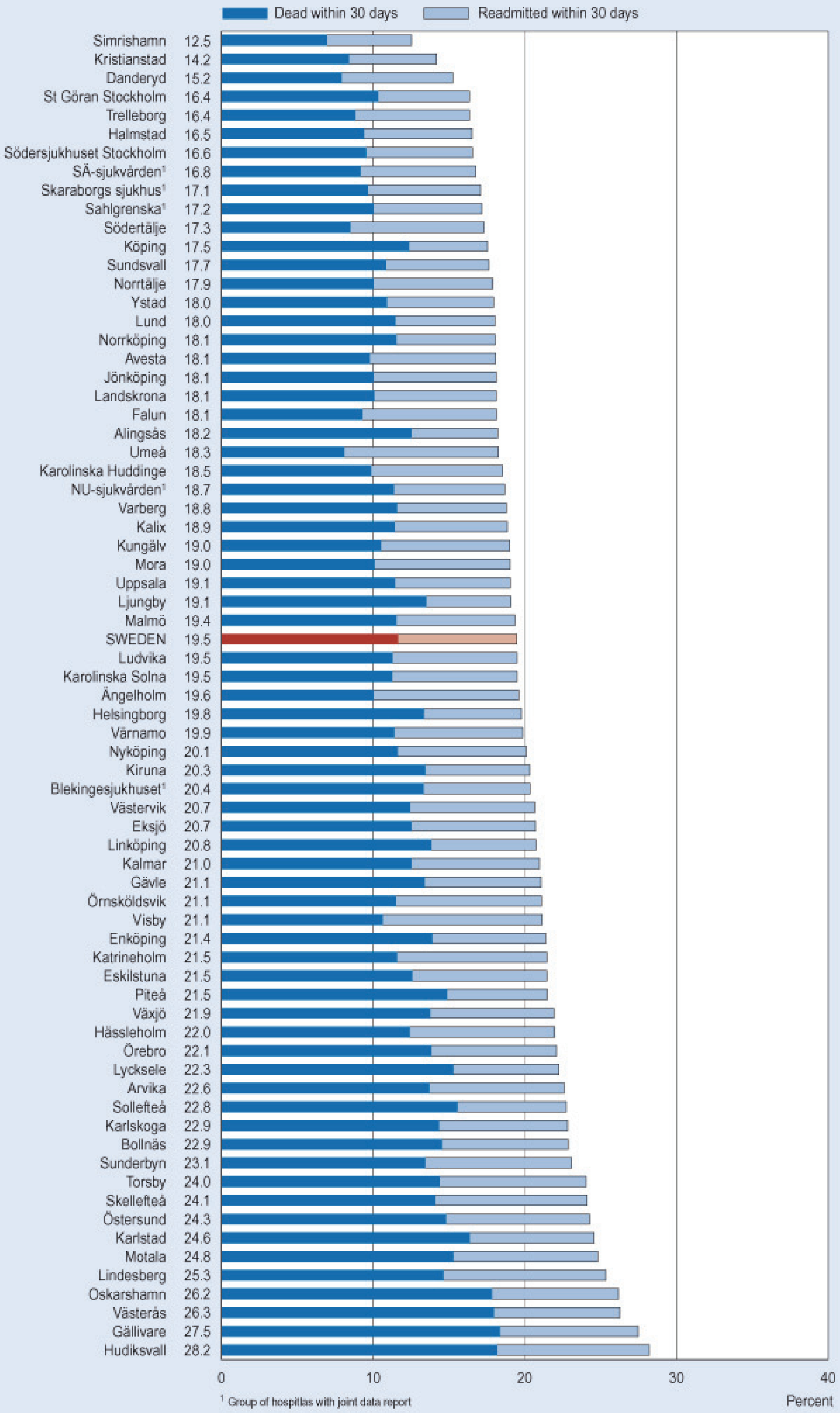


Figure D5
Hospitals

Percentage of patients dead or readmitted within 30 days after hospital-treated heart failure, 2004–2007. Age standardised.

Source: The National Patient Register and the Cause of Death Register, National Board of Health and Welfare



[1] Group of hospitlas with joint data report

Heart valve disease and infantile heart disease

Waiting times for valve surgery (E1)

In 2007, in the country as a whole, around 1,600 isolated heart valve operations were performed, which is equivalent to 20% of heart surgery interventions. The number of valve operations has risen since the beginning of the 2000s, from a little over 1,000 operations annually to the present level. Valve surgery is performed at eight hospitals in the country and on more than twice as many men as women.

Long waiting times for valve surgery can represent risks to the individual patient due to such things as a deteriorating medical condition or, in the worst case, death. Even if in medical terms the patient's condition is considered stable, waiting for an operation in the case of a potential life-threatening illness can be a mental strain.

According to the maximum waiting-time guarantee, an operation should take place within ninety days of the decision date, and the above factors make it desirable to strive for considerably shorter waiting times for valve surgery. The indicator is found in the national cardiac care guidelines from the National Board of Health and Welfare.

The comparison and the result

The indicator shows the median waiting time for an operation, measured from the decision date. The comparison includes 1,570 patients who in 2007 underwent a valve surgery intervention. Combined interventions are not included, and data have been obtained from the Swedish Cardiac Surgery Register.

In 2007 the national median waiting time was fifty-four days. During the last five years the waiting time has varied from the level of forty-five to fifty days at the beginning of the period to just below sixty days during the period from 2005 to 2006 before reaching today's level of fifty-four days.

There are considerable variations in waiting times for patients of the various county councils. Those from Östergötland and Jönköping had to wait longer than 100 days for their operations while the patients in Blekinge, Örebro, Värmland, Västernorrland and Västmanland waited between twenty and forty days. The differences for the patients of the various county councils arise due to the noticeable variation in waiting times at the eight hospitals. Linköping and Lund have noticeably longer waiting times than the others will Karlskrona and Örebro have the shortest.

An analysis of waiting times ought to take account of the different needs of the patients. In clinical practice patients with valve illness are allocated priority differently, depending on the symptoms and the degree of severity of the heart defect. Patients with tight symptomatic aortic stenosis, which causes heart failure and fainting, are operated on with the highest level of priority, while a patient with minor symptoms from a moderately leaking mitral valve is operated on without any priority. The distribution of different patients groups at the clinics can thus influence the waiting times that are reported.

The median waiting time states the waiting time for the "middle" patient. The measure does not provide any information about waiting times for the patients who had to wait the longest. Alternative descriptions should be able to provide more information about waiting time duration, but this will require several measures that complement each other.

Figure E1
Hospitals

Waiting times for valve surgery, measured as median time from decision to completed operation, 2007.

Source: Swedish Heart Surgery Registry

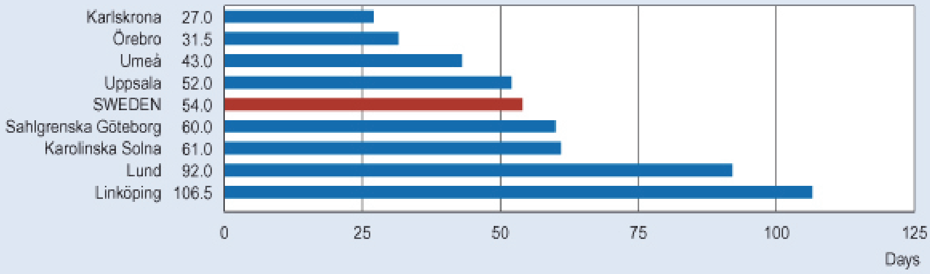


Figure E1
Sweden

Waiting times for valve surgery, measured as median time from decision to completed operation.

Source: Swedish Heart Surgery Registry

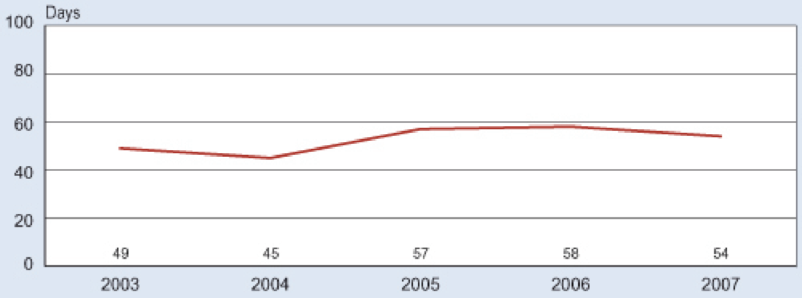


Figure E1
Women and men

Waiting times for valve surgery, measured as median time from decision to completed operation, 2007.

