

## Socioeconomic differences in the burden of disease in Sweden

Rickard Ljung,<sup>1</sup> Stefan Peterson,<sup>2</sup> Johan Hallqvist,<sup>3</sup> Inger Heimerson,<sup>4</sup> & Finn Diderichsen<sup>5</sup>

**Objective** We sought to analyse how much of the total burden of disease in Sweden, measured in disability-adjusted life years (DALYs), is a result of inequalities in health between socioeconomic groups. We also sought to determine how this unequal burden is distributed across different disease groups and socioeconomic groups.

**Methods** Our analysis used data from the Swedish Burden of Disease Study. We studied all Swedish men and women in three age groups (15–44, 45–64, 65–84) and five major socioeconomic groups. The 18 disease and injury groups that contributed to 65% of the total burden of disease were analysed using attributable fractions and the slope index of inequality and the relative index of inequality.

**Findings** About 30% of the burden of disease among women and 37% of the burden among men is a differential burden resulting from socioeconomic inequalities in health. A large part of this unequally distributed burden falls on unskilled manual workers. The largest contributors to inequalities in health for women are ischaemic heart disease, depression and neurosis, and stroke. For men, the largest contributors are ischaemic heart disease, alcohol addiction and self-inflicted injuries.

**Conclusion** This is the first study to use socioeconomic differences, measured by socioeconomic position, to assess the burden of disease using DALYs. We found that in Sweden one-third of the burden of the diseases we studied is unequally distributed. Studies of socioeconomic inequalities in the burden of disease that take both mortality and morbidity into account can help policy-makers understand the magnitude of inequalities in health for different disease groups.

**Keywords** Cost of illness; Socioeconomic factors; Disabled persons; Mental disorders/epidemiology; Cardiovascular diseases/epidemiology; Chronic disease/epidemiology; Quality-adjusted life years; Epidemiologic studies; Sweden (*source: MeSH, NLM*).

**Mots clés** Coût maladie; Facteur socioéconomique; Handicapé; Troubles mentaux/épidémiologie; Maladie chronique/épidémiologie; Rapport qualité vie-survie; Etude analytique (Epidémiologie); Suède (*source: MeSH, INSERM*).

**Palabras clave** Costo de la enfermedad; Factores socioeconómicos; Personas incapacitadas/epidemiología; Trastornos mentales/epidemiología; Enfermedad crónica/epidemiología; Calidad de acuerdo a los años de vida; Estudios epidemiológicos; Suecia (*fuentes: DeCS, BIREME*).

الكلمات المفتاحية: تكلفة المرض، العوامل الاقتصادية والاجتماعية، المصابون بالعجز، الاضطرابات النفسية، وبائيات (إبيديميولوجيا) الاضطرابات النفسية، المرض القلبي الوعائي، وبائيات (إبيديميولوجيا) المرض القلبي الوعائي، المرض المزمن، وبائيات (إبيديميولوجيا) المرض المزمن، سنوات العمر المصححة باحتساب جودة الحياة، دراسات وبائية (إبيديميولوجية)، السويد. (المصدر: رؤوس الموضوعات الطبية المكتب الإقليمي لشرق المتوسط)

Bulletin of the World Health Organization 2005;83:92-99.

Voir page 98 le résumé en français. En la página 98 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 99.

### Introduction

Burden of disease measurements that use disability-adjusted life years (DALYs) have been carried out at international, national and subnational levels in high-income, medium-income and low-income countries (1–5). The burden of disease has also been disaggregated by risk factors (6–8) as a basis for making projections about health gains from population interventions (9). DALYs have also been used to estimate the global burden of disease among the poor (10). There have also been recommendations that a more comprehensive list of both distal and proximal

risk factors should undergo further analysis at the national level (6). A distal risk factor of key concern to policy-makers is socioeconomic position (11, 12). A vast body of literature exists on measuring health differentials across socioeconomic groups, and applicable methods have been summarized by Mackenbach & Kunst (13). However, the use of overall levels without causes or cause-specific comparisons does not lend itself to targeting interventions at diseases and risk factors that cause health differentials. Measuring the cause-specific burden of disease by socioeconomic group would fill this need.

<sup>1</sup> Medical doctor, Department of Public Health Sciences, Division of Social Medicine, Karolinska Institutet, Norrbacka S-171 76 Stockholm, Sweden (email: rickard.ljung@smd.sll.se). Correspondence should be sent to this author.

<sup>2</sup> Medical doctor, Department of Public Health Sciences, Division of International Health (IHCAR), Karolinska Institutet, Stockholm, Sweden.

<sup>3</sup> Associate Professor, Department of Public Health Sciences, Division of Social Medicine, Karolinska Institutet, Stockholm, Sweden.

<sup>4</sup> Medical doctor, Department of Public Health Sciences, Division of Social Medicine, Karolinska Institutet, Stockholm, Sweden.

<sup>5</sup> Professor, Department of Social Medicine, Institute of Public Health, University of Copenhagen, Copenhagen, Denmark.

Ref. No. 03-009886

(Submitted: 9 December 2003 – Final revised version received: 9 October 2004 – Accepted: 20 October 2004)

Therefore, using data from the Swedish Burden of Disease Study 1998 (14) we set out to analyse how much of the total burden of disease is due to inequalities in health between socioeconomic groups and how this unequal burden is distributed over different disease groups and socioeconomic groups. We also studied the absolute and relative differences in the burden of disease in Sweden by socioeconomic group.

