Decomposing Inequality in Diabetes Patients' Morbidity Patterns, Survival and Health Care Usage in Denmark

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Abstract

Measurement of socioeconomic inequalities in health and health care, and understanding the determinants of such inequalities, are critical for achieving higher equity in health care through targeted health intervention strategies. The aim of the paper is to quantify inequality in diabetes morbidity patterns, survival and health care service usage and understand determinants of these inequalities in relation to socio-demographic and clinical morbidity factors. Further, to compare income level and educational level as proxies for Socio Economic Status (SES).

Data on the entire Danish diabetes population in 2011, N = 318,729, were applied. Patients' unique personal identification number enabled individual patient data from several national registers to be linked. Cox survival method and a concentration index decomposition approach are applied. Results indicate that lower socioeconomic status is associated with higher morbidity, mortality and lower survival. Differences in diabetes patients' morbidity patterns, time of diagnosis and health state at diagnosis as well as health care utilization patterns suggest that despite the Danish universal health care system use of services differ among patients of lower and higher SES. Especially out-patient services, rehabilitation and specialists in primary care show different usage patterns according to SES. Comparison of educational level and income level as proxy for patients' SES indicate important differences in inequality estimates. This is a result of reversed causality between diabetes morbidity and income as well as income related inequality to a higher extent being explained by morbidity.

Keywords: health inequality; diabetes; morbidity patterns; health care service usage: decomposition; socio-economic inequality.

JEL classification: I12, I14, I18

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Abbreviations:

- C: Concentration Index
- CC: Concentration Curve
- CG0: Complication group 0 (no complications)
- CG1: Complication group 1 (minor complications)
- CG2: Complication group 2 (major complications)
- CIs: Concentration Indices
- DRG: Diagnosis-Related Group
- DAGS: Danish Ambulant Grouping System
- GP: General Practice
- L(S): Concentration curve
- M: Men
- NDR: Danish National Diabetes Register
- OLS: Ordinary Least Squares
- PIN: Danish Personal Identification Number
- PYRS: Patient Years
- SD: Statistics Denmark
- SES: Socio Economic Status
- Sig.: Statistical Significance
- W: Women

Introduction

Globally, increasing numbers of chronic patients are in need of treatment and care(1, 2). Diabetes Mellitus is one of contemporary time's most burdensome chronic diseases. Especially diabetes patients with late complications are posing high costs on societies(3, 4), making secondary prevention and compliance to treatment highly important, not only for patients' quality and quantity of life, but also for societies to control the costs of the increasing diabetes populations(5, 6).

Despite universal coverage health care systems, social inequalities have been evidenced in most European countries(7). It is well known, that socioeconomic inequality exists in diabetes with higher incidence and mortality among lower socio-economic groups (8-13). Diabetes is a chronic disease, which requires a great deal of self-care actions by the individual patient, such as self-monitoring of blood glucose, adjustment of insulin and oral anti-diabetic agents in response to blood glucose readings and illnesses, management of co-morbid medical conditions (e.g. hypertension and hyperlipidemia), dietary adherence, exercise, and smoking.(13). Differences in novel morbidity indicators, including age at diagnosis, complication state and time to complication can throw light on new inequality aspects from a diabetes patient's diagnosis to death.

Several Danish reports have underlined that great differences exist in compliance to treatment, especially preventive efforts and retention of life style changes among chronic patients(14-16). Access to health care, hence is not only a question of equal potential access, as in a universal health care system like the Danish. The concept of "realized access" (17) reflects patients' actual use of the available services. In health care systems with universal coverage, realized access may be constrained by financial and organizational barriers to the use of benefits, such as required co-payments or other out-of-pocket payments, restrictions on specialty referrals, or lack of proximity to health care facilities(17). Differences in use of health care, within patient groups of same need, provide insights into patients' ability to take advantage of the services provided in a universal health care system. Such knowledge can guide future effort in relation to targeted treatment, to increase success of early detection, secondary prevention and treatment.

Several studies have assessed the level of socioeconomic inequalities in health using concentration indices and concentration curves (7, 18-20). Though the value of the Concentration Index (C) attempts to reflect the degree of socio-economic inequality, it does not reveal the determinants of inequality. Decomposition of inequalities, therefore, is critical for

exploring socioeconomic inequalities in diabetes in-dept. Finally, since the literature of concentration indices normally apply income as proxy for SES (7, 18, 21), while the public health literature commonly apply patients' highest attained educational level (22), an objective of the study was to compare estimates of inequality in diabetes applying income versus educational level as proxy for patients' SES.

Taking advantage of the detailed Danish social and health registers as well as the unique Danish personal identification number (PIN) enables a combination of data from different national registers on the individual patient level (23). We apply data on patients' health care and pharmaceutical usage, patients' demographic characteristics and patients' clinical morbidity patterns. Access to comprehensive data on patients' morbidity patterns is unique, allowing for investigation of novel associations between SES and diabetes patients' morbidity patterns and health care seeking activities. The study hereby adds to the literature on inequality in health and inequality in diabetes.

The study is part of a large-scale observational investigation, the Diabetes impact study 2013, investigating epidemiology, health economics and socioeconomics of diabetes in Denmark (4-6, 24).

Hypothesis

We investigate the hypothesis that Danish diabetes patients with high SES – measured by annual income or educational level – are favoured, thus causing inequality in morbidity, survival, health care and pharmaceutical usage.

To investigate this hypothesis we set three research inquiries 1) to quantify socioeconomic inequality in diabetes morbidity patterns, survival rates and time before complication development as well as in health care and pharmaceutical usage (reflected through cost indicators), 2) to decompose these inequalities by quantifying the contribution attributable to individual demographic determinants and individual morbidity characteristics, and 3) to compare educational level with income level as proxy for patients' SES.

Data and methods

Data and design

Data was collected from the following national registers: NDR, the Danish National Patient Register (25), the Danish National Prescription Registry (26), the Danish National Health Service Register (27) as well as the Danish Civil Registration System (28) and social registers at Statistics

Denmark (SD). Linkage of person-specific data between registers is possible using Danish Personal Identification Number (PIN), assigned to each Danish citizen and used for administrative purposes throughout the public and private sectors. All data were analysed using anonymized PINs.

The study population is based on the prevalence period of diabetes and covers all patients registered in NDR diagnosed before 1st of January 2012 and alive 1st of January 2011, as described in detail elsewhere (24), leaving N = 318,729 patients. Data for this population were retrieved retrospectively back to time of diagnosis and forward until death or until 31st of December 2013 with respect to morbidity and mortality. For costs, the time span is a window of one calendar year (2011) in a cross-sectional design. This design does not by definition allow for causational conclusions over time to be drawn, but it enables identification of differences between groups and hence cost pattern exploration (29).

Method of analysis

Correlation analysis

Simple correlation analyses are used to provide initial descriptive explorations of relationships between proxies for SES (educational level and income level) and outcome variables (morbidity indicators and health care costs).

Survival analysis

The Cox proportional hazards model for survival-time is used to explore the effects of patients' SES on survival time and time to complications. The Cox regression method is a semi-parametric method investigating the effect of several variables upon the time until a specified event occurs, for instance death, and is a common used model for duration within health care(30).

The BOX model of the dynamics of a disease:
A chronic disease with stratification by complication
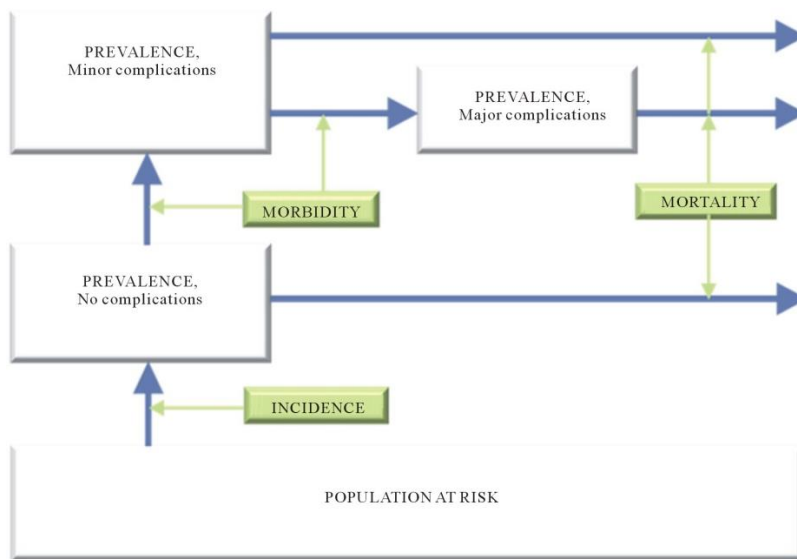
Figure 1. The BOX model

In the Cox regression, censoring occurred at July 3rd 2013 for time to event outcomes. The following time to event outcomes are investigated: 1) time from diagnosis to death, 2) time from diagnosis to development of minor complications (CG1), 3) time from CG1 to development of severe complications (CG2), and 4) time from CG2 to death. Time to event is reflected in an epidemiological framework outlined in the BOX model, which is a simple health transition model (see Figure 1). The model is described in detail elsewhere (6). In the BOX model, an individual is either non-diabetic (i.e. belonging to population at risk) or belonging to one of the diabetic complication groups: CG0 (no complications), CG1 (minor complications), or CG2 (major complications). ICD codes defined for each complication group is given elsewhere (6). Patients included in the time window of analysis are hence distributed across all health states. Irreversibility is assumed, implying that patients can move forward only in the model. Flows between health states are in focus of survival analysis.

Educational level and income level are applied as differentiating factors between SES status groups of patients. Covariates include age, gender, marital status, ethnicity and region of residence.

Concentration Index

Similar to previous studies initiated by Wagstaff et al.(31), the Concentration Index (C) is used to measure relative socioeconomic inequality (7, 18, 20). C is defined on the basis of a

Concentration Curve (CC). The CC plots the cumulative proportion of the population, ranked by SES, (beginning with lowest SES), against the cumulative proportion of a health outcome variable. If CC coincides with the diagonal (a 45-degree line denoted the equality line), then everyone is equally off, implying that the distribution of, as example diabetes patients' pharmaceutical costs, is not influenced by the distribution of SES. However, if CC lies above the diagonal, inequality in the distribution of costs exists favoring those of high SES, while a CC under the diagonal indicates distribution of costs in favor of those with low SES. The minimum and maximum values of C are -1 and +1, respectively, representing the (hypothetical) situation where costs are concentrated in the hand of the most and the least disadvantaged person, respectively. Thus, the larger magnitude of C, the more absence of equal distribution of costs among SES groups exists.

Decomposing inequality

Decomposing inequality into the contributions of determinants was proposed by Wagstaff et al. (32). A brief verbal presentation of their method follows; see their paper for technical details.

The point of departure for the method is a regression model, which relates the outcome in question to the determinants. For the present study, a linearly additive regression model, based on Ordinary Least Squares (OLS), is applied, given that the outcome variables are measured on continuous scales. For binary outcome variables, like incident in 2011, logit estimations should ideally be applied. However, due to numerical problems, the logit function in STATA could not converge. Therefore, we apply an OLS regression instead. Given that our focus is not on prediction of probabilities, but merely on decomposition of the expected mean as outlined below, the OLS based decomposition approach serves as a reasonable approximation.

Specifically, income related inequality in, say, pharmaceutical costs, can be written as a sum of two terms: Predicted (or explained) inequality (as predicted by the determinants of the regression), and residual (or unexplained) inequality. Predicted inequality in turn is obtained as a weighted sum of inequality contributions from each of the included determinants. In principle, the contribution from a determinant to total inequality is obtained by multiplying three parts: 1) the determinant's impact on the outcome variable as measured by the regression coefficient, 2) the degree of income related inequality in the determinant itself as measured by the concentration index for the determinant, and 3) the determinants' heaviness in the population as measured by its average value. It should be noted that when the determinant is a binary indicator

for a certain condition, for example being retired, its average value simply represents the proportion of the population with the condition, for example the proportion of the population who is retired (7). Finally, the residual inequality is simply obtained by subtracting predicted inequality from observed inequality.

Statistical inference

In order to assess sampling variability and to obtain standard errors for the estimated quantities, we apply a bootstrap procedure with replacement (33) and 1,000 iterations. Standard errors for contributions from the determinants are estimated by calculating their standard deviations based on the 1,000 replicates, whereby t statistics could be calculated. The analyses include 30-34 possible socio-economic determinants and morbidity predictors. The contribution of each variable is presented as a percentage of the predicted inequality in the given outcome variable. Three, two and one asterisks symbolize significance on a 1%, 5% and 10% level, respectively, based on the t statistics.

Variable definitions

Patients' SES: We apply data on patients annual gross income as a ranking variable when calculating concentration indices, since this measure is the most common measure of SES in the literature analysing inequality through concentration indices (7, 18, 21). However, we also apply patients' highest attained education as ranking variable since this measure is often used as a measure of SES in the public health literature due to its simplicity and universality (22). Reversed causality between diabetes and socioeconomic group as demonstrated in more international studies (34-36) is generally avoided when using educational level as a proxy for socioeconomic status since most people who develop diabetes have attained their highest educational level earlier in life.

Patients' demographic characteristics: We include demographic variables: *age, gender, ethnicity, civil status, region of residence* and *degree of urbanity of residence*, given that these characteristics may be expected to influence on diabetes risk, morbidity patterns and patients' health care seeking activities.

Patients' need for health care services: Data on patients' need for health care services are included. Given our expectation of differences in patients' need according to SES, it is relevant

to analyse associations between health care service usage and socio-demographic variables and patients' need. Ideally, patients' need for health care and pharmaceuticals should be measured by health care professionals' clinical opinion of the individual patient's need. However, as such data are unavailable, we apply clinically defined morbidity patterns in relation to development of specified complications as a proxy for patients' need. Patients are classified into three complication groups, (table 1), according to the progression of their diabetes, based on the the above described BOX model (6).

Patients' morbidity indicators: *Incidence* (i.e. whether the person was diagnosed with diabetes in 2011) and *mortality* (i.e. whether the person died in 2011) are included as typical epidemiological disease indicators. Furthermore, diagnosis and death in 2011 will influence on patients' costs in this year. It has been evidenced in several studies that much of lifetime cost in the health care system is spent during the last year before death (37). Death in 2011, therefore, is expected to be an important determining factor in the decomposition analysis of costs.

Age at diagnosis and *complication group at diagnosis* reflect patients' knowledge of risk factors and pro-activity in seeking health care assistance. *Number of patient years (PYRS)* in each of the three complication states (none, minor and severe complications), together with *age at death,* are applied as expressions of patients' ability to comply with treatment and preventive efforts.

Table 1: Definition of cost components and calculation

Cost component	Cost unit
Inpatient and outpatient services delivered in Danish hospitals registered in the National Patient Register divided into the following components: 1) Inpatient services 2) Inpatient services for stays longer than the average patient in this DRG-group 3) Inpatient services for rehabilitation 4) Outpatient services 5) Outpatient services for stays longer than the average patient in this DAGS-group 6) Outpatient services for rehabilitation	Diagnosis Related Grouping (DRG) system and Danish Ambulant Grouping System (DAGS) tariffs - year 2012(38). The DRG-tariff system is developed for administrative purpose and based on rough average costs across hospitals for specific diagnostic groups. Excludes interest and depreciation of buildings and equipment while other overhead costs are included.
Primary care services delivered by general practitioners and privately practicing specialists such as: dentists, physiotherapists, chiropractors, chiropodists who are registered in the National Health Service Register divided into the following components:	Reimbursement fees between the National Health Insurance scheme and private practicing physicians are used as cost units. General Practitioners are compensated by regions through a combination of per capita fee (app.30% of total) and fee for service (app. 70%)(39). To

1) Services in general practices 2) Services for privately practicing specialists	reflect this payment scheme in the unit cost, 43.8% of the fee for service in general practice was added on top. Overhead costs covered by capitation fee were hence not distributed across numbers of visits, as would have been most appropriate, but by resource burden.
Prescribed pharmaceuticals dispensed by Danish pharmacies and registered in the Danish national prescription register. (Pharmaceuticals consumed in hospitals are included in DRG-tariffs. Over-the-counter drugs are not included in the statements).	Total sales price includes patient out of pocket payments since costs of prescribed pharmaceuticals are shared between the patient and the primary health care sector by a copayment scheme where patients are reimbursed according to their need. These costs were aggregated since total costs are measured regardless of who pays. 20% VAT was subtracted.

Usage of services: The overall volume of treatment related health care services, including pharmaceuticals received by the individual patient, are approximated by the costs of these services. This implies that we do not consider number or type of services but merely the total costs by sectors. Health care services may be divided into primary and secondary care, where the latter is divided into inpatient and outpatient costs and further subdivided into rehabilitation costs and costs for stays longer than the average patient as given by the Diagnosis Related Grouping System group (DRG). Measurement of health care and pharmaceutical consumption in the defined categories as well as choice of appropriate cost unit are described in Table 1.

The included patient characteristics are listed in table 2 along with definitions and categorizations.

Table 2: Definition of sociodemographic and clinical patient characteristics: along with variable categorizations

Characteristics	Definitions	Categories
Socioeconomics*		
Highest educational level attained	Highest educational level attained at date of data extraction, based on the main groups in the Danish educational Nomenclature with 13 educational groups based on years of education.	Variable with 3 or 9 categories: 1) Primary education (< 11 years) 2) Middle high education (11 to 15years 3) Higher education (16+ years) 1) Primary education 2) Upper secondary education 3) Vocational education and training 4) Qualifying educational programmes

		5) Short cycle higher education
		6) Vocational bachelors education
		7) Bachelor programmes
		8) Master programmes
		9) PhD programmes
Income level	Annual gross income 2011	Continuous variable or categorical with 3 categories:
		1) 149,999 or less DKK
		2) 150,000 – 349,999 DKK
		3) 350,000 or more DKK
Demographics*		
Gender	Gender	1) Male
		2) Female
Age	Age in midyear	Continuous
Civil status	Marital status	1) Married or in civil partnership
		2) Unmarried
		3) Widow or longest living partner
		4) Divorced or cancelled partnership
Ethnicity	Based on registrations in the Central Person Register 2011.	1) Ethnic Dane
		2) Immigrant
		3) Descendant
Region of residence	Residence 2011 in relation to the Danish five regions	1) "Capital Region of Denmark"
		2) "Region Zealand"
		3) "Region of Southern Denmark"
		4) "Central Denmark Region"
		5) "North Denmark Region"
Urbanity	Residence in type of geographic area in relation to urbanity	1) City
		2) Suburbs
		3) Outer areas/country side
Occupational status	Affiliation to the labour market	1) Affiliated to the labour market (employed or self-employed)
		2) Unemployed (maternal leave, job seeker allowance)
		3) Unemployed (unemployment benefit)
		4) Education
		5) Early retirement
		6) Retired
		7) Child
Morbidity indicators		
Incidence 2011	Patient diagnosed in calendar year 2011	0) Diagnosed in year ≠ 2011
		1) Diagnosed in 2011
Complication group at present	Complication group at 31st of December 2011	1) CG0
		2) CG1
		3) CG2
Complication group at diagnosis	Complication group at diagnosis	1) CG0
		2) CG1
		3) CG2

Age at diagnosis	Age in midyear of diagnosis	Continuous
PYRS in CG0	Number of years diagnosed with diabetes before developing minor or major complications or dying before 3rd of July 2013 for patients diagnosed in CG0	Continuous
PYRS in CG1	Number of years the patient lives in CG1 before developing major complications or dying before 3rd of July for patients diagnosed in CG0 or CG1	Continuous
PYRS in CG2	Number of years the patient lives in CG2 before dying before 3rd. of July for patients diagnosed in CG0, CG1 or CG2	Continuous
Duration of diabetes (total PYRS)	Number of patient years before 3rd of July	Continuous
Mortality in costing year (2011)	Death in 2011	0) Alive 2011 1) Death 2011
Age at death	Patient age at death	Continuous
Survival time indicators		
Diagnosis to death	Years from diagnosis to death or censoring with death in 2011, 2012 or 2013 (<3rd of July) representing an event.	Variable with event or censoring.
Diagnosis to CG1	Years from diagnosis to patient experiencing minor complications or censoring with minor complications presenting in 2011, 2012 or 2013 (<3rd of July) representing an event	Variable with event or censoring
CG1 to CG2	Years from CG1 to patient experiencing major complications or censoring with major complications presenting in 2011, 2012 or 2013 (<3rd of July) representing an event	Variable with event or censoring
CG2 to death	Years from CG2 to patient's death or censoring with death in in 2011, 2012 or 2013 (< 3rd of July) representing an event.	Variable with event or censoring

*based on registrations on the 31st of December 2011

Results

Throughout, the hypothesis of unequal distribution of morbidity and health care resource usage according to patients' SES in favor of patients with higher income or higher education is underlying the analyses. The present section describes results from the different investigation methods: simple association (correlation) analyses, survival analyses, and concentration index decomposition. The first part of the result section presents results according to patients' morbidity indicators, followed by similar analyses according to patients' health care and pharmaceutical usage. Along with the presentation of main results, short discussions of specific results are included, while extensive main discussions of results are deferred to the discussion section at the end of the paper.

