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Can Life Style account for the Social Gradient in Self-reported Health in a Dynamic Health Model?

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Abstract

Recent studies of socio-economic differences in health have stressed that only a small part of these differentials are explained by health behaviour. However, few studies are conducted in a dynamic context, even though both epidemiologic and economic theories of health determination often stress a dynamic framework. In this paper we examine whether social gradients in men's and women's self-rated health (SRH) in Denmark can be explained by life-style indicators when modelled in a dynamic context. We use interval regression models on a Danish longitudinal survey data set from 1990 and 1995. Large education and wage related gradients are found in SRH for both men and women. It is found that education related differences in SRH in 1995 exist independently of life style risk factors and health status in 1990 for women, but not for men. Wage related differences in SRH exist above educational differentials, are larger for men than for women and are not explained by health status in 1990 and life style risk factors.

JEL classifications: I1, C25

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INTRODUCTION

During the last couple of decades, a considerable amount of attention, academic as well as public, has been given to differences in health and mortality that are related to social status. In European countries, several trans-national working groups have addressed the issue[1], and many public authorities have set as a main health goal to reduce social inequalities in health[2]. This study adds to our knowledge on social inequalities in health using Danish data.

Some evidence suggests, although subject to a lot of uncertainty, that social inequalities in morbidity and mortality are quite substantial by international standards in Nordic European countries in spite of their egalitarian policies (Cavelaars et al., 1998; Mackenbach et al., 1997; Kunst et al., 1998; critized in Vågerø & Erikson, 1997). Moreover, as in some other western countries (see e.g. Pappas et al., 1998), it seems that there has been a rise in social inequality in mortality from 1970 to 1995 in Denmark, at least with respect to occupation related differences (Andersen et al., 2001). There are therefore great incentives to try to understand these relationships further to help improve policy.

Health knowledge and health behaviour, while the most common targets for intervention, are now often argued to explain only a small part of health inequalities, internationally (Kenkel, 1991; Marmot, 1994; Macintyre, 1997; Lantz et al. 1998) as well as in Denmark (Sundhedsministeriet, 2000). In the case that health behaviour only explains a fraction of socio-economic gradients in health, it may be useful to consider other explanations in order to understand how interventions can be improved. A causal social gradient can e.g. be based on psycho-social explanations (Adler et al., 1993; Wilkinson, 1996; Siegrist & Marmot, 2004). Other types of variation may however be driving

[1] E.g. the ECuity group (led by Adam Wagstaff and Eddy van Doorslaer) and the working group at the Erasmus University Rotterdam (led by Anton Kunst and Johan Mackenbach).

[2] See for instance the British Acheson report (Acheson 1998) or the latest two Danish Health programs (Sundhedsministeriet, 1999; Indenrigs- og Sundhedsministeriet, 2002).

the social gradient in health, for instance social selection (Blane et al., 1993; Manor et al. 2003), meaning either that previous health is causing SES or that a common unobserved factor determines both (e.g. Fuchs, 1982).

However, existing evidence about whether health behaviour explains the social health gradient is rarely conducted in a dynamic framework, even though several theories of health determination suggest this. The goal of this paper is to explore to what extent life style risk factors, often targeted by national health plans, explain social health gradients, taking dynamic theories of health determination as our outset. Therefore, the statistical model of interest is a dynamic model of health determination. There is rather limited empirical work on health in a dynamic context and, as far as we are aware, none with the aim that this paper has.

Contoyannis et al. (2004) is among the first explicitly to model dynamics in self-reported health using the dynamic panel probit model suggested by Wooldridge (2005). They use a fairly long panel; the British Household Panel Survey from 1991 to 1997, and include SES measures (income and education) but no life style risk factors. Haliday (2005) takes a flexible semi-parametric approach to model dynamics and heterogeneity of self-reported health, but only includes age and gender as explanatory variables. He uses a long panel; the PSID from 1984 to 1997.

A few studies have applied smaller panels and simpler methods to deal with the dynamics. Taubman and Rosen (1982) examine the education related gradient in self-reported health in a dynamic context using three waves of the Retirement History Survey using simple cross-tabulations and transition matrices. Adams et al. (2003) use a three-wave panel (the AHEA) and examine the relation between SES and health by estimating independent probit models for different health condition indicators. They control for demographic variables, SES, past health conditions and contemporary health conditions. Indeed, in this framework, it seems that many social gradients are weakened. However, it is not possible from their analysis to infer to what extent life style risk factors or previous health conditions account for the gradient. Borg and Kristensen (2000) examine whether work environment can account for SES differences in self-reported health. They use probit models for sub-samples of individuals with initial poor or good SRH. Finally, the aim of Contoyannis and Jones (2004) is related to the aim of this paper, since they examine the extent to which health related behaviour can account for social gradients in health, when endogeneity of health inputs are taken into account. They do not however apply a dynamic framework of health.