## Material and methods

### The Swedish Burden of Disease Study

DALYs measure the combined burden of mortality and disability for different diseases. DALYs are composed of years of life lost (YLL) and years lived with disability (YLD) (15). The Swedish Burden of Disease Study aimed to document disease burden as a basis for formulating national health policy goals (14). The focus on the present burden of disease, together with the use of data from national health interview surveys and inpatient registers led to some methodological modifications of the standard DALY in the 1998 study. In calculating the burden for an average year during the period 1988–95, global disability weights were used but they were not discounted or age-weighted. The life expectancy at birth was set to 80 years for men and 82.5 years for women. The prevalence of conditions was used to calculate the morbidity burden because the aim was to focus on the present burden of disease; the incidence of deaths was used to calculate the mortality burden. For a discussion of the values of these choices see Murray et al. (16).

The Swedish Burden of Disease Study calculated the burden of disease for 141 disease and injury groups. The national cause-of-death registry was used to calculate YLLs by using the underlying cause of death. The reliability of this register has been found to be satisfactory (17). Population-based inpatient registers, national survey information and expert judgements on the prevalence of morbidity were used to calculate YLDs. Comorbidity was not taken into account. The 20 disease and injury groups that contributed the most to the burden of disease in Sweden accounted for 70% of the total burden (Table 1) (14).

In our study, we analysed 18 of the 20 disease groups. Perinatal diseases and sudden infant death syndrome in both sexes were excluded. Prostate cancer and gynaecological cancers were also excluded because these do not occur in both sexes. The absolute values, YLLs and YLDs by sex, age group and disease and injury group are fixed in our study and are taken directly from the earlier study (14). The 18 diseases that we analysed accounted for 65% of the burden of disease in Sweden.

### Study base

Data from the Swedish Burden of Disease Study form the basis for our analysis. We have restricted the analysis to all Swedish men and women in three age groups (15–44, 45–64 and 65–84) and five major socioeconomic groups for the study period 1988–95 (Table 2).

Table 1. **The 20 disease and injury groups found by the Swedish Burden of Disease Study to contribute most to the burden of disease in Sweden.** Total number of disability-adjusted life years (DALYs) and the percentage of the total for an average year are given for 1988–95

Men			Women		
Disease group and rank	DALY	%	Disease group and rank	DALY	%
1. Ischaemic heart disease	200 277	19.2	1. Ischaemic heart disease	133 985	13.7
2. Depression and neurosis	69 046	6.6	2. Depression and neurosis	106 527	10.9
3. Stroke	60 975	5.8	3. Stroke	67 767	6.9
4. Alcohol addiction	46 693	4.5	4. Dementia	61 188	6.3
5. Self-inflicted injuries	44 217	4.2	5. Breast cancer	29 851	3.1
6. Dementia	32 801	3.1	6. Asthma and COPD	27 769	2.8
7. Asthma and COPD <sup>a</sup>	29 242	2.8	7. Psychosis excluding schizophrenia	24 931	2.6
8. Bronchial and lung cancer	28 197	2.7	8. Neck and back disease	22 876	2.3
9. Traffic accidents	24 266	2.3	9. Respiratory infections	20 136	2.1
10. Psychosis excluding schizophrenia	24 140	2.3	10. Gynaecological cancer	20 014	2.0
11. Prostate cancer	23 734	2.3	11. Self-inflicted injuries	19 334	2.0
12. Hearing disorder	22 132	2.1	12. Colorectal cancer	17 926	1.8
13. Respiratory infections	21 059	2.0	13. Congenital malformations	17 324	1.8
14. Neck and back disease	20 085	1.9	14. Bronchial and lung cancer	16 689	1.7
15. Congenital malformations	18 696	1.8	15. Hearing disorder	16 040	1.6
16. Colorectal cancer	17 886	1.7	16. Diabetes	16 037	1.6
17. Diabetes	16 339	1.6	17. Alcohol addiction	13 427	1.4
18. Falls	14 010	1.3	18. Falls	12 385	1.3
19. Blood malignancies	13 901	1.3	19. Traffic accidents	11 828	1.2
20. Perinatal disease and SIDS <sup>b</sup>	13 502	1.3	20. Perinatal disease and SIDS	11 526	1.2
Subtotal	741 198	71	Subtotal	667 560	68
Others	305 692	29	Others	309 834	32
<b>Total</b>	<b>1 046 890</b>	<b>100</b>	<b>Total</b>	<b>977 394</b>	<b>100</b>

Source: 14.

<sup>a</sup> COPD = chronic obstructive pulmonary disease.

<sup>b</sup> SIDS = sudden infant death syndrome.

Table 2. Distribution of men and women by socioeconomic group and age during an average year in Sweden, 1988–95<sup>a</sup> (See the Annex (web version only, available at: <http://www.who.int/bulletin>) for information on the socioeconomic classifications)

	Age group	Socioeconomic category					Omitted groups	Total
		Manual		Non-manual				
		Unskilled	Skilled	Lower	Intermediate	Higher		
Women	15–44	8.0	2.2	5.0	3.1	0.7	29.0	48.0
	45–64	10.1	1.7	6.3	4.0	1.5	5.7	29.2
	65–84	8.2	0.7	2.8	1.5	0.4	9.2	22.8
<b>Total<sup>b</sup></b>		<b>26.3</b>	<b>4.5</b>	<b>14.1</b>	<b>8.5</b>	<b>2.6</b>	<b>44.0</b>	<b>100</b>
Men	15–44	8.1	6.9	2.2	3.0	1.3	29.9	51.4
	45–64	7.5	6.9	3.2	6.5	3.6	2.0	29.7
	65–84	5.1	3.9	2.2	4.0	1.5	2.0	18.8
<b>Total<sup>b</sup></b>		<b>20.7</b>	<b>17.7</b>	<b>7.5</b>	<b>13.6</b>	<b>6.5</b>	<b>34.0</b>	<b>100</b>

<sup>a</sup> Based on calculation of person-years during the period 1988–95.