Source: Swedish Heart Surgery Registry

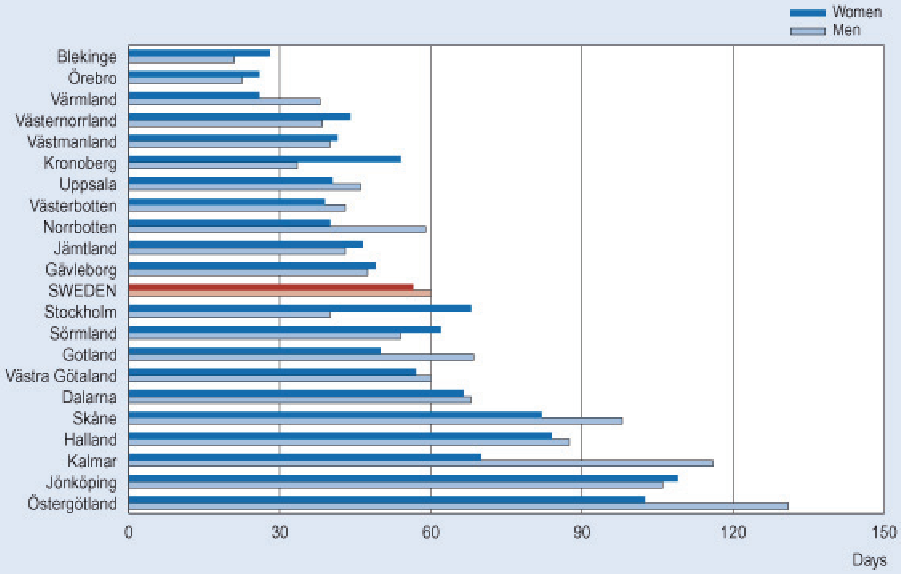
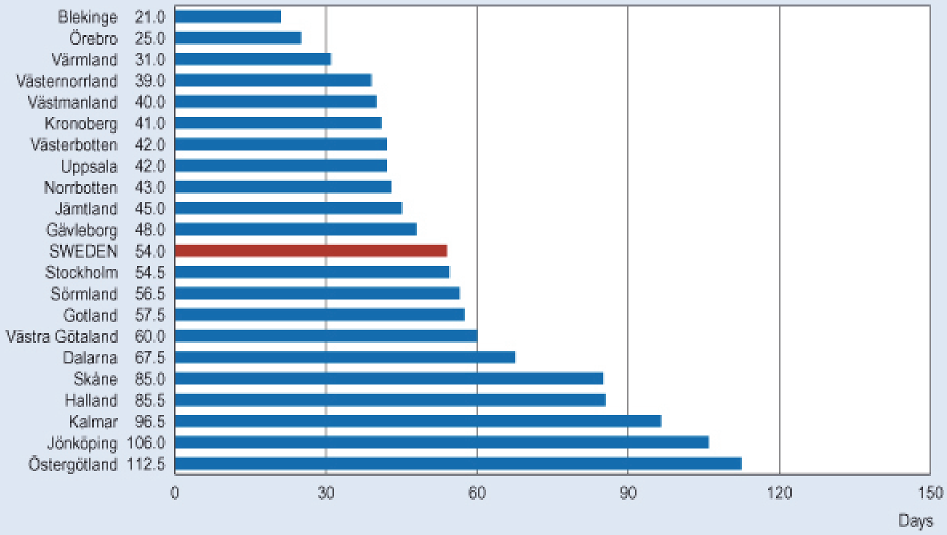


Figure E1
Total

Waiting times for valve surgery, measured as median time from decision to completed operation, 2007.

Source: Swedish Heart Surgery Registry



30-day case fatality rate after valve surgery (E2)

The indicator shows the percentage of patients who died within thirty days of a valve operation. The comparison includes 2,908 patients over eighteen who were operated on during the period from 2006 to 2007. A little over 1,100 of these were women, and nearly half of all patients who underwent surgery were over seventy. The comparison is not age-standardised, and the data have been obtained from the Swedish Cardiac Surgery Register.

The 30-day case fatality rate after valve surgery is a measure of the quality of this operative intervention and the post-operative care. The results are also affected to a high degree by the condition of the patients operated on prior to the operation and the type of surgery that is performed at the various units (case mix).

In recent years the fatality rate has been between 2% and 4% and is at a stable level, although a higher percentage of older patients are undergoing surgery. During the period from 2006 to 2007 Lund and Linköping have the lowest fatality rates, while the remaining hospitals all are close to 3%.

Since the fatality rate is generally low, individual deaths among severely ill patients, who were accepted for cardiac surgery intervention at a clinic, can have a considerable effect on the results, expressed in percentage terms. The percentage of deaths may thus sometimes be a measure that is hard to interpret in comparisons of care quality, despite the fact that a confidence interval is used in order to illustrate the statistical uncertainty.

The fatality rate in Sweden stands up well in comparison with American results [4]. In the *Society of Thoracic Surgery Database* 46,000 valve operations performed on white patients in the USA were analysed. The post-operative fatality rate after aortic valve surgery was 3.6% and 6.2% after mitral valve interventions. The Swedish Cardiac Surgery Register describes deaths within thirty days, which implies on average a longer observation time after the operation date, compared with the American study.

Figure E2
Sweden

30-day case fatality rate after heart valve operation. Age >18 years.

Source: Swedish Heart Surgery Registry

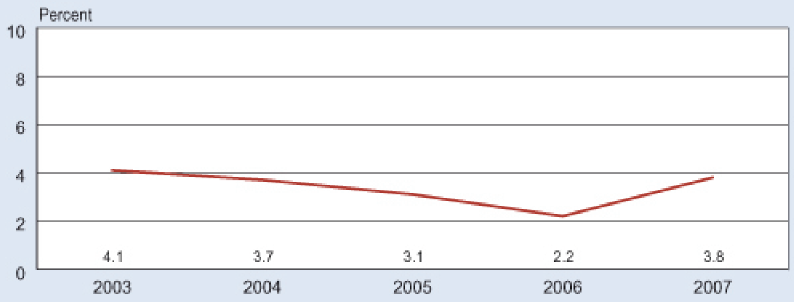
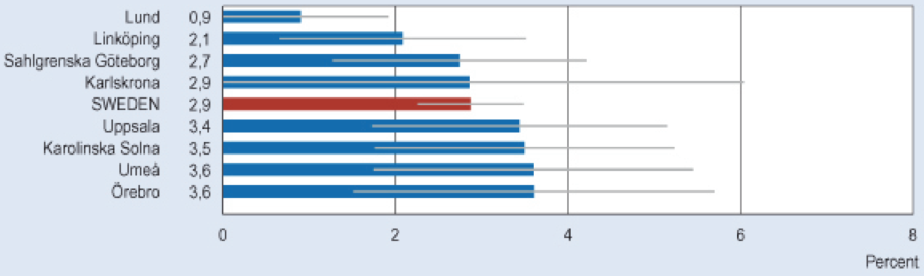


Figure E2
Hospitals

30-day case fatality rate after heart valve operation, 2006–2007. Age >18 years.

Source: Swedish Heart Surgery Registry



Heart disease mortality for children and young people (E3)

Heart disease mortality in children provides a measure of the ability of the medical services to discover, treat and prevent premature deaths in children from heart disease.

Congenital heart defects belong to the most common deformities with an incidence of barely 1% of live births. A total of 712 children with congenital heart defects were reported in 2006, which is 0.7% of the total number of children born that year. Certain heart defects constitute acute conditions within hours or days of birth. Others do not manifest themselves until later in life, and the development of better diagnostics and treatment has improved survival considerably.

In total, around 0.3% of young people have heart diseases that imply a greater risk of sudden heart death during exertion, for example, in conjunction with athletics. The most efficient way of reducing this mortality is to have a greater degree of observation and investigation of early symptoms of heart disease, and in particular hypertrophic cardiomyopathy, which is the most common cause of sudden heart death in the under-35s.

The indicator states the number of deaths of children and young people up to eighteen years of age per 100,000. It serves no purpose to state the number of deaths from heart disease per county council as there are so few cases and there is a great risk of random variations from one year to another. Consequently, only national figures are shown.

In absolute terms, the number has varied from six to twenty-two deaths annually between 1997 and 2006. During the five-year period from 2002 to 2006 the average number of deaths per 100,000 inhabitants of equivalent ages was 0.79. This indicator is suitable for international comparisons.

Figure E3. Sweden. Number of deaths from cardiac disease per 100 000 inhabitants under 18 years of age. Source: The Cause of Death Register, National Board of Health and Welfare

Five year period	Number of deaths during the period	Deaths per 100 000 under the age of 18
1997-2001	67	0,69
1998-2002	61	0,63
1999-2003	66	0,68
2000-2004	61	0,63
2001-2005	77	0,79
2002-2006	77	0,79

References

1 Nationella riktlinjer för hjärtsjukvården [National Cardiac Care Guidelines], National Board of Health and Welfare, 2008

2 God vård – Om ledningssystem för kvalitet och patientsäkerhet [Good Care – About Management for Quality and Patient Safety], National Board of Health and Welfare, 2006

3 Analys av effektivitet – en metodstudie med hjärtsjukvården som exempel [Performance Analysis – A Methodological Study with Cardiac Care as an example], National Board of Health and Welfare, 2009

4 Taylor, NE., O'Brien, S., Edwards, FH, Peterson, ED., Bridges, CR. Relationship Between Race and Mortality and Morbidity After Valve Replacement Surgery Circulation**.** 2005;111:1305-1312

Appendix 2: Cardiovascular disease – risk factors, morbidity and mortality

The primary purpose of this Appendix is to brief the reader on the incidence of cardiovascular diseases. It highlights their risk factors, followed by a survey of their morbidity and mortality in a Swedish and an international perspective, and then presents the five disease groups cited in the national cardiac care guidelines, which divide these diseases into the following groups: coronary artery diseases, heart defects and valves, arrhythmia, heart failure, and congenital heart defects. Wherever possible, the presentation states the number of those suffering from any one of these illnesses (prevalence) as well as the number who are affected by this illness during a specific period of time (incidence). The Appendix also presents the latest available statistics on the number of those receiving somatic in-patient care with a primary diagnosis of some form of heart disease.

What are cardiovascular diseases?

These are the same as the diseases of the circulatory organs and comprise diseases of the heart and the blood vessels, including myocardial infarction, angina pectoris, stroke etc. Their primary cause is hardening of the arteries (arteriosclerosis), i.e., fatty deposits blocking the blood vessels, which impairs the circulation, resulting in a lack of oxygen (ischemia) in the organs of the body that can cause irreparable damage to the heart and brain. Heart failure means that part of the cardiac muscular tissue dies from lack of oxygen.

Risk factors for cardiovascular diseases

Over 200 risk factors for cardiovascular diseases have been discussed in the scientific literature [1]. Apart from advanced age and male gender, smoking, high blood pressure and elevated blood fat levels are the best known and most well-established risk factors for cardiovascular diseases including myocardial infarction. The risk of these diseases is also aggravated by diabetes, overweight, an inadequate social network, and also difficult social conditions such as financial strain and increased psychosocial stress. Also very demanding, monotonous and stressful jobs that offer little scope for any influence over one's working situation have been shown to increase the risk of cardiovascular diseases. Alcohol abuse increases the risk of damage to the heart and blood vessels, while moderate consumption in adults can lower it.