We examine social gradients based on both education and wages as socioeconomic variables, as they may be related differently to health for several reasons. We conduct gender specific analyses, using a survey of Danish workers from 1990 and 1995, with self-reported health as health outcome. As opposed to previous studies we suggest the use of an interval regression model based on previous estimated thresholds. Interval regression is more efficient than a standard probit and provides coefficients with a simple interpretation. Although the model contains several potentially endogenous variables, it would be very difficult to deal with endogeneity of all variables, so we stick to a descriptive estimation strategy.

THEORY

In this section we show two examples of different, but widely applied, theories of health determination, which both imply that health is determined in a dynamic setting.

The first example is from the epidemiological literature, and is more a set of ideas rather than a unified theory. This is the idea that health, and social differences in health in particular, must be considered in a life-course perspective. It is discussed at length in Singer and Ryff (1997). One hypothesis is that a large part of observed social differences in health is due to accumulation of adverse health events over the life course (Wadsworth, 1997; Barker, 1992). Deaton & Paxson (1998) point out how a version of the life course hypothesis can be captured by a dynamic model of health. With H_t being the stock of health in period t, one version of this may look like:

(1) $$H_{it} = \alpha_i H_{it-1} + \varepsilon_{it}, V(\varepsilon_{it}) = \sigma_i^2$$

When α_i is less than one health is mean reverting, capturing the idea that on average individuals recover from illnesses, but some events have lasting effects. The persistence of health shocks, measured by α_i, and the variance of health shocks, σ_i^2, determines how fast health changes over time. Social status may matter for two reasons: either because α_i differs across social groups, e.g. due to differences in knowledge and means to recover from illnesses or because of different variance in the health shocks, due to different exposures to health threats.

The dynamic nature of health determination is also an essential feature in economic models of health. Even though the perhaps most common economic model of health, the pure investment model from Grossman (1972), is myopic, Grossman (2000) shows that this is not the case when there is costs of adjustment in the production of health. Grossman uses a very simplified linear model excluding wages and education. In the appendix we show that Grossman's standard pure investment model with costs of adjustment in health production implies the following equation for health:

(2) $$\ln H_t = \alpha_0 + \alpha_1 \ln H_{t-1} + \alpha_2 \ln w_t + \alpha_3 \ln w_{t-1} + \alpha_4 \ln p_t + \alpha_5 \ln p_{t-1} + \alpha_6 \ln \delta_t + \alpha_7 E$$

Therefore, in a version of the perhaps most common model of health within economics, current health depends independently on lagged health as well as wages, *w*, prices of health inputs, *p*, the rate of health depreciation, δ and education, *E*[3]. Nevertheless, surprisingly few studies have examined whether standard life style risk factors explain social gradients in a dynamic context.

[3] In this model, the coefficient on lagged health is between -1 and 0, the sign of the coefficient on education is positive while the sign of the coefficient on the current wage is ambiguous, see the appendix.

Education and wages are often, together with for instance occupation or combinations of these, viewed as proxies for the one underlying concept of social status. As can be seen from the Grossman model, education and wages may have independent effects on health. The reason that wages are related to health in the pure investment version of the Grossman model is that higher wages imply higher costs of sickness time if a loss of income is incurred (either directly or through an increased risk of being fired), or e.g. from increased work load when returning to work. Education is related to health because it is assumed that the more educated are more efficient producers of health than the less educated, as often seen on the labour market. Therefore the more educated will tend to become healthier with the same set of health inputs. In more general terms, education may be related to health through its link to health knowledge and ability to use new information and technologies, whereas wages may be related to health through its link to economic constraints on how and where to live. Education and wages may however be related differently to health for other reasons. They may be markers of two different scales of social rank, which for instance men and women might associate themselves differently with.

METHODS AND DATA

The statistical analyses are conducted using an interval regression model, which is an alternative to ordered probit/logit in the case where the threshold parameters among health categories are known from an external source. Using such information, the estimates of the coefficients for the individual characteristics are more efficient (Jones, 2000) and are directly interpretable as marginal effects. For the interval regression, two sets of external estimates of the thresholds between health categories are applied. The first set was derived from applying the HUI-3 health instrument in a 1994 Canadian survey (van Doorslaer et al., 1997; van Doorslaer et al., 2003). The second set was derived applying the 15D health instrument to a Finnish 1995/96 survey (Lauridsen et al., 2004). These thresholds of the health categories are summarised in Table 2. As described below, only two waves of data are available. Therefore, it is not feasible to account for dynamics and individual specific effects as done e.g. by Contoyannis et al. (2004). The estimates are therefore sensitive to biases from spurious state dependence.