Morbidity indicators – simple associations

Simple associations between patients' income or educational level and morbidity indicators, where no confounding determinants are included, are presented in table 3. These analyses show clear tendencies that patients from the lower income or educational groups are diagnosed in an older age, experience higher risks of complications at diagnosis and at present, that they live slightly fewer years without complications, and that they experience higher mortality than patients with longer education or higher income. Contrary to what was expected, incidence and age at death, respectively, are found to be higher and lower respectively among people with longer education and higher income. Overall, it is noted that greater disparities are found for income than for education.

Table 3: Simple associations between SES (income and educational level) and morbidity indicators

Morbidity indicators	Simple correlation with income level			Simple correlation with educational level		
	Low income	Middle income	High income	Short education	Middle-high education	High education
Incidence in 2011	8.9%	10.2%	11.4%	9.5%	10.4%	10.2%
Complication group at present						
CG0	48.7%	55.2%	63.4%	51.7%	55.8%	58.9%
CG1	18.9%	19.3%	20.4%	19.2%	19.7%	19.3%
CG2	32.4%	25.4%	16.1%	29.1%	24.4%	21.8%
Complication group at diagnosis						
CG0	77.6%	81.2%	86.5%	79.1%	81.7%	84%
CG1	9.6%	8.7%	7.6%	9.3%	8.8%	7.7%
CG2	12.8%	10.1%	5.9%	11.6%	9.5%	8.3%

Age at diagnosis	59.9	55.1	48.5	58.1	53.8	52.8
PYRS in CG0	5.7	5.9	6.5	5.8	6.0	6.4
PYRS in CG1	1.9	1.9	2	1.8	1.9	2.0
PYRS in CG2	2.3	1.9	1.2	2.1	1.8	1.6
Duration (total PYRS)	9.8	9.7	9.7	9.7	9.7	10.1
Mortality 2011	9%	1%	0.3%	4.3%	2.8%	2.2%
Age at death	78.6	76.3	70.6	77.2	73.8	74.6

Morbidity indicators – survival

Turning to the Cox model analyses, we compared survival time and time to complications across income and educational level to investigate possible differences. In these analyses, we controlled for age, gender, ethnicity, civil status and region of residence. Table 4 shows hazard ratios of educational level (upper part of table) and income level (lower part of table) for the four periods estimated: 1) from diagnosis to death, 2) from diagnosis without complications to development of minor complications, 3) from experiencing minor complications to development of severe complications, and 4) from experiencing severe complications to death. Full regression tables are given in Appendix A1.

Table 4: Hazard ratios for survival and time to complication development for educational level and income level

Survival outcome*	Diagnosis -death		Diagnosis- Minor complications		Minor complications - severe complications		Severe complications- death	
SES variable (reference)	Exp(B)	95% CI	Exp(B)	95% CI	Exp(B)	95% CI	Exp(B)	95% CI
Education (primary)								
Middle-high	0.87	0.85 0.90	0.93	0.92 0.94	0.96	0.95 0.98	0.96	0.95 0.98
High	0.74	0.71 0.77	0.86	0.85 0.88	0.90	0.88 0.92	0.90	0.88 0.92
Income (Low)								
Middle	0.56	0.55 0.57	0.90	0.89 0.91	0.98	0.96 0.99	0.58	0.57 0.60
High	0.34	0.32 0.36	0.74	0.72 0.75	0.80	0.78 0.82	0.40	0.37 0.44

 * controlled for: age, gender, civil status, ethnicity and region of residence. Significant on a 1% level.

Table 4 shows that patients with high education have approximately 26% lower risk of dying when diagnosed with diabetes as compared to patients with short education, when confounders are taken into account. For income, interestingly, the risk is 66% lower for patients with high income as compared to low income groups (column 2). Compared to patients with short education, patients with high education have 10-15 percent lower risk of developing minor and severe complications as well as dying when having severe complications. For income, again, the

difference in risk is higher, with 20-60 percent reduction for patients of higher income groups compared to lower income groups (columns 3-5). This means that patients with lower annual income or with shorter education live shorter with diabetes from diagnosis, that they develop minor complications faster after diagnosis, and that they develop severe complications faster when having minor. Finally, when they have severe complications, they die sooner as compared to patients with high annual income or high educational level, respectively. This indicate consistent differences by SES, also when relevant confounders as age, gender, ethnicity, civil status and region of residence is taken into account. The observed differences between effects of education and income, as proxy for SES, may reflect reverse causality, i.e. that the more morbid patients have incomes being influenced by their morbidity. Given that education is typically fulfilled before the morbidity occurs, such reverse causality should to a less extent be expected when basing the analyses on educational level.

Survival functions by educational level for risk of dying from diagnosis and onward is depicted in Figure 2, with cumulative hazard for survival (scale 0-1) on the y-axis and years on the x-axis, showing clearly the pattern already described.
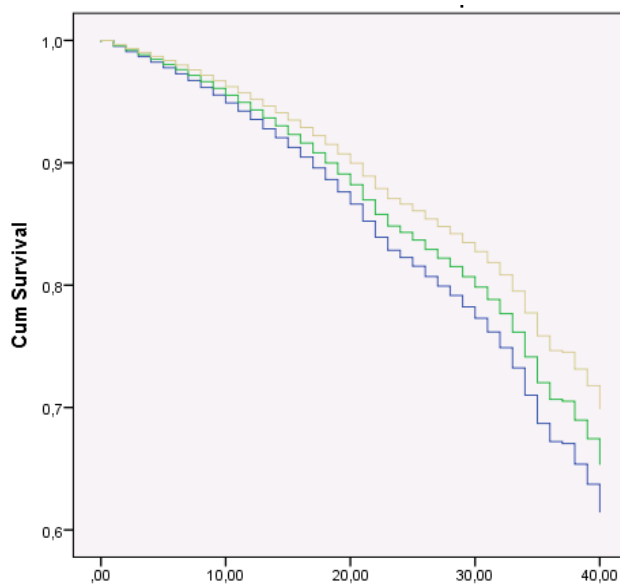
BLUE) Primary education < 11 years of education

GREEN) Middle high education < 16 years,of education

YELLOW) Higher education 16+ years of education

Figure 2: Survival from diagnosis and onwards, by educational level

Survival by complication state at diagnosis inhibits the expected pattern with increased survival with fewer complications at diagnosis. Stratifying by complication at diagnosis, the survival function for risk of death from diagnosis and onwards by educational group is depicted in Figure 3. The Figure shows that the relative lower survival rate among patients of lower educational level as compared to higher educational level is consistent across the three complication groups at diagnosis.
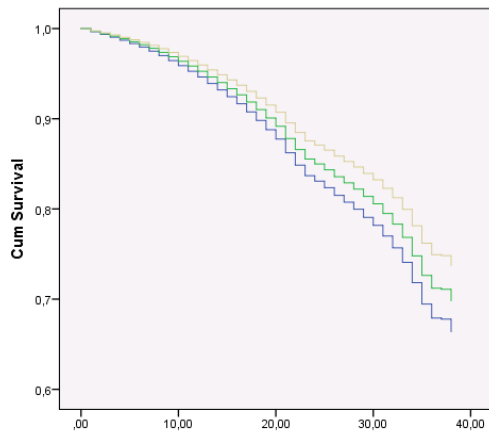
BLUE) Primary education < 11 years of education
GREEN) Middle high education < 16 years,of education
YELLOW) Higher education 16+ years of education

No complications at diagnosis
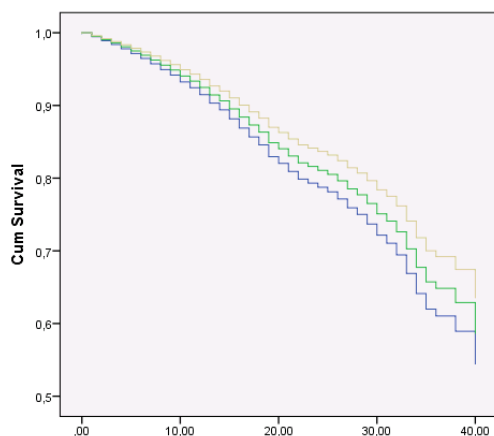
BLUE) Primary education < 11 years of education
GREEN) Middle high education < 16 years,of education
YELLOW) Higher education 16+ years of education

Minor complications at diagnosis
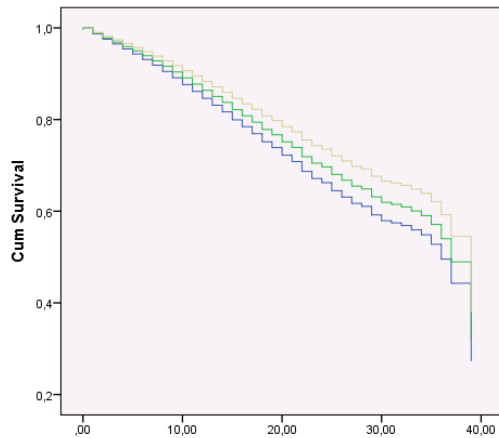
BLUE) Primary education < 11 years of education

GREEN) Middle high education < 16 years,of education

YELLOW) Higher education 16+ years of education

Severe complications at diagnosis

Figure 3: Survival from diagnosis and onwards by educational level and complication group at diagnosis

Morbidity indicators – Concentration index

Turning to the concentration index approach and the decomposition of inequality into its determinants, we analyze nine selected morbidity indicators ranked according to both income and educational level. As determinants, we include a range of socio-demographic variables (presented in table 2). Table 5 presents concentration indices calculated for the nine selected morbidity indicators applying income level as rank variable. Furthermore, the contributions of the socio-demographic determinants to the overall predicted concentration index of inequality are presented, (the former in percentage of the latter). Regression coefficients and individual concentration indices for each of the determinants are in Appendix A2, since these are used to explain the contribution of each determinant, in the following. Due to the comprehensive set of analyses, only selected results are presented.

(Table 5 around here; see end of paper)

From the concentration indices reported in Figure 4, it appears that severe complications at diagnosis, patient years with severe complications (PYRS in CG2) and death inhibits the highest values for observed as well as predicted C, all with a negative sign indicating that these patterns are concentrated among the lower income groups. Incident in 2011, patient years without

complications (PYRS in CG0) and duration of diabetes (PYRS) are, to the contrary, morbidity indicators with positive signs, indicating that these concentrate among the higher income groups.
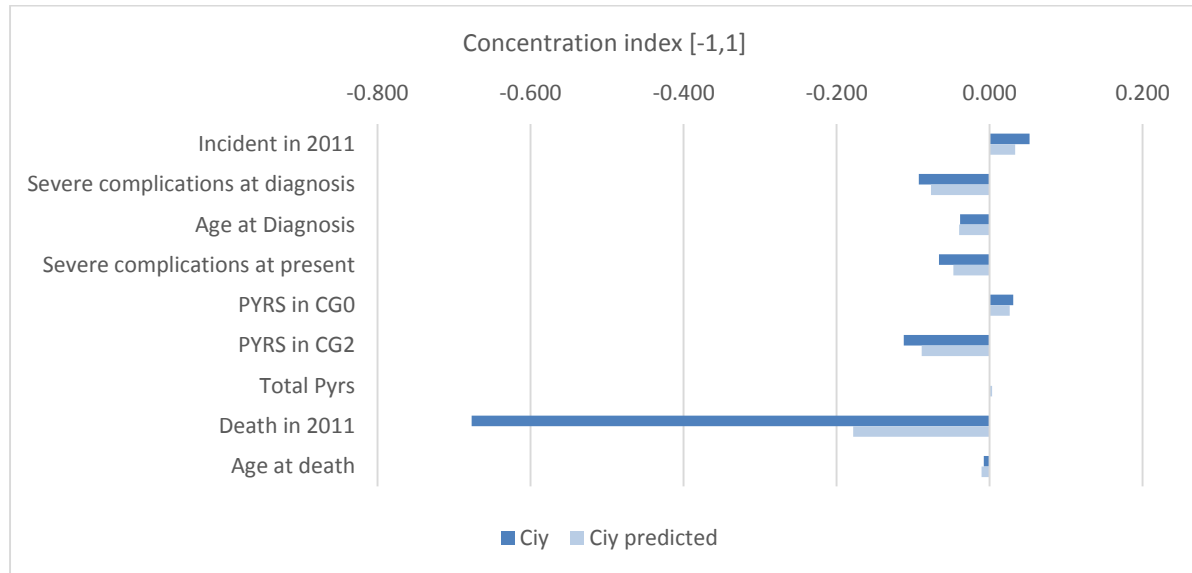
*Ciy = Observed concentration index for outcome variable   Ciy predicted: Concentration index as predicted by included determinants for outcome variable

Figure 4: Concentration index (observed and predicted by determinants)* of income-related inequalities in morbidity indicators

Results indicate a pattern of worst morbidity at diagnosis and during diabetes being concentrated among the lowest socioeconomic groups, whereas more healthy years with diabetes and longer duration of diabetes concentrate among the socioeconomic better off patients. Two results are, however, rather surprising. First, incidence is higher among patients of higher SES, which supports findings in the initial association analyses. This finding is contrary to most international literature evidencing higher incidence among lower SES groups. An explanation for our finding might be that patients from higher income groups are more likely to be included in NDR, (31% >< 26%) through the criteria of undergoing regular blood glucose level testing in primary care, and hence are falsely registered as diabetics (further elaborated in the discussion section). Another reason for higher incidence among patients of higher SES might be that these patients are diagnosed earlier. Looking at the decomposition of incidence in 2011 (Figure 5), it appears that, apart from age and gender, it is especially retired, early retired, under education and short education, which contribute to higher incidence among lower income levels, whereas especially

age 45-59 contribute to higher incidence among higher income groups. This underpins the explanation of higher income groups being diagnosed earlier.
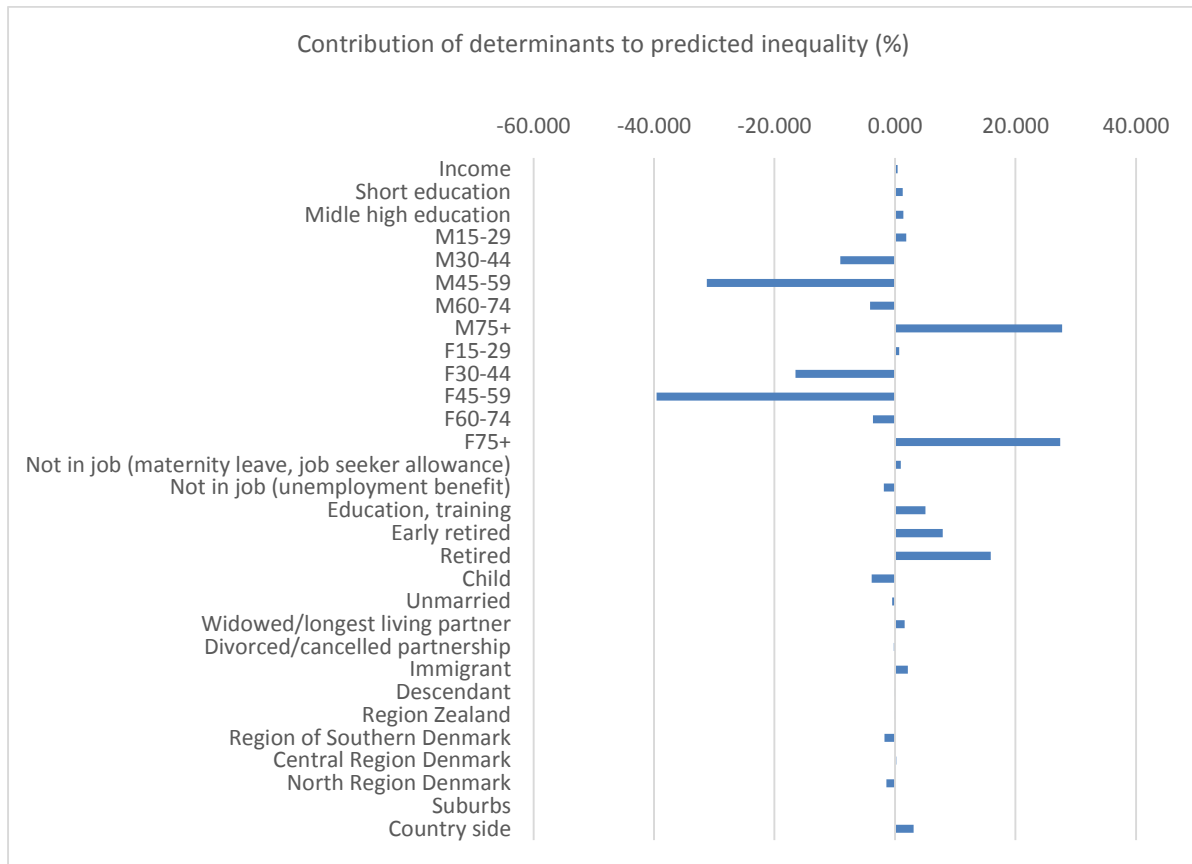
Figure 5: Decomposition of income-related inequality of incidence in 2011

The second surprising finding is that age of death is higher among patients of lower SES, which is counterintuitive with these patients being more morbid. Inequality is almost non-existing in this variable, however, Figure 6 shows that only age is explaining inequality with 75+ age groups contributing to higher age at death among lower income groups whereas the other age groups contribute to the opposite. This indicates that it is not as such the lower income groups who are reaching the highest age before dead, but rather the elder age groups that are becoming poorer.
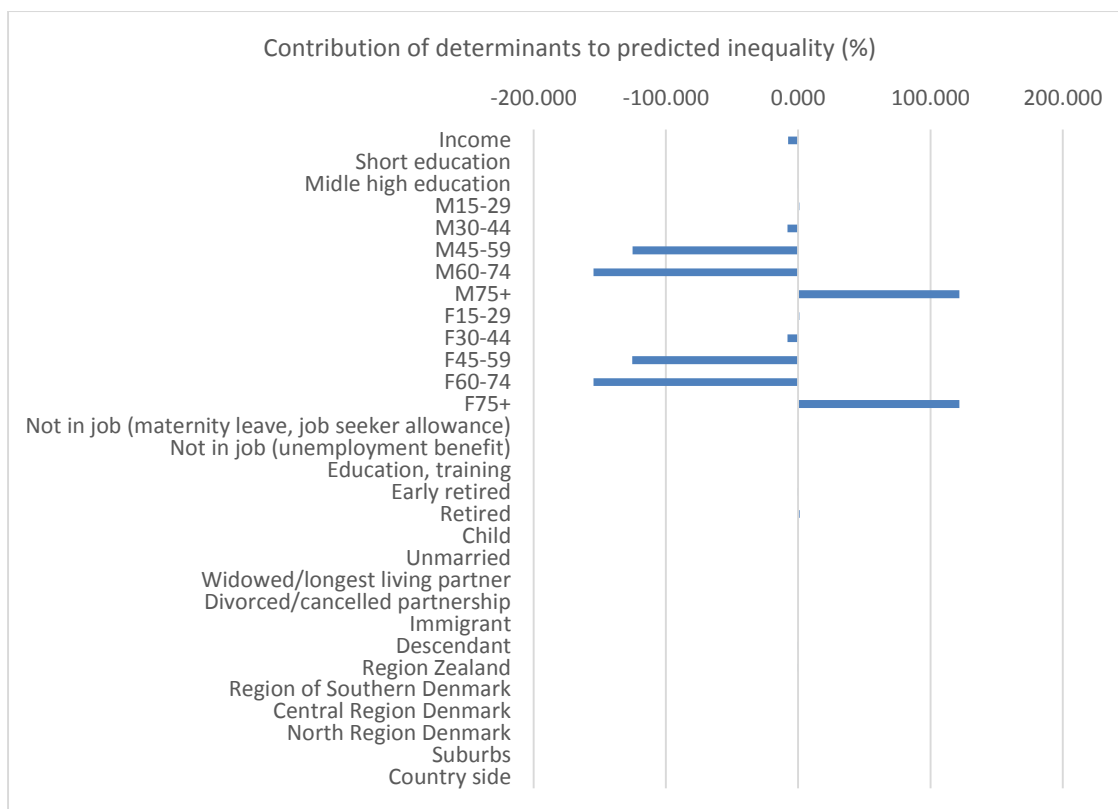
Figure 6: Decomposition of income-related inequality of age at death

Looking at the contribution by socioeconomic determinants to explained inequality (table 5), it is seen that income is not significantly explaining inequality for any of the morbidity indicators. Education is significantly positively signed for several indicators, indicating that these morbidity indicators are concentrated among the lower income groups among patients of low education to a higher extent than among patients of higher education. This is true for severe complications at diagnosis, current complications at time of analysis, age at diagnosis and age at death and years with severe complications. Only death in 2011 and total PYRS have negative signs, showing that these outcomes to a higher extent are concentrated among the higher income groups. This makes good sense for total PYRS where especially the well-off patients with low education experience a long duration of diabetes.