<sup>b</sup> Totals do not sum exactly due to rounding of decimals.

## DALYs

Total absolute YLLs and YLDs for each disease and injury group were distributed over socioeconomic groups. We took into account the size of each socioeconomic group as well as the specific relative risk of each disease and injury group for each socioeconomic group stratified by age and sex. Two sources of information were used to determine the relative risks by socioeconomic group. Our first source was the Social Database managed by the Swedish National Board of Health and Welfare; this database contains information on all deaths and patients being treated in hospital as well as information on socioeconomic and demographic data linked together by personal identification number. The socioeconomic information in this database is based on occupational information reported during national censuses; the most recent was performed in 1990 (18). Our second source was the Swedish Survey of Living Conditions, which is conducted yearly using a nationally representative sample. It contains information on self-reported illness, health-care utilization and socioeconomic factors (19).

## Years of life lost (YLL)

Mortality rates for each of the 18 diseases studied were classified by socioeconomic group and stratified by age and sex using data from the above mentioned Social Database for the period 1988–95. Relative mortality risks were derived from these.

## Years lived with disability (YLD)

The years lived with a disability were calculated as follows.

- For bronchial, lung, breast, and colorectal cancer, and blood malignancies it was assumed that the relative risk of morbidity was the same as the relative risk of mortality.
- For self-inflicted violence, ischaemic heart disease and respiratory infections the YLL accounted for more than 90% of the total DALY, therefore the relative risk used for mortality was also used for morbidity.
- For alcohol addiction, dementia, psychosis (excluding schizophrenia), traffic accidents, falls and stroke, the prevalence ratio for the first three diseases and the incidence rate ratio for the latter three were based on data on patients treated in hospital between 1991 and 1994. These data were derived from the Social Database.

- For back and neck disease, asthma and chronic obstructive pulmonary disease disorder, depression and neurosis, hearing disorders, and diabetes, the prevalence ratio was derived from self-reports on long-standing illness from the Swedish Survey of Living Conditions (19).

## Socioeconomic groups

The final analysis is restricted to the five major socioeconomic groups of unskilled manual workers, skilled manual workers, lower non-manual workers, intermediate non-manual workers and higher non-manual workers as defined by the socioeconomic classifications of Statistics Sweden (18). (See the Annex (web version only, available at: <http://www.who.int/bulletin>) for an explanation of these groups.)

People who were self-employed, farmers and those whose status was unclassified were omitted; they accounted for 34% of the person-years in men and 44% in women. Additionally, they accounted for 44% of the disease burden in men and 51% of the burden in women. The self-employed are a socioeconomically heterogeneous group. Sweden has few farmers. The largest group contains those whose status is unclassified; many of them are in the youngest age group and they had not yet entered the labour market at the time of the most recent census. They cannot therefore be categorized in the socioeconomic classification system (Table 2). The remainder of those who are unclassified are a mixture of people for whom information is missing, who retired early, those who have been excluded from the labour market and a small number of students and military conscripts. People who were ill with severe diseases, e.g. schizophrenia, and have never been in the labour market may also be unclassified. By restricting our analysis to 18 disease and injury groups and five socioeconomic groups we are able to study one-third of the total measured burden of disease in Sweden.

## Statistical analysis

We have studied the differential burden of disease by assuming the counterfactual distribution of exposure based on the principle of plausible minimal risk: that is, all socioeconomic groups have the same risk as the most affluent group. Previous studies have attributed the burden of disease to specific risk factors (6, 9, 10). We have used the same method to analyse the burden of disease attributable to socioeconomic position.

In the analysis of attributable fractions in Fig. 1 and Fig. 2 the measure analysed is DALYs per socioeconomic group. The slope index of inequality is the slope of the regression line showing the relationship between a group's health and its relative rank in the socioeconomic distribution; this can be interpreted as the absolute difference in health between the least-advantaged and most-advantaged groups (13, 20–22). The relative index of inequality (as modified by Mackenbach & Kunst) is the ratio of the estimated rate of health problems occurring among those in the least-advantaged group to that occurring among those in the most-advantaged group (13). The measure studied for the slope index of inequality and the relative index of inequality is DALY per 100 000 person-years. There is no standard method of calculating random bias for the slope index of inequality and the relative index of inequality. We have chosen to use the recommended equation in Kakwani et al. (23). All calculations have been made using Excel version 5 and SAS statistical software version 8.1.

## Results

In women 30% of the burden of disease across socioeconomic groups is a differential burden resulting from socioeconomic inequalities (Fig. 1). Altogether 75% of this differential burden falls on unskilled workers. Ischaemic heart disease, depression and neurosis, and stroke account for more than half of the differential burden. Breast cancer accounts for about 1% of the differential burden but this differential affects those in the higher non-manual socioeconomic groups, thereby reducing the overall share of the differential burden that falls on the lower socioeconomic groups.

Among men more than one-third of the burden is a differential burden, half of which falls on unskilled workers.

Ischaemic heart disease, alcohol addiction and self-inflicted injuries account for one-half of the differential burden in men (Fig. 2).

Table 3 shows the absolute and relative differences in the burden of specific disease groups among women and men by socioeconomic group. For both sexes, ischaemic heart disease accounts for the greatest absolute difference in health between the least advantaged group and the most advantaged group.