However, it is the overall risk pattern rather than individual risk factors that constitute the total risk and which must form the basis for actions by the individual, the medical practitioner and society when it comes to preventive measures. SCORE (Systematic COronary Risk Evaluation) is one example of a risk assessment instrument developed by the European Society of Cardiology (ESC) that is included in the scientific documentation on coronary artery disease [2] from the National Board of Health and Welfare. SCORE includes gender, age, smoking, systolic blood pressure and serum cholesterol and by taking these five factors into account, it is possible to calculate a ten-year risk of death from a cardiovascular disease. A risk level of below 5% is considered low, 5% to 10% is a slightly higher risk and 10%, a moderately higher risk.

The majority of the population are found in groups with low or moderate risks of death from cardiovascular diseases, which means that the largest number of these deaths occurs in these groups. If many people reduced their risks very slightly, this can save more lives overall than if a small number of people in the high-risk category substantially cut their risks. In preventive efforts it is thus advisable to combine strategies that address high-risk individuals with population strategies that are directed at a wider audience [3].

In the light of these preventive efforts, it may be of interest to study different risk factors in various counties and municipalities. In a recently published compilation of statistics of eight different risk factors [4] what was termed as a high-risk group, was distributed among all the counties and regions in Sweden. This high-risk group included individuals who were simultaneously receiving drug treatment for diabetes, high blood pressure and high blood fats. In the compilation each risk factor had been divided into five approximately equal-sized groups from the lowest to the highest values.

In general, the compilation showed that more men than women had risky alcohol habits, were overweight, were being treated for diabetes and blood fats with drugs and also belonged to the high-risk group. Furthermore, the percentage that ate fruit and vegetables at least five times a day was lower among men than among women. On the other hand, there were more women than men who smoked on a daily basis. The percentage of women who were treated with drugs for high blood pressure was higher than for men, and among the women, there was also a smaller percentage that were physically active for at least thirty minutes per day. In the compilation it is also possible to study risks factors by individual counties and regions and compare them with each other.

Morbidity and mortality in cardiovascular disease

Of all deaths in 2006, 42% were attributable to a cardiovascular disease. Ischemic heart diseases (caused by a lack of oxygen in the heart) represented the largest group with 18% of total deaths among women and 21% among men. The cerebrovascular diseases (those in the blood vessels of the brain, strokes, etc.) comprised 10% of the deaths among women and 8% of those among men. Tumours account for the next most common cause of death at 23% among women and 27% among men. Injuries and poisoning accounted for around 5% of the deaths in 2006 [5].

The risk of dying from a cardiovascular disease has dropped dramatically, which is the most important cause of the increasing mean life expectancy of both men and women. Cardiovascular diseases, however, are still the most common cause of death. The risk of dying of a form of cancer has not decreased to the same extent and cancer in relative terms is becoming an increasingly common cause of death.

Mortality from myocardial infarction has decreased more than mortality from stroke, and the risk of dying from myocardial infarction has been virtually halved in twenty years. Mortality for this disease has fallen less among women than among men, both in percentage terms and as an absolute decrease in the number of deaths per 100,000 inhabitants. The percentage that died of myocardial infarction in 2006 was 56% of the corresponding level among women for 1987 and 48% among men. This reduction in mortality is due in part to the fact that the risk of suffering myocardial infarction has declined, and also to the greater chances of surviving an infarction. The percentage of those suffering an infarction in 2006 among women was 86% of the corresponding level for 1987 and 75% among men. Hence, mortality has declined more than incidence [6].

In 2001, the diagnostic criteria for myocardial infarction were amended, which meant that very small cardiac muscle injuries were classified as myocardial infarctions, although this had previously not been the case. This change to the criteria meant that the incidence was displaced upwards from 2002. Despite this, it can be seen that both myocardial infarction incidence and mortality continue to decline steadily.

Unlike myocardial infarction, neither stroke incidence nor mortality decreased to any greater extent until the end of the 1990s [7].

Stroke incidence in percentage terms declined almost equally among women and men, and in 2006, its incidence was 80% of the 1987 level. However, mortality has dropped somewhat less among women and was 78% of the 1987 level, as against 74% for men.

This decline in the case of stroke is due, as in myocardial infarction, to the fact that fewer people suffer a stroke and more survive. This decrease in absolute terms, as the number of deaths or strokes per 100,000, is greater among men than among women. Men still have a noticeably higher risk of suffering and dying from a stroke or myocardial infarction, but the absolute differences in the risk of death between men and women are decreasing.

The risk factors behind suffering a myocardial infarction and a stroke are the same but their relative importance is different. The reduced incidence of myocardial infarction is probably mainly a result of lower levels of smoking, and falling blood fat levels due to changes in diet. High blood pressure is the most important cause of a stroke, and the average blood pressure of the population has remained rather static over a long period. It was only in recent years that the blood pressure levels began to fall, which may be the most important reason why stroke incidence is also falling. The risk of dying from a myocardial infarction or stroke has also decreased as a result of better treatment by healthcare and medical services.

However, the socio-economic differences in cardiovascular diseases are notable [8, 9]. The risk of suffering a myocardial infarction is twice as high among people with a low educational level, which means a maximum of two years at upper secondary school, compared with those with a high level, i.e., education beyond upper secondary level. These social differences are somewhat smaller than they were fifteen years ago, but in principle they still persist.

References

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2. Kranskärlssjukdom – vetenskapligt underlag för Nationella riktlinjer för hjärtsjukvård, The National Board of Health and Welfare, Stockholm 2008
3. Rose G, Sick individuals and sick populations, International Journal of Epidemiology 2001;30(3):427-32, discussion 433-4.
4. Öppna jämförelser och utvärdering 2009 – Hjärtsjukvård, Bilaga 2, The National Board of Health and Welfare, Stockholm 2009: 182-183
5. Dödsorsaker 2006, Sveriges officiella statistik, The National Board of Health and Welfare, Stockholm 2006
6. Mortality in myocardial infarction per 100 000 inhabitants 1987-2006, age standardised values, The Cause of Death Register, The National Board of Health and Welfare
7. Mortality in stroke per 100 000 inhabitants 1987-2006, age standardised values, The Cause of Death Register, The National Board of Health and Welfare
8. Data from the Patient Register, The National Board of Health and Welfare, Stockholm 1991-2005
9. Data from Utbildningsregistret, Statistiska Centralbyrån, 1991-2005

Appendix 4: Descriptions of Indicators

In this Appendix, the National Board of Health and Welfare describes the indicators used in greater detail than in the main report. This enables those readers who so desire, to avail themselves of the assessments made with regard to every indicator, the measuring methods employed, and the potential risk and sources of error associated with the choice of indicators and measuring methods.

Mortality in ischemic heart disease (A1)

Measure Mortality in ischemic heart disease and the percentage of avoidable mortality thereof.

Description The measure shows the number of deaths from ischemic heart disease per 100,000 inhabitants in the age groups below eighty years old, and in this publication, also the percentage portion above the national level for 50% of these deaths.

Ischemic heart diseases are currently not included as a component of the measures of avoidable mortality that are published annually in the causes of death statistics from the National Board of Health and Welfare. The dramatic drop in mortality in ischemic heart diseases over many years indicates, however, that a percentage of these deaths can be avoided through medical intervention or changes to lifestyles and living conditions.

The measure is suitable for comparisons over time.

Method of measurement Details of underlying cause of death have been obtained from the Cause of Death Register

Underlying cause of death Diagnosis	**ICD-10**
Ischemic heart disease	I20 – I25

The calculations have been corrected for differences in the age structure among different county councils. Age standardisation was undertaken using the 2000 national population as the standard population, which was used for both men and women.

The percentage of avoidable mortality was calculated as that exceeding 50% of the national level between 2005 and 2006.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

Data sources The Cause of Death Register, the National Board of Health and Welfare

Sources of error The method of establishing a cause of death diagnosis may vary from one region to another.

Recurrent avoidable hospitalisations for cardiac care (A2)

Measure The number of persons per 100,000 inhabitants who, in the course of a year, were treated for heart failure or atrial fibrillation and hospitalised on at least three occasions.

Description The measure shows the number of persons per 100,000 inhabitants who had at least three in-patient care episodes where the primary diagnosis was heart failure or atrial fibrillation.

The indicator is intended to measure how successful the healthcare is and it includes the effects of both primary and specialist care. The measure also reflects the extent to which good primary care and day-case care prevent unnecessary admissions to acute care hospitals.

Method of measurement Data have been obtained from details of the primary diagnosis in the in-patient section of the Patient Register.

Primary diagnosis	**Diagnosis code - ICD-10**
Heart failure	I50, I110, I420, I426
Atrial defibrillation	I48

Continuous hospitalisations have been merged into care episodes prior to calculation.

The calculations have been corrected for differences in the age structure among different county councils. Age standardisation was undertaken using the 2000 national population as the standard population, which was used for both men and women.

Data sources The Patient Register, the National Board of Health and Welfare

Sources of error There may be differences among the county councils with respect to the categories of patients with heart failure and atrial fibrillation who were admitted to hospital and those who received either day-case or primary care, respectively.

The use of the diagnoses of heart failure and atrial fibrillation may differ among caregivers and be more or less well substantiated. Whether a primary or a secondary diagnosis is used in registration may also affect the outcome of this indicator and only a primary diagnosis has been used in this measurement.

Reperfusion therapy in ST-segment elevation myocardial infarction (B1)

Measure

Percentage of patients, aged between 0 and 80 years, with ST-segment elevation myocardial infarction or left bundle branch block given reperfusion therapy in 2007.

Description

This indicator refers to patients with a myocardial infarction and ST-segment elevation or left bundle branch block on an ECG. The measure shows the percentage who received acute reperfusion treatment, divided according to the different therapies: PCI, thrombolysis and CABG.

Numerator: The number of patients ≤80 years with ST-segment elevation myocardial infarction or left bundle branch block given reperfusion therapy in 2007.