Turning to the demographic determinants, the tendencies of morbidity being mostly concentrated among the lower income groups, whereas duration of diabetes and years without complications are concentrated among the higher income groups, are underpinned overall.

Looking at age and gender it is clear that these variables, which make up the unavoidable part of inequality, explain a lot of the observed inequality in morbidity patterns. Similar patterns are seen

for men and women and across all morbidity indicators (except total PYRS). Where the younger age groups (<30) and the elder age groups (75+) contribute to the described inequality in the morbidity indicators, the middle-aged groups (30-74) reduce inequality, especially the age-group 45-59. An explanation for the highest age groups contributing to inequality might be that diabetes patients above 75 years in general are "survivors", living long despite their disease and to a higher degree belonging to the higher SES groups. For the middle-aged groups diabetes morbidity appears to be more equally distributed.

For ethnicity, it is noticed that figures for descendants are not significant. However this group is vaguely represented with most descendants being in the young age groups, not yet having reached the ages with the highest risk of diabetes. For immigrants, it appears that especially total PYRS to a higher extent than among Danes are concentrated among patients of higher incomes. This is due to immigrants generally belonging to lower income groups than Danes, resulting in a negative concentration index, and immigrants experiencing less of all morbidity indicators except age at diagnosis, which is higher. This might be explained by higher cultural barriers for health care usage among immigrants of lower income groups opposed to immigrants of higher income groups, resulting in these groups not being able to fully utilize the Danish health care system offers, being diagnosed later and not having all complications diagnosed.

For labor market affiliation, not being in job is associated with a higher extent of morbidity than being in job and with a lower duration of both PYRS in CG0 and in total. Since these groups generally have lower incomes, they contribute to inequality in the morbidity indicators. For early retired the picture is rather mixed with more morbidity for some indicators, but also with higher total duration and higher age at death. Retired are contributing to the inequality by having low incomes and experiencing for instance less years without complications as well as more severe complications.

Turning to regions and urbanity of residence, a very mixed pattern is seen. Overall, it seems that living in the countryside and living in regions outside the Capital Region is associated with less morbidity and higher age at death, but also with shorter duration of diabetes and higher incidence.

Morbidity indicators - income versus education as rank variable

Table 6 mirrors table 5, just with educational level used as rank variable instead of income, and table A3 in supplementary materials likewise mirrors table A2.

(Table 6 around here; see end of paper)

Comparing the two tables 5 and 6, it is seen that signs are generally pointing in similar directions. For concentration indices, all signs agree, except for age at death, where income has negative and education positive sign. There is a tendency of inequality being estimated higher when ranked by income than by education for the predicted concentration indices (Figure 7). This is consistent with results from the initial association analyses and survival analyses, which might be explained from reversed causality between income and health. Especially for the indicators death in 2011, severe complications at diagnosis, and PYRS in CG2, inequality estimates based on income are higher than estimates based on education. This corresponds well with the expectation since the severest morbidity affects income levels most. The observed pattern is, however, not consistent within the different determinants, as it is seen that the magnitudes of the contributions vary with education and income as rank factors, but not always with income as the largest.
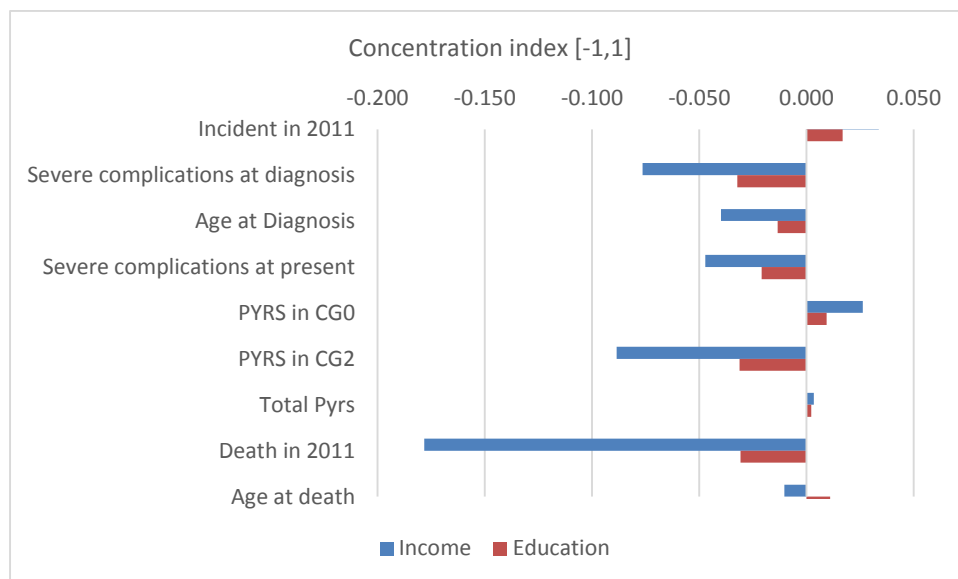
Figure 7: Concentration indices of morbidity indicators ranked by income and educational level

Both regressions agree that income is not significant, whereas education is significant. Using education as rank variable, educational level, as expected, becomes more important with higher contribution to predicted inequality.

Turning to age at death, the overall sign of predicted inequality shifts from negative, when using income as rank variable, to positive, when using educational level. This supports the explanation of reversed association between income and age at death, where elder are becoming poorer. For education, this reversed association does not apply and the more intuitive pattern, with higher educated surviving longer, is observed.

For marital status, opposite signs for overall predicted inequality is also observed between the two tables, for both unmarried and divorced. Using income as rank variable it appears, that morbidity indicators are concentrated among the higher income groups for these characteristics compared to married people, whereas the opposite is true for educational level. The explanation behind is that while divorced people are more morbid and die younger they earn more to be able to finance their living. On the contrary, it is the lowest educated who are divorced explaining some of the higher morbidity in this group.

To summarize, morbidity indicators for diabetes patients supports the hypothesis of different morbidity patterns among patients of higher and lower SES with the worse morbidity impact concentrating among lower levels of income. The reversed association between morbidity and income as well as between age and income, with elder and morbid people generally becoming poorer, hence contributes to explain these inequalities, when income is used as proxy for SES.

Health care and pharmaceutical usage – simple associations

So far, our analyses have confirmed the hypothesis of higher morbidity among patients of lower SES. Turning to patients' health care usage we expect that taking patients morbidity into consideration, patients of lower SES will consume relatively fewer health care services. In the following, results of simple association analyses and decomposition of concentration indices for health care and pharmaceutical usage is presented.

Simple associations between income or educational level and costs, without control for confounders, are shown in table 7. Mean patient costs for primary care, secondary care and pharmaceuticals are markedly decreasing with increasing income level (between 21-47% from low to high income) and likewise with increasing educational level (between 9-20% increase from short to high educational level).

Table 7: Simple relationships between income/education and costs

Variables	Income level (Mean DKK)			Educational level (Mean DKK)		
	Low income	Middle income	High income	Short education	Middle high education	high education
Costs in primary care	7,784	7,925	6,151	5,399	5,072	4,973
Costs in secondary care	40,691	32,735	21,665	35,335	31,838	29,354
Pharmaceutical costs	5,391	5,477	4,242	6,466	5,703	5,532

Health care and pharmaceutical usage – concentration index

The same approach as for morbidity indicators is applied on health care usage. Table 8 presents concentration indices of the eight selected cost variables together with contributions of socio-demographic and morbidity determinants to the predicted inequality (the former in percentage of the latter). Regression coefficients and concentration indices for each of the determinants are given in Appendix A4.

(Table 8 around here; see end of paper)

Table 8 presents concentration indices providing insights on the usage of health care and pharmaceuticals by SES. Overall, it is clear that the magnitudes of the figures in the table are modest, reflecting the Danish universal health care system with equal access to treatment (40). It is seen that observed and predicted concentration indices for a majority of the cost variables are negative. This means that health care costs are concentrated among patients of lower income groups relative to patients of higher income groups. This is depicted in Figure 8, where all contributions to the left means a contribution to costs accumulating among lower SES groups, whereas the right side contributions are interpreted oppositely. Most of the inequalities in the cost variables are explained by the included socio-demographic variables, as observed and predicted C are much similar (Figure 8).

Concentration index [-1,1]
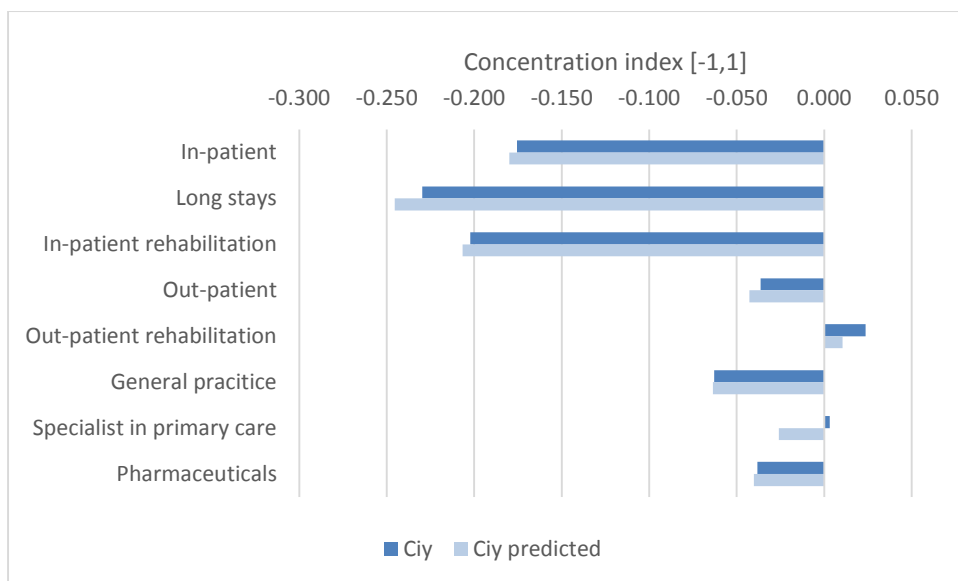
*Ciy = Observed concentration index for the outcome variable   Ciy predicted = Concentration index predicted by the included determinants for the outcome variable

Figure 8: Concentration index (observed and predicted by determinants)* of income-related inequalities in cost outcomes

In the decomposition analysis, we included patients' morbidity patterns; degree of complications at time of analysis and if the patient was diagnosed or died in the current year (2011). Patients' morbidity patterns should ideally explain inequality in the distribution of health care costs if costs were allocated exactly according to patients' need. This, of course, is an unrealistic expectation, since morbidity indicators cannot capture patients' exact need and since costs of services cannot proxy the exact received number of needed services. However, it is seen that between 62 and 97 percent of inequality in relation to costs concentrated among the lower income groups, in inpatient and outpatient care, are explained from having severe complications or dying in 2011.

From Figure 8 it is clear that especially in-patient health care services inhibit inequality, favoring patients with lower incomes. This corresponds well to these patients experiencing higher morbidity and mortality (as described from table 3-6). Looking at the decomposition of inequality in in-patient care, (Figure 9), it is seen, that morbidity patterns explain a great part of predicted inequality. Especially, morbidity indicators: severe complications at time of analysis and death in 2011, as expected, have marked influences on inequality in that costs accumulate among patients with these morbidity characteristics, which are also the ones with the lowest educational level. This pattern with costs accumulating among the lower income groups is consistent across the included socio-demographic and morbidity variables. Only among immigrants and elder

(75+) is the pattern clearly opposite with costs accumulating to a higher extent among the higher income groups (Figure 9).
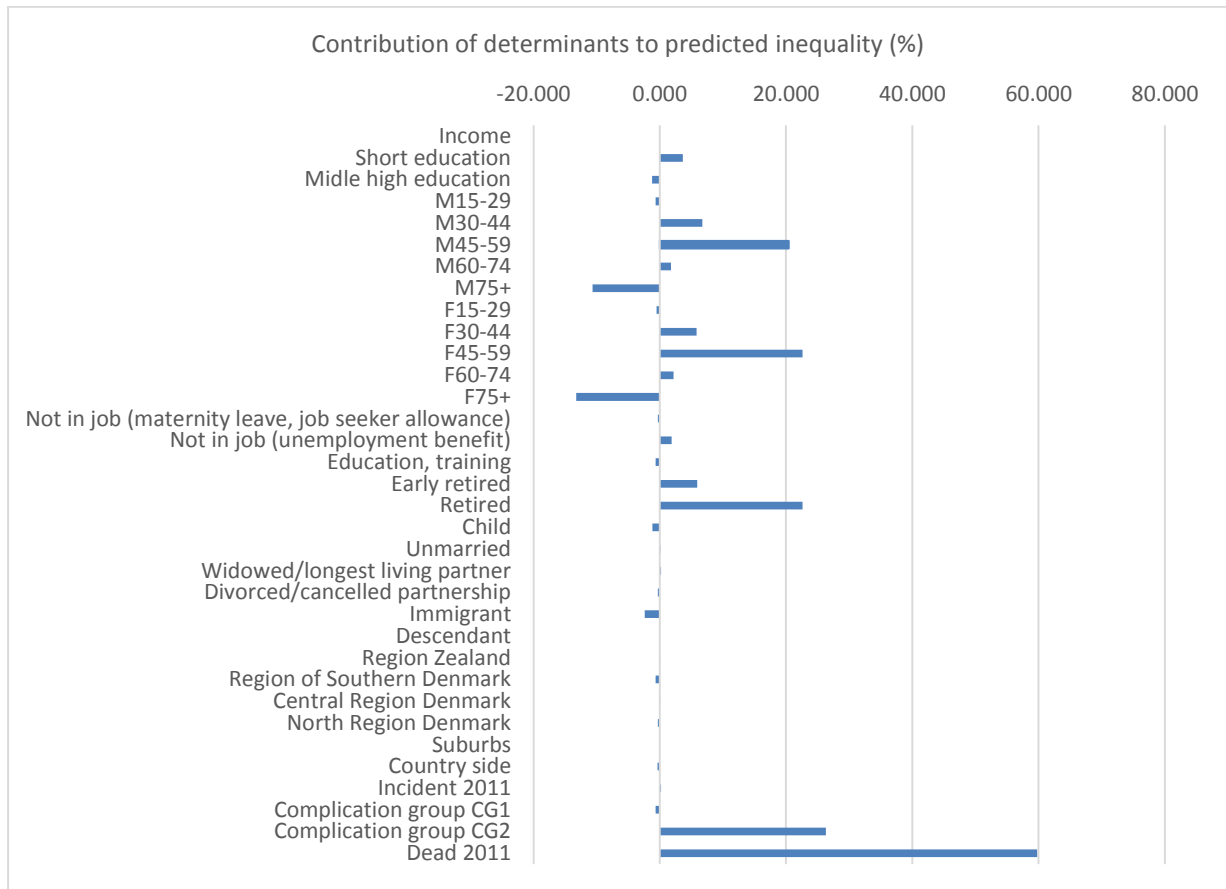
Figure 9: Decomposition of income-related inequality in in-patient care costs

Considering the positive regression coefficients (table A4), it is observed that having severe complications or dying in the current year results in higher costs in cost variables except rehabilitation and general practice. Furthermore, it is seen that all concentration indices of the individual determinants (table A4) are negative, pointing towards costs being accumulated among the lower income groups, who experience the most morbidity. The opposite is, however, true for costs in general practice and pharmaceutical costs, where services to a greater extent are concentrated among the higher income groups of patients dying in 2011. The same applies for rehabilitation services as outpatient or at specialists in primary care for patients with minor or severe complications, who tend to receive more services with higher income as compared to patients without complications. Overall, concentration indices for outpatient rehabilitation and specialist treatment in primary care are the only ones being positive (Figure 10). This indicates that especially patients of higher income groups receive rehabilitation services either as

outpatient or in primary care. The explanation for this is probably dual, with patients from higher income groups being prioritized when rehabilitation services are offered but also being more pro-active in seeking and participating in rehabilitation offers (14, 16). For these two cost variables, none of the included determinants are significant, however, the pattern is that these services to a higher degree than for the other cost variables are concentrated among the higher income groups. Figure 11 illustrates the decomposition of inequality of out-patient rehabilitation costs.
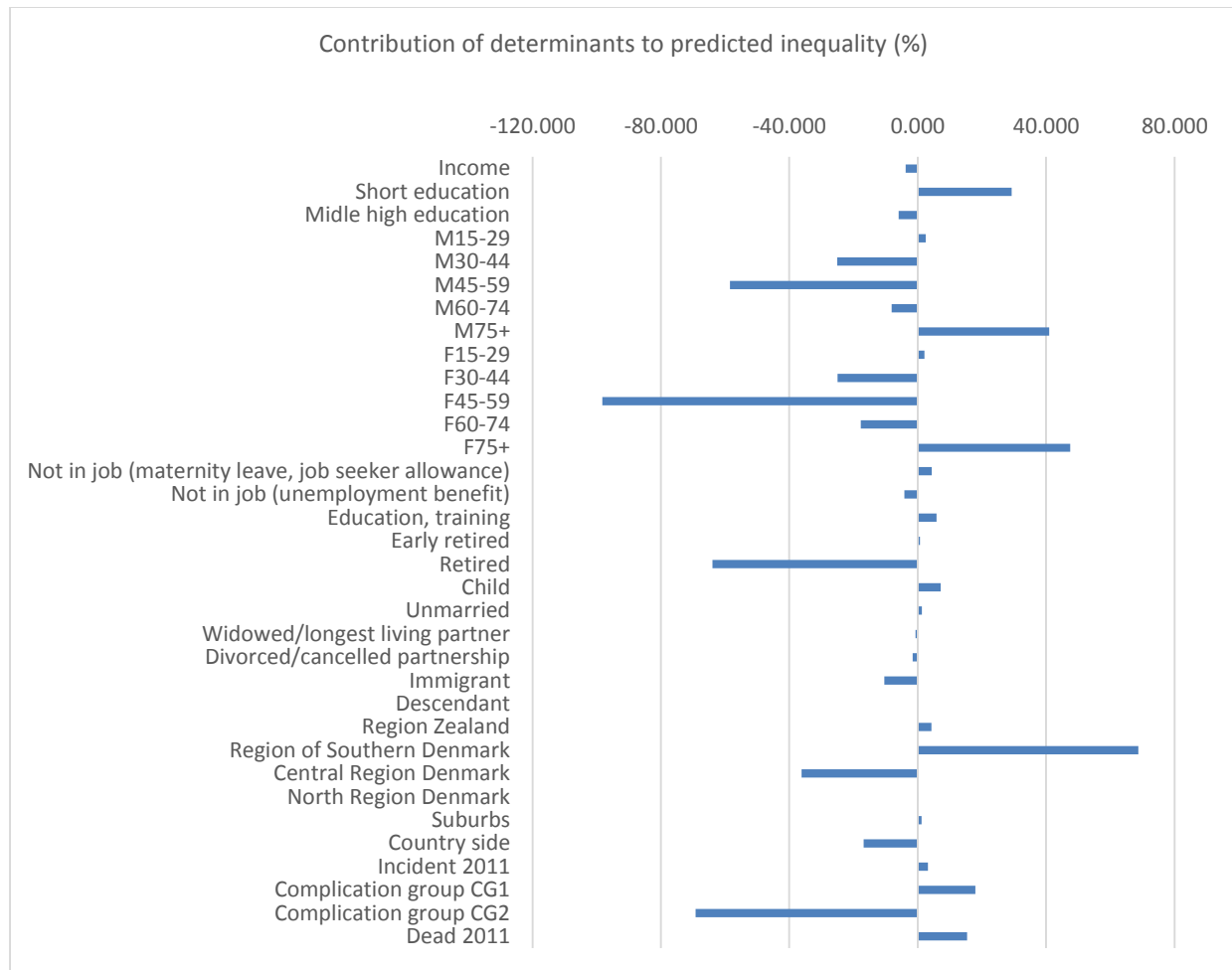
*Contributions are not significant

Figure 10: Decomposition of income-related inequality in out-patient rehabilitation costs*

Turning to the sociodemographic determinants, income is not a significant determinant in the regressions, whereas educational level is significant for in-patient, out-patient and general practice services. Among patients of lower education, especially the higher income patients are receiving outpatient services whereas the lower income patients are receiving inpatient services and services in general practice. This pattern is also reflected in the regression coefficients, where

low educational level implies higher inpatient but lower outpatient costs than higher educational levels.