For women, the disease group depression and neurosis carries the largest burden of disease, and it is the second greatest contributor to the absolute inequality in the burden of disease. In contrast to other diseases, however, breast cancer has an inequality that favours those in less-advantaged groups, with 338 more DALYs occurring per 100 000 person-years among women in the most-advantaged group compared with the least-advantaged. Alcohol addiction is the disease with the greatest relative inequality among women, followed by neck and back disease, ischaemic heart disease, diabetes and dementia.

Among men ischaemic heart disease is the largest contributor to inequalities in the burden of disease with a slope index of inequality more than double that of the second largest contributor (alcohol addiction). Self-inflicted injuries, depression and neurosis, neck and back disease, and stroke are other diseases with large absolute inequalities. Alcohol addiction, neck and back disease, and self-inflicted injuries also show large relative inequalities. In contrast to the findings for women, large relative inequalities occur for traffic accidents and falls among men.

The composition of the burden due to mortality and morbidity differs between disease groups (Table 3). For ischaemic heart disease and self-inflicted injuries more than 90% of the burden results from mortality. For two other large contributors

Fig. 1. Proportion of total DALYs attributable to adverse socioeconomic position for women aged 15–84 years during an average year in Sweden, 1988–95. The higher non-manual classification is the reference group. Figure shows burden of disease that would be eliminated if all people in Sweden were exposed to the same causal pattern as those in the reference group and how different disease groups contribute to excess burden of disease (see text for details). (Note: the differential burden of breast cancer is greater for women in the reference group.) Information on socioeconomic groups is given in the Annex

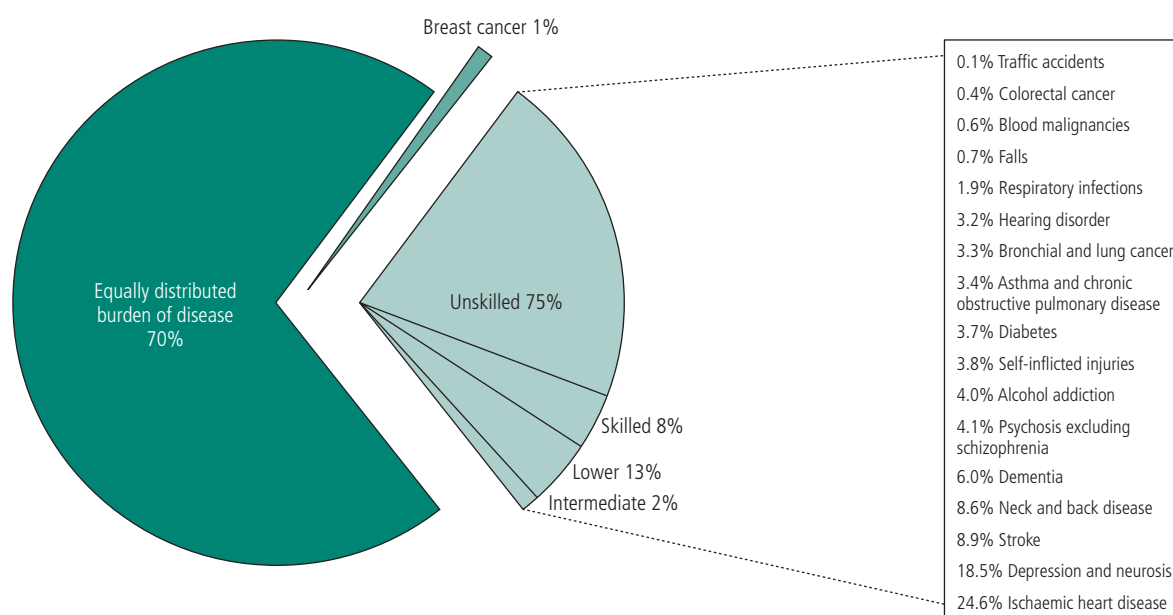
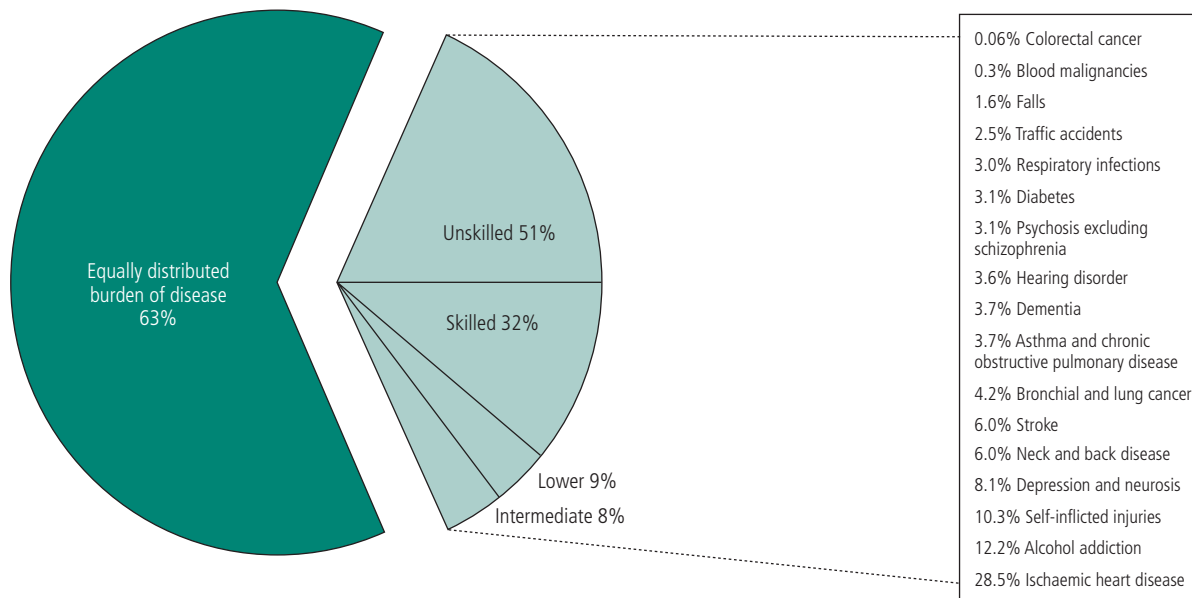