Denominator: All patients ≤80 years who were treated for ST-segment elevation myocardial infarction or left bundle branch block in 2007.

The indicator reflects the quality of the healthcare process in conjunction with an acute onset of the conditions diagnosed, from pre-hospital care and up to and including the first twenty-four hours of in-patient care.

This indicator is part of the RIKS-HIA quality register 2007 and also of the publication *Quality and Efficiency in Swedish health Care – Regional Comparisons*, 2008.

Method of measurement

Data have been obtained from the database of the RIKS-HIA quality register using the following ICD-10-codes:

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

In addition to a diagnosis of myocardial infarction, ST-segment elevation or left bundle branch block on an ECG is required.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA only lists patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Time until reperfusion therapy in ST-segment elevation myocardial infarction (B2)

Measure The time delay between the first ECG and reperfusion therapy in ST-segment elevation myocardial infarction, measured as the percentage of patients treated within the target time, in 2007. Refers to patients ≤80 years.

Description The indicator refers to the time delay between the first ECG and the start of reperfusion therapy of patients with ST-segment elevation myocardial infarction or left bundle branch block. The measure shows the percentage of patients that were treated within the target time: 90 minutes for PCI and 30 minutes for thrombolysis.

Numerator: The number of patients ≤80 years with ST-segment elevation myocardial infarction who after a first ECG were treated with PCI within 90 minutes or thrombolysis within 30 minutes in 2007.

Denominator: All patients ≤80 years with ECG-confirmed ST-segment elevation myocardial infarction or left bundle branch block treated with PCI or thrombolysis in 2007.

The indicator reflects the quality of the healthcare process in conjunction with an acute onset of the conditions diagnosed, in acute care and pre-hospital treatment and at the hospital.

This indicator is part of RIKS-HIA quality register 2007.

Method of measurement Data have been obtained from the database of the RIKS-HIA quality register using the following ICD-10-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

In addition to a diagnosis of myocardial infarction, ST-segment elevation or left bundle branch block on an ECG is required.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error Incomplete registration of the delay from the first ECG recorded.

RIKS-HIA primarily lists patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain underreporting of the number of patients with myocardial infarction.

Coronary Angiography in patients with non-ST-segment elevation myocardial infarction and an additional risk factor (B3)

Measure The percentage of patients with non-ST-segment elevation myocardial infarction where a coronary angiography was either planned or undertaken, in 2007. Refers to patients ≤ 80 years.

Description The indicator shows percentage of patients with non-ST-segment elevation myocardial infarction and at least one risk factor who underwent a coronary angiography or where one was planned in conjunction with hospital care.

Numerator: The number of patients ≤80 years with non-ST-segment elevation myocardial infarction who underwent a coronary angiography in 2007.

Denominator: All patients ≤80 years with non-ST-segment elevation myocardial infarction in 2007.

The indicator reflects the quality of the healthcare process at the hospital's myocardial infarction unit through the assessment by the treating physician as to continuing diagnostics in conjunction with the myocardial infarction and decisions on this matter.

This indicator is part of the RIKS-HIA quality register 2007 and also of the publication *Quality and Efficiency in Swedish health Care – Regional Comparisons*, 2008.

Method of measurement

Data have been obtained from the database of the RIKS-HIA quality register using the following ICD-10-codes:

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Non-ST-segment elevation myocardial infarction refers to myocardial infarction without ST-segment elevations on an ECG.

One of the following risk factors must be present to be included in the comparison:

- Lung rales grade 2-3
- LVEF <50%
- Diabetes
- ST-segment depression on arrival ECG
- Previous myocardial infarctions

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

PCI frequency with different indications (B4)

Measure The number of PCI treatments in the case of different indications per 100,000 inhabitants, between 2006 and 2007.

Description The indicator shows the number of annual PCI treatments per 100,000 inhabitants, distributed according to the treatment indications. This is not a quality measure but rather an approximate account of the variation throughout the country in the use of PCI as a form of treatment.

The indicator describes treatment volumes only; no optimum level has been defined for this measure.

Method of measurement Data have been obtained from the database of the national quality registry SCAAR. All patients who underwent PCI are included in the comparison as are all ages.

Population data from 31/12-2007 (Population in the country, counties and municipalities 31/12/2007) have been used in calculations based on population size.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

Data sources SCAAR – The Swedish Coronary Angiography and Angioplasty Registry

Sources of error Incomplete registration.

PCI in main stem stenosis (B5)

Measure The percentage of patients with coronary arterial stenosis who were treated by means of PCI, between 2006 and 2007. Refers to patients <80 years.

Description The indicator measures the percentage of patients with stenosis of the coronary artery who were treated by means of PCI. The *National Guidelines for Cardiac Care, 2008* give open-heart surgery (CABG) higher priority for this type of condition.

Numerator: The number of patients treated with PCI for coronary arterial stenosis during the measurement period.

Denominator: The total number of patients with coronary arterial stenosis during the measurement period.

The measure reflects the choice of revascularisation method by the treating physician.

Method of measurement Data have been obtained from the database of the national quality registry SCAAR. All patients under 80 years of age with coronary arterial stenosis are included in the measure but not patients with ST-segment elevation myocardial infarction or previous coronary artery surgery.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided.

Data sources SCAAR – The Swedish Coronary Angiography and Angioplasty Registry.

Sources of error Unclear definition or distinction between acute myocardial infarction and intervention at a calmer stage in the case of coronary arterial disease.

Drug-eluting stent in PCI (B6)

Measure	The percentage of patients given a drug-eluting stent in PCI treatment in 2007.
Description	The indicator measures how many of the patients who underwent PCI treatment and were given a stent, received one that was drug eluting. There is no target level for this indicator; the intention is instead to examine variations among different county councils and hospitals in the use of drug-eluting stents. *Numerator*: The number of patients who underwent PCI treatment and received a drug-eluting stent during the measurement period. *Denominator*: All patients who underwent PCI-treatment and received a stent during the measurement period.
Method of measurement	Data have been obtained from the database of the national quality registry SCAAR. All ages are included in the comparison. The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.
Data sources	SCAAR – The Swedish Coronary Angiography and Angioplasty Registry
Sources of error	Risk of incorrect stent type registration.

Waiting times for coronary artery surgery (B7)

Measure	Waiting times for coronary artery surgery; median time from a decision to a completed operation, in 2007. Number of days.
Description	The indicator measures the median waiting time in days from a decision to operate until the operation has been completed. The measure reflects the process quality in the care and treatment at a hospital by measuring the period of time from diagnosis to treatment.

Method of measurement Data have been obtained from the database of the national quality register, the Swedish Cardiac Surgery Register. Coronary artery surgery refers to coronary surgery and coronary surgery non-ECC, operation groups 2 and 12 as defined in the Swedish Cardiac Surgery Register. Combined interventions such as valve and coronary artery surgery are not included in the measure.

Patients of all ages are included.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided.

Data sources The Swedish Cardiac Surgery Register

Sources of error Irregular administration of waiting lists may occur, which can result in errors in waiting-time statistics.

Anti-coagulant treatment at discharge after myocardial infarction (B8)

Measure The percentage of patients on ASA, other thrombocyte inhibitors or Warfarin upon discharge after myocardial infarction, in 2007. Refers to patients ≤80 years

Description The indicator measures the percentage of patients who received hospital care for a myocardial infarction and who at the point of discharge were using anti-coagulant drugs as a secondary preventive measure.

Numerator: The number of patients≤80 years discharged from hospital after treatment for a myocardial infarction during 2007 and who were treated with ASA, another thrombocyte inhibitor or Warfarin.

Denominator: All patients≤80 years discharged from hospital after treatment for a myocardial infarction during 2007.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician's assessment of the prescription of, and decision to prescribe, secondary preventive drugs after myocardial infarction.

Method of measurement

Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Drugs	ATC-code
Thrombocyte inhibitor	B01A C04-C07, B01A C30
Warfarin	B01A A03

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided.

Data sources

The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error

RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Anti-thrombotic treatment 12–18 months after myocardial infarction (B9)

Measure The percentage of patients on ASA, another thrombocyte inhibitor or anti-coagulants 12 to 18 months after myocardial infarction, between 2005 and 2006. Refers to patients ≤ 80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who 12 to 18 months after discharge were using anti-coagulant treatment as a secondary preventive measure.

Numerator: The number of patients≤ 80years who were treated in hospital for a myocardial infarction, some time during 2005 or 2006, and who 12 to 18 months after discharge had obtained ASA, another thrombocyte inhibitor or Warfarin from a pharmacy.

Denominator: The total number of patients ≤80 years who were treated for a myocardial infarction some time during 2005 or 2006.

The indicator reflects process quality within hospital and primary care with respect to decisions on and follow-up of secondary preventive drug treatment.

Method of measurement Data have been obtained from The Patient Register and The Swedish Prescribed Drug Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Drugs	**ATC-code**
Thrombocyte inhibitor	B01A C04-C07, B01A C30
Warfarin	B01A A03

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the treatment chain is recorded.

Data sources The Patient Register and The Swedish Prescribed Drug Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drug Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

Beta-blockers at discharge after myocardial infarction (B10)

Measure The percentage of patients with beta-blockers upon discharge after myocardial infarction in 2007. Refers to patients ≤80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who at the point of discharge were using beta-blockers as a secondary preventive measure.

Numerator: The number of patients≤80 years discharged from hospital after treatment for a myocardial infarction during 2007 and who were being treated at that time with beta-blockers.

Denominator: All patients≤80 years discharged from hospital after treatment for a myocardial infarction during 2007.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician's assessment of the prescription of secondary preventive drugs after myocardial infarction and his/her decision to do so.

Method of measurement

Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Myocardial infarction	I21, I22

Drugs	ATC-code
Beta-blockers	C07A

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources

The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error

RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Beta-blockers 12–18 months after myocardial infarction (B11)

Measure

The percentage of patients on beta-blockers 12 to 18 months after myocardial infarction, between 2005 and 2006. Refers to patients <80 years.