Both separate and joint analyses of wage and education gradients are conducted, with and without life style risk factors and previous health status. References to significance levels will be at a five percent level, unless otherwise mentioned.

Data

The present study uses data from the Work Environment Cohort Study (WECS), which is a survey of Danish workers, aged between 18 and 59, interviewed in 1990 with a follow-up in 1995. The survey was collected by the Danish National Institute of Occupational Health (AMI) and the National Institute of Social Research (SFI). Further details are found in the appendix.

The data set includes self-rated health (very poor, poor, fair, good and very good), which will be our main health measure. Self-rated health has been found to be a good overall summary measure of health, related e.g. to risks of functional disability and mortality (Idler, 1994; Idler and Benyamin, 1997). Some studies have been concerned that self-reported health measures are reported with error (e.g. Butler et al., 1997; Dwyer & Mitchell, 1999; Benítez-Silva et al. 1999; Crossley and Kennedy, 2002), which, if related to SES, may create a spurious gradient. Controlling for other self-reported variables with related measurement error might alleviate this problem.

We use the following educational levels: 9th form, semi-skilled, short education, vocational, short advanced, medium advanced and long advanced degree. Short education covers those with 10th form, gymnasium or another type of education beyond 9th form of at most a year of length. Missing values of SRH and education were deleted, so the final data set consists of 2023 men and 1732 women.

The data allow us to control for the following indicators of health-related life style variables: body mass index, (whether a doctor has reported) having high blood pressure, satisfied with job and years of smoking. Rather than body mass index we use indicators of being between fat (BMI between 25 and 30) and obese (BMI above 30).

Table 1 contains descriptive statistics; distributions of explanatory variables and the share with poor SRH (the original three worst outcomes fair, poor or very poor health). The table shows that SRH varies with type of education, age, wage level and the life style risk factors. Finally, to apply health in 1990 to the regression, the categories of health for this year were scaled by replacing with the mid-point of the intervals of the health categories according to the HUI and 15D thresholds.

STATISTICAL ANALYSIS

This section describes the empirical results. They are collected in table 3 through 6, which contain a set of estimates for each gender and each set of threshold estimates (HUI and 15D). To be able to infer the extent to which life style risk factors and baseline health account for social gradients, each table consists of 7 sets of estimates: one with only education variables, then we add the life style risk factors and then add baseline health. These are repeated with wages instead of education and finally all sets of regressors are included. We start by examining the empirical results for men.

Male education gradients

Table 3 contains results with HUI thresholds and table 4 with 15D thresholds. The results in the two tables are overall very alike. Take for instance the coefficient for a long advanced degree. It shows the estimated difference in the health-indices between individuals with a long advanced degree and the baseline group, which are individuals with at most 9th form. With the HUI-index it is 0.014 and with the 15D-index it is 0.012. Both are statistically significant on a 1% level. The reference level for those with at most 9th form is given by the constant, which is 0.95 with HUI- and 0.97 with the 15D-index. As can be seen, all men with any type of schooling beyond 9th form, besides the semi-skilled, report better health than those with at most 9th form. In particular, those with an advanced degree have the best health, and increasingly so with the length of the degree (table 3 and 4, model (1)). In addition, it cannot be rejected that differences between several educational categories are significant, that is, a graded relationship is found.

Controlling for life style risk factors and baseline health

Life style risk factors are included as dummies for being fat, obese, having high blood pressure, and the number of years the individual has been smoking and an indicator of being satisfied with your job. When life style risk factors are included the educational gradient is reduced (table 3 and 4, model (2)), but significant differences between education groups persist. Contrary to this, when baseline health status in 1990 is controlled for (indicators for very good or good SRH), only those with a short advanced degree differ from those with only 9th form (table 3 and 4, model (3)). The results reveal that SRH shows a rather large degree of persistence over the 5 year period, as the coefficient for health in 1990 is 0.3 (which is e.g. 18 times higher than the impact of having high blood pressure).

Male wage gradients

Hourly wages are strongly related to SRH. Even with controls for life style risk factors and previous health, the wage gradient is large and significant (table 3 and 4, models (5) and (6)). Finally, including education and wages and all controls simultaneously hardly affects the wage gradient, whereas it leaves no significant education related differences in SRH (table 3 and 4, model (7)).

Female education gradients

The education related differences in SRH are substantial for women as well (table 5 and 6, model (1)). Women with a vocational education have better health than those with a short or medium advanced degree, which was not the case for men, but the best health is reported by those with a long advanced degree as was the case for men.

Controlling for life style risk factors and baseline health

Controlling for life style risk factors reduces health advantages for better educated, in particular for those with a long advanced degree (table 5 and 6, model (2)), whereas controlling for baseline health has a larger impact on the differences between people with lower educations (table 5 and 6, model (3)). The persistence over time in SRH is substantial but less than the persistence for men.