According to patients' ethnicity, negative regression coefficients (table A4) imply that immigrants accumulate fewer costs than do ethnic Danes. Given that immigrants have lower incomes (as shown by the negative concentration indices of table A4), this observation conflicts with the general observation of costs being concentrated among low income groups. A potential explanation may be that costs are relatively more concentrated among the higher socioeconomic groups of immigrants than is the case for ethnic Danes. This rather surprising tendency, which is observed for in-patient as well as out-patient care and for pharmaceuticals, even when all other demographics and morbidity patterns are taken into account, may be explained by immigrants experiencing language and cultural barriers hindering them in taking full advantage of the Danish universal health care system(15). This finding underpins the findings from morbidity indicators where immigrants of higher income levels also to a greater extent than among ethnic Danes experienced longer duration of diabetes.

For labour market affiliation, the pattern is much similar across cost variables. Especially, being retired contributes highly to the level of inequality with magnitudes around 20-25% of the predicted inequalities in costs. Only children and patients under education have lower costs than patients' in job whereas all the other categories in general incur higher costs, especially early retired.

Turning to inequality caused by differences in age and gender distribution, it can be seen that these, as expected, contribute markedly to inequality in the distribution of costs. Overall, for in-patient care, long inpatient stays, outpatient treatments, specialists in primary care and pharmaceuticals, negative contributions to inequality in costs are found, especially among the younger age group (<30 years) and oldest age group (75+ years). Given the negative concentration indices and negative regression coefficients for these groups (Table A4), it is implied that they simultaneously earn lower incomes and generate less costs, whereby counteracting the tendency of costs being concentrated among low income groups. However, the interpretations and implications of these findings may be different for the two age groups. Given that young people are of better health, it is not surprising that they generate lower costs, and it is also to be expected that they have lower incomes, as many of them are studying or in

the beginning of their labor market career. However, for the elder group, a potential interpretation may be that elder with low incomes are disfavored with respect to treatment cost.

From differences across the regions, it can be seen that for the Region of Southern Denmark and North Denmark Region, patients from higher income levels are slightly favored by having a higher health care usage than is the case for the Capital Region. Turning to the regression coefficients (table A4), some (although minor) differences across regions are found. Thus, the Capital Region and Zealand Region have higher costs for in-patient, out-patient, special care in primary care and pharmaceuticals than the three other regions, whereas the opposite is true for services in general practice. Overall, this pattern is also reflected in the level of urbanity, where especially residents in country side use less resources than patients resident in cities, and where costs are more concentrated among patients from higher income levels. This might be explained by the Capital region and cities having more resources to seek up all patients and invest in secondary prevention efforts targeting all patients.

Turning to marital status, divorced patients generally have better income as indicated by the positive concentration index (table A4), and that they accumulate more in-patient services but less pharmaceutical costs and GP expenditure compared to married. The latter corresponds well with an expectation of divorced being more reluctant or hesitating to see a doctor. The former supports an expectation of divorced patients being in worse conditions when hospitalized and more depending on hospital care, given lack of care from a spouse at home. This pattern was also supported in the morbidity analyses, where divorced people were more morbid than married.

Health care and pharmaceutical usage - income versus education as rank variable

Table 9 mirrors table 8, just with educational level used as rank variable instead of income, table A5 in supplementary materials likewise mirrors table A4.

(Table 9 around here, see end of paper)

Comparing concentration indices ranked by education versus income, the previously observed picture with higher concentration indices for ranking according to income is likewise seen here. The picture of costs for outpatient rehabilitation and specialists in primary care concentrating among the higher income levels is underpinned, but with stronger associations with ranking according to education, where overall concentration indices are significant, also for out-patient

care (Figure 11). This indicate that it is especially educational level which is decisive for the higher usage of patients of higher SES of outpatient services, rehabilitation and specialist in primary care.
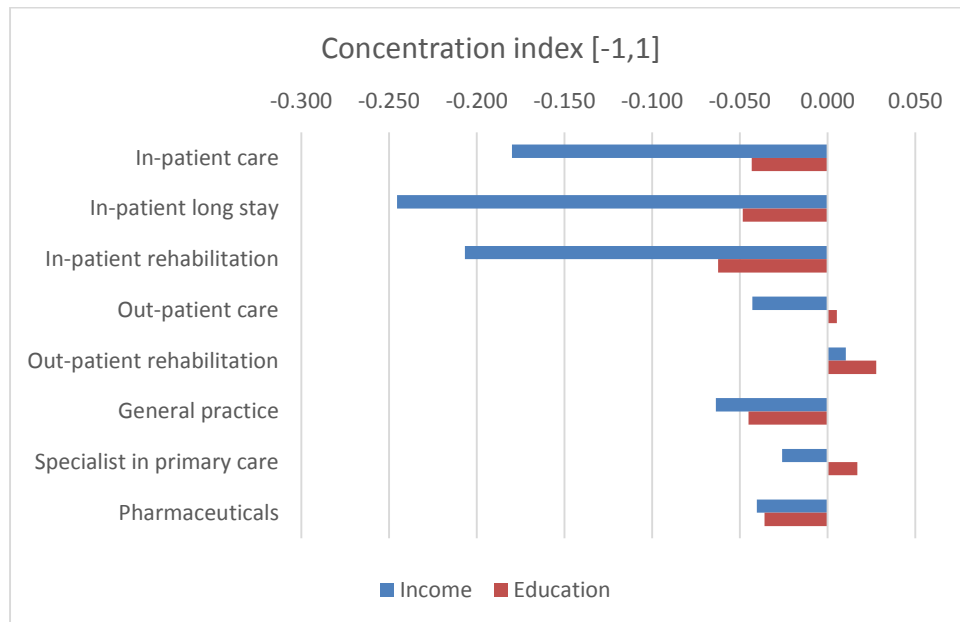
Figure 11: Concentration indices of health care and pharmaceutical usage ranked by income and educational level

While none of the sociodemographic determinants were significant for specialists in primary care, applying income as rank variable, a majority of the determinants are significant when applying education. This shows that especially usage of specialist services in primary care is associated with educational level. In the Danish health care system, general practice serves as gate-keeper with referrals required for specialist treatment(40). This might be part of the explanation for higher educated patients being favored or being more pro-active in receiving these services. Decomposition of inequality of costs for specialists in primary care (Figure 12) shows that especially for women 45+ and residents in the countryside and overall in the other regions as compared to the Capital Region, costs concentrate among higher educated patients. For early retired and retired, the opposite pattern is seen with costs concentrating among the lower educated patients, since these patient groups on average have lower educational level than patients in job (as indicated by negative Cs in table A5) and consume more resources since they are more morbid (cf. the positive regression coefficients in table A5). The same applies for patients with severe complications and for immigrants. For the latter, the explanation is,

however, reversed, as immigrants have higher educational level and consume less resources (table A5). Therefore their contribution to inequality is in the direction of costs accumulating among the lower educational groups.
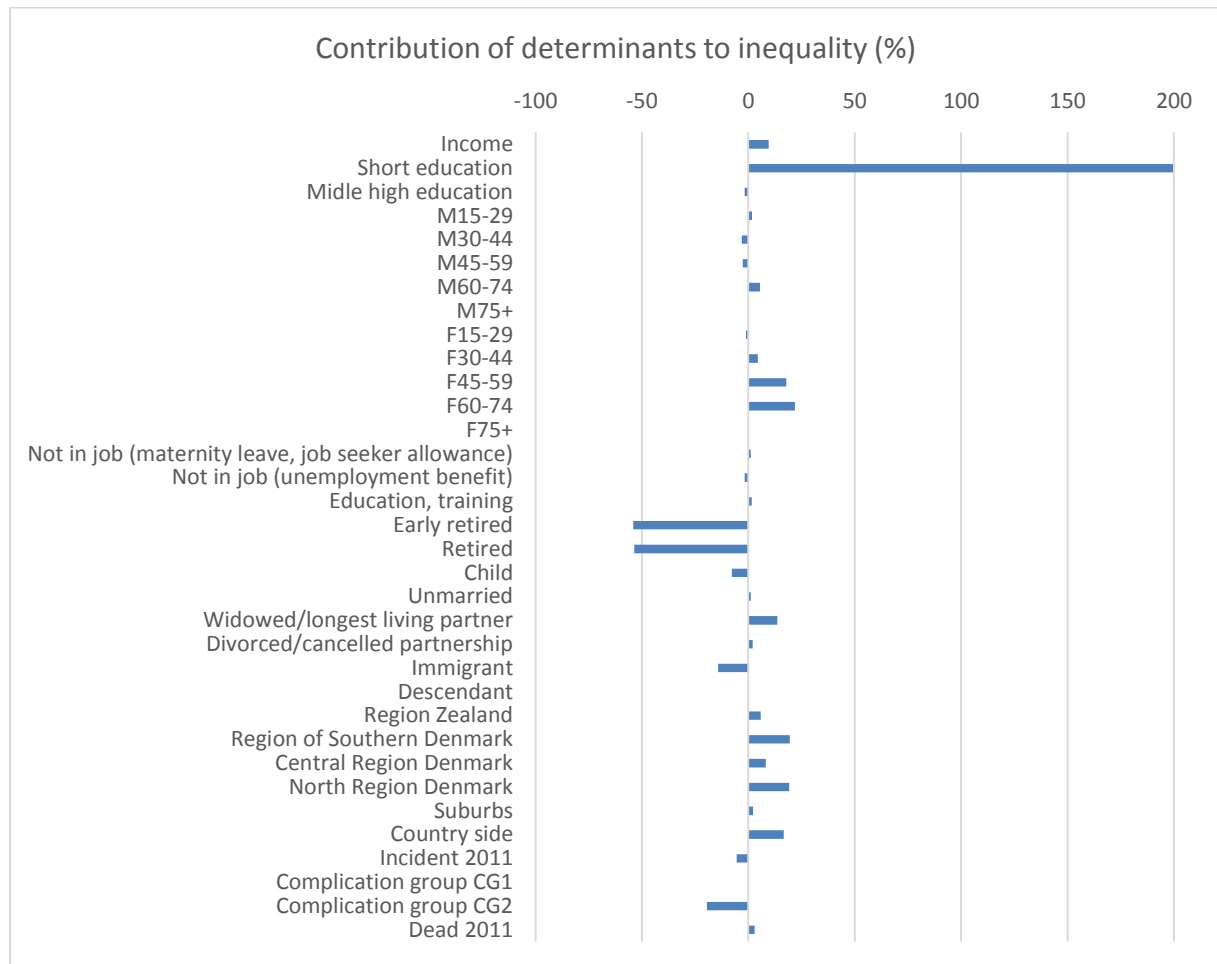
Figure 12: Decomposition of educational inequality in costs for specialists in primary care

Concentrating on ethnicity, the observed pattern for specialist treatment is likewise for all three types of in-patient care and pharmaceutical usage, where the contribution to inequality of immigrants is towards costs accumulating among lower educational groups. According to the negative regression coefficients (table A5), immigrants accumulate less in-patient costs than do ethnic Danes. However, since they have higher education than Ethnic Danes (as shown by the positive concentration indices of table A5) their contribution is opposite of the findings from using income level, where immigrants also had a lower usage, however, in general belonging to the lower income levels, resulting in contributions towards costs accumulating among the higher income groups. For general practice, the pattern is opposite indicating that immigrants of lower

educational levels have higher usage of these services than do ethnic Danes (table A5). That immigrants have a higher average educational level than ethic Danes is counterintuitive. One explanation might be that only the highest educated among immigrants are diagnosed at all, another that the preventive effect of high education is not the same among ethnic Danes and immigrants.

Turning to morbidity indicators, severe complications and dead in 2011 generally explain more of income inequality than they do of educational inequality. While between 62 and 97 percent of income inequality in relation to costs concentrated among the lower income groups for in-patient and out-patient care were explained from having severe complications or dying in 2011, the same figures for educational level are 25-45 percent. This is especially the case for dead in 2011, where markedly lower contributions are observed. For out-patient care, as much as 92 percent of costs accumulating among lower levels of income were explained from these two morbidity indicators. For education, the observed opposite direction with as much as 245 percent of inequality with costs accumulating among higher educated are explained from these two morbidity indicators. This indicates that for education-related inequality in health care usage there are other characteristics at stake than merely morbidity.

For labor market affiliation, similar patterns are observed across the two tables, however with greater magnitude of contributions of the determinants for income inequality than educational inequality. For age and gender, patterns overall agree across the two tables.

To summarize, morbidity characteristics explain a majority of usage in in-patient care, whereas out-patient care, especially rehabilitation services and specialist care in primary care to a greater extent favor patients of higher SES. According to demographic determinants, results point to higher costs among higher income groups especially among immigrants, elder 75+ years and residents in outer areas. For educational level, a lower degree of inequality is explained from morbidity indicators and greater inequality is seen for out-patient and specialist care favoring patients of high educational level.

Discussion

Persistent differences in health by socio-economic status (SES) have long been a serious health policy concern in many European countries(7). Evidence on the contributing factors to inequality in health in general and disease specific inequality may guide future efforts to reduce unequal distributions of for instance health care. This study presents – to our knowledge - first time evidence on the composition of socioeconomic inequality in a range of diabetes morbidity indicators and health care costs reflecting diabetes patients' lifetime with diabetes from diagnosis to death including received health care and pharmaceuticals. Our comprehensive data pool allows us to proxy patients' need through complication status and apply both educational and income level as proxy for SES. This framework provides novel insights, valuable for guiding future strategic efforts in diabetes. Some of these findings may underpin more universal structures behind inequality in diabetes and hence be generalized across borders.

Diabetes morbidity patterns

Diabetes is a public health disease, which hits both rich and poor. However, morbidity of the disease to a high degree depends on patients' self-care actions including compliance to treatment and secondary prevention efforts(13, 16). Our results underpin that the impact of diabetes mainly is loading on patients of lower SES, with these patients living fewer years without developing complications, experiencing severe complications sooner and dying sooner than do patients of higher SES. This pattern was consistent regardless of health state at diagnosis. Already at time of diagnosis, morbidity patterns were significantly different with patients of lower SES diagnosed in a higher age and at a worse health state with more complications. Results from the decomposition analyses underpinned this pattern, with morbidity indicators of worse health states at diagnosis and during diabetes progression to a higher extent concentrating among lower SES groups, while better health states were concentrated among patients of higher SES. Our findings hence support and expand international literature on inequality in diabetes mortality across Europe(8), and international evidence that SES of patients with diabetes, may determine risk of diabetes-related complications(13).

Turning to the demographic factors, we evidence that especially patients outside the labor market, immigrants and divorced patients are patient groups relevant to target. While the first group carry a great burden in respect to morbidity of diabetes, at the same time as they belong to lower levels of SES both in relation to education and income, the two latter groups stands out

with morbidity concentrating among higher income levels. For pensioners, our results hence support a well-known phenomenon for Denmark, where the elder traditionally receive relatively low incomes while enjoying worst health states, which in turn generate higher health care costs(7, 41). For immigrants the explanation might be that immigrants of lower income are not diagnosed ore followed in their disease in the same way as the more well-off immigrants, possibly due to cultural barriers.

Our findings concerning incidence are in contrast to most international literature. One explanation might be that patients of higher SES are diagnosed earlier (in a younger age), another reason might be the registration process in NDR, to be discussed under limitations.

Diabetes patients' health care and pharmaceutical usage

We demonstrate modest inequality in diabetes patients' health care and pharmaceutical usage reflecting that the Danish universal health care system is generally not inequitable. Our results however indicate that the amount of inequality explained by patients' morbidity patterns varied greatly across type of services showing different levels of realized access. This corresponds with previous findings concerning income-related inequality in health care utilization in Denmark (42). Type of services showing inequality however differ from previous findings, suggesting that different utilization patterns are at stake within a specific chronic disease area. This points to disease specific investigations within the large public health diseases, to inform future strategic efforts and national guidelines. In relation to inequality in health care usage, results stress that education is more decisive than income for patients' ability to take advantage of the health care system offers.

For in-patient and out-patient care, and especially for patients lying in hospital longer than expected from their DRG-code, majority of income-related inequality could be explained from patients' suffering from severe complications or dying in the current year. Regarding education-related inequality, results indicated that other characteristics besides morbidity were also important explaining determinants.

With morbidity impacting harder on patients of lower SES, as demonstrated, usage of especially in-patient services were concentrated among patients of lower SES. More specialized care, especially rehabilitation services and specialist care in primary care, was found to a greater extent

to concentrate among higher income patients, especially for patients with complications. This is in line with international findings (18). For patients dying in 2011 results likewise indicated that costs accumulate among higher income patients in general practice and for pharmaceuticals. Together, this indicate that patients of higher SES, especially patients of higher educational level, are favored or are more proactive in receiving services when they are seriously ill, and that they likewise are more willing to accept rehabilitation services and seek specialist care when diagnosed with diabetes. Such findings are important supplements to existing literature on differences in especially preventive services and maintenance of life style changes(14) and for efforts seeking to reduce productivity loss among chronic disease patients. According to demographic determinants, results point to higher costs among higher income groups among immigrants, elder 75+ years and residents in outer areas. For immigrants, this finding illustrate lower realized access, which along with the findings concerning morbidity in this group stress the importance of reducing the barriers for these patient groups for fully taking advantage of the Danish health care system.

Policy implications

This study does not investigate what could be done and how to change inequality components, however, it does show where the greatest potential for socio-economic related inequality reduction lies, thus providing an important basis for future research and efforts to reduce inequality in diabetes and in health as such. Policy implications of our results may be that health intervention strategies aiming at reducing socioeconomic inequality in diabetes could benefit from being supplemented with strategies aiming at targeting opportunistic screening programs to social vulnerable groups of lower SES aiming at achieving an earlier diagnosis and hence fewer complications at diagnosis. Furthermore, for diagnosed diabetes patients, secondary and tertiary prevention including rehabilitation services could be directed towards patients of lower SES, especially immigrants, elder patients and patients living alone to reduce inequality in diabetes.

Given marked prevalence increase of diabetes both in Denmark and globally (1, 6), our findings indicate that inequality in diabetes will also increase. This only stresses the importance of recognition and prioritizing of inequality aspects within chronic disease and diabetes.

Proxies for SES

Our study adds to the literature with methodological insights on choice of proxy for SES. We point out important differences of applying income and education as proxy for patients' SES, and hence the importance of choosing one or the other depending on the research inquiry in question. With the aim to investigate associations between SES and morbidity or mortality, education provides more univocal results, as education generally is not expected to be influenced by morbidity, being attained earlier in life. Evidence of negative impact of type 1 diabetes' on children's school performance (43), however, challenges this expectation for approximately 10% of the study population diagnosed with type 1 diabetes. Education hereby provides a more accurate indication of the effect of SES on morbidity. Income level, on the other hand, provides a mere immediate picture of this relationship, including also reversed causality between disease and SES. The observed differences in the two measures is in itself a valuable indication of this latter reversed causality between diabetes and patients' SES, stressing that diabetes impact patients' possibilities on the labor market. The oldest age groups, however, experience a marked part of the observed reversed causality due to a combination of older age groups becoming poorer and more morbid simultaneously. In relation to inequality in health care usage, our results indicate that education is more decisive than income for patients' realized access. Education as rank variable might hence be preferable in analyses of utilization patterns. Application of both education and income can be recommended, especially in explorative studies with more open research questions, since the two together enables a more nuanced and comprehensive understanding of results.

Limitations

There are certain limitations of the study, which should be noticed.

First, due to the registration process in NDR, some people in our patient population might be falsely registered, having had their blood glucose levels checked regularly. We have previously estimated that approximately 50% of the NDR registered, included through this criteria, do not have diabetes (24). This aspect influence results in the sense that these patients hereby are less morbid (provided they are not suffering from diabetes), and hence their health care usage correspondingly will be lower. However, since difference in relative number of patients included through regular blood glucose testing is in the range of 5 percentage points (26% ><31%) across SES groups, we do not see this as a serious disturbance of the findings concerning differences

within SES. For incidence, our results are, however, opposite to international findings. A review of 23 studies of the incidence of type 2 diabetes and socioeconomic position concluded that low levels of income, education and occupation were associated with increased risk of diabetes (9). One explanation for our finding might be the fact, that patients from higher income groups are more likely to be included in NDR, through the criteria of undergoing regular blood glucose level testing in primary care.