Description

The indicator measures the percentage of patients who were treated at a hospital for a myocardial infarction, and who 12 to 18 months after discharge use beta-blockers for secondary preventive purposes.

Numerator: The number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006 and who 12 to 18 months after discharge had collected beta-blockers from a pharmacy.

Denominator: The total number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician's assessment of the prescription of, and decision to prescribe, secondary preventive drugs after myocardial infarction.

Method of measurement

Data have been obtained from The Patient Register and The Prescribed Drug Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes.

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Drugs	**ATC-code**
Beta-blockers	C07A

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and The Swedish Prescribed Drug Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drug Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

Lipid lowering drug therapy upon discharge after myocardial infarction (B12)

Measure The percentage of patients treated with lipid lowering drug therapy upon discharge after myocardial infarction, 2007. Refers to patients ≤80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who at the point of discharge were using lipid lowering drug therapy as a secondary preventive measure.

Numerator: The number of patients≤80 years discharged alive from hospital after treatment for a myocardial infarction during 2007 and who at the time were being treated with lipid lowering drugs.

Denominator: All patients≤80 years discharged alive from hospital after treatment for a myocardial infarction during 2007.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician’s assessment of the prescription of, and decision to prescribe, secondary preventive drugs after myocardial infarction.

Method of measurement Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Drugs	ATC-code
Lipid lowering drugs	C10A (all)

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Lipid lowering drug therapy 12–18 months after myocardial infarction (B13)

Measure The percentage of patients treated with lipid lowering drug therapy 12-18 months after myocardial infarction, between 2005 and 2006. Refers to patients <80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who 12 to 18 months after discharge use lipid lowering drug therapy as a secondary preventive measure.

Numerator: The number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006 and who 12 to 18 months after being discharged had collected lipid-lowering drugs from a pharmacy.

Denominator: The total number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006.

The indicator reflects the process quality within hospital and primary care with regard to decisions on secondary preventive drug therapy and its follow-up thereof.

Method of measurement

Data have been obtained from The Patient Register and The Prescribed Drug Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Drugs	ATC-code
Lipid lowering drugs	C10A (all)

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources

The Patient Register and The Swedish Prescribed Drug Register, The National Board of Health and Welfare.

Sources of error

Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drug Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

Goal compliance for LDL cholesterol after myocardial infarction (B14)

Measure

The percentage of patients who reach the target level for LDL cholesterol (<2.5 mmol/l) one year after myocardial infarction, between 2006 and 2007. Refers to patients <75 years.

Description

The indicator measures the percentage of myocardial infarction patients who reach the desired target level for lipids one year after myocardial infarction.

Numerator: The number of patients with LDL cholesterol <2.5 mmol/l one year after myocardial infarction.

Denominator: The total number of patients still alive one year after myocardial infarction.

Method of measurement

Data have been obtained from the database of the national quality register SEPHIA.

The age limitation for this comparison is set at 75 years due to the technical requirements of the register.

Data sources

The national quality register SEPHIA

Sources of error

A number of hospitals do not report their data to SEPHIA; the participation rate in 2007 was around 45 %, which diminishes the statistical basis for the indicator.

Low-cost statins in myocardial infarction (B15)

Measure

The percentage of patients on low-cost statins for statin therapy after myocardial infarction, January to June 2008. Refers to patients with a myocardial infarction between 1998 and 2007.

Description

The indicator measures the percentage of myocardial infarction patients who use lipid-lowering therapy (statins) who receive low-cost drugs.

Numerator: The number of patients who collected low-cost statins from a pharmacy during the relevant follow-up period, first collection.

Denominator: Patients who had myocardial infarction during the period between 1998 and 2007 and collected statins from pharmacies during the relevant follow-up period.

The indicator reflects the process quality primarily within primary care but also at the point of discharge from the hospital with regard to the choice by the treating physician of secondary preventive therapy after myocardial infarction.

Method of measurement

Data have been obtained from The Patient Register and The Prescribed Drugs Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Drugs	**ATC-code**
Low-cost statins	C10A A01+A03
All statins	C10A A

The following criteria apply:

- Hospital care for a myocardial infarction some time between 1/1-1998 and 31/12-2007. A ten-year period has been selected to allow long-term follow-up, widen the population and also reflect the contribution made by primary care.
- Follow-up period for this comparison: 1/1-2008 to 1/7-2008 for recording the latest available data.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

Data sources The Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drugs Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

RAAS inhibitor upon discharge after myocardial infarction (B16)

Measure The percentage of patients with RAAS inhibitor upon discharge after myocardial infarction, 2007. Refers to high-risk patients ≤80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who upon discharge use RAAS inhibitors as a secondary preventive measure. This comparison refers to all ages.

Numerator: The number of high-risk patients ≤80 years discharged from hospital after treatment for a myocardial infarction during 2007 and who were treated with one or more RAAS inhibitors.

Denominator: All high-risk patients≤80 years di s-charged from hospital after treatment for a myocardial infarction during 2007.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician’s assessment of the prescription of, and decision to prescribe, secondary preventive drugs after myocardial infarction.

Method of measurement Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Drugs	ATC-code
ACE inhibitor and ARB	C09 (all except X)

Further criteria are that the patient has at least one of the following risk factors:

- Lung rales grade 2-3
- Prescribed diuretics
- LVEF <50%
- Diabetes
- Hypertension
- Chronic heart failure

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in which they reside.

Data sources

The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error

RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

RAAS inhibitor 12–18 months after myocardial infarction (B17)

Measure The percentage of patients with RAAS inhibitor 12-18 months after myocardial infarction, 2005-2006. Refers to patients <80 years.

Description The indicator measures the percentage of patients who were treated in hospital for a myocardial infarction, and who 12 to 18 months after discharge use a RAAS inhibitor as a secondary preventive measure.

Numerator: The number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006 and who 12 to 18 months after discharge collected a RAAS inhibitor from a pharmacy.

Denominator: The total number of patients <80 years who were treated for a myocardial infarction some time during 2005 or 2006.

The indicator reflects process quality within hospital and primary care with regard to decisions on secondary preventive drug therapy and the follow-up thereof.

Method of measurement Data have been obtained from The Patient Register and The Prescribed Drugs Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Drugs	**ATC-code**
ACE inhibitor and ARB	C09 (all except X)

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drugs Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

ARB as a RAAS inhibitor after myocardial infarction (B18)

Measure The percentage of patients with angiotensin II receptor blockers (ARB) in treatment with a RAAS inhibitor after myocardial infarction, 2007.

Description The indicator highlights the choice of a RAAS inhibitor after treatment for a myocardial infarction. The choice between ARB and the considerably less expensive ACE inhibitor is of macroeconomic interest.

Numerator: The number of patients with a myocardial infarction who upon discharge are treated only with ARB.

Denominator: All patients who are treated with an ARB or ACE inhibitor (RAAS inhibitor) upon discharge after myocardial infarction.

The indicator is a measure of cost-effective treatment choices.

Method of measurement Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Drugs	ATC-code
ACE inhibitor and ARB	C09 (all except X)
ARB	C09C, C09D

This comparison refers to all ages.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in which they reside.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Furthermore, RIKS-HIA data does not show whether a patient had previously tried an ACE inhibitor and did not tolerate it due to side effects. The reason for a patient being given ARB instead of an ACE inhibitor upon discharge is therefore not known.

Clopidogrel therapy in non-ST-segment elevation myocardial infarction (B19)

Measure The percentage of patients receiving clopidogrel therapy in non-ST-segment elevation myocardial infarction, in 2007. Refers to patients ≤80 years.

Description The indicator refers to secondary preventive therapy for patients with non-ST-segment elevation myocardial infarction. The measure shows the percentage of patients who upon discharge from hospital were being treated with clopidogrel, a drug that reduces the risk of suffering another myocardial infarction.

Numerator: The number of patients ≤80 years discharged from hospital after non-ST-segment elevation myocardial infarction and who were treated with clopidogrel.

Denominator: All patients ≤80 years discharged from hospital after non-ST-segment elevation myocardial infarction.

The measure reflects the process quality of the hospital myocardial infarction unit with regard to the treating physician's assessment of the prescription of, and decision to prescribe, secondary preventive drugs after myocardial infarction.

Method of measurement

Data have been obtained from RIKS-HIA using the following ICD- and ATC- codes:

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Drugs	**ATC-code**
Clopidogrel	B01A C04
Tiklopidin	B01A C05

Non-ST-segment elevation myocardial infarction refers to myocardial infarction without ST-segment elevations on an ECG.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of an age limit. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in which they reside.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Reinfarction within 365 days of myocardial infarction (B20)

Measure The percentage of patients with first-time infarction who suffered a new infarction within 365 days.

Description The measure shows the percentage of all patients without a registered infarction during the previous seven years who have a new infarction within 365 days.

Only persons who survive the acute 28-day period were followed up and only new infarctions after this period were counted as such.

The percentage of patients who have a new infarction may be a result of both care efforts during the acute stage and secondary preventive measures.

Numerator: The number of myocardial infarction patients who have at least one new infarction during the period of 28 to 365 days among all cases of myocardial infarction as defined in the denominator.

Denominator: All cases of myocardial infarction where the patient survived 28 days after the infarction and had not had one during the preceding seven years.

Method of measurement Data have been obtained from the in-patient section of the Patient Register and the Cause of Death Register.

Primary or Secondary Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

Cases of acute myocardial infarction have been defined in the same way as for the myocardial infarction statistics at the National Board of Health and Welfare. This means, among other things, that all admissions within a period of 28 days are attributed to an infarction (or attack).

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register, The National Board of Health and Welfare

Sources of error Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

Re-admission within 30 days of discharge after myocardial infarction (B21)

Measure The percentage of patients with first-time myocardial infarction who were re-admitted for cardiovascular disease within 30 days of discharge.

Description The measure shows the percentage of all patients with no record of myocardial infarction in the preceding seven years who were re-admitted for cardiovascular disease within 30 days of discharge after myocardial infarction.