Female wage gradients

A wage gradient is also present in SRH for women (table 5 and 6, model (4)), although it is not as strong as for men. The gradient is affected to the same extent as for men when life style risk factors are controlled for (table 5 and 6, models (5), (6)). When wages, education and all controls enter the model simultaneously, education coefficients are still significant and substantial in size (table 5 and 6, model (7)). The wage gradient, however, is reduced and becomes insignificant.

DISCUSSION

The present study examines education and wage related differences in SRH, using a Danish survey of individuals who have been working within the last two months of the interview in 1990, with a follow-up interview in 1995. In general, a sample of workers would be expected to be a group where health inequalities are lower than in the total population. Indeed, the health differences between those in the labour force and those outside are often of such magnitude that they completely overshadow most differences within the working population (Andersen et al., 2001; Kjøller et al., 1995). Nevertheless, substantial education and wage related differences in SRH among both men and women are found in this sample. As opposed to several other studies (Macintyre, 1997; Preston & Taubman, 1994), including Danish findings on mortality (Andersen m.fl., 2001), education related differences in SRH are larger for women than for men. For both gender, non-monotone relationships between length of education and SRH are found which correspond roughly to findings on mortality in Denmark (Munch & Svarer, 2001).

Wage related health differences are very large for both gender. The education related differences in SRH are wiped out for men, but persist for women, when wages are controlled for. It should be stressed that these findings cannot be interpreted causally, and in particular, changes in health from 1990 to 1995 may affect wages in 1995. Causality issues have not been examined here and therefore care should be taken when interpreting results. We do note that recent evidence on the relation between education and health suggest that there is a causal component running from education to health (Adams, 2001; Arkes, 2002; Auld & Sidhu, 2004; Arendt, 2004, 2005; Lleras-Muney, 2005; Spasojevic, 2003).

Controlling for life style risk factors measured by being fat, obese, having high blood pressure, years of smoking and job satisfaction has only a modest impact on education and wage gradients in static models, in accordance with the view that life style and health behaviour explains only a fraction of the gradients.

Turning to dynamic models that control for baseline health shows that SRH is very persistent over the five year period from 1990 to 1995. When baseline health status is controlled for in addition to life style risk factors, most education related differences in health are insignificant for men, whereas this is not the case for women. Additional estimations (not shown) reveal that the male education gradient is not explained by baseline health status solely. In addition, the impact of life style risk factors is quantitatively alike in static and dynamic models, meaning that they explain a much larger share of the variation in the dynamic models. This indicates that for men with the same SRH in one year, life style and health behaviour may explain a large part of education related differences in their SRH five years later.

The picture is somewhat different with respect to wage gradients, as these are only robust to inclusion of education, life style risk factors and previous health for men. Adding the controls reduces the wage gradient by 50% for men and by two-thirds for women.

The finding that differences in health are associated with wages to a higher extent for men and with education to a higher extent for women, corresponds fairly well to international findings on income related differences in health and mortality (Deaton, 2003; Arber, 1997), as well as to findings in Denmark on mortality (Munch & Svarer, 2001). This may reveal a social construct, where men associate more of their personal values and prestige from their achievements on the labour market than women do.

APPENDIX

A Dynamic Grossman model

To derive (2) we use the pure investment version of the model for health demand from Grossman (1972). The equation for health demand is determined from the first-order condition (FOC) with respect to health investments. This is given as (see Grossman (1972), p. 231)[4]:

(A.1) $$w_t G_t = \pi_{t-1}(r - \tilde{\pi}_t + \delta_t)$$

Where w_t is the individual wage in period t, G_t is the marginal product of stock of health in production of healthy time, π_t is the marginal costs of health investments, r is an interest rate and δ_t the health depreciation rate. We make the simplifying assumption: $r - \tilde{\pi}_{t-1} = 0$. This is also applied in Grossman (2000), section 5.1. This leaves us with the following FOC:

(A.2) $$w_t G_t = \pi_{t-1} \delta_t$$

As in Grossman (2000), production of health investments is assumed to be of the Cobb-Douglas type:

(A.3) $$\ln I_t = K_1 \ln M_t + K_2 \ln T_t + \rho E$$

M_t and T_t are inputs of goods and time respectively in the production of health and E is education, which is assumed to affect the efficiency of the production of health units. In contrast to the most

[4] This is under the assumption that $\delta_t \tilde{\pi}_{t-1} = 0$, as stated by Grossman (1972), footnote 9.

commonly applied version of the pure consumption model we allow for diminishing returns to scale, $K_1 + K_2 < 1$, and therefore costs of adjustment in health production. This is crucial to obtain a dynamic model.