Next, data on patients' need evaluated from a physician or the patient self would enhance the study. However, access to comprehensive clinical data make up the best possible available proxy. Data on patients' life style choices, BMI etc. were unavailable, but would have nuanced findings. Nocon and colleagues recently found that health risk behaviours, especially obesity and smoking, are more strongly influenced by educational level than income and occupational status (44). Robbins and colleagues also investigated the association between SES and incidence of diabetes, concluding that control for potential mediators, including body size variables, diet, physical activity, and alcohol and tobacco use, substantially attenuated the associations with income and education (12). Investigating associations between SES and diabetes, it is hence relevant to be aware that since diabetes is highly influenced by health risk behaviours, observed associations might to a high degree be explained by these life style choices and hence could as well be attributed to these characteristics.

Furthermore, in Denmark inequality in mortality has almost doubled during the last twenty years, in spite of a relatively low economic inequality in the country (16). This shows that beyond diabetes inequality in morbidity and mortality exists. Lawlor and colleagues investigated association of SES with diagnosis, treatment, control and survival of women with diabetes and concluded that the lower survival among diabetes patients with low SES corresponded to the general lower survival among diabetes-free persons of lower SES (45). We were not able to control results for this background inequality in morbidity.

Finally, as described under methods, we applied an OLS regression instead of a logit estimation for binary variables, which would have been the ideal choice. However, since the linear regression function merely stands out from the logit regression function with respect to prediction of probabilities in the lower and upper end of the distribution, and since these predicted probabilities are beyond the scope of the study, we consider the linear regression approach to be a reasonable approximation for our purpose. In our regression, we chose not to include interactions to ease calculation and interpretation of results.

Conclusion

We evidence inequality in diabetes morbidity patterns from diagnosis to death, with patients of lower SES being diagnosed in a worse state, living shorter with their disease and experiencing more severe complications. Survival and time to complication show clear decreasing tendencies with decreasing SES. To reduce inequality in health, it is therefore important to invest in efforts targeted social vulnerable groups in relation to early detection and follow-up according to secondary prevention and disease progression. Even in a universal health care system, results indicate differences in realized access with patients of higher SES, especially higher educational level, to a greater extent enjoying offers of especially out-patient services, rehabilitation and specialists in primary care. Health care usage of patients of lower SES hereby not always corresponds to their need. Especially elder people, divorced, people outside the labor-market and immigrants are vulnerable when belonging to lower SES groups and would benefit from being targeted directly. Results indicate that different utilization patterns are at stake within a specific chronic disease as diabetes, compared to general health care utilization patterns. Methodologically, our findings underpin important differences of using respectively income and educational level as proxy for SES. Results indicate that education is more decisive than income for patients' realized access whereas income-related inequality in health care usage to a higher extent is explained by morbidity. Higher estimates of income-related inequality compared to education related inequality is an expression of reversed causality between diabetes and SES. This aspect of inequality is in itself a valuable message of diabetes' impact on patients' labour market participation. More of these findings may underpin universal structures behind inequality in diabetes and in chronic disease in general, valuable beyond Denmark.

Conflicts of Interest

Neither the Danish Diabetes Association nor the consortium of sponsors from the pharmaceutical industry has had any influence on the conduct of the study.

References

1.   WHO. Global status report on non-communicable diseases 2010. Description of the global burden of NCDs,

their risk factors and determinants. WHO, 2011.
2.   InternationalDiabetesFederation. IDF Diabetes Atlas Update 2012. 2012.
3.   Alva ML, Gray A, Mihaylova B, Leal J, Holman RR. The impact of diabetes-related complications on healthcare costs: new results from the UKPDS (UKPDS 84). diabeticMedicine. 2015;32:459-66.
4.   Sortsø C, Green A, Jensen P, Emneus M. Sociatal costs of diabetes mellitus in Denmark. Diabetic Med. 2015;September.
5.   Sortsø C, Emneus M, Green A, Jensen P, Eriksson T. Societal costs of diabetes mellitus 2015 and 2040 - forecasts based on real world cost evidence and observed epidemiological trends in Denmark. . Modern Economy. 2015;6:1150-66.
6.   Green A, Sortsø C, Jensen P, Emneus M. Incidence, morbidity, mortality and prevalence of diabetes in Denmark, 2000-2011: results from the Diabetes Impact Study 2013. Journal of clinical epidemiology. 2015;7:421-30.
7.   van Doorslaer E, Koolman X. Explaining the differences in income-related health inequalities across European countries. Health economics. 2004;13(7):609-28. Epub 2004/07/20.
8.   Espelt A, Borrell C, Roskam AJ, Rodriguez-Sanz M, Stirbu I, Dalmau-Bueno A, et al. Socioeconomic inequalities in diabetes mellitus across Europe at the beginning of the 21st century. Diabetologia. 2008;51(11):1971-9. Epub 2008/09/10.
9.   Agardh E, Allebeck P, Hallqvist J, Moradi T, Sidorchuk A. Type 2 diabetes incidence and socio-economic position: a systematic review and meta-analysis. International journal of epidemiology. 2011;40(3):804-18. Epub 2011/02/22.
10.   Imkampe AK, Gulliford MC. Increasing socio-economic inequality in type 2 diabetes prevalence--repeated cross-sectional surveys in England 1994-2006. European journal of public health. 2011;21(4):484-90. Epub 2010/08/06.
11.   Kristensen F, Sigmund H. Health Technology Assessment Handbook. Copenhagen: National Board of Health, 2007.
12.   Robbins JM, Vaccarino V, Zhang H, Kasl SV. Socioeconomic status and diagnosed diabetes incidence. Diabetes research and clinical practice. 2005;68(3):230-6. Epub 2005/06/07.
13.   Brown AF, Ettner SL, Piette J, Weinberger M, Gregg E, Shapiro MF, et al. Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. Epidemiologic reviews. 2004;26:63-77. Epub 2004/07/06.
14.   Sundhedsstyrelsen. Kronisk sygdom - Patient, sundhedsvæsen og samfund. Forudsætninger for det gode forløb. København: Sundhedsstyrelsen, 2005.
15.   Sundhedsstyrelsen. Strategi for indsatsvedrørende diabetes blandt etniske minoriteter. København: 2007.
16.   Sundhedsstyrelsen. Ulighed i sundhed - Årsager og indsatser. København: 2011.
17.   Gold M. Part I: The Concept of Access and Managed Care . Beyond Coverage and Supply: Measuring Access to Healthcare in Today's Market. Health Services Reserach 1998;33(3).

18.   van Doorslaer E, Koolman X, Jones AM. Explaining income-related inequalities in doctor utilisation in Europe. Health economics. 2004;13(7):629-47. Epub 2004/07/20.
19.   Wagstaff A, van Doorslaer E. Overall versus socioeconomic health inequality: a measurement framework and two empirical illustrations. Health economics. 2004;13(3):297-301. Epub 2004/02/26.
20.   Lauridsen J, Pradhan J. Socio-economic inequality of immunization coverage in India. Health Economics Review. 2011;1(11).
21.   van Doorslaer E, Masseria C, Koolman X. Inequalities in access to medical care by income in developed countries. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2006;174(2):177-83. Epub 2006/01/18.
22.   Eze CO, Onwuekwe IO, Agu CE, Kalu UA. The prevalence of orthostatic hypotension in type 2 diabetes mellitus patients in a diabetic clinic in Enugu South-East Nigeria. Nigerian journal of medicine : journal of the National Association of Resident Doctors of Nigeria. 2013;22(3):175-80. Epub 2013/11/05.
23.   Thygesen LC, Daasnes C, Thaulow I, Hansen HB. Introduction to Danish (nationwide) registers on health and social issues: structure, access, legislation and archiving. Scandinavian journal of public health. 2011;39 (suppl. 7).
24.   Green A, Sortsø C, Jensen PB, Emneus M. Validation of the Danish National Diabetes Register. Journal of clinical epidemiology. 2015;7. Epub 18. December 2014.
25.   Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. Scandinavian journal of public health. 2011;39(suppl- 7).
26.   Kildemoes H, Sørensen H, Hallas J. The Danish National Prescription Registry. Scandinavian journal of public health. 2011;Jul;39((7 Suppl)):38-41.
27.   Andersen JS, Olivarius NDF, Krasnik A. The Danish National Health Service Register. Scandinavian journal of public health. 2011;39(suppl 7).
28.   Bruce Wirta S, Hodgkins P, Joseph A. Economic burden associated with chronic constipation in Sweden: a retrospective cohort study. ClinicoEconomics and outcomes research : CEOR. 2014;6:369-79. Epub 2014/08/22.
29.   Juul S. Epidemiologi og evidens. København: Munksgaard Danmark; 2004.
30.   Cleves M, Gould W, Gutierrez RG, Machenko Y. An introduction to survival analysis using stata. books sp, editor2010.
31.   Wagstaff A, Paci P, Doorslaer E. On The Measurement Of Inequalities in Health Social Sciience Medicine 1991;33(5):545-57.
32.   Wagstaff A, Doorslaer EV, Watanabe N. On decomposing the causes of health sector inequalities, with an application to malnutrition inequalities in Vietnam. J Econom. 2003;112:219–27.
33.   Efron B, Tibshirani R. An Introduction to the Bootstrap. London: Chapman & Hall; 1993.
34.   Dias PR. Inequality of opportunity in health: evidence from a UK cohort study. Health economics. 2009;18:1057-74.
35.   Razzaghi H, Marcinkevage J, Peterson C. Prevalence of undiagnosed diabetes among non-pregnant women of reproductive age in the United States, 1999-2010. Primary care diabetes. 2013. Epub 2013/11/13.
36.   Aguilera E, Serra E, Granada ML, Alonso N, Pellitero S, Pizarro E, et al. Low Prevalence of Sublinical Atherosclerosis in Asymptomatic Patients With Type 1 Diabetes Mellitus in a European Mediterranean Population. Diabetes care. 2013. Epub 2013/10/19.
37.   Werblow A, Felder S, Zweifel P. Population ageing and health care expenditure: a school of 'red herrings'? Health economics. 2007;16(10):1109-26. Epub 2007/02/22.
38.   Ministeriet-sundhedogforebyggelse. DRG-leksikon. 2012 [cited 2012 30-04]; Available from: http://www.sum.dk/Sundhed/DRG-systemet/DRG-leksikon.aspx.

39.   Kristensen T, Olsen KR, Sortsø C, Ejersted C, Thomsen JL, Halling A. Resources allocation and health care needs in diabetescare in Danish GP clinics. Health Policy. 2013.

40.   Vallgårda S, Krasnik A. Sundhedsvæsen og sundhedspolitik. Vallgårda S, Krasnik A, editors. København: Munksgaard Danmark; 2007.

41.   Christiansen T, Lauridsen J. Determinants of Inequalities in Health in Europe with Focus on Retired – with particular Regard to retired Danes. 2009.

42.   Gundgaard J, Lauridsen J. Explaining the Source of Income-Related Inequality in Health Care Utilization in Denmark. COHERE: 2013.

43.   Persson S, Dahlquist G, Gerdtham UG, Steen Carlsson K. Impact of childhood-onset type 1 diabetes on schooling: a population-based register study. Diabetologia. 2013;56(6):1254-62. Epub 2013/02/26.

44.   Nocon M, Keil T, Willich SN. Education, income, occupational status and health risk behaviour. J Public Health-Uk. 2007;15(5):401-5.

45.   Lawlor DA, Patel R, Fraser A, Smith GD, Ebrahim S. The association of life course socio-economic position with diagnosis, treatment, control and survival of women with diabetes: findings from the British Women's Heart and Health Study. Diabetic medicine : a journal of the British Diabetic Association. 2007;24(8):892-900. Epub 2007/05/19.

Table 5: Decomposition of inequality in morbidity predictors ranked by income

Ranked by income	MORBIDITY - AT DIAGNOSIS						MORBIDITY - DISEASE PROGRESSION								MORBIDITY - AT DEATH			
	Incident in 2011		Severe complications at diagnosis		Age at Diagnosis		Severe complications at present		PYRS in CG0*		PYRS in CG2*		Total PYRS*		Death in 2011		Age at death	
Mean	0.099	***	0.193	***	55.795	***	0.459	***	5.923	***	1.900	***	9.715	***	0.037	***	77.409	***
C (observed)	0.052	***	-0.093	***	-0.039	***	-0.066	***	0.031	***	-0.112	***	0.000		-0.677	***	-0.008	***
C (predicted)	0.034	***	-0.076	***	-0.040	***	-0.047	***	0.026	***	-0.088	***	0.004	***	-0.178	***	-0.010	***
C (unexplained)	0.018	***	-0.016	***	0.001	***	-0.019	***	0.005	***	-0.023	***	-0.004	***	-0.499	***	0.003	***
Determinants (reference group)	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.
SES																		
Income	0.42		1.56		-0.17		1.88		2.40		1.96		-10.74		4.66		-7.65	
Educational level (high education)																		
Primary education	1.28		6.09	***	1.41	***	3.69	***	10.64	***	1.54	*	-382.87		-2.55	***	0.47	
Medium education	1.36		-1.66	***	-0.54	***	-0.45		-3.67	***	-0.42		138.62		1.52	***	-0.17	
Age and gender (Males0-14) (Females0-14)																		
M15-29	1.84	***	1.77	***	1.58	***	1.83	***	1.00	***	1.19	***	15.66		0.85	***	0.84	**
M30-44	-9.10	***	-18.67	***	-24.90	***	-17.20	***	-12.52	***	-16.63	***	-205.58		-8.75	***	-8.07	***
M45-59	-31.24	***	-82.16	***	-119.21	***	-59.03	***	-67.30	***	-59.57	***	77.31		-30.73	***	-125.09	***
M60-74	-4.15	***	-9.07	***	-13.09	***	-6.35	***	-6.70	***	-6.56	***	-5.05		-3.09	***	-154.52	***
M75+	27.75	***	55.43	***	76.74	***	40.59	***	37.52	***	42.33	***	158.26		21.40	***	121.93	***
F15-29	0.70	**	1.61	***	1.69	***	1.28	***	1.59	***	1.18	***	-8.73		0.85	***	0.84	**
F30-44	-16.50	***	-15.74	***	-24.77	***	-10.25	***	-1.67		-14.20	***	-209.09		-8.62	***	-8.10	***
F45-59	-39.57	***	-60.89	***	-116.98	***	-38.34	***	-21.49	***	-49.24	***	-478.68		-29.34	***	-125.36	***
F60-74	-3.66	***	-6.42	***	-13.10	***	-4.18	***	-3.88	***	-5.02	***	-1.76		-2.83	***	-154.62	***
F75+	27.41	***	43.32	***	76.64	***	32.40	***	25.30	***	37.06	***	200.52		19.28	***	121.96	***
Labour market affiliation (in job)																		
Not in job (maternity leave, job seeker allowance)	0.97	***	-0.17	***	-0.08	***	-0.21	***	-0.85	***	-0.03		16.58		-0.03		-0.05	
Not in job (unemployment benefit)	-1.84	**	1.70	***	0.44	***	2.19	***	6.16	***	0.67	***	-125.24		0.01		0.13	

Education, training	5.07	***	2.40	***	0.76	***	1.41	***	3.69	***	1.26	***	-68.42		1.22	***	0.09	
Early retired	7.90	***	7.85	***	-0.72	***	9.71	***	8.79	***	10.67	***	160.74		1.09	***	-0.06	
Retired	15.89	***	20.69	***	-0.84	***	26.76	***	25.71	***	28.65	***	442.09		-1.22		1.08	
Child	-3.88	***	5.95	***	2.84	***	2.17	***	11.24	***	3.53	***	-275.21		2.72	***	0.11	
Marital status (married)																		
Unmarried	-0.49	***	-0.03		0.04	***	-0.40	***	-0.16	*	-0.34	***	-5.62		-0.30	***	0.05	*
widowed/longest living partner	1.60	***	1.00	***	-0.06	**	1.58	***	0.68	***	0.98	***	12.80		1.07	***	0.06	
Divorced/cancelled partnership	-0.20		-0.46	***	0.01		-0.67	***	-0.66	***	-0.39	***	-2.28		-0.29	***	0.07	***
Ethnicity (Ethic Dane)																		
Immigrant	2.13	***	-2.96	***	0.77	***	-2.52	***	2.15	***	-3.12	***	-161.11		-0.65	***	0.14	
Descendant	-0.07		0.10	**	0.03	***	-0.05		0.12	*	-0.02		-3.58		0.00		0.00	
Region of residence (Capital Region of Denmark)																		
Region Zealand	-0.06		-0.01		0.00		0.04		0.11		-0.05		-0.34		0.00		0.00	
Region of Southern Denmark	-1.75	***	-0.09		0.26	***	-0.44	***	1.38	***	-1.71	***	-64.53		-0.13	***	0.02	
Central Denmark Region	0.20		-0.02		-0.02		-0.03		-0.22		0.07		-0.45		0.01		0.01	
North Denmark Region	-1.46	***	-0.02		0.03	***	-0.14	***	0.11		-0.81	***	-7.58		-0.05	***	0.02	
Degree of urbanity of residence (cities)																		
Suburbs	0.03		-0.01		0.00		-0.07	*	-0.15	*	-0.01		-0.62		0.01		0.00	
Country side	3.06	***	-0.65	***	0.09	***	-2.73	***	-4.52	***	-0.73	***	-5.83		0.10	*	0.01	

* PYRS = Patient years, CG0 = no complications, CG1 = minor complications, CG2 = severe complications

Table 6: Decomposition of inequality in morbidity predictors ranked by education

Ranked by education	MORBIDITY - AT DIAGNOSIS						MORBIDITY - DISEASE PROGRESSION								MORBIDITY - AT DEATH			
	Incident in 2011		Severe complications at diagnosis		Age at Diagnosis		Severe complications at present		PYRS in CG0*		PYRS in CG2*		Total PYRS*		Death in 2011		Age at death	
Mean	0.099	***	0.193	***	55.795	***	0.459	***	5.922	***	1.901	***	9.715	***	0.037	***	77.408	***
C (observed)	0.018	***	-0.032	***	-0.013	***	-0.020	***	0.009	***	-0.031	***	0.002	***	-0.025	***	0.011	***
C (predicted)	0.017	***	-0.032	***	-0.013	***	-0.021	***	0.009	***	-0.031	***	0.002	***	-0.031	***	0.011	***
C (unexplained)	0.001		0.000		0.000		0.000		0.000		0.000		0.000		0.006	***	0.000	
Determinants (reference group)	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.
SES																		
Income	0.51		1.35		-0.15		1.85		2.54		2.20		-2.05		43.03		0.97	
Educational level (high education)																		
Primary education	7.94		52.71	***	12.12	***	36.09	***	108.60	***	17.23	**	414.57	**	-226.40	**	-1.95	
Medium education	10.11		-10.86	***	-3.55	***	-3.36		-28.82	**	-3.74		-128.63	*	101.99	***	0.51	
Age and gender (Males0-14) (Females0-14)																		
M15-29	4.71	***	4.26	***	3.80	***	4.97	***	2.92	**	3.62	***	-6.71		20.52	***	-0.39	**
M30-44	-6.05	***	-11.58	***	-15.40	***	-12.02	***	-9.35	***	-13.07	***	20.76	*	-54.37	***	1.26	
M45-59	-18.47	***	-45.82	***	-66.10	***	-37.09	***	-45.22	***	-42.10	***	-8.04		-171.28	***	7.27	*
M60-74	-34.89	***	-71.71	***	-103.04	***	-56.56	***	-63.78	***	-65.72	***	3.02		-244.18	***	63.80	***
M75+	0.59		1.13		1.56		0.93		0.94		1.10		-0.48		4.22		126.80	***
F15-29	1.82	**	3.87	***	4.06	***	3.48	***	4.62	**	3.61	***	3.11		20.48	***	-0.39	**
F30-44	-10.89	***	-9.76	***	-15.32	***	-7.17	***	-1.29		-11.15	***	23.99	*	-53.55	***	1.26	
F45-59	-23.43	***	-33.97	***	-64.87	***	-24.09	***	-14.59	**	-34.80	***	41.11		-163.51	***	7.28	*
F60-74	-30.85	***	-50.81	***	-103.11	***	-37.27	***	-36.96	***	-50.26	***	2.75		-224.03	***	63.84	***
F75+	0.58		0.89		1.56		0.75		0.64		0.96		-0.62		3.81		126.84	***
Labour market affiliation (in job)																		
Not in job (maternity leave, job seeker allowance)	1.61	***	-0.27	***	-0.12	***	-0.37	***	-1.59	***	-0.07		-4.70	*	-0.40		0.01	
Not in job (unemployment benefit)	-0.69	**	0.60	***	0.15	***	0.87	***	2.61	**	0.30	***	6.17	*	0.03		0.06	
Education, training	6.24	***	2.75	***	0.87	***	1.83	***	5.13	***	1.83	***	15.65	*	14.06	***	-0.01	
Early retired	20.93	***	19.65	***	-1.79	***	27.41	***	26.42	***	33.87	***	-65.85	*	27.41	***	-0.04	
Retired	13.94	***	17.35	***	-0.69	***	25.30	***	25.87	***	30.50	***	-49.03	*	-10.43		-0.07	