Re-admission within 28 days with any diagnosis of acute myocardial infarction has not been counted as re-admission in these calculations. These admissions have been viewed as part of the treatment for the acute myocardial infarction. Instead, the last hospitalisation for myocardial infarction within the 28-day period has been followed up and the percentage of re-admitted patients within 30 days of the last discharge date has been calculated. This avoids planned re-admissions for a coronary arterial operation or PCI treatment from being included in the percentage of re-admitted patients.

Re-admission to hospital shortly after treatment for myocardial infarction may be a sign of shortcomings in initial treatment or follow-up. Unplanned and avoidable re-admissions reflect inadequate quality and a greater risk to the patient, as well as inefficient use of healthcare resources.

Numerator: The number of myocardial infarction patients admitted because of cardiovascular diseases within 30 days of discharge after treatment for myocardial infarction as defined in the *Denominator*. Re-admission because of myocardial infarction within 28 days is counted as care for the initial infarction and is thus not considered as re-admission in this report.

Denominator: All cases of myocardial infarction where the patient survived for 28 days after the infarction and had not had any infarction during the preceding seven years.

Method of measurement

Data have been obtained from the in-patient section of the Patient Register.

Primary or Secondary Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Underlying or contributory cause of death	**ICD-10**
Acute myocardial infarction	I21, I22

A case of acute myocardial infarction has been defined in the same way as for the myocardial infarction statistics at the National Board of Health and Welfare. This means, among other things, that all admissions within a period of 28 days are attributed to an infarction (or attack).

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and the Cause of Death Register, The National Board of Health and Welfare.

Sources of error Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

Dead or re-admitted within 365 days of myocardial infarction (B22)

Measure The percentage of patients with first-time myocardial infarction who were re-admitted for cardiovascular disease within 30 days of discharge.

Description The measure shows the percentage of all patients with no record of myocardial infarction in the preceding seven years who were re-admitted for certain cardiovascular diseases or who died within one year of an infarction.

Dead includes death irrespective of the cause and also during initial hospitalisation, while re-admission applies to in-patient care with a primary diagnosis of myocardial infarction, stroke, heart failure or clots in arms, legs or abdominal arteries.

Re-admission within 28 days with any diagnosis of acute myocardial infarction has not been counted as re-admission in these calculations. These admissions have been viewed as part of the treatment of the acute myocardial infarction.

Numerator: The number of myocardial infarction patients re- admitted because of myocardial infarction, stroke, heart failure or clots in arms, legs or abdominal arteries or who die within 365 days of discharge after an infarction as defined in the *Denominator*. Re-admission because of myocardial infarction within 28 days is counted as care for the initial infarction and is thus not considered as re-admission in this report.

Denominator: All cases of myocardial infarction where the patient was admitted to hospital and had not had any infarction during the preceding seven years.

Method of measurement Data on acute myocardial infarction and primary diagnosis have been obtained from the in-patient section of the Patient Register.

Primary or secondary diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Primary diagnosis in follow-up	**ICD-10**
Acute myocardial infarction, stroke, heart failure and also clots in arms, legs or abdominal arteries.	I21, I20, I500, I501, I509, I420, I426, I61, I63, I64, I740, I743, I742, I744

Cause of death in follow-up	**All causes**

Data on the date of death have been obtained from the Cause of Death Register.

Cases of acute myocardial infarction have been defined in the same way as for the myocardial infarction statistics at the National Board of Health and Welfare. This means, among other things, that all admissions within a period of 28 days are attributed to an infarction (or attack).

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources

The Patient Register and the Cause of Death Register, The National Board of Health and Welfare.

Sources of error

Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

Myocardial infarction - 28-day case fatality rate (B23)

Measure The percentage that died within 28 days of myocardial infarction.

Description The measure shows the percentage of all cases of acute myocardial infarction leading to death within 28 days of the infarction, divided into those treated at an acute hospital and those who died elsewhere.

The measure is intended to measure the quality of the entire care chain from preventive care to ambulance services, emergency care and subsequent care.

Numerator: The number of cases leading to death within 28 days (day 0-27) after myocardial infarction.

Denominator: All cases of myocardial infarction during the period.

Method of measurement Cases of acute myocardial infarction have been defined in the same way as for the myocardial infarction statistics at the National Board of Health and Welfare. All hospitalisations with any diagnosis of acute myocardial infarction in the in-patient section of the Patient Register or a death within 28 days where the cause is acute myocardial infarction are attributed to a case of myocardial infarction. The measure thus includes those not treated in hospital**.** 28-day case fatality is measured using the Cause of Death Register where all deaths are taken into account irrespective of their cause.

Primary or Secondary Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

Underlying or contributory cause of death	**ICD-10**
Acute myocardial infarction	I21, I22

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources

The Patient Register and the Cause of Death Register, The National Board of Health and Welfare.

Sources of error

Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

Myocardial infarction - 28-day case fatality rate in hospital care (B24)

Measure

The percentage of those dying within 28 days of a myocardial infarction of all those treated in hospital.

Description

The measure shows the percentage of all hospital care cases of acute myocardial infarction that resulted in death within 28 days of the infarction.

The measure is intended to measure the quality of the emergency care of myocardial infarction patients and subsequent hospital care.

Numerator: The number of cases of myocardial infarction treated in hospital that result in death within 28 days (day 0-27) of an infarction.

Denominator: All cases of a myocardial infarction initially treated in hospital during the period.

Method of measurement

Cases of acute myocardial infarction have been defined in the same way as for the myocardial infarction statistics at the National Board of Health and Welfare. All hospitalisations with any diagnosis of acute myocardial infarction in the in-patient section of the Patient Register within 28 days are attributed to a case of myocardial infarction.

The date of death has been obtained from the Cause of Death Register.

Primary or Secondary Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and the Cause of Death Register, The National Board of Health and Welfare.

Sources of error Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

Myocardial infarction - 28-day case fatality rate in hospital care (RIKS-HIA) (B25)

Measure The percentage of deaths within 28 days of a myocardial infarction treated in hospital, between 2005 and 2007. Age-standardised values.

Description The measure shows the percentage of all cases of acute myocardial infarction leading to death within 28 days of the infarction, divided into those treated at an acute hospital and those who died elsewhere.

The measure is intended to measure the quality of the entire care chain from preventive care to ambulance services, emergency care and subsequent care.

Numerator: The number of cases leading to death within 28 days (day 0-27) after myocardial infarction.

Denominator: All cases of myocardial infarction during the period.

Method of measurement Data have been obtained from the database of the RIKS-HIA quality register. The measure includes all patients registered in RIKS-HIA who had been diagnosed with myocardial infarction during the measurement period.

Diagnosis	**ICD-10**
Acute myocardial infarction	I21, I22

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided.

Data sources

The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error

Differences among caregivers in the diagnostication of acute myocardial infarction may occur.

RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain underreporting of the number of patients with a myocardial infarction.

Fatality rate within 28 and 365 days in ST-segment elevation myocardial infarction (B26)

Measure

The percentage of deaths within 28 and 365 days, respectively, after ST-segment elevation myocardial infarction or left bundle branch block between 2005 and 2006. Age-standardised values.

Description

The measure shows the percentage of all cases of acute ST-segment elevation myocardial infarction or left bundle branch block that resulted in death 28 and 365 days, respectively, after the infarction.

Numerator: The number of deaths within 0 to 27 and 28 to 365 days, respectively.

Denominator: The total number of patients treated for ST-segment elevation myocardial infarction.

The indicator reflects both the results of emergency treatment and also of secondary preventive measures after discharge from hospital.

Method of measurement

Data have been obtained from the database of the RIKS-HIA quality register using the following ICD- and ATC-codes and criteria:

Diagnosis	ICD-10
Acute myocardial infarction	I21, I22

In addition to a diagnosis of myocardial infarction ST-segment elevation or left bundle branch block on an ECG is required.

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided.

Data sources The Register of Information and Knowledge about Swedish Intensive Care Admissions - RIKS-HIA

Sources of error RIKS-HIA includes primarily patients with a myocardial infarction who are treated at a myocardial infarction unit or the equivalent, which means that there is a certain under-reporting of the number of patients with a myocardial infarction.

Coronary artery by-pass surgery – 30-day case fatality rate (B27)

Measure The percentage of deaths within 30 days of a coronary artery operation, 2006-2007. Refers to patients >18 years.

Description The indicator shows the percentage of patients who died within 30 days of undergoing a coronary artery operation.

Numerator: The number of deaths within 30 days of first-time coronary artery surgery.

Denominator: The total number of all patients undergoing first-time coronary artery surgery during the measurement period.

The indicator measures quality with regard to care and treatment in conjunction with coronary artery surgery.

Method of measurement

Data have been obtained from the database of the national quality register, the Swedish Cardiac Surgery Register. Coronary artery surgery refers to coronary surgery and coronary surgery non-ECC operation groups 2 and 12 as defined in the Swedish Cardiac Surgery Register. Combined interventions such as valve and coronary artery surgery are not included in the measure. Only patients >18 years, who underwent their first coronary artery operation, are included in the records.

At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources

The Swedish Cardiac Surgery Register

Re-operation after a coronary artery by-pass surgery (B28)

Measure

The percentage of patients who needed a second round of surgery after a coronary artery operation, between 2006 and 2007. Refers to a re-operation due to sternum complications.

Description

The indicator measures the percentage of patients who after undergoing cardiovascular surgery are forced to have a second operation due to complications in the form of sternum insufficiency and/or mediastinitis.

Numerator: The number of patients undergoing a re-operation on the sternum or mediastinum during hospitalisation as a post-operative event in cardiovascular surgery.

Denominator: All patients who underwent cardiovascular surgery.

The indicator measures process quality in conjunction with care and treatment in hospital.

Method of measurement

Data have been obtained from the database of the national quality register, the Swedish Cardiac Surgery Register. Coronary artery surgery refers to coronary surgery and coronary surgery non-ECC operation groups 2 and 12 as defined in the Swedish Cardiac Surgery Register. Combined interventions such as valve and coronary artery surgery are not included in the measure.