Marginal costs, π_t, are determined jointly with production inputs from the cost minimization conditions:

(A.4) $$\ln \pi_t = \ln p_t - \ln K_1 - \ln I_t + \ln M_t$$

(A.5) $$\ln T_t = \ln p_t - \ln w_t + \ln M_t + \ln \frac{K_2}{K_1}$$

Finally, the equation of motion for health is:

(A.6) $$H_t = (1-\delta_t)H_{t-1} + I_{t-1} \Rightarrow \ln I_{t-1} = \ln(1 + \frac{H_t - H_{t-1}}{\delta_t H_{t-1}}) + \ln H_{t-1} + \ln \delta_t$$

Letting $\tilde{H}_t = (H_t - H_{t-1})/H_{t-1}$ we also assume that $\tilde{H}_t / \delta_t$ is small such that $\ln(1 + \tilde{H}_t / \delta_t)$ is close to zero, considerably simplifying the equation of motion for health: $\ln I_{t-1} = \ln H_{t-1} + \ln \delta_t$. This is applied several times in Grossman (2000), e.g. in section 5.1. Health is implicitly determined from (A.2) because G_t depends on H_t. Grossman (1972), p. 239, assumes the relationship takes the form:

(A.7) $$G = \beta_1 \beta_2 H^{-\beta_2 - 1}$$

Combined with (A.2) and taking logs yields[5]:

(A.8) $$\ln H_t = \varepsilon \ln \beta_1 \beta_2 + \varepsilon \ln w_t - \varepsilon \ln \pi_{t-1} - \varepsilon \ln \delta_t$$

ln π_{t-1} can be eliminated by using the two cost minimization conditions and the Cobb-Douglass equation. After some algebra, this gives:

(A.9) $$\begin{aligned} &\ln H_t = \alpha - \varepsilon \{(1 - K_1 - K_2)\ln M_{t-1} - \ln w_t + K_2 \ln w_{t-1} - \ln p_t - K_2 \ln p_{t-1} - \rho E + \ln \delta_t\} \\ &\alpha = \varepsilon \ln \beta_1 \beta_2 + \varepsilon \ln K_1 - \varepsilon K_2 \ln \frac{K_1}{K_2} \end{aligned}$$

[5] Here, $\varepsilon = 1/(1+\beta_2)$.

To eliminate ln M_{t-1} from the equation we isolate ln M_t in the Cobb-Douglas specification and use the simplified equation of motion for health as well as the second condition for cost minimization (A.5) to replace ln T_t, yielding:

$$\text{(A.10)} \qquad \ln M_t = \frac{1}{K_1 + K_2}\left[\ln H_t + \ln \delta_{t+1}\right] + \frac{K_2}{K_1 + K_2}\left[\ln p_t - \ln w_t + \ln \frac{K_2}{K_1}\right] - \frac{\rho}{K_1 + K_2} E$$

Now ln M_{t-1} can be replaced in (A.9), yielding:

$$\text{(A.11)} \qquad \ln H_t = \alpha_2 + \varepsilon \begin{Bmatrix} -\eta \ln H_{t-1} + (1-\eta K_2)\ln w_t + K_2 \ln w_{t-1} - \\ (1-\eta K_2)\ln p_t - K_2 \ln p_{t-1} - (1+\eta)\ln \delta_t + \rho(1+\eta)E \end{Bmatrix}$$

where:

$$\alpha_2 = \varepsilon \ln \beta_1 \beta_2 - \varepsilon(\ln K_1 + K_2 \ln \frac{K_1}{K_2} - \frac{(1-K_1-K_2)K_2}{K_1+K_2} \ln \frac{K_2}{K_1}),$$

$$\eta = \frac{(1-K_1-K_2)}{K_1+K_2}$$

which is equivalent to (2). Note that when $K_1 + K_2 \leq 1$, $\eta \geq 0$, so the effect of education is positive. The effect of wages however is ambigious. Finally, under constant returns to scale, $K_1 + K_2 = 1$, $\eta = 0$, and lagged health vanishes from the equation.