Child	9.09	***	-13.23	***	-6.27	***	-5.44	***	-30.13	***	-9.93	***	-89.81	*	-60.39	***	0.07	
Marital status (married)																		
Unmarried	0.81	**	0.05		-0.06	***	0.70	***	0.29		0.67	***	-1.54		4.66	***	0.02	
widowed/longest living partner	5.88	***	3.51	***	-0.21	**	6.25	***	2.90	*	4.37	***	-8.09		37.59	***	-0.02	
Divorced/cancelled partnership	0.46		1.02	***	-0.01		1.66	***	1.77	**	1.08	***	0.51		6.33	***	0.03	**
Ethnicity (Ethic Dane)																		
Immigrant	-4.59	**	6.08	***	-1.58	***	5.83	***	-5.29	**	8.09	***	-62.85	*	13.33	***	0.12	
Descendant	0.09		-0.14	**	-0.03	***	0.08		-0.19		0.03		-1.24		0.07		0.00	
Region of residence (Capital Region of Denmark)																		
Region Zealand	-0.96	**	-0.08		0.06	***	0.67	***	2.09	**	-1.02	***	2.51		0.08		-0.01	
Region of Southern Denmark	-5.11	***	-0.24		0.71	***	-1.38	***	4.59	***	-5.94	***	27.44	*	-3.56	**	-0.01	
Central Denmark Region	-4.66	***	0.36	***	0.40	***	0.81	***	5.71	***	-1.92	***	15.21	*	-2.24	***	-0.02	
North Denmark Region	-8.72	***	-0.12		0.18	***	-0.90	***	0.78		-5.89	***	6.91	*	-2.69	**	-0.02	
Degree of urbanity of residence (cities)																		
Suburbs	0.62		-0.15		0.03		-1.34	***	-2.98	**	-0.23		1.21		0.85		0.00	
Country side	14.76	***	-2.95	***	0.43	***	-14.07	***	-24.87	***	-4.20	***	17.37		4.72		-0.01	

* PYRS = Patient years, CG0 = no complications, CG1 = minor complications, CG2 = severe complications

Table 8: Decomposition of inequality in health care and pharmaceutical usage ranked by income

Ranked by income	SECONDARY CARE										PRIMARY CARE				PHARMACEUTICALS	
	INPATIENT						OUTPATIENT									
											General pracitice		Specialist			
	Care		long stays		Rehabilitation		Care		Rehabilitation							
Number of observations	318,684		318,684		318,684		209,530		8,089		318,684		318,684		318,684	
Mean	20996.5	***	718.561	***	236.955	***	16836.740	***	3954.549	***	3069.671	***	2108.611	***	7489.03	***
C (observed)	-0.176	***	-0.230	***	-0.202	***	-0.036	***	0.024	***	-0.063	***	0.003	**	-0.038	***
C (predicted)	-0.180	***	-0.245	***	-0.207	***	-0.043	***	0.011	*	-0.064	***	-0.026	***	-0.040	***
C (unexplained)	0.004	*	0.016	**	0.004		0.006	***	0.013	***	0.001		0.029	***	0.002	**
Determinants (reference group)	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.	C	Sig.
SES																
Income	0.06		-0.81		0.28		-3.41		-3.72		1.10	*	99.38		-2.81	
Educational level (high education)																
Primary education	3.67	***	2.73		0.81		-14.15	***	29.22		14.78	***	97.09		2.46	
Medium education	-1.21	***	-1.18		0.39		2.26		-5.93		-4.89	***	1.99		2.45	***
Age and gender (Males0-14) (Females0-14)																
M15-29	-0.66	***	-0.86	***	0.18	**	-3.55	***	2.49		0.16	***	1.88		-0.82	***
M30-44	6.73	***	6.29	***	-1.76	**	24.22	***	-25.07		-6.20	***	-11.23		9.30	***
M45-59	20.45	***	20.20	***	-9.69	***	71.29	***	-58.47		-32.51	***	28.93		49.04	***
M60-74	1.80	***	1.97	***	-1.09	***	3.93	***	-8.11		-3.93	***	7.23		5.58	***
M75+	-10.65	***	-9.91	***	9.75	***	-45.51	***	40.92		26.83	***	-36.67		-33.88	***
F15-29	-0.53	***	-0.55	***	0.16	**	-1.74	***	2.06		1.05	***	-4.84		-1.25	***
F30-44	5.83	***	5.69	***	-2.43	***	17.72	***	-24.96		-10.59	***	54.68		17.01	***
F45-59	22.60	***	19.94	***	-10.61	***	78.07	***	-98.23		-42.88	***	205.85		50.83	***
F60-74	2.18	***	2.04	***	-1.25	***	4.53	***	-17.74		-4.14	***	17.25		4.66	***
F75+	-13.21	***	-11.54	***	10.23	***	-50.92	***	47.46		24.59	***	-49.24		-27.46	***
Labour market affiliation (in job)																
Not in job (maternity leave, job seeker allowance)	-0.29	***	-0.36	***	-0.30	***	-0.84	***	4.34		-0.69	***	2.88		-0.10	
Not in job (unemployment benefit)	1.86	***	0.54		0.84	***	2.68	***	-4.15		4.40	***	-21.52		2.81	***
Education, training	-0.63	**	-1.34	***	0.40	***	1.98	**	5.89		-0.87	***	4.43		1.60	*
Early retired	5.95	***	5.47	***	2.98	***	23.32	***	0.74		8.56	***	-114.36		40.97	***

Retired	22.60	***	18.74	***	14.34	***	74.14	***	-63.97		33.23	***	-349.57		71.38	***
Child	-1.18	***	-2.30	***	0.91	***	2.30		7.16		0.73	***	14.16		-3.47	***
Marital status (married)																
Unmarried	0.10	*	-0.35	**	-0.07		0.36	**	1.29		0.25	***	-4.49		-0.75	***
widowed/longest living partner	0.22		0.99	**	0.88	***	-1.91	***	-0.71		-0.11		20.81		0.71	***
Divorced/cancelled partnership	-0.29	***	-0.48	***	-0.40	***	0.78	**	-1.53		0.00		-5.02		-1.20	***
Ethnicity (Ethic Dane)																
Immigrant	-2.37	***	-2.09	***	-2.07	***	-5.93	***	-10.37		0.79	***	35.59		-13.87	***
Descendant	-0.05		-0.13	***	-0.05	**	-0.17		0.09		0.01		0.93		-0.31	***
Region of residence (Capital Region of Denmark)																
Region Zealand	0.02		-0.08		0.00		-0.13		4.30		0.04		3.82		-0.03	
Region of Southern Denmark	-0.64	***	-1.55	***	2.58	***	1.84	***	68.74		1.57	***	34.67		-0.76	***
Central Denmark Region	0.03		0.11		-0.15		-0.01		-36.14		-0.16		1.31		0.05	
North Denmark Region	-0.28	***	-0.35	***	0.64	***	-1.43	***	0.15		1.10	***	21.02		0.08	
Degree of urbanity of residence (cities)																
Suburbs	-0.01		0.02		0.00		-0.05		1.16		0.06	*	1.03		0.07	*
Country side	-0.35	**	-0.02		-0.79	***	-3.56	***	-16.87		1.92	***	25.08		0.46	*
Morbidity indicators																
Incident in 2011	0.18	***	0.01		0.23	***	-0.40	***	3.18		2.55	***	-26.42		3.42	***
Complication group CG1 (CG0) *	-0.67	***	-0.63	***	-0.45	***	-3.90	***	17.93		-0.23	***	2.67		-3.53	***
Complication group CG2 (CG0)*	26.30	***	20.01	***	23.68	***	57.50	***	-69.18		8.06	***	-116.38		50.73	***
Death in 2011	59.76	***	77.45	***	37.84	***	34.38	***	15.37		-8.04	***	152.06		-20.36	***

*CG0 = no complications, CG1 = minor complications, CG2 = severe complications

Table 9: Decomposition of inequality in health care and pharmaceutical usage ranked by education

Ranked by education	SECONDARY CARE										PRIMARY CARE				PHARMACEUTICALS	
	INPATIENT						OUTPATIENT									
	Care		long stays		Rehabilitation		Care		Rehabilitation		General pracitice		Specialist			
Number of observations	318,684		318,684		318,684		209,530		8,089		318,684		318,684		318,684	
Mean	20998.880	***	719.892	***	236.974	***	16830.080	***	3959.272	***	3069.761	***	2108.322	***	7488.065	***
C (observed)	-0.044	***	-0.047	***	-0.064	***	0.006	*	0.027	***	-0.045	***	0.015	***	-0.036	***
C (predicted)	-0.043	***	-0.048	***	-0.062	***	0.005	*	0.028	***	-0.045	***	0.017	***	-0.036	***
C (unexplained)	0.000		0.002		-0.002		0.001		0.000		0.000		-0.002	***	0.000	
Determinants (reference group)	C		C		C		C		C		C		C		C	
SES																
Income	0.06		-1.33		0.28		11.18		0.48		0.48	*	9.62		-0.95	
Educational level (high education)																
Primary education	43.98	***	37.37		7.60		363.57		65.54	*	61.19	***	199.47	***	7.99	
Medium education	-11.41	***	-14.11		2.60		-34.53		-15.47		-15.48	***	-1.73		5.62	**
Age and gender (Males0-14) (Females0-14)																
M15-29	-2.24	***	-3.86	**	0.50	**	34.68		2.29		0.19	***	1.74	***	-0.70	***
M30-44	5.87	***	7.41	*	-1.23	**	-74.69		-4.28		-1.85	***	-3.02	***	2.08	***
M45-59	15.98	***	21.08	**	-6.01	***	-167.99		-13.05		-8.69	***	-2.67		9.86	***
M60-74	20.02	***	29.27	**	-9.48	***	-241.32		-18.19		-14.92	***	5.54	*	15.95	***
M75+	-0.31		-0.37		0.22		-3.22		-4.34		0.27		-0.11		-0.26	
F15-29	-1.81	***	-2.51	*	0.43	**	18.00		1.86		1.22	***	-1.10	***	-1.10	***
F30-44	5.09	***	6.66	*	-1.68	***	-54.11		-4.28		-3.16	***	4.38	***	3.81	***
F45-59	17.68	***	20.85	**	-6.55	***	-180.17		-21.80		-11.47	***	17.85	***	10.23	***
F60-74	24.17	***	30.07	**	-10.89	***	-278.22		-40.58	*	-15.70	***	21.88	***	13.36	***
F75+	-0.38		-0.45		0.23		-3.60		-5.08		0.24		-0.15		-0.21	
Labour market affiliation (in job)																
Not in job (maternity leave, job seeker allowance)	-0.64	***	-1.04	*	-0.51	***	3.47		1.08		-0.52	***	1.12	***	-0.06	
Not in job (unemployment benefit)	0.92	***	0.35		0.33	***	-3.96		-0.84		0.74	***	-1.78	***	0.36	***
Education, training	-0.98	**	-2.83	**	0.52	**	-7.67		1.50		-0.48	***	1.52	**	0.68	*
Early retired	20.88	***	25.70	***	8.21	***	-242.75		1.00		10.30	***	-54.05	***	37.18	***
Retired	26.66	***	29.38	**	13.32	***	-254.03		-12.14		13.41	***	-53.57	***	21.77	***

	V1		V2		V3		V4		V5		V6		V7		V8	
Child	3.72	***	9.54	*	-2.23	***	16.49		-3.98		-0.78	***	-7.75	***	2.78	***
Marital status (married)																
Unmarried	-0.22		1.04		0.13		2.24		0.02		-0.19	***	1.21	***	0.42	***
widowed/longest living partner	0.96		6.21	**	3.29	***	48.90		6.44		-0.19		13.59	***	0.90	***
Divorced/cancelled partnership	0.90	***	1.96	**	0.99	***	6.64		0.00		0.00		2.07	***	0.96	***
Ethnicity (Ethic Dane)																
Immigrant	6.77	***	7.63	**	4.67	***	-42.78		4.97		-0.78	***	-14.18	***	10.31	***
Descendant	0.10		0.30	*	0.08	*	-0.61		0.31		0.00		-0.26	**	0.15	***
Region of residence (Capital Region of Denmark)																
Region Zealand	0.54	***	-2.35	*	-0.04		6.83		2.77		0.34	***	5.76	***	-0.15	*
Region of Southern Denmark	-2.47	***	-7.99	**	7.77	***	-21.85		47.04	*	2.08	***	19.42	***	-0.77	***
Central Denmark Region	-0.93	***	-4.68	**	3.46	***	13.59		-19.07		1.70	***	8.27	***	-0.37	***
North Denmark Region	-2.22	***	-3.80	**	4.00	***	39.02		6.71		2.99	***	19.12	***	0.16	
Degree of urbanity of residence (cities)																
Suburbs	-0.36	*	0.74		0.04		2.65		-1.93		0.52	***	2.19	***	0.44	***
Country side	-2.21	**	-0.19		-3.92	***	69.52		-22.51	*	4.21	***	16.68	***	0.75	
Morbidity indicators																
Incident in 2011	0.25	***	0.04		0.25	***	3.22		1.63		1.19	***	-5.53	***	1.20	***
Complication group CG1 (CG0) *	0.13		0.15		0.07		8.98		1.05		0.02		-0.09		0.18	
Complication group CG2 (CG0)*	29.52	***	29.86	***	20.87	***	-217.68		-5.92		3.12	***	-19.41	***	14.79	***
Death in 2011	8.81	***	15.21	**	4.37	***	-28.03		-0.08		-0.41	***	2.94	***	-0.78	***

*CG0 = no complications, CG1 = minor complications, CG2 = severe complications

Appendices

A1 Cox regressions

A1a: Cox regression diagnosis to death/censoring with income as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Income (low)			3118.846	2	0			
Middle	-0.581	0.012	2363.859	1	0	0.559	0.547	0.573
High	-1.092	0.029	1375.067	1	0	0.336	0.317	0.356
Gender	-0.519	0.012	1964.51	1	0	0.595	0.581	0.609
Age	0.065	0.001	13156.674	1	0	1.068	1.066	1.069
Marital status (married)			1854.204	3	0			
Unmarried	0.573	0.02	857.226	1	0	1.774	1.707	1.844
Widowed	0.449	0.015	933.377	1	0	1.566	1.522	1.612
Divorced	0.557	0.017	1098.366	1	0	1.745	1.689	1.804
Ethnicity (Dane)			220.65	2	0			
Immigrant	-0.388	0.026	220.251	1	0	0.678	0.644	0.714
Descendant	-0.122	0.151	0.651	1	0.42	0.885	0.659	1.19
Region of residence (Capital Region)			46.866	4	0			
Region Zealand	-0.01	0.017	0.342	1	0.559	0.99	0.957	1.024
Region of Southern Denmark	-0.066	0.015	19.146	1	0	0.936	0.908	0.964
Central Denmark Region	-0.069	0.016	19.435	1	0	0.933	0.905	0.962
North Denmark Region	-0.106	0.019	29.614	1	0	0.9	0.866	0.935

A1b: Cox regression diagnosis to death/censoring with education as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Education (short)			256.767	2	0			
Middle	-0.135	0.013	108.354	1	0	0.874	0.852	0.897
High	-0.307	0.021	210.838	1	0	0.736	0.706	0.767
Gender	-0.446	0.012	1281.337	1	0	0.64	0.625	0.656
Age	0.075	0.001	14587.427	1	0	1.078	1.077	1.079
Marital status (married)			1013.147	3	0			
Unmarried	0.462	0.02	515.808	1	0	1.588	1.526	1.653
Widowed	0.257	0.015	287.926	1	0	1.293	1.255	1.332
Divorced	0.445	0.017	678.391	1	0	1.561	1.51	1.614
Ethnicity (Dane)			50.427	2	0			
Immigrant	-0.22	0.031	50.355	1	0	0.802	0.755	0.853
Descendant	-0.061	0.18	0.115	1	0.735	0.941	0.662	1.338
Region of residence (Capital Region)			13.778	4	0.008			
Region Zealand	0.036	0.018	4.066	1	0.044	1.037	1.001	1.074
Region of Southern Denmark	-0.006	0.016	0.152	1	0.696	0.994	0.963	1.026
Central Denmark Region	-0.019	0.017	1.235	1	0.267	0.982	0.95	1.014
North Denmark Region	-0.039	0.021	3.554	1	0.059	0.962	0.923	1.002

A1c: Cox regression diagnosis to minor complications/censoring with income as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Income (low)			1209.791	2	0			
Middle	-0.111	0.006	380.916	1	0	0.895	0.885	0.905
High	-0.308	0.009	1171.498	1	0	0.735	0.722	0.748
Gender	-0.419	0.005	6011.762	1	0	0.658	0.651	0.665
Age	0.017	0	6036.63	1	0	1.017	1.017	1.018
Marital status (married)			874.921	3	0			
Unmarried	0.147	0.008	316.574	1	0	1.158	1.14	1.177
Widowed	0.156	0.008	427.187	1	0	1.169	1.151	1.186
Divorced	0.162	0.008	456.207	1	0	1.176	1.159	1.194
Ethnicity (Dane)			34.687	2	0			
Immigrant	-0.056	0.01	33.415	1	0	0.946	0.928	0.964
Descendant	0.049	0.051	0.923	1	0.337	1.05	0.95	1.161
Region of residence (Capital Region)			560.449	4	0			
Region Zealand	-0.005	0.008	0.326	1	0.568	0.995	0.98	1.011
Region of Southern Denmark	-0.107	0.007	220.306	1	0	0.898	0.886	0.911
Central Denmark Region	0.031	0.007	18.902	1	0	1.032	1.017	1.046
North Denmark Region	-0.13	0.009	192.662	1	0	0.878	0.862	0.894

A1d: Cox regression diagnosis to minor complications/censoring with education as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Education (short)			339.975	2	0			
Middle	-0.07	0.006	146.199	1	0	0.933	0.922	0.943
High	-0.148	0.009	295.711	1	0	0.863	0.848	0.877
Gender	-0.401	0.006	5252.219	1	0	0.67	0.662	0.677
Age	0.019	0	7313.558	1	0	1.019	1.019	1.02
Marital status (married)			731.312	3	0			
Unmarried	0.158	0.008	352.953	1	0	1.171	1.152	1.191
Widowed	0.123	0.008	252.882	1	0	1.131	1.114	1.148
Divorced	0.151	0.008	387.906	1	0	1.163	1.146	1.181
Ethnicity (Dane)			6.061	2	0.048			
Immigrant	-0.022	0.011	4.319	1	0.038	0.978	0.958	0.999
Descendant	0.073	0.058	1.615	1	0.204	1.076	0.961	1.204
Region of residence (Capital Region)			510.362	4	0			
Region Zealand	0	0.008	0.002	1	0.96	1	0.984	1.016
Region of Southern Denmark	-0.103	0.007	190.383	1	0	0.902	0.889	0.916
Central Denmark Region	0.035	0.007	22.742	1	0	1.036	1.021	1.051
North Denmark Region	-0.123	0.01	162.572	1	0	0.884	0.868	0.901

A1e: Cox regression minor complications to severe complications/censoring with income as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Income (low)			308.7	2	0			
Middle	-0.024	0.007	10.779	1	0.001	0.976	0.962	0.99
High	-0.222	0.013	298.155	1	0	0.801	0.781	0.821
Gender	-0.17	0.007	567.575	1	0	0.844	0.832	0.856
Age	0.027	0	7635.019	1	0	1.027	1.026	1.028
Marital status (married)			73.441	3	0			
Unmarried	0.03	0.012	6.802	1	0.009	1.03	1.007	1.054
Widowed	0.016	0.009	3.038	1	0.081	1.017	0.998	1.036
Divorced	0.084	0.01	72.274	1	0	1.088	1.067	1.109
Ethnicity (Dane)			16.833	2	0			
Immigrant	-0.054	0.013	16.705	1	0	0.948	0.923	0.972
Descendant	0.022	0.078	0.08	1	0.778	1.022	0.877	1.192
Region of residence (Capital Region)			243.379	4	0			
Region Zealand	-0.071	0.01	47.506	1	0	0.931	0.913	0.95
Region of Southern Denmark	-0.06	0.009	42.264	1	0	0.942	0.925	0.959
Central Denmark Region	-0.082	0.009	77.328	1	0	0.921	0.904	0.938
North Denmark Region	-0.186	0.012	226.756	1	0	0.831	0.811	0.851