The definition of a sternum re-operation according to page 31 of the 2007 annual report of The Swedish Cardiac Surgery Register, deep infections or sternum instability that commenced during the first hospitalisation, i.e., complications that affected the sternum after cardiac surgery.

Patients of all ages are included.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources

The Swedish Cardiac Surgery Register

Sources of error

Many complications do not become evident until the patient has left the hospital; these are then addressed during a second hospitalisation and are not included in these statistics. This also means that the duration of medical care may affect the reported incidence.

Smoking cessation after myocardial infarction (B29)

Measure

The percentage of smokers who had stopped smoking according to a follow-up 6 to 10 weeks after myocardial infarction, between 2006 and 2007. Refers to patients <75 years.

Description

The indicator refers to patients who were smokers at the time of their myocardial infarction. It measures how many of them stopped smoking as a post-operative event after the infarction.

Numerator: The number of former smokers who stopped smoking according to a follow-up 6 to 10 weeks after myocardial infarction.

Denominator: The total number of myocardial infarction patients who were smokers when they had a myocardial infarction.

The indicator measures the results of secondary preventive measures within both hospital and primary care.

Method of measurement

Data have been obtained from the database of the national quality register SEPHIA using the following ICD-codes:

Primary or Secondary Diagnosis	**ICD-10**
Myocardial infarction	I21, I22

Follow-up took place 6 to 10 weeks after myocardial infarction, either at a clinic or by means of a telephone call.

The age limitation for this comparison has been set at 75 year due to the technical requirements of the register.

The comparison is based on a two-year measurement period in order to allow a hospital-level record, which increases the number of cases and thus decreases the statistical uncertainty.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The national quality register SEPHIA

Sources of error A number of hospitals do not report their data to SEPHIA; the participation rate in 2007 was around 45%, which diminishes the statistical basis for the indicator.

Full-time sick leave after myocardial infarction (B30)

Measure The percentage of patients on full-time sick leave 6 to 10 weeks after myocardial infarction, between 2006 and 2007. Refers to patients previously fit for work.

Description The indicator refers to patients of working age who were gainfully employed at the time of their myocardial infarction. The measure shows the percentage of those who were on full-time sick leave at follow-up 6 to 10 weeks after the myocardial infarction.

Numerator: The number of myocardial infarction patients previously fit for work who are on full-time sick leave 6 to 10 weeks after myocardial infarction.

Denominator: All myocardial infarction patients previously fit for work.

The indicator measures process quality and highlights the doctor's assessment of the fitness for work of the myocardial infarction patient and the results of the dialogue between the patient and the doctor on this issue. It is advisable that the infarction patient should return to work as soon as possible.

Method of measurement Data have been obtained from the database of the national quality register SEPHIA. Follow-up took place 6 to 10 weeks after myocardial infarction, either at a clinic or by means of a telephone call.

The age limitation for this comparison has been set at 75 year due to the technical requirements of the register.

The comparison is based on a two-year measurement period in order to allow a hospital-level record, which increases the number of cases and thus decreases the statistical uncertainty.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided.

Data sources National quality register SEPHIA

Sources of error A number of hospitals do not report their data to SEPHIA; the participation rate in 2007 was around 45 %, which diminishes the statistical basis for the indicator.

Avoidable in-patient care in atrial fibrillation (C1)

Measure The number of persons treated and also the number of care episodes for atrial fibrillation or flutter during one year per 100,000 inhabitants.

Description The measure shows both the number of persons with any period of care for atrial fibrillation or flutter and also the number of care episodes with these diagnoses per year and 100,000 inhabitants. The calculations are undertaken for care episodes where the primary diagnosis was one of atrial fibrillation or flutter.

The indicator aims to reflect how successful the healthcare is in treating patients with atrial fibrillation and reflects efforts within both primary and specialist care. The expression ”avoidable in-patient care" emphasises that the need for in-patient care can be influenced.

Method of measurement

Primary diagnosis	ICD-10
Atrial fibrillation or flutter	I48

Continuous hospitalisations have been merged into care episodes prior to calculation.

The calculations have been corrected for differences in the age structure of the myocardial infarction patients among different county councils. Age standardisation was undertaken using the age composition of the myocardial population in 2000 as the standard population, which was used for both men and women.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register, The National Board Of Health and Welfare

Sources of error Differences among caregivers in the diagnostication of atrial fibrillation may occur.

The most common method of restoring a normal heart rhythm is known as DC conversion (electric shock). This can be registered as an outpatient visit or in-patient care. If variation practice varies from one hospital to another, this will affect the comparison.

Warfarin treatment in patients with atrial fibrillation and an additional risk factor (C2)

Measure The percentage treated with Warfarin January to June 2008 from among patients with atrial fibrillation and a risk factor, between 2005 and 2007.

Description The indicator refers to patient treated in hospital for atrial fibrillation, and who also have a complicating risk factor. The measure measures the percentage of those who were treated with the anti-coagulant drug Warfarin.

Numerator: The number of patients with atrial fibrillation and at least one risk factor who were treated with Warfarin.

Denominator: The total number of patients with atrial fibrillation and at least one risk factor.

The measure reflects process quality within both in-patient and primary care with regard to the treating physician's assessment of the prescription of secondary preventive drugs and his/her decision to do so in conjunction with care and treatment of atrial fibrillation.

Method of measurement

Data have been obtained from the database of the Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare, using the following criteria:

- Patients with atrial fibrillation as a primary or secondary diagnosis (ICD-code I48) who were treated in hospital and who have one or more of the following risk factors:
- Ischemic stroke or TIA (treated in hospital between 1997 and 2007, as a primary or secondary diagnosis).
- Heart failure (treated in hospital between 1997 and 2007, as a primary or secondary diagnosis with ICD10-code I50.0, I50.1, I50.9, I42.0, I42.6).
- Aged 75 years and older.
- Diabetes (use of diabetes drugs (ATC-code A10) during the period from 1/1-2008 up to and including. 30/6-2008).
- Hypertension (treated in hospital during 1997-2007, as a primary or secondary diagnosis, ICD10-codes I10-I15).
- Mechanical artificial heart valve implanted (treated in hospital during 1997-2007, as a primary diagnosis, ICD10-codes Z95.2).
- Mitral stenosis (treated in hospital during 1997-2007, as a primary or secondary diagnosis, ICD10-codes I34.2, I05.0, I05.2).

To measure the use of Warfarin data have been extracted from the Swedish Prescribed Drugs Register relating to drugs collected from pharmacies during the first six months of 2008. ATC code:

Drugs	ATC-code
Warfarin	B01A A03

Data sources

The Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare.

Sources of error

Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drugs Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

It is not possible to pinpoint diabetics who control their disease by means of diet and exercise, i.e., without the use of drugs.

Pacemaker type in sick sinus syndrome (C3)

Measure

The percentage of patients who received an AAI/DDD pacemaker for a sick sinus between 2006 and 2007. Refers to patients treated with a pacemaker <90 years.

Description

The indicator measures the percentage of patients with a sick sinus who have a type AAI/DDD pacemaker implanted. It is these modes that are recommended in the national guidelines rather than those of type VVI.

Numerator: The total number of patients who had en AAI/DDD pacemaker implanted for a sick sinus.

Denominator: All patients who have pacemaker due to a sick sinus.

The indicator reflects process quality in hospital in conjunction with the treating physician's choice of treatment method in the care and treatment of a sick sinus.

Method of measurement

Data have been obtained from the national quality register, The Swedish Pacemaker and ICD Registry using the following criteria:

Patients <90 years with ECG codes E4 (SSS, sinus arrest, bradycardia) or E5 (SSS, tachybradia) are included in the documentation.

DDD pacemakers are defined as boxes with sub-type DDD and DDDR.

AAI pacemakers are defined as boxes with subtype SSI and SSIR with pacing modes AAI and AAIR.

The comparison is based on a two-year measurement period in order to allow a hospital-level record, which increases the number of cases and thus decreases the statistical uncertainty.

At the county-council level the place of residence of the patients is used to match them to the correct county councils. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided.

Data sources

The Swedish Pacemaker and ICD Registry

Complications in pacemaker and ICD-implantation (C4)

Measure The percentage of patients who suffered complications during the insertion or replacement of a standard pacemaker, a failure pacemaker (CRT) or an implantable defibrillator (ICD), between 2006 and 2007.

Description The indicator shows the percentage of patients who were affected within 365 days by complications in a new implantation, replacement or correction of a standard pacemaker, a CRT pacemaker or an implantable defibrillator.

Numerator: The number of patients who are affected by complications in a new implantation or replacement of standard pacemakers, ICD or CRT.

Denominator: The total number of patients who underwent a new implantation or replacement of a standard pacemaker, ICD or CRT during the measurement period.

Method of measurement Data have been obtained from the national quality register, The Swedish Pacemaker and ICD Registry.

A complication is defined as a problem that can be attributed to an implantation of a standard pacemaker, ICD or CRT and which occurs within 365 days of the surgery. Typical complications are perforation/tamponade, infections, bleeding, and electrical interference.

The comparison is based on a two-year measurement period in order to allow a hospital-level record, which increases the number of cases and thus decreases the statistical uncertainty.

At the county-council level the place of residence of the patients is used to match them to the correct county councils. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided.

Data sources The Swedish Pacemaker and ICD Registry.

Number of ICD implantations (C5)

Measure The number of patients who received an implantable defibrillator per 100,000 inhabitants, 2006-2007. Refers to new insertions. Age-standardised values.

Description The indicator shows the number of insertions of an implantable pacemaker per 100,000 inhabitants in the different county councils.

Numerator: The number of patients with impaired left ventricular function (EF<35%) and in function class NYHA II-III more that three months after myocardial infarction, or patients with heart failure and EF<35% and in function class NYHA II-III who received an implantable defibrillator.

Denominator: Population per 100,000 inhabitants.

Method of measurement Data have been obtained from the national quality register, The Swedish Pacemaker and ICD Registry.