Data construction

In 1990, 9653 persons aged between 19 and 59 were randomly chosen and 8664 were interviewed (90% response rate) (Borg & Burr, 1997). In 1995, the sample was extended to make it representative of the Danish population aged 19-59. 8.583 were interviewed (80,2% response rate), among which 7.532 were also interviewed in 1990. The questions used to construct the hourly wage are: “What is your usual wage payment before tax and deductions” (answer a_1 in Danish kr.), “How is your wage usually paid” (answer a_2 = 1, 2, 3, 4, 5 or 6 for respectively pay per hour, day, week, second week, month, or other) and “How many hours do you usually work per week in your main job” (answer a_3 in hours). The following rules are used to convert the answers into one variable containing hourly wages: $w = a_1$ if $a_2 = 1$, $w = 5a_1/a_3$ if $a_2 = 2$, $w = a_1/a_3$ if $a_2 = 3$, $w = a_1/2a_3$ if $a_2 = 4$, *w* = $a_1/4a_3$ if a_2 = 5 and *w* = missing if a_2 = 6. 949 observations with missing information on education in both 1990 and 1995 are deleted, as well as 722 of the remaining individuals who are still under education in 1995, since focus is on the effect of completed education. 2956 observations have missing age, primarily because the individuals were only interviewed in one of the years. These are deleted. For 10 individuals, their age is reported as more than 6 or less than 4 years in 1995 from the reporting in 1990, i.e. erroneously, so they are deleted. Among the now 6477 remaining observations, only 3755 of these contain information on SHR in both 1990 and 1995. Among these there are 2023 men and 1732 women. The large number of missing observations SRH exists because only people who were employed within the last two months of the interview were asked about SRH. The sample does not differ much with respect to age, education and occupational distribution from the national representative sample of employed workers (Borg & Burr, 1997).

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TABLES

Table 1. Distribution of study population, 1990 and 1995.		
	Men	Women

	Number	Proportion with poor health	Number	Proportion with poor health
Education:				
7th form	160	0.18	197	0.22
9th form	168	0.11	159	0.22
10th form	129	0.11	163	0.11
Gymnasium	56	0.09	38	0.15
Other short	129	0.11	329	0.12
Semi-skilled	182	0.23	139	0.19
Vocational-short	45	0.07	45	0.16
Vocational-long	2003	0.11	1119	0.09
Short advanced	283	0.09	506	0.12
Medium advanced	494	0.10	634	0.09
Long advanced	397	0.05	135	0.09
Age:				
18-24	271	0.04	166	0.05
25-34	1185	0.08	863	0.08
35-44	1266	0.11	1216	0.12
45-55	995	0.16	970	0.14
55-65	332	0.15	249	0.20
Hourly wage:				
< 10 pctile	208	0.26	472	0.21
>10 and <25 pctile	474	0.14	528	0.19
>25 and <50 pctile	1000	0.14	966	0.12
>50 and <75 pctile	962	0.12	884	0.09
>75 pctile	1402	0.08	602	0.12
Health risks:				
Fat	1710	0.14	678	0.16
Obese	259	0.21	153	0.22
High blood pressure	265	0.22	242	0.18
Satisfied with job	2700	0.08	2299	0.10
10+ years of smoking	1995	0.14	1393	0.15
Total	4046	0.11	3464	0.12
Notes: Hourly wage only available in 1995. Percentiles are: 10th=87, 25th=118, 75th=142 DKK/hour.				

Table 2. HUI and 15D thresholds of health.				
Health category	HUI thresholds		15D thresholds	
Very poor	0	0.428	0	0.6778
Poor	0.428	0.756	0.6778	0.7978
Neutral	0.756	0.897	0.7978	0.9135
Good	0.897	0.947	0.9135	0.9631
Very good	0.947	1	0.9631	1

Table 3.
Interval regressions with self-rated health in 1995 as dependent variable. HUI thresholds applied. Men.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Short education	0.0047 (0.0052)	0.0017 (0.0051)	0.0018 (0.0048)				0.0006 (0.0049)
Semi-skilled	-0.0199*** (0.0061)	-0.0184*** 0.0060)	-0.0150*** (0.0057)				-0.0152*** (0.0057)
Vocational	0.0059 (0.0039)	0.0039 (0.0038)	0.0038 (0.0036)				0.0020 (0.0037)
Short advanced	0.0114** (0.0053)	0.0105** (0.0052)	0.0090* (0.0049)				0.0069 (0.0051)
Medium advanced	0.0098** (0.0047)	0.0064 (0.0046)	0.0040 (0.0044)				0.0008 (0.0045)
Long advanced	0.0141*** (0.0049)	0.0091* (0.0048)	0.0054 (0.0046)				0.0003 (0.0050)
Ln(wage)				0.0209*** (0.0032)	0.0163*** (0.0032)	0.0116*** (0.0030)	0.0107*** (0.0033)
Fat		-0.0015 (0.0022)	-0.0009 (0.0020)		-0.0026 (0.0022)	-0.0016 (0.0021)	-0.0012 (0.0021)
Obese		-0.0113*** (0.0040)	-0.0104*** (0.0038)		-0.0113*** (0.0041)	-0.0105*** (0.0038)	-0.0097** (0.0038)
High blood pressure		-0.0216*** (0.0038)	-0.0213*** (0.0036)		-0.0219*** (0.0039)	-0.0216*** (0.0037)	-0.0218*** (0.0037)
Satisfied with job		0.0152*** (0.0021)	0.0122*** (0.0020)		0.0148*** (0.0021)	0.0120*** (0.0020)	0.0120*** (0.0021)
10 years of smoking		-0.0003*** (0.0001)	-0.0001 (0.0001)		-0.0002*** (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Health in 1990			0.2985*** (0.0192)			0.2968*** (0.0195)	0.2934*** (0.0195)
Age	-0.0006*** (0.0001)	-0.0005*** (0.0001)	-0.0003*** (0.0001)	-0.0008*** (0.0001)	-0.0006*** (0.0001)	-0.0004*** (0.0001)	-0.0004*** (0.0001)
Constant	0.9595*** (0.0058)	0.9516*** (0.0058)	0.6657*** (0.0192)	0.8801*** (0.0152)	0.8801*** (0.0152)	0.6175*** (0.0227)	0.6231*** (0.0236)
LogL	-2524.23	-2470.23	-2346.54	-2431.35	-2431.35	-2312.92	-2305.14
No. Obs.	2023	2023	2023	1987	1987	1987	1987