Fig.2. Proportion of total DALYs attributable to adverse socioeconomic position for men aged 18–84 years during an average year in Sweden, 1988–95. The higher non-manual classification is the reference group. Figure shows burden of disease that would be eliminated if all people in Sweden were exposed to the same causal pattern as those in the reference group and how different disease groups contribute to excess burden of disease (see text for details). Information on socioeconomic groups is given in the Annex



WHO 04.208

to absolute inequalities (depression and neurosis and neck and back disease) almost 100% of the burden results from morbidity. In women mortality accounts for 49% of the equally distributed burden and 54% of the differential burden; in men these figures are 63% and 60%, respectively (data not shown).

Precise calculations show that the unequal distribution is not the result of random bias. For the largest contributor to inequality, ischaemic heart disease among men, which has a slope index of inequality of 3616 DALYs per 100 000 person-years the 95% confidence interval (CI) is 2793–4439 DALYs per 100 000. For blood malignancies among women, a disease for which there are few cases and there is a much smaller inequality, the slope index of inequality is 48 DALYs per 100 000 (95% CI = -13–109 DALYs per 100 000).

## Discussion

This is the first study to use socioeconomic differences, measured by socioeconomic position, to assess the burden of disease using DALYs. The results show that in Sweden one-third of the burden of the diseases studied is unequally distributed. The unequal distribution falls to a large extent on unskilled manual workers. A few disease groups account for more than half of the unequal distribution. The diseases that account for most of the total burden of disease are also those that have the largest differentials in burden. With the exception of breast cancer, which is a large contributor of disease burden in women, inequality in the burden of disease implies that there is less disease burden among more-advantaged groups. Had we included other determinants of inequality, e.g. ethnicity, the unequally distributed burden would have been even greater.

The burdens of mortality and morbidity occur in the same proportions in the differential burden as they do in the

equally distributed burden. From this it is clear that people in manual groups not only die younger than those in non-manual groups but also suffer from more non-fatal diseases during their lifetime. Overall we found that among men there were greater absolute inequalities and greater relative inequalities in health than among women. The largest contributors to the burden of disease are similar for men and women. The exceptions were the larger contributors among men: alcohol addiction, self-inflicted injuries, bronchial and lung cancer, and traffic accidents.

We restricted our analysis to the 18 disease groups in the Swedish Burden of Disease Study that accounted for two-thirds of the total burden of disease. We suspect that if we were to analyse the entire burden of disease then the groups of rare diseases would have a more equal distribution across socioeconomic groups. This would increase the burden of equally distributed diseases and, as a consequence, decrease the differential burden. The Swedish Burden of Disease Study did not adjust for comorbidity. This is likely to affect diseases such as diabetes and ischaemic heart disease, thus increasing the differential burden. We studied the five major socioeconomic groups usually studied in Sweden (19). If the groups classified as self-employed, farmers and unclassified had been included, then the differential burden of disease resulting from socioeconomic distribution would be even larger, and both the slope index of inequality and the relative index of inequality would increase for each of the disease groups studied. Those who were classified as self-employed or as farmers have a burden of disease that is close to that found in the lower non-manual group (data not shown). The unclassified group has the highest burden for most of the diseases (data not shown). We suspect that this large group consists of relatively more manual than non-manual workers who are unemployed or who retired early because of illness or injury. This would lead to an underestimation of the social gradient for some of

Table 3. Slope Index of Inequality (SII), Relative Index of Inequality (RII), Years of Life Lost (YLL) and Years Lived with a Disability (YLD) per 100 000 person-years, by disease group, ranked by falling slope index of inequality (disability-adjusted life years per 100 000 person-years) for men and women aged 15–84 years during an average year in Sweden, 1988–95

Disease group	Men				Women				
	SII	RII <sup>a</sup>	YLL	YLD	Disease group	SII	RII <sup>a</sup>	YLL	YLD
Ischaemic heart disease	3616	2.03	4940	373	Ischaemic heart disease	1997	2.50	1933	400
Alcohol addiction	1549	11.26	267	659	Depression and neurosis	1502	1.72	12	2818
Self-inflicted injuries	1306	2.85	1355	4	Stroke	721	1.80	870	387
Depression and neurosis	1031	1.76	7	1859	Neck and back disease	698	2.90	2	714
Neck and back disease	765	4.07	2	630	Dementia	486	2.43	142	441
Stroke	763	1.65	1101	462	Psychosis excluding schizophrenia	334	1.90	11	526
Bronchial and lung cancer	534	1.94	818	16	Alcohol addiction	328	4.25	55	210
Asthma and COPD <sup>b</sup>	471	1.98	331	386	Self-inflicted injuries	310	1.68	600	7
Dementia	470	2.39	120	454	Diabetes	302	2.48	165	191
Hearing disorder	457	2.09	0	647	Asthma and COPD	279	2.40	229	380
Psychosis excluding schizophrenia	394	2.48	15	450	Bronchial and lung cancer	265	1.66	523	9
Diabetes	391	2.43	278	191	Hearing disorder	259	1.88	0	424
Respiratory infections	381	2.78	361	44	Respiratory infections	158	1.98	192	49
Traffic accidents	320	2.16	364	72	Falls	58	1.34	73	129
Falls	201	2.23	160	104	Blood malignancies	49	1.19	273	9
Blood malignancies	34	1.09	373	11	Colorectal cancer	33	1.07	429	39
Colorectal cancer	8	1.02	480	41	Traffic accidents	6	1.03	144	50
					Breast cancer	-338	0.70	900	59

<sup>a</sup> The Relative Index of Inequality is modified according to Mackenbach & Kunst (13).