All new insertions of implantable defibrillators, as primary and secondary preventive measures, are shown in the comparison.

The comparison is based on a two-year measurement period in order to allow a hospital-level record, which increases the number of cases and thus decreases the statistical uncertainty.

At the county-council level the place of residence of the patients is used to match them to the correct county councils.

Data sources The Swedish Pacemaker and ICD Registry.

Sources of error Small volumes allow greater scope for random variations. The need for the treatment method may vary both over time and geographically.

Avoidable in-patient care in heart failure (D1)

Measure The number of persons who were treated for heart failure and also the number of care episodes per 100,000 inhabitants during one year.

Description The measure shows both the number of persons with any care episode for heart failure and the number of care episodes with this diagnosis per year and 100,000 inhabitants. These calculations are performed for care episodes where heart failure was the primary diagnosis.

The indicator aims to reflect how successful the healthcare is in treating patients with heart failure and reflects efforts within both primary and specialist care. The expression ”avoidable in-patient care" emphasises that the need for in-patient care can be influenced.

Method of measurement

Primary diagnosis	ICD-10
Heart failure	I50, I110, I420, I426

Continuous hospitalisations have been merged into care episodes prior to calculation.

The calculations have been corrected for differences in the age structure of the patients among different county councils. Age standardisation was undertaken using the age composition of the national population in 2000 as the standard population, which was used for both men and women.

Data sources The Patient Register, The National Board of Health and Welfare.

Sources of error Differences among caregivers in the diagnostication of heart failure may occur.

RAAS inhibitor in heart failure (D2)

Measure The percentage of patients on RAAS inhibitors after hospital treatment for heart failure in 2007. Refers to patients <80 years and drug treatment 0-6 months after discharge.

Description The indicator refers to patients with a diagnosis of heart failure who were treated as in-patients, and the percentage of those who were treated with RAAS inhibitors, i.e., ARB or ACE inhibitors.

Numerator: The number of heart failure patients <80 years who received treatment with ACE inhibitor or ARB, individually or in combination with each other.

Denominator: The total number of heart failure patients <80 years.

The measure reflects the process quality of the hospital with regard to the treating physician's assessment of the prescription of drug treatment of heart failure and his/her decision to do so.

Method of measurement Data have been obtained from The Patient Register and The Prescribed Drugs Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Diagnosis	ICD-10
Heart failure	I50, I42.0

Drugs	ATC-code
ACE inhibitor and ARB	C09 (all except X)

The comparison includes all patients with a primary diagnosis of heart failure who are alive during the relevant measurement period.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contraindication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of the age limit < 80 years. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drugs Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

Beta-blockers in heart failure (D3)

Measure

The percentage of patients on beta-blockers after hospital treatment for heart failure in 2007. Refers to patients <80 years and drug treatment 0-6 months after discharge.

Description

The indicator refers to patients with a diagnosis of heart failure who were treated as in-patients, and the percentage of those who were treated with beta-blockers 0 to 6 months after discharge from the hospital.

Numerator: The number of patients <80 years with heart failure who receive treatment with beta-blockers 0-6 months after discharge from hospital.

Denominator: The total number of patients <80 years with heart failure.

The measure reflects the process quality of the hospital with regard to the treating physician's assessment of the prescription of drug treatment of heart failure and his/her decision to do so.

Method of measurement

Data have been obtained from The Patient Register and The Prescribed Drugs Register, The National Board of Health and Welfare, using the following ICD- and ATC-codes:

Diagnosis	**ICD-10**
Heart failure	I50, I42.0

Drugs	**ATC-code**
Beta-blockers	C07A

The comparison includes all patients with a primary diagnosis of heart failure who are alive during the relevant measurement period.

An age limit of 80 years has been set as patients of more advanced years with a myocardial infarction to a higher degree have other concomitant illnesses that are a contra-indication for the treatment in question. This may obstruct accurate comparisons between hospitals that have different proportions of elderly patients. As a comparison/quality indicator the measure is made more accurate through the use of the age limit < 80 years. However, in clinical practice individual consideration must naturally be given to the treatment of all patients regardless of age.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council where they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and The Swedish Prescribed Drugs Register, The National Board of Health and Welfare.

Sources of error Divergent diagnosis criteria at the different county councils may affect population size.

Lack of compliance by the patient may result in a failure to have the prescription filled despite the doctor's prescription.

The Swedish Prescribed Drugs Register does not include drugs obtained from a drugs cupboard at an old age home or over-the-counter non-prescription drugs, which may lead to an underestimate of drugs use by the elderly. Furthermore, this register contains information only about drugs supplied by pharmacies, which may result in an underestimate of the quantity of drugs prescribed.

The number of implanted pacemakers for cardiac resynchronisation therapy (D4)

Measure The number of implanted failure pacemakers (CRT) per 100,000 inhabitants between 2006 and 2007. Age-standardised values.

Description The indicator shows the number of heart failure patients per 100,000 inhabitants who during the period from 2006 to 2007 had a failure pacemaker (CRT-P) or an ICD with CRT-function (CRT-D) inserted.

Numerator: The number of implantations of CRT in heart failure patients.

Denominator: Population per 100,000 inhabitants.

Method of measurement Data have been obtained from the national quality register, The Swedish Pacemaker and ICD Registry. The patients were registered with symptom D2 heart failure in the Pacemaker- and ICD-register and had undergone implantation of an electrode in the left auricle. Insertion of both CRT-P (pacemakers) and CRT-D (defibrillators) is included.

The comparison is based on a two-year measurement period in order to increase the number of cases and decrease the statistical uncertainty. To diminish the effect of age variations, age-standardised values are used.

At the county-council level the place of residence of the patients is used to match them to the correct county councils.

Data sources The Swedish Pacemaker and ICD Registry.

Sources of error Small volumes allow greater scope for random variations. The need for the treatment method may vary both over time and geographically.

Dead or re-admitted 30 days after heart failure (D5)

Measure The percentage of dead or re-admitted within 30 days of heart failure.

Description The measure states the percentage of patients who within 30 days of discharge either had died or were re-admitted to hospital with a diagnosis of heart failure.

The causes of this re-admission may include premature discharge of heart failure patients, inadequate drug treatment or patients receiving excessively poor information about this disease. Avoidable re-admissions are a quality defect that cause both greater patient suffering and higher healthcare costs.

Method of measurement

Primary diagnosis	ICD-10
Heart failure	I50, I110, I420, I426

Continuous hospitalisations have been merged into care episodes prior to calculation. Only cases of heart failure where the patient had not been treated for this condition during the preceding 365-day period were followed up.

The date of death was obtained from the Cause of Death Register.

The calculations have been corrected for differences in the age structure of the patients among different county councils. Age standardisation was undertaken using the age composition of the national population in 2000 as the standard population, which was used for both men and women

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county. At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources The Patient Register and Cause of Death Register, The National Board of Health and Welfare.

Sources of error Differences among caregivers in the diagnostication of heart failure may occur.

Waiting times for valve surgery (E1)

Measure Waiting times for valve surgery, median time between decision and completed operation in 2007. Number of days.

Description The indicator measures the median waiting time in days from taking a decision to operate until the operation is performed.

The measure reflects process quality in hospital care and treatment by measuring the period of time between diagnostication and treatment.

Method of measurement Data have been obtained from the database of the national quality register, The Swedish Cardiac Surgery Register. The measure includes all cardial localisation of valve defects, first-time surgery and re-operations as well as multiple valves, but not combination interventions of other surgery including aortic vessels. The patient sample thus corresponds to operation group 1 in accordance with the terminology of the Swedish Cardiac Surgery Register (The 2007 Annual Report of the Swedish Cardiac Surgery Register). Operation group 1 implies isolated valve surgery, i.e., interventions restricted to one or several heart valves. This includes both operations to insert artificial valves and valve repair interventions.

Patients of all ages are included.

The geographical distribution was undertaken on the basis of the patients' home county, which means that even healthcare at a hospital in a different county was recorded as having been given within the home county.

At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources The Swedish Cardiac Surgery Register.

Sources of error Irregular administration of waiting lists may occur, which can result in errors in waiting-time statistics.

30-day case fatality rate after valve surgery (E2)

Measure The percentage of deaths within 30 days of a heart valve operation between 2006 and 2007. Refers to patients >18 years.

Description The indicator shows the percentage of patients who died within 30 days of a completed heart valve operation.

Numerator: The number of patients who died within 30 days of complete valve surgery.

Denominator: The total number of patients >18 years who underwent valve surgery.

The 30-day case fatality rate after heart valve surgery is a measure of the quality of the operative intervention and the postoperative care. The results are also affected to a considerable degree by the patients' condition prior to the operation and the type of surgery performed at the various units (case mix).

Method of measurement Data have been obtained from the database of the national quality register, The Swedish Cardiac Surgery Register. The patient sample includes adult patients >18 years, all with cardial localisation of valve defects, first-time surgery and re-operations as well as multiple valves, but not combination interventions of other surgery including aortic vessels.

At hospital level all patients treated at and discharged from the clinic are recorded irrespective of the county council in whose area they resided. The first hospital in the care chain is recorded.

Data sources The Swedish Cardiac Surgery Register.

Sources of error No account has been taken of the patients' degree of illness prior to the operation, which may have a random effect on the case fatality. Different indications for heart valve surgery may occur.

Heart disease mortality for children and young people (E3)

Measure The number and percentage of children and young people below 18 who died of heart disease between 1997 and 2006.

Description The indicator shows how many children and young people below 18 who died of heart disease throughout the country during the measurement period. The account gives both the actual figures and the number of deaths per 100,000 children and young people.

The indicator reflects the ability of the healthcare service to discover and treat heart illness and prevent premature deaths from heart disease among children and young people.

Method of measurement

Underlying cause of death	ICD-10
Heart diagnoses	I20-I25, I30-I52

The results are shown per 100,000 inhabitants in the age groups below 18 and for five-year periods.

Data sources The Causes of Death Register, The National Board of Health and Welfare.