Notes: Standard deviations are presented in parentheses. Significance indicated at 1% level (***), 5% level (**), and 10% level (*).

Table 4. Interval regressions with self-rated health in 1995 as dependent variable. 15D thresholds applied. Men.							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Short education	0.0053 (0.0042)	0.0028 (0.0041)	0.0026 (0.0039)				0.0016 (0.0039)
Semi-skilled	-0.0151*** (0.0050)	-0.0139*** (0.0049)	-0.0110** (0.0046)				-0.0111** (0.0046)
Vocational	0.0052 (0.0032)	0.0035 (0.0031)	0.0032 (0.0029)				0.0017 (0.0030)
Short advanced	0.0099** (0.0043)	0.0091** (0.0042)	0.0075* (0.0040)				0.0058 (0.0041)
Medium advanced	0.0085** (0.0038)	0.0056 (0.0038)	0.0033 (0.0035)				0.0006 (0.0037)
Long advanced	0.0123*** (0.0040)	0.0081** (0.0040)	0.0047 (0.0037)				0.0003 (0.0040)
Ln(wage)				0.0178*** (0.0026)	0.0140*** (0.0026)	0.0097*** (0.0025)	0.0091*** (0.0027)
Fat		-0.0016 (0.0018)	-0.0010 (0.0017)		-0.0025 (0.0018)	-0.0016 (0.0017)	-0.0012 (0.0017)
Obese		-0.0088*** (0.0033)	-0.0081*** (0.0031)		-0.0088*** (0.0033)	-0.0081*** (0.0031)	-0.0075** (0.0031)
High blood pressure		-0.0178*** (0.0031)	-0.0174*** (0.0029)		-0.0180 (0.0032)	-0.0176*** (0.0030)	-0.0178*** (0.0030)
Satisfied with job		0.0130*** (0.0017)	0.0103*** (0.0016)		0.0127*** (0.0018)	0.0102*** (0.0017)	0.0102*** (0.0017)
10 years of smoking		-0.0002*** (0.0001)	-0.0001 (0.0001)		-0.0002*** (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Health in 1990			0.3136*** (0.0195)			0.3175*** (0.0198)	0.3142*** (0.0198)
Age	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0003*** (0.0001)	-0.0006*** (0.0001)	-0.0005*** (0.0001)	-0.0003*** (0.0001)	-0.0003*** (0.0001)
Constant	0.9701*** (0.0048)	0.9634*** (0.0048)	0.6543*** (0.0194)	0.8932*** (0.0126)	0.9028*** (0.0124)	0.6146*** (0.0216)	0.6188*** (0.0223)
LogL	-2549.83	-2493.05	-2356.99	-2505.12	-2450.58	-2320.49	-2313.67
No. Obs.	2023	2023	2023	1987	1987	1987	1987
Notes: See notes to Table 3.							