<sup>b</sup> COPD = chronic obstructive pulmonary disease.

the diseases. This may be particularly true for major causes of early retirement: neck and back disease, psychiatric diseases and alcohol addiction. It could be argued that students whose socioeconomic status has not yet been classified will eventually belong to the intermediate and higher non-manual groups, and, accordingly, they would contribute DALYs to these groups, thus increasing the equally distributed burden. As the members of this group are young and have only a small burden of disease we do not believe their exclusion influenced our calculation of the differential burden to any great extent.

The DALY measure incorporates value judgements, e.g. disability weights, and can also incorporate discounting and age weighting. People in socioeconomic groups in the manual category die younger than those in the non-manual categories. Discounting would put proportionally less burden on future years of healthy life lost due to deaths and chronic diseases occurring at younger ages. This would narrow the gap between the burden of disease in the manual and higher non-manual socioeconomic groups. Age weighting, in which death and disease in older age are valued less than in younger age, could reduce the burden on the higher non-manual socioeconomic groups relatively more than on the manual groups. With age weighting, diseases that usually occur at a younger age, such as psychiatric disease and traffic accidents, would account for a relatively larger share of the total burden of disease.

In Europe, socioeconomic inequalities in health have been targeted as one of the most important issues to be tackled by public health policy (12). DALYs make it possible to quantify overall differences in the burden of disease and also make it possible to analyse which specific disease groups contribute most to socioeconomic inequalities in health while taking both

mortality and morbidity into account. This helps policy-makers understand overall and disease-specific inequalities in health and subsequently to target measures to address them. For example, the Swedish Parliament has decided on public health priorities and goals for the coming 10 years (24). Two of these goals are to reduce alcohol consumption and the incidence of smoking. There are large inequalities in the burden of disease associated with these lifestyle risk factors, and these inequalities fall disproportionately on people in less-advantaged groups. Other goals are to strengthen social capital and improve mental health; these correspond with our findings that the group depression and neurosis is one of the largest contributors to inequalities in disease burden. So far there have been no difficult choices: targeting the largest contributors to the overall burden of disease will also do the most to reduce inequalities in health.

To make between-country comparisons of socioeconomic differences in the burden of disease it is necessary to have a universal classification system for social stratification. This may be possible in western Europe but a global classification scheme would be impossible, especially if it were to include countries that are not industrialized or where a majority of the workforce is not employed in the formal sector. Several European countries have been shown to have larger absolute socioeconomic inequalities in mortality than Sweden (25, 26). Studying socioeconomic differences in the burden of disease would therefore most likely demonstrate that there are larger inequalities in these countries than there are in Sweden. It may be easier to make comparisons within a country and then use the relevant social stratification measures for each setting. However, it will still be necessary for deaths to be registered and characterized socioeconomically. It may be easier to make between-country comparisons that include low-income countries using higher

non-manual workers as a reference group. In such comparisons we would expect low-income countries to have larger differential burdens than those found in our study. If the reference group higher non-manual workers, which is largely composed of civil servants, is used to make between-country comparisons it is possible that in low-income countries members of this group are more likely to suffer from diseases such as obesity and diabetes as these populations enter the epidemiological transition. ■

### Acknowledgements

We thank Hannu Kiviranta for computer assistance with classifying deaths and person-time per socioeconomic group.

**Funding:** This research was funded by the National Institute of Public Health, Sweden.

**Conflicts of interest:** none declared.

## Résumé

### Écarts socioéconomiques dans la charge de morbidité en Suède

**Objectif** Les auteurs ont tenté d'analyser dans quelle mesure la charge de morbidité totale en Suède, évaluée en années de vie corrigées de l'incapacité (DALY), est la conséquence d'inégalités en matière de santé entre les groupes socioéconomiques. Ils se sont également efforcés de déterminer comment cette charge inégale se répartit entre les différents groupes de morbidité et groupes socioéconomiques.

**Méthodes** Les auteurs ont analysé les données de l'étude sur la charge de morbidité en Suède. Ils ont pris en compte tous les suédois, hommes et femmes, appartenant à trois classes d'âge (15-44, 45-64, 65-84) et à cinq grands groupes socioéconomiques. Ils ont analysé les 18 groupes de morbidité et de traumatisme représentant 65 % de la charge de morbidité totale, à l'aide des fractions attribuables, de l'indice de pente d'inégalité et de l'indice relatif d'inégalité.

**Résultats** Environ 30 % de la charge de morbidité féminine et 37 % de la charge de morbidité masculine correspond à une

grandeur différentielle résultant d'inégalités socioéconomiques en matière de santé. Une forte proportion de cette charge inégalement répartie pèse sur les travailleurs manuels non qualifiés. Les plus importants facteurs d'inégalité en matière de santé parmi les femmes sont l'insuffisance coronarienne, la dépression ou la névrose et l'accident vasculaire cérébral. Chez les hommes, les facteurs majeurs sont l'insuffisance coronarienne, l'alcoolisme et les traumatismes auto-infligés.