A1f: Cox regression minor complications to severe complications/censoring with education as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Education (short)			97.035	2	0			
Middle	-0.04	0.008	27.725	1	0	0.961	0.947	0.975
High	-0.11	0.011	91.761	1	0	0.896	0.876	0.916
Gender	-0.123	0.007	281.629	1	0	0.884	0.872	0.897
Age	0.022	0	4864.93	1	0	1.022	1.022	1.023
Marital status (married)			73.123	3	0			
Unmarried	0.052	0.012	19.447	1	0	1.053	1.029	1.078
Widowed	0.003	0.01	0.068	1	0.794	1.003	0.984	1.022
Divorced	0.078	0.01	60.838	1	0	1.081	1.06	1.102
Ethnicity (Dane)			4.9	2	0.086			
Immigrant	0.032	0.015	4.828	1	0.028	1.033	1.003	1.063
Descendant	-0.021	0.088	0.054	1	0.816	0.98	0.824	1.165
Region of residence (Capital Region)			271.513	4	0			
Region Zealand	-0.074	0.011	48.147	1	0	0.929	0.91	0.948
Region of Southern Denmark	-0.1	0.01	108.92	1	0	0.905	0.888	0.922
Central Denmark Region	-0.11	0.01	129.171	1	0	0.896	0.879	0.913
North Denmark Region	-0.187	0.013	214.343	1	0	0.83	0.809	0.851

A1g: Cox regression severe complications to death/censoring with income as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Income (low)			1507.857	2	0			
Middle	-0.541	0.015	1239.793	1	0	0.582	0.565	0.6
High	-0.911	0.04	508.208	1	0	0.402	0.372	0.435
Gender	-0.388	0.015	633.155	1	0	0.679	0.659	0.7
Age	0.053	0.001	4583.908	1	0	1.054	1.053	1.056
Marital status (married)			782.058	3	0			
Unmarried	0.516	0.026	391.914	1	0	1.676	1.592	1.764
Widowed	0.399	0.019	450.816	1	0	1.491	1.437	1.547
Divorced	0.43	0.022	377.014	1	0	1.538	1.472	1.606
Ethnicity (Dane)			64.176	2	0			
Immigrant	-0.267	0.033	63.424	1	0	0.766	0.717	0.818
Descendant	-0.183	0.193	0.9	1	0.343	0.833	0.571	1.215
Region of residence (Capital Region)			14.88	4	0.005			
Region Zealand	0.027	0.022	1.523	1	0.217	1.027	0.984	1.072
Region of Southern Denmark	-0.031	0.019	2.454	1	0.117	0.97	0.934	1.008
Central Denmark Region	-0.05	0.02	6.209	1	0.013	0.951	0.914	0.989
North Denmark Region	0.009	0.026	0.115	1	0.735	1.009	0.959	1.061

A1h: Cox regression severe complications to death or censoring with education as differentiating factor

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Education (low)			97.824	2	0			
Middle	-0.038	0.008	25.029	1	0	0.963	0.949	0.977
High	-0.111	0.011	93.942	1	0	0.895	0.875	0.915
Gender	-0.156	0.007	456.705	1	0	0.855	0.843	0.868
Age	0.029	0	8718.299	1	0	1.029	1.029	1.03
Marital status (married)			91.813	3	0			
Unmarried	0.052	0.012	19.489	1	0	1.053	1.029	1.078
Widowed	0.009	0.01	0.86	1	0.354	1.009	0.99	1.028
Divorced	0.091	0.01	82.243	1	0	1.095	1.074	1.116
Ethnicity (Dane)			3.777	2	0.151			
Immigrant	-0.026	0.015	3.078	1	0.079	0.975	0.947	1.003
Descendant	0.071	0.088	0.65	1	0.42	1.074	0.903	1.276
Region of residence (Capital Region)			217.75	4	0			
Region Zealand	-0.066	0.011	39.057	1	0	0.936	0.917	0.955
Region of Southern Denmark	-0.054	0.01	32.179	1	0	0.947	0.93	0.965
Central Denmark Region	-0.077	0.01	64.244	1	0	0.926	0.908	0.943
North Denmark Region	-0.183	0.013	205.663	1	0	0.833	0.813	0.854

A2 Decomposition of inequality in morbidity predictors ranked by income, B and CI

Ranked by income		MORBIDITY - AT DIAGNOSIS						MORBIDITY - DISEASE PROGRESSION						MORBIDITY - AT DEATH			
		Incident in 2011		Severe complications at diagnosis		Age at Diagnosis		Severe complications at present		PYRS in CG0*		PYRS in CG2*		Total PYRS*		Death in 2011		Age at death	
Variable (reference group)		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean	
Income																			
Income	b01**	3E-10		-3.59E-09		4E-08		-7.4E-09		6E-08		-0		-2E-08		-2E-08		0.00	
	ci01***	0.34	***	0.34	***	0.34	***	0.34	***	0.34	***	0.34	***	0.34	***	0.34	***	0.34	***
Education (high education)																			
low education	b02	0.00		0.01	***	0.37	***	0.01	***	-0.24	***	0.04	*	-0.34	***	-0.01	***	0.07	
	ci02	-0.19	***	-0.19	***	-0.19	***	-0.19	***	-0.19	***	-0.19	***	-0.19	***	-0.19	***	-0.08	***
Medium education	b03	0.00		0.01	***	0.26	***	0.00		-0.16	***	0.02		-0.25	***	-0.01	***	0.05	
	ci03	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.06	***
Age and gender (Males0-14) (Females0-14)																			
M15-29	b04	0.00	***	0.01	***	0.86	***	0.01	***	-0.05	***	0.06	***	0.04	***	0.01	***	0.96	***
	ci04	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.41	***
M30-44	b05	0.00	***	0.01	***	0.91	***	0.01	***	-0.04	***	0.06	***	0.03	***	0.00	***	0.98	***
	ci05	0.39	***	0.39	***	0.39	***	0.39	***	0.39	***	0.39	***	0.39	***	0.39	***	0.20	***
M45-59	b06	0.00	***	0.01	***	0.96	***	0.01	***	-0.05	***	0.05	***	0.00		0.00	***	0.99	***
	ci06	0.38	***	0.38	***	0.38	***	0.38	***	0.38	***	0.38	***	0.38	***	0.38	***	0.28	***
M60-74	b07	0.00	***	0.01	***	0.96	***	0.01	***	-0.04	***	0.05	***	0.00		0.00	***	0.99	***
	ci07	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.06	***
M75+	b08	0.00	***	0.01	***	0.96	***	0.01	***	-0.04	***	0.05	***	0.01	***	0.00	***	0.99	***
	ci08	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.03	***
F15-29	b09	0.00	***	0.01	***	0.92	***	0.01	***	-0.07	***	0.06	***	-0.02	**	0.01	***	0.97	***
	ci09	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.43	**
F30-44	b10	0.00	***	0.00	***	0.91	***	0.01	***	-0.01		0.05	***	0.04	***	0.00	***	0.99	***
	ci10	0.32	***	0.32	***	0.32	***	0.32	***	0.32	***	0.32	***	0.32	***	0.32	***	0.37	***
F45-59	b11	0.00	***	0.00	***	0.94	***	0.00	***	-0.01	***	0.04	***	0.02	***	0.00	***	0.99	***
	ci11	0.48	***	0.48	***	0.48	***	0.48	***	0.48	***	0.48	***	0.48	***	0.48	***	0.55	***

F60-74	b12	0.00	***	0.00	***	0.97	***	0.00	***	-0.02	***	0.04	***	0.00		0.00	***	0.99	***
	ci12	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.02	***	0.12	***
F75+	b13	0.00	***	0.00	***	0.96	***	0.01	***	-0.03	***	0.05	***	0.01	***	0.00	***	0.99	***
	ci13	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.16	***	-0.03	***
Labour market affiliation (in job)																			
Not in job (maternity leave, job seeker allowance)	b14	0.03	***	0.02	***	0.86	***	0.03	***	-0.82	***	0.04		-0.87	***	0.00		0.12	
	ci14	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.41	***
	b15	0.01	**	0.03	***	1.07	***	0.07	***	-1.28	***	0.16	***	-1.07	***	0.00		0.42	*
Not in job (unemployment benefit)	ci15	-0.44	***	-0.44	***	-0.44	***	-0.44	***	-0.44	***	-0.44	***	-0.44	***	-0.44	***	-0.28	***
Education, training	b16	-0.04	***	0.06	***	2.20	***	0.06	***	-0.92	***	0.36	***	-1.00	***	0.04	***	1.97	
	ci16	-0.90	***	-0.90	***	-0.90	***	-0.90	***	-0.90	***	-0.90	***	-0.90	***	-0.90	***	-0.86	***
Early retired	b17	-0.02	***	0.08	***	-0.87	***	0.17	***	-0.92	***	1.28	***	0.81	***	0.02	***	0.06	
	ci17	-0.15	***	-0.15	***	-0.15	***	-0.15	***	-0.15	***	-0.15	***	-0.15	***	-0.15	***	0.06	***
Retired	b18	-0.01	***	0.03	***	-0.16	***	0.07	***	-0.42	***	0.53	***	0.28	***	0.00		0.19	
	ci18	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.04	***
Child	b19	0.04	***	0.19	***	11.08	***	0.12	***	-3.77	***	1.36	***	-4.00	***	0.12	***	7.91	
	ci19	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.99	***
Marital status (married)																			
Unmarried	b20	-0.01	***	0.00		-0.16	***	0.03	***	-0.06	*	0.15	***	0.11	***	0.02	***	-0.03	
	ci20	0.03	***	0.03	***	0.03	***	0.03	***	0.03	***	0.03	***	0.03	***	0.03	***	0.11	***
widowed/longest living partner	b21	-0.01	***	0.01	***	-0.09	**	0.03	***	-0.09	***	0.14	***	0.09	**	0.02	***	-0.03	
	ci21	-0.09	***	-0.09	***	-0.09	***	-0.09	***	-0.09	***	-0.09	***	-0.09	***	-0.09	***	0.04	***
Divorced/cancelled partnership	b22	0.00		0.01	***	-0.03		0.04	***	-0.22	***	0.15	***	-0.02		0.01	***	-0.04	**
	ci22	0.04	***	0.04	***	0.04	***	0.04	***	0.04	***	0.04	***	0.04	***	0.04	***	0.08	***
Ethicity (Ethic Dane)																			
Immigrant	b23	-0.01	***	-0.03	***	0.87	***	-0.04	***	-0.21	***	-0.35	***	-0.88	***	-0.01	***	0.08	
	ci23	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***	-0.21	***
Descendant	b24	0.00		0.02	**	0.72	***	-0.02		-0.29	*	-0.05		-0.66	***	0.00		0.04	
	ci24	-0.24	***	-0.24	***	-0.24	***	-0.24	***	-0.24	***	-0.24	***	-0.24	***	-0.24	***	-0.08	
Region of residence (Capital Region of Denmark)																			
Region Zealand	b25	0.00	***	0.00		0.14	***	0.02	***	-0.34	***	-0.18	***	-0.15	***	0.00		0.02	
	ci25	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
Region of Southern Denmark	b26	0.01	***	0.00		0.63	***	-0.02	***	-0.29	***	-0.41	***	-0.61	***	0.00	***	0.01	
	ci26	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***

Central Denmark Region	b27	0.02	***	0.01	***	0.87	***	0.02	***	-0.90	***	-0.33	***	-0.85	***	-0.01	***	0.03	
	ci27	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		-0.01	**
North Denmark Region	b28	0.02	***	0.00		0.21	***	-0.01	***	-0.06		-0.52	***	-0.20	***	0.00	***	0.03	
	ci28	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.04	***
Urbanity (Cities)																			
Suburbs	b29	0.00		0.00		0.05		-0.03	***	0.37	***	-0.03		-0.05		0.00		0.00	
	ci29	0.00	*	0.00	*	0.00	*	0.00	*	0.00	*	0.00	*	0.00	*	0.00	*	-0.01	
Country side	b30	-0.01	***	-0.01	***	0.13	***	-0.05	***	0.52	***	-0.10	***	-0.13	***	0.00	*	0.00	
	ci30	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.05	***

* PYRS = Patient years, CG0 = no complications, CG1 = minor complications, CG2 = severe complications

** bN = Regression coefficient of variable N

***ciN = Concentration index of variable N

A3 Decomposition of inequality in morbidity predictors ranked by education, B and CI

Ranked by education		MORBIDITY - AT DIAGNOSIS						MORBIDITY - DISEASE PROGRESSION								MORBIDITY - AT DEATH			
		Incident in 2011		Severe complications at diagnosis		Age at Diagnosis		Severe complications at present		PYRS in CG0*		PYRS in CG2*		Total PYRS*		Death in 2011		Age at death	
Variable (reference group)		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean	
Income	b01**	4E-10		-3.4E-09		5E-08		-7E-09		5E-08		-5E-08		-2E-08		-2E-08		9E-07	
	ci01***	0.109	***	0.109	***	0.109	***	0.109	***	0.109	***	0.109	***	0.109	***	0.109	***	0.089	***
Education (high education)																			
low education	b02	0.00		0.01	***	0.37	***	0.01	***	-0.24	***	0.04	**	-0.33	***	-0.01	***	0.07	
	ci02	-0.58	***	-0.58	***	-0.58	***	-0.58	***	-0.58	***	-0.58	***	-0.58	***	-0.58	***	-0.50	***
middlehigh education	b03	0.00		0.01	***	0.27	***	0.00		-0.16	***	0.02		-0.25	***	-0.01	***	0.05	
	ci03	0.25	***	0.25	***	0.25	***	0.25	***	0.25	***	0.25	***	0.25	***	0.25	***	0.31	***
Age and gender (Males0-14) (Females0-14)																			
M15-29	b04	0.00	***	0.01	***	0.86	***	0.01	***	-0.05	***	0.06	***	0.04	***	0.01	***	0.96	***
	ci04	-0.14	***	-0.14	***	-0.14	***	-0.14	***	-0.14	***	-0.14	***	-0.14	***	-0.14	***	-0.28	***
M30-44	b05	0.00	***	0.01	***	0.91	***	0.01	***	-0.04	***	0.06	***	0.03	***	0.00	***	0.98	***
	ci05	0.08	***	0.08	***	0.08	***	0.08	***	0.08	***	0.08	***	0.08	***	0.08	***	0.05	
M45-59	b06	0.00	***	0.01	***	0.96	***	0.01	***	-0.05	***	0.05	***	0.00		0.00	***	0.99	***
	ci06	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.02	*
M60-74	b07	0.00	***	0.01	***	0.96	***	0.01	***	-0.04	***	0.05	***	0.00		0.00	***	0.99	***
	ci07	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.04	***
M75+	b08	0.00	***	0.01	***	0.96	***	0.01	***	-0.04	***	0.05	***	0.01	***	0.00	***	0.99	***
	ci08	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.05	***
F15-29	b09	0.00	***	0.01	***	0.92	***	0.01	***	-0.07	***	0.06	***	-0.02	**	0.01	***	0.97	***
	ci09	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.30	**
F30-44	b10	0.00	***	0.00	***	0.91	***	0.01	***	-0.01		0.05	***	0.04	***	0.00	***	0.99	***
	ci10	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.08	
F45-59	b11	0.00	***	0.00	***	0.94	***	0.00	***	-0.02	***	0.04	***	0.02	***	0.00	***	0.99	***
	ci11	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.09	***	0.05	*
F60-74	b12	0.00	***	0.00	***	0.97	***	0.00	***	-0.02	***	0.04	***	0.00		0.00	***	0.99	***

	ci12	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***	0.07	***
F75+	b13	0.00	***	0.00	***	0.96	***	0.01	***	-0.03	***	0.05	***	0.01	***	0.00	***	0.99	***
	ci13	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.04	***
Labour market affiliation (in job)																		
Not in job (maternity leave, job seeker allowance)	b14	0.03	***	0.02	***	0.86	***	0.03	***	-0.83	***	0.04		-0.87	***	0.00		0.11	
	ci14	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.05	***	0.13	***
	b15	0.01	**	0.03	***	1.07	***	0.08	***	-1.28	***	0.16	***	-1.08	***	0.00		0.41	*
Not in job (unemployment benefit)	ci15	-0.05	***	-0.05	***	-0.05	***	-0.05	***	-0.05	***	-0.05	***	-0.05	***	-0.05	***	0.18	***
Education, training	b16	-0.04	***	0.06	***	2.21	***	0.06	***	-0.93	***	0.36	***	-1.01	***	0.04	***	2.03	
	ci16	-0.36	***	-0.36	***	-0.36	***	-0.36	***	-0.36	***	-0.36	***	-0.36	***	-0.36	***	-0.15	
Early retired	b17	-0.02	***	0.08	***	-0.87	***	0.17	***	-0.92	***	1.28	***	0.81	***	0.02	***	0.05	
	ci17	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.08	***
Retired	b18	-0.01	***	0.03	***	-0.16	***	0.07	***	-0.42	***	0.54	***	0.28	***	0.00		0.18	
	ci18	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	0.00	*
Child	b19	0.04	***	0.19	***	11.07	***	0.12	***	-3.78	***	1.36	***	-4.01	***	0.12	***	8.06	
	ci19	0.76	***	0.76	***	0.76	***	0.76	***	0.76	***	0.76	***	0.76	***	0.76	***	0.88	***
Marital status (marriaged)																		
Unmarried	b20	-0.01	***	0.00		-0.16	***	0.03	***	-0.06	*	0.15	***	0.11	***	0.02	***	-0.03	
	ci20	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.05	***
widowed/longest living partner	b21	-0.01	***	0.01	***	-0.09	**	0.03	***	-0.09	***	0.14	***	0.09	**	0.02	***	-0.03	
	ci21	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.11	***	0.02	***
Divorced/cancelled partnership	b22	0.00		0.02	***	-0.02		0.04	***	-0.22	***	0.15	***	-0.02		0.01	***	-0.04	**
	ci22	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.05	***
Ethicity (Ethic Dane)																		
Immigrant	b23	-0.01	***	-0.03	***	0.87	***	-0.04	***	-0.21	***	-0.35	***	-0.88	***	-0.01	***	0.08	
	ci23	0.15	***	0.15	***	0.15	***	0.15	***	0.15	***	0.15	***	0.15	***	0.15	***	0.27	***
Descendant	b24	0.00		0.02	**	0.72	***	-0.02		-0.29	*	-0.05		-0.68	***	0.00		0.04	
	ci24	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.11	***	0.22	**
Region of residence (Capital Region of Denmark)																		
Region Zealand	b25	0.00	***	0.00		0.14	***	0.02	***	-0.34	***	-0.18	***	-0.15	***	0.00		0.02	
	ci25	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02	**
Region of Southern Denmark	b26	0.01	***	0.00		0.63	***	-0.02	***	-0.29	***	-0.41	***	-0.62	***	0.00	***	0.01	
	ci26	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.02	***
Central Denmark Region	b27	0.02	***	0.01	***	0.87	***	0.02	***	-0.90	***	-0.33	***	-0.85	***	-0.01	***	0.02	

	ci27	-0.01	***	-0.01	***	-0.01	***	-0.01	***	-0.01	***	-0.01	***	-0.01	***	-0.01	***	-0.03	***
North Denmark Region	b28	0.02	***	0.00		0.21	***	-0.01	***	-0.06		-0.52	***	-0.20	***	0.00	***	0.03	
	ci28	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***
Urbanity (Cities)																			
Suburbs	b29	0.00		0.00		0.05		-0.03	***	0.37	***	-0.03		-0.05		0.00		0.00	
	ci29	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.02	***
Country side	b30	-0.01	***	-0.01	***	0.12	***	-0.05	***	0.52	***	-0.10	***	-0.13	***	0.00	*	0.00	
	ci30	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***

 * PYRS = Patient years, CG0 = no complications, CG1 = minor complications, CG2 = severe complications