Table 5.
Interval regressions with self-rated health in 1995 as dependent variable. HUI thresholds applied. Women.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Short education	0.0111** (0.0054)	0.0116** (0.0053)	0.0084 (0.0052)				0.0071 (0.0053)
Semi-skilled	0.0118 (0.0077)	0.0120 (0.0076)	0.0142* (0.0074)				0.0128* (0.0075)
Vocational	0.0228*** (0.0048)	0.0216*** (0.0047)	0.0195*** (0.0046)				0.0175*** (0.0048)
Short advanced	0.0132** (0.0054)	0.0123** (0.0054)	0.0107** (0.0053)				0.0084 (0.0055)
Medium advanced	0.0223*** (0.0052)	0.0212*** (0.0051)	0.0179*** (0.0050)				0.0161*** (0.0053)
Long advanced	0.0267*** (0.0078)	0.0225*** (0.0078)	0.0206*** (0.0076)				0.0164** (0.0082)
Ln(wage)				0.0182*** (0.0046)	0.0148*** (0.0046)	0.0114** (0.0045)	0.0065 (0.0049)
Fat		-0.0029 (0.0034)	-0.0023 (0.0033)		-0.0035 (0.0034)	-0.0027 (0.0033)	-0.0023 (0.0033)
Obese		-0.0164** (0.0066)	-0.0155** (0.0064)		-0.0178*** (0.0066)	-0.0169*** (0.0065)	-0.0156** (0.0064)
High blood pressure		-0.0136*** (0.0047)	-0.0127*** (0.0046)		-0.0112** (0.0047)	-0.0107** (0.0046)	-0.0113** (0.0046)
Satisfied with job		0.0130*** (0.0027)	0.0114*** (0.0026)		0.0126*** (0.0027)	0.0112*** (0.0026)	0.0110*** (0.0026)
10 years of smoking		-0.0001 (0.0001)	-0.0001 (0.0001)		-0.0002* (0.0001)	-0.0002 (0.0001)	-0.0001 (0.0001)
Health in 1990			0.2449*** (0.0219)			0.2413*** (0.0220)	0.2403*** (0.0220)
Age	-0.0006*** (0.0001)	-0.0004*** (0.0002)	-0.0003*** (0.0001)	-0.0007*** (0.0001)	-0.0005*** (0.0002)	-0.0004*** (0.0001)	-0.0003** (0.0002)
Constant	0.9421*** (0.0082)	0.9342*** (0.0082)	0.7021*** (0.0223)	0.8784*** (0.0222)	0.8855*** (0.0221)	0.6679*** (0.0293)	0.6781*** (0.0300)
LogL	-2395.92	-2373.55	-2313.40	-2357.09	-2335.53	-2277.81	-2268.06
No. Obs.	1732	1732	1732	1703	1703	1703	1703

Notes: See notes to Table 3.

Table 6.
Interval regressions with self-rated health in 1995 as dependent variable. 15D thresholds applied. Women.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Short education	0.0093** (0.0042)	0.0097** (0.0042)	0.0067 (0.0041)				0.0054 (0.0041)
Semi-skilled	0.0091 (0.0061)	0.0092 (0.0060)	0.0112* (0.0058)				0.0098* (0.0058)
Vocational	0.0186*** (0.0038)	0.0175*** (0.0037)	0.0154*** (0.0036)				0.0135*** (0.0037)
Short advanced	0.0178*** (0.0043)	0.0110*** (0.0042)	0.0093** (0.0041)				0.0071* (0.0043)
Medium advanced	0.0182*** (0.0041)	0.0171*** (0.0040)	0.0141*** (0.0039)				0.0122*** (0.0041)
Long advanced	0.0219*** (0.0061)	0.0184*** (0.0061)	0.0163*** (0.0059)				0.0121* (0.0063)
Ln(wage)				0.0157*** (0.0036)	0.0129*** (0.0036)	0.0102*** (0.0035)	0.0066* (0.0038)
Fat		-0.0024 (0.0027)	-0.0018 (0.0026)		-0.0028 (0.0027)	-0.0021 (0.0026)	-0.0018 (0.0026)
Obese		-0.0149*** (0.0052)	-0.0140*** (0.0050)		-0.0160*** (0.0052)	-0.0152*** (0.0050)	-0.0140*** (0.0050)
High blood pressure		-0.0094** (0.0037)	-0.0085** (0.0036)		-0.0073** (0.0037)	-0.0068* (0.0036)	-0.0073** (0.0036)
Satisfied with job		0.0100*** (0.0021)	0.0086*** (0.0020)		0.0097*** (0.0021)	0.0084*** (0.0020)	0.0083*** (0.0020)
10 years of smoking		-0.0001 (0.0001)	-0.0001 (0.0001)		-0.0002* (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Health in 1990			0.2575*** (0.0207)			0.2539*** (0.0207)	0.2526*** (0.0207)
Age	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0003*** (0.0001)	-0.0006*** (0.0001)	-0.0005*** (0.0001)	-0.0003*** (0.0001)	-0.0003** (0.0001)
Constant	0.9560*** (0.0064)	0.9502*** (0.0065)	0.7032*** (0.0208)	0.9005*** (0.0174)	0.9067*** (0.0173)	0.6728*** (0.0254)	0.6791*** (0.0259)
LogL	-2352.84	-2330.47	-2257.97	-2310.74	-2288.96	-2218.76	-2209.59
No. Obs.	1732	1732	1732	1703	1703	1703	1703

Notes: See notes to Table 3.

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