**Conclusion** La présente étude est la première à utiliser les écarts socioéconomiques, mesurés par la position socioéconomique, pour évaluer la charge de morbidité en DALY. Les auteurs ont constaté qu'en Suède, un tiers de la charge de morbidité étudiée était inégalement répartie. Les études consacrées aux inégalités socioéconomiques dans la charge de morbidité prenant en compte à la fois la mortalité et la morbidité peuvent aider les décideurs politiques à comprendre l'ampleur des inégalités en matière de santé entre les différents groupes de morbidité.

## Resumen

### Diferencias socioeconómicas en la carga de morbilidad en Suecia

**Objetivo** Decidimos analizar qué parte de la carga de morbilidad total de Suecia, medida en años de vida ajustados en función de la discapacidad (AVAD), se deben a las desigualdades en salud entre los distintos grupos socioeconómicos. Otro objetivo fue determinar cómo se distribuye esa carga desigual entre los diferentes grupos de enfermedades y grupos socioeconómicos.

**Métodos** Se emplearon datos del Estudio de la Carga de Morbilidad en Suecia. Agrupamos a hombres y mujeres en tres grupos de edad (15-44, 45-64, 65-84 años) y en cinco grandes grupos socioeconómicos. Se analizaron 18 grupos de enfermedades y traumatismos que contribuían al 65% de la carga total de morbilidad, usando para ello las fracciones atribuibles, la pendiente del índice de desigualdad y el índice relativo de desigualdad.

**Resultados** Aproximadamente un 30% de la carga de morbilidad entre las mujeres y el 37% de la carga entre los hombres se deben a las desigualdades socioeconómicas en salud. Una

gran parte de esa carga desigualmente distribuida recae en los trabajadores manuales no cualificados. Los factores que más contribuyen a las desigualdades en salud entre las mujeres son la cardiopatía isquémica, las depresiones o neurosis y los accidentes cerebrovasculares. En los hombres, los factores más importantes son la cardiopatía isquémica, la adicción al alcohol y las autolesiones.

**Conclusión** Este es el primer estudio en el que se usan las diferencias socioeconómicas, medidas en función de la posición socioeconómica, para evaluar la carga de morbilidad basada en los AVAD. En Suecia, según nuestros resultados, un tercio de la carga que suponen las enfermedades consideradas se distribuye desigualmente. Los estudios de la relación entre desigualdades socioeconómicas y carga de enfermedades en los que se tienen en cuenta tanto la mortalidad como la morbilidad pueden ayudar a los formuladores de políticas a entender mejor la magnitud de las desigualdades en salud para distintos grupos de enfermedades.

## ملخص

## الفروق الاجتماعية في عبء الأمراض في السويد

الهدف: يتمثل هدفنا بتحليل كمية عبء الأمراض في السويد، مقاساً بسنوات العمر المصححة باحتساب مدد العجز، والذي ينتج عن عدم الإنصاف بين المجموعات الاقتصادية والاجتماعية. كما كان هدفنا أيضاً معرفة مدى توزع هذا التفاوت في العبء بين المجموعات المختلفة من الأمراض ومن المجموعات الاقتصادية والاجتماعية.

الطريقة: استند تحليلنا على معطيات استمدت من الدراسة السويدية لعبء الأمراض، فقد درسنا جميع الرجال والنساء السويديين في ثلاث مجموعات عمرية هي المجموعة التي تتراوح أعمارها بين 15 و44 وبين 45 و64 وبين 65 و84 عاماً، إلى جانب خمس من المجموعات الاقتصادية والاجتماعية. وتم تحليل 18 من مجموعات الأمراض والأذيات التي تساهم في 65% من إجمالي عبء الأمراض وذلك باستخدام أدوات التحليل الإحصائي المناسبة مثل الأقسام الكسرية المعزوة ومنسب الميلان لعدم الإنصاف والمنسب النسبي لعدم الإنصاف. **الموجودات:** إن 30% من عبء الأمراض لدى النساء و37% من عبء الأمراض لدى الرجال يعد بمثابة عبء إضافي ينتج عن عدم الإنصاف في

الصحة بين المجموعات الاقتصادية والاجتماعية. ويقع القسم الأعظم من العبء الموزع توزيعاً غير منصف على الرجال من العاملين غير المهرة. وكان أكثر العوامل المساهمة في عدم الإنصاف في الصحة لدى النساء هي مرض القلب الإقفاري والاكتئاب أو العصاب والسكنة، أما بالنسبة للرجال فقد كان أكثر العوامل المساهمة مرض القلب الإقفاري وإدمان الكحول والأذيات الموجهة للذات.

الاستنتاج: هذه هي الدراسة الأولى التي درست الفروق الاقتصادية والاجتماعية وقياسها وفق الوضع الاقتصادي والاجتماعي، لتقييم عبء الأمراض مقدراً بسنوات العمر المصححة باحتساب مدد العجز. وقد وجدنا أن ثلث عبء الأمراض في السويد في دراستنا موزع توزيعاً غير منصف، ويمكن للدراسات التي تتناول حالات عدم الإنصاف الاجتماعي والاقتصادي وتقدير عبء الأمراض وتأخذ في حسابها معدلات الوفيات ومعدلات المراضة أن تساعد في تفهم أصحاب القرار السياسي لدى عدم الإنصاف في الصحة بين مختلف مجموعات الأمراض.