** bN = Regression coefficient of variable N

***ciN = Concentration index of variable N

A4 Decomposition of inequality in health care costs ranked by income, B and CI

Ranked by income		SECONDARY CARE													PRIMARY CARE				PHARMACEUTICALS	
		INPATIENT						OUTPATIENT							General pracitice		Specialist			
		Care		long stays		Rehabilitation		Care		Rehabilitation										
Variable (reference group)		Mean		Mean		Mean		Mean		Mean					Mean		Mean		Mean	
Income	b01**	0.00		0.00		0.00		0.00		0.00					0.00		0.00	*	0.00	
	ci01***	0.34	***	0.34	***	0.34	***	0.34	***	0.31	***				0.34	***	0.34	***	0.34	***
Education (high education)																				
low education	b02	1656.98	***	54.93		4.80		-1036.59	***	-287.87	*				349.09	***	-262.41	***	86.52	
	ci02	-0.19	***	-0.19	***	-0.19	***	-0.20	***	-0.19	***				-0.19	***	-0.19	***	-0.19	***
middlehigh education	b03	1025.82	***	44.26		-4.24		-322.94		-137.91					216.14	***	-8.86		-159.67	***
	ci03	0.11	***	0.11	***	0.11	***	0.10	***	0.08	***				0.11	***	0.11	***	0.11	***
Age and gender (Males0-14) (Females0-14)																				
M15-29	b04	-613.27	***	-35.70	***	2.24	**	-450.86	***	-114.50	***				7.93	***	-17.02	***	-59.22	***
	ci04	-0.16	***	-0.16	***	-0.16	***	-0.17	***	-0.14					-0.16	***	-0.16	***	-0.16	***
M30-44	b05	-423.91	***	-17.71	***	1.44	**	-244.19	***	-58.19	***				20.43	***	-7.84	***	-45.28	***
	ci05	0.39	***	0.39	***	0.39	***	0.41	***	0.36	***				0.39	***	0.39	***	0.39	***
M45-59	b06	-283.26	***	-12.50	***	1.75	***	-181.37	***	-20.66					23.57	***	-1.83		-52.54	***
	ci06	0.38	***	0.38	***	0.38	***	0.38	***	0.35	***				0.38	***	0.38	***	0.38	***
M60-74	b07	-227.19	***	-11.16	***	1.79	***	-147.29	***	-15.57					26.02	***	2.06	*	-54.51	***
	ci07	0.02	***	0.02	***	0.02	***	0.01	***	0.03	**				0.02	***	0.02	***	0.02	***
M75+	b08	-228.72	***	-9.51	***	2.72	***	-175.53	***	-26.77	**				30.16	***	2.68	***	-56.25	***
	ci08	-0.21	***	-0.21	***	-0.21	***	-0.19	***	-0.18	***				-0.21	***	-0.21	***	-0.21	***
F15-29	b09	-492.86	***	-22.93	***	1.95	**	-220.61	***	-91.68	***				51.24	***	10.34	***	-90.40	***
	ci09	-0.13	***	-0.13	***	-0.13	***	-0.14	***	-0.07					-0.13	***	-0.13	***	-0.13	***
F30-44	b10	-366.93	***	-16.01	***	1.99	***	-178.72	***	-57.76	***				34.93	***	10.76	***	-82.82	***
	ci10	0.32	***	0.32	***	0.32	***	0.34	***	0.23	***				0.32	***	0.32	***	0.32	***
F45-59	b11	-313.06	***	-12.33	***	1.91	***	-198.61	***	-33.74	**				31.09	***	10.80	***	-54.44	***
	ci11	0.48	***	0.48	***	0.48	***	0.39	***	0.40	***				0.48	***	0.48	***	0.48	***
F60-74	b12	-274.92	***	-11.52	***	2.05	***	-169.68	***	-32.91	***				27.37	***	8.50	***	-45.58	***
	ci12	0.02	***	0.02	***	0.02	***	0.01	***	0.03	**				0.02	***	0.02	***	0.02	***

		1		2		3		4		5		6		7		8	
F75+	b13	-283.56	***	-11.09	***	2.86	***	-196.36	***	-31.08	***	27.64	***	3.61	***	-45.60	***
	ci13	-0.16	***	-0.16	***	-0.16	***	-0.15	***	-0.12	***	-0.16	***	-0.16	***	-0.16	***
Labour market affiliation (in job)																	
Not in job (maternity leave, job seeker allowance)	b14	5656.97	***	310.30	***	76.42	***	2065.49	***	796.35	**	705.00	***	344.42	***	147.77	
	ci14	0.09	***	0.09	***	0.09	***	0.11	***	0.13	***	0.09	***	0.09	***	0.09	***
Not in job (unemployment benefit)	b15	7714.01	***	100.31		45.45	***	1793.17	***	355.39		955.25	***	518.71	***	900.41	***
	ci15	-0.44	***	-0.44	***	-0.44	***	-0.43	***	-0.42	***	-0.44	***	-0.44	***	-0.44	***
Education, training	b16	-3160.16	**	-297.82	***	25.81	***	1328.96	**	-1347.85	**	-227.81	***	-165.51	***	621.87	*
	ci16	-0.90	***	-0.90	***	-0.90	***	-0.91	***	-0.85	***	-0.90	***	-0.90	***	-0.90	***
Early retired	b17	12395.85	***	509.88	***	80.83	***	8147.46	***	-67.01		932.87	***	1113.52	***	6599.71	***
	ci17	-0.15	***	-0.15	***	-0.15	***	-0.14	***	-0.10	***	-0.15	***	-0.15	***	-0.15	***
Retired	b18	7303.15	***	271.48	***	60.31	***	4240.48	***	431.49	*	562.26	***	511.90	***	1784.64	***
	ci18	-0.21	***	-0.21	***	-0.21	***	-0.20	***	-0.18	***	-0.21	***	-0.21	***	-0.21	***
Child	b19	-7903.27	***	-687.25	***	79.26	***	1970.06		-2358.20	*	257.09	***	-591.64	***	-1792.82	***
	ci19	-0.98	***	-0.98	***	-0.98	***	-0.98	***	-0.99	***	-0.98	***	-0.98	***	-0.98	***
Marital status (marriaged)																	
Unmarried	b20	-793.18	*	118.66	**	7.18		-967.62	***	91.72		-98.20	***	-144.60	***	435.56	***
	ci20	0.03	***	0.03	***	0.03	***	0.02	***	0.09	***	0.03	***	0.03	***	0.03	***
widowed/longest living partner	b21	546.13		110.96	**	28.94	***	-1280.55	***	-317.43	*	-14.08		-242.16	***	138.57	***
	ci21	-0.09	***	-0.09	***	-0.09	***	-0.06	***	0.01		-0.09	***	-0.09	***	-0.09	***
Divorced/annuled partnership	b22	1960.90	***	143.55	***	35.08	***	-729.78	**	-89.68		0.94		-154.77	***	625.22	***
	ci22	0.04	***	0.04	***	0.04	***	0.05	***	0.08	***	0.04	***	0.04	***	0.04	***
Ethicity (Ethic Dane)																	
Immigrant	b23	-4598.66	***	-180.16	***	-52.24	***	-1906.88	***	556.50	**	80.42	***	-332.02	***	-2082.04	***
	ci23	-0.21	***	-0.21	***	-0.21	***	-0.22	***	-0.18	***	-0.21	***	-0.21	***	-0.21	***
Descendant	b24	-2601.88		-272.86	***	-32.93	**	-1257.39		1008.95		19.62		-241.26	***	-1152.62	***
	ci24	-0.24	***	-0.24	***	-0.24	***	-0.25	***	-0.01		-0.24	***	-0.24	***	-0.24	***
Region of residence (Capital Region of Denmark)																	
Region Zealand	b25	1518.98	***	-218.02	***	-1.39		-1508.86	***	-1203.57	***	146.81	***	-559.62	***	-121.78	*
	ci25	0.00		0.00		0.00		0.00		-0.03		0.00		0.00		0.00	
Region of Southern Denmark	b26	-2690.03	***	-289.19	***	140.30	***	1281.61	***	-2932.85	***	343.49	***	-731.81	***	-246.01	***
	ci26	-0.04	***	-0.04	***	-0.04	***	-0.03	***	-0.05	***	-0.04	***	-0.04	***	-0.04	***
Central Denmark Region	b27	-2483.33	***	-418.62	***	154.80	***	-1992.48	***	-2226.42	***	697.56	***	-766.99	***	-293.93	***
	ci27	0.00		0.00		0.00		0.00		0.04	***	0.00		0.00		0.00	
North Denmark Region	b28	-3087.03	***	-173.55	***	91.92	***	-3236.22	***	-1330.41	***	632.16	***	-916.56	***	69.90	

	ci28	-0.03	***	-0.03	***	-0.03	***	-0.03	***	0.00		-0.03	***	-0.03	***	-0.03	***
Urbanity (Cities)																	
Suburbs	b29	-750.90	*	52.07		1.25		-439.30		971.95	***	170.91	***	-162.38	***	278.42	***
	ci29	0.00	*	0.00	*	0.00	*	0.00		0.01		0.00	*	0.00	*	0.00	*
Country side	b30	-791.07	**	-1.76		-23.64	***	-1447.17	***	975.13	***	230.68	***	-206.41	***	82.10	*
	ci30	-0.04	***	-0.04	***	-0.04	***	-0.04	***	-0.03	***	-0.04	***	-0.04	***	-0.04	***
Morbidity indicators																	
Incident in 2011	b31	-1287.16	***	-4.70		-21.37	***	1873.66	***	293.34		-949.62	***	-1000.48	***	-1880.24	***
	ci31	0.05	***	0.05	***	0.05	***	0.02	***	0.11	***	0.05	***	0.05	***	0.05	***
Complication group CG1 (CG0) *	b32	8924.98	***	370.12	***	77.74	***	3043.54	***	1104.35	***	158.60	***	192.82	***	3609.95	***
	ci32	0.01	***	0.01	***	0.01	***	0.04	***	0.05	***	0.01	***	0.01	***	0.01	***
Complication group CG2 (CG0)*	b33	29216.04	***	993.73	***	342.16	***	11567.27	***	2064.34	***	469.02	***	662.58	***	4359.56	***
	ci33	-0.13	***	-0.13	***	-0.13	***	-0.10	***	-0.07	***	-0.13	***	-0.13	***	-0.13	***
Death in 2011	b34	87725.75	***	5083.04	***	722.43	***	8603.19	***	-912.07	***	-617.85	***	-1014.66	***	-2310.90	***
	ci34	-0.68	***	-0.68	***	-0.68	***	-0.63	***	-0.53	***	-0.68	***	-0.68	***	-0.68	***

 *CG0 = no complications, CG1 = minor complications, CG2 = severe complications

** bN = Regression coefficient of variable N

***ciN = Concentration index of variable N

A5 Decomposition of inequality in health care costs ranked by education, B and CI

Ranked by education		SECONDARY CARE					PRIMARY CARE		PHARMACEUTICALS	
		INPATIENT			OUTPATIENT					
		Care	long stays	Rehabilitation	Care	Rehabilitation	General pracitice	Specialist		
Variable (reference group)		Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	
Income	b01	0.00	0.00	0.00	0.00	0.00	0.00 *	0.00 *	0.00	
	ci01	0.11 ***	0.11 ***	0.11 ***	0.11 ***	0.10 ***	0.11 ***	0.11 ***	0.11 ***	
Education (high education)										
low education	b02	1671.70 ***	57.60	5.09	-1044.36 ***	-302.94 *	349.05 ***	-260.11 ***	91.10	
	ci02	-0.58 ***	-0.58 ***	-0.58 ***	-0.58 ***	-0.57 ***	-0.58 ***	-0.58 ***	-0.58 ***	
middlehigh education	b03	1055.65 ***	47.62	-3.79	-334.48	-145.09	215.94 ***	-6.32	-152.72 **	
	ci03	0.25 ***	0.25 ***	0.25 ***	0.25 ***	0.28 ***	0.25 ***	0.25 ***	0.25 ***	
Age and gender (Males0-14) (Females0-14)										
M15-29	b04	-620.08 ***	-35.51 ***	2.27 **	-454.78 ***	-112.13 ***	7.99 ***	-16.68 ***	-58.14 ***	
	ci04	-0.14 ***	-0.14 ***	-0.14 ***	-0.13 ***	-0.16 *	-0.14 ***	-0.14 ***	-0.14 ***	
M30-44	b05	-426.18 ***	-17.70 ***	1.47 **	-247.64 ***	-56.56 ***	20.41 ***	-7.58 ***	-45.05 ***	
	ci05	0.08 ***	0.08 ***	0.08 ***	0.10 ***	0.08 **	0.08 ***	0.08 ***	0.08 ***	
M45-59	b06	-284.55 ***	-12.48 ***	1.77 ***	-183.38 ***	-19.55	23.57 ***	-1.65	-52.41 ***	
	ci06	0.07 ***	0.07 ***	0.07 ***	0.07 ***	0.10 ***	0.07 ***	0.07 ***	0.07 ***	
M60-74	b07	-229.27 ***	-11.19 ***	1.80 ***	-149.42 ***	-14.46	26.00 ***	2.20 *	-54.49 ***	
	ci07	0.05 ***	0.05 ***	0.05 ***	0.06 ***	0.07 ***	0.05 ***	0.05 ***	0.05 ***	
M75+	b08	-229.99 ***	-9.48 ***	2.74 ***	-177.51 ***	-25.93 **	30.16 ***	2.81 ***	-56.25 ***	
	ci08	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	
F15-29	b09	-500.86 ***	-23.04 ***	1.98 **	-224.03 ***	-88.97 ***	51.19 ***	10.54 ***	-90.45 ***	
	ci09	-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***	-0.08 *	-0.11 ***	-0.11 ***	-0.11 ***	
F30-44	b10	-369.02 ***	-15.98 ***	2.02 ***	-181.68 ***	-56.30 ***	34.92 ***	10.99 ***	-82.49 ***	
	ci10	0.07 ***	0.07 ***	0.07 ***	0.08 ***	0.05 **	0.07 ***	0.07 ***	0.07 ***	
F45-59	b11	-314.80 ***	-12.28 ***	1.93 ***	-200.69 ***	-32.70 **	31.10 ***	10.98 ***	-54.35 ***	

	ci11	0.09	***	0.09	***	0.09	***	0.08	***	0.11	***	0.09	***	0.09	***	0.09	***
F60-74	b12	-276.81	***	-11.50	***	2.07	***	-171.59	***	-31.94	**	27.36	***	8.67	***	-45.62	***
	ci12	0.07	***	0.07	***	0.07	***	0.06	***	0.08	***	0.07	***	0.07	***	0.07	***
F75+	b13	-284.82	***	-11.08	***	2.87	***	-198.21	***	-30.10	***	27.64	***	3.74	***	-45.61	***
	ci13	0.00		0.00		0.00		0.00		0.02		0.00		0.00		0.00	
Labour market affiliation (in job)																	
Not injob (maternity leave, job seeker allowance)	b14	5647.67	***	310.49	***	75.85	***	2050.64	***	801.14	*	705.60	***	343.97	***	146.35	
	ci14	0.05	***	0.05	***	0.05	***	0.05	***	0.04		0.05	***	0.05	***	0.05	***
Not in job (unemployment benefit)	b15	7754.26	***	102.21		45.48	***	1755.88	***	345.08		954.64	***	520.03	***	905.78	***
	ci15	-0.05	***	-0.05	***	-0.05	***	-0.06	***	-0.11	**	-0.05	***	-0.05	***	-0.05	***
Education, training	b16	-3047.98	**	-296.37	***	26.77	***	1239.85	**	-1327.45	**	-226.53	***	-163.62	***	634.89	**
	ci16	-0.36	***	-0.36	***	-0.36	***	-0.38	***	-0.27	***	-0.36	***	-0.36	***	-0.36	***
Early pensioner	b17	12424.47	***	516.77	***	80.95	***	8113.88	***	-61.04		932.31	***	1111.59	***	6598.69	***
	ci17	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.12	***	-0.13	***	-0.13	***	-0.13	***
Pensioner	b18	7360.21	***	273.17	***	60.90	***	4243.02	***	430.83	*	563.12	***	510.89	***	1791.89	***
	ci18	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.05	***	-0.06	***	-0.06	***	-0.06	***
Child	b19	-8016.24	***	-679.84	***	79.79	***	1863.83		-2312.99	*	257.14	***	-578.69	***	-1788.10	***
	ci19	0.76	***	0.76	***	0.76	***	0.75	***	0.66	***	0.76	***	0.76	***	0.76	***
Marital status (marriaged)																	
Unmarried	b20	-762.99	*	119.34	**	7.51		-983.54	***	87.62		-98.00	***	-144.59	***	436.33	***
	ci20	-0.02	***	-0.02	***	-0.02	***	-0.01	***	0.00		-0.02	***	-0.02	***	-0.02	***
widowed/longest living partner	b21	498.17		111.25	**	28.21	***	-1264.30	***	-328.09	**	-14.91		-243.26	***	139.54	***
	ci21	-0.11	***	-0.11	***	-0.11	***	-0.11	***	-0.12	***	-0.11	***	-0.11	***	-0.11	***
Divorced/annuled partnership	b22	1959.70	***	144.38	***	35.48	***	-722.93	**	-93.74		0.99		-155.19	***	624.10	***
	ci22	-0.03	***	-0.03	***	-0.03	***	-0.03	***	0.00		-0.03	***	-0.03	***	-0.03	***
Ethicity (Ethic Dane)																	
Immigrant	b23	-4583.20	***	-184.46	***	-52.36	***	-1895.54	***	566.97	**	80.27	***	-331.87	***	-2081.26	***
	ci23	0.15	***	0.15	***	0.15	***	0.14	***	0.11	***	0.15	***	0.15	***	0.15	***
Descendant	b24	-2549.32		-270.53	***	-33.09	**	-1229.19		1017.49		19.23		-236.49	***	-1134.00	***

	ci24	0.11	***	0.11	***	0.11	***	0.12	***	0.13		0.11	***	0.11	***	0.11	***
Region of residence (Capital Region of Denmark)																
Region Zealand	b25	1529.58	***	-219.20	***	-1.67		-1514.75	***	-1215.46	***	146.88	***	-560.24	***	-125.67	*
	ci25	-0.02	***	-0.02	***	-0.02	***	-0.02	***	-0.02		-0.02	***	-0.02	***	-0.02	***
Region of Southern Denmark	b26	-2687.59	***	-291.85	***	140.25	***	1267.48	***	-2931.74	***	344.33	***	-731.61	***	-251.59	***
	ci26	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.04	***	-0.03	***	-0.03	***	-0.03	***
Central Denmark Region	b27	-2496.60	***	-422.31	***	154.16	***	-2012.19	***	-2215.80	***	696.83	***	-767.81	***	-298.20	***
	ci27	-0.01	***	-0.01	***	-0.01	***	-0.02	***	0.03	***	-0.01	***	-0.01	***	-0.01	***
North Denmark Region	b28	-3077.69	***	-177.70	***	91.88	***	-3251.57	***	-1313.66	***	631.06	***	-916.52	***	63.75	
	ci28	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***
Urbanity (Cities)																
Suburbs	b29	-769.59	*	52.32		1.32		-421.47		975.00	***	171.33	***	-162.57	***	278.79	***
	ci29	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.01		-0.03	***	-0.03	***	-0.03	***
Country side	b30	-794.58	**	-1.55		-23.33	***	-1437.32	***	979.44	***	229.74	***	-206.84	***	79.69	
	ci30	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.05	***	-0.06	***	-0.06	***	-0.06	***
Morbidity indicators																
Incident in 2011	b31	-1291.89	***	-5.98		-21.65	***	1862.19	***	307.23		-950.00	***	-999.99	***	-1878.38	***
	ci31	0.02	***	0.02	***	0.02	***	0.02	***	0.07	***	0.02	***	0.02	***	0.02	***
Complication group CG1 (CG0) *	b32	8970.85	***	371.90	***	78.17	***	3050.01	***	1100.95	***	159.51	***	193.67	***	3614.41	***
	ci32	0.00		0.00		0.00		0.01	***	0.00		0.00		0.00		0.00	
Complication group CG2 (CG0)*	b33	29218.30	***	994.70	***	342.29	***	11571.10	***	2057.79	***	469.32	***	662.94	***	4362.94	***
	ci33	-0.03	***	-0.03	***	-0.03	***	-0.03	***	-0.01		-0.03	***	-0.03	***	-0.03	***
Death in 2011	b34	87694.00	***	5094.08	***	720.90	***	8658.61	***	-921.76	***	-618.34	***	-1012.35	***	-2311.31	***
	ci34	-0.02	***	-0.02	***	-0.02	***	-0.05	***	0.00		-0.02	***	-0.02	***	-0.02	***

*CG0 = no complications, CG1 = minor complications, CG2 = severe complications