## References

- World Health Organization. *Burden of disease project*, 2003. Available from: <http://www3.who.int/whosis/menu.cfm?path=whosis,bod,burden&language=english>
- Stouthard M, Essink-Bot ML, Bonsel G, Barendregt J, Kramer P, van der Waters H, et al. *Disability weights for diseases in the Netherlands*. Rotterdam: Department of Public Health, Erasmus University; 1997.
- Mathers CD, Vos ET, Stevenson CE, Begg SJ. The burden of disease and injury in Australia. *Bulletin of the World Health Organization* 2001;79:1076-84.
- Schopper D, Pereira J, Torres A, Cuende N, Alonso M, Baylin A, et al. Estimating the burden of disease in one Swiss canton: what do disability adjusted life years (DALY) tell us? *International Journal of Epidemiology* 2000;29:871-7.
- Hyder AA, Morrow RH. Applying burden of disease methods in developing countries: a case study from Pakistan. *American Journal of Public Health* 2000;90:1235-40.
- Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJL, and the Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. *Lancet* 2002;360:1347-60.
- Kominski GF, Simon PA, Ho A, Luck J, Lim YW, Fielding JE. Assessing the burden of disease and injury in Los Angeles County using disability-adjusted life years. *Public Health Reports* 2002;117:185-91.
- Rehm J, Room R, Monteiro M, Gmel G, Graham K, Rehn N, et al. Alcohol as a risk factor for global burden of disease. *European Addiction Research* 2003;9:157-64.
- Ezzati M, Hoorn SV, Rodgers A, Lopez AD, Mathers CD, Murray CJL and the Comparative Risk Assessment Collaborating Group. Estimates of global and regional potential health gains from reducing multiple major risk factors. *Lancet* 2003;362:271-80.
- Gwatkin DR, Guillot M, Heuveline P. The burden of disease among the global poor. *Lancet* 1999;354:586-9.
- Woodward A, Kawachi I. Why reduce health inequalities? *Journal of Epidemiology and Community Health* 2000;54:923-9.
- Mackenbach JP, Bakker MJ for the European network on Interventions and Policies to Reduce Inequalities in Health. Tackling socioeconomic inequalities in health: analysis of the European experiences. *Lancet* 2003;362:1409-14.
- Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. *Social Science and Medicine* 1997;44:757-71.
- Peterson S, Backlund I, Diderichsen F. *Sjukdomsburden i Sverige — en svensk DALY-kalkyl* [Burden of disease in Sweden — a Swedish DALY calculation]. Stockholm: National Public Health Institute; 1998. p. 50. In Swedish.
- Murray CJL, Lopez AD. *The global burden of disease*. Cambridge (MA): Harvard University Press; 1996.
- Murray CJ, Salomon JA, Mathers CD. A critical examination of summary measures of population health. In: Murray CJ, Salomon JA, Mathers CD, Lopez AD, editors. *Summary measures of population health: concepts, ethics, measurement and application*. Geneva: World Health Organization; 2002.
- Center for Epidemiology, National Board of Health and Welfare, Sweden. *Dödsorsaker 2001: Causes of death 2001*, (<http://www.sos.se/FULLTEXT/42/2003-42-5/2003-42-5.pdf>). [With summary in English.]
- SCB [Statistics Sweden]. *Swedish socioeconomic classification: reports on statistical co-ordination*. Stockholm: SCB; 1982. p. 4.
- SCB [Statistics Sweden]. *The Swedish Survey of Living Conditions: Design and Methods*. Örebro: SCB-Tryck; 1995.
- Wagstaff A, Paci P, van Doorslaer E. On the measurement of inequalities in health. *Social Science and Medicine* 1991;33:545-57.
- Anand S, Diderichsen F, Evans T, Shkolnikov VM, Wirth M. Measuring disparities in health: methods and indicators. In: Evans T, Whitehead M, Diderichsen F, Bhuiya A, Wirth M, editors. *Challenging inequities in health: from ethics to action*. New York: Oxford University Press; 2001.
- Manor O, Matthews S, Power C. Comparing measures of health inequality. *Social Science and Medicine* 1997;45:761-71.
- Kakwani N, Wagstaff A, van Doorslaer E. Socioeconomic inequalities in health: measurement, computation, and statistical interference. *Journal of Econometrics* 1997;77:87-103.
- Swedish National Committee for Public Health. Health on equal terms — national goals for public health. *Scandinavian Journal of Public Health* 2001;57:1-68.
- Mackenbach JP, Kunst AE, Cavelaars AE, Groenhouf F, Geurts JJ. Socio-economic inequalities in morbidity and mortality in western Europe. The EU Working Group on Socio-economic Inequalities in Health. *Lancet* 1997;349:1655-9.
- Vagero D, Erikson R. Socio-economic inequalities in morbidity and mortality in western Europe. *Lancet* 1997;350:516-8.



# Annex

## The five major socioeconomic groups in Sweden

In Sweden the socioeconomic classification scheme is based on a person's occupation and the educational requirements of each occupational level.

The five categories are as follows.

- Unskilled manual workers: people in this category have normally had less than 2 years of post-comprehensive school education. (e.g. drivers, shop assistants).
- Skilled manual workers: people in this category have normally had 2 or more years of post-comprehensive school education. (e.g. bakers, mechanics, nursing assistants).
- Lower non-manual workers: people in this category normally have had 2, but not 3, years of post-comprehensive school education. (e.g. pharmacy assistants).
- Intermediate non-manual workers: people doing these jobs normally have had 3–5 years, but not 6, years of post-comprehensive school education. (e.g. registered nurses, mechanical engineers).
- Higher non-manual workers: people in these jobs normally have had at least 6 years of post-comprehensive school education. (e.g. teachers, government administrators).