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A decomposition of income-related health inequality applied to EQ-5D

Health-related quality-of-life (HRQL) measures are frequently used in health policy decision making to allocate health care resources efficiently. However, policy-makers are not only concerned about efficiency. The distribution of health in the population is also of concern. Equality in health is among the main objectives of health policy in many countries [1, 2, 3]. This implies that HRQL measures are also applied in studies of equality in health. Income-related inequality in health is measured by the concentration index, which has become a standard method for measuring health inequalities [4, 5, 6, 7, 8]. The concentration index summarizes income-related inequality as a single measure. However, as the HRQL instrument consists of various dimensions of health, it can be useful to decompose the concentration index into different components in order to understand the sources that contribute to inequality in health [9]. Furthermore, if health is related to determinants such as socioeconomic and sociodemographic characteristics and life-style factors, the concentration index can also be decomposed into contributions from background characteristics [10]. For policy purposes it is relevant to be informed about relationships between characteristics and health inequality to be able to target policies optimally.

The present study considers the EQ-5D instrument which is frequently used in cost-effectiveness analyses or in health surveys to assess HRQL. The EQ-5D questionnaire is a standardized generic health instrument consisting of five dimensions of health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is divided into three levels of health: no problems, some or moderate problems, or extreme problems [11, 12, 13, 14]. The Danish EQ-5D, established by Wittrup-Jensen et al. [15], implicitly added a sixth dimension consisting of an indicator for being dysfunctional (i.e., having moderate or severe problems in any of the five dimensions). The six dimensions are summarized into a single HRQL index by weighting the levels of the dimensions by a standard set of general population preference time trade-off (TTO) weights [16, 17, 18].

The analyses of the study follow the lines of earlier studies [9, 10, 19]. Clark et al. [9] decomposed a concentration index by dimension and subgroup separately and Wagstaff et al. [10] used a multivariate regression approach. The regression approach assisted a decomposition of the single characteristic's impact on inequality in a health component into (a) its regressive impact on the variation in the health component and (b) the impact due to income-related inequality in the characteristic itself [10]. Lauridsen et al. [19] merged the decomposition by dimension from Clark et al. [9] with the regression approach from Wagstaff et al. [10]. This was applied on a concentration index with health status measured by the generic health instrument 15D [20]. The concentration index was decomposed into the different dimensions of health summing up to the index and the effect on health from different socioeconomic characteristics. Lauridsen et al. [19] applied the decomposition on data from a Finnish survey. The analysis showed that

Table 1 Descriptive statistics and concentration indices of EQ-5D and each of its dimensions (n=2,915)

	Mean	Std	Min	Max	C_i	T	Std C_i	Weight	Contrib.	Contrib. (%)
Mobility	−0.0063	0.0234	−0.411	0	−0.1782	−4.5246	0.0394	−0.0071	0.0013	9.6679
Self-care	−0.0022	0.0171	−0.192	0	−0.1920	−2.266	0.0847	−0.0024	0.0005	3.5476
Usual activity	−0.0078	0.0223	−0.144	0	−0.1847	−6.0407	0.0306	−0.0086	0.0016	12.2566
Pain, discomfort	−0.0284	0.0653	−0.396	0	−0.1241	−5.0629	0.0245	−0.0316	0.0039	30.1516
Anxiety, depression	−0.0119	0.0415	−0.367	0	−0.1471	−3.9543	0.0372	−0.0133	0.0019	14.9847
Dysfunctional	−0.0455	0.0558	−0.114	0	−0.0755	−5.7823	0.0131	−0.0507	0.0038	29.3916
EQ-5D score	0.8980	0.1543	−0.266	1	0.0130	7.1413	0.0018	1.0000	0.0130	100

Table 2 Descriptive statistics and concentration indices of the regressor variables (n=2,915)

	Mean	Std	C_i	T	Std C_i
ln(income)[a]	11.9890	0.7579	0.0339	133.9107	0.0003
Men					
31–45 years	0.1479	0.3550	0.4644	19.1842	0.0242
46–60 years	0.1479	0.3550	0.4169	17.0172	0.0245
61–70 years	0.0587	0.2350	−0.0918	−2.1422	0.0428
71–80 years	0.0346	0.1829	−0.3224	−5.7404	0.0562
Women					
16–30 years	0.1087	0.3114	−0.4816	−16.4338	0.0293
31–45 years	0.1585	0.3653	0.0751	3.0523	0.0246
46–60 years	0.1286	0.3349	0.0185	0.6630	0.0278
61–70 years	0.0631	0.2432	−0.4319	−10.6806	0.0404
71–80 years	0.0360	0.1864	−0.5304	−9.7361	0.0545
Low education	0.6724	0.4694	−0.0134	−1.7962	0.0075
Medium education	0.1451	0.3523	0.3304	13.0917	0.0252
Other education	0.1273	0.3333	−0.5637	−21.6787	0.0260
Skilled worker	0.1554	0.3624	0.2314	9.4142	0.0246
White-collar worker	0.2878	0.4528	0.3563	23.0143	0.0155
Self-employed	0.0491	0.2160	0.4900	10.6001	0.0462
Assisting spouse	0.0051	0.0716	−0.2533	−1.7030	0.1487
Housewife	0.0148	0.1206	−0.5683	−6.5455	0.0868
Apprentice	0.0154	0.1233	−0.5397	−6.3588	0.0849
Student	0.0926	0.2900	−0.7138	−23.1957	0.0308
Retired	0.1918	0.3938	−0.3767	−18.0856	0.0208
Unemployed	0.0216	0.1454	−0.3299	−4.5981	0.0717
Other job	0.0597	0.2370	0.0868	2.0453	0.0424
Cohabitant	0.1479	0.3550	0.0687	2.6785	0.0257
Separated	0.0058	0.0762	0.1189	0.8508	0.1397
Divorced	0.0511	0.2203	0.0579	1.2566	0.0461
Widowed	0.0453	0.2080	−0.3324	−6.8194	0.0487
Alone	0.1808	0.3849	−0.3775	−17.4149	0.0217
Other	0.0017	0.0414	−0.0376	−0.1457	0.2582
Daily smoker	0.3660	0.4818	−0.0184	−1.3094	0.0141
High alcohol	0.0991	0.2989	0.0182	0.5650	0.0323
Vegetables, cooked	0.2985	0.4577	0.0183	1.1177	0.0164
Vegetables, raw	0.2820	0.4500	0.0369	2.1649	0.0171
Fruit	0.5983	0.4903	−0.0176	−2.0053	0.0088
No exercises	0.1142	0.3182	−0.0728	−2.4466	0.0298
Smoker and alcohol	0.0480	0.2139	−0.0284	−0.5954	0.0476
Smoke, alcohol, no exercise	0.0099	0.0993	−0.2064	−1.9343	0.1067

[a] *Ln (income) ranged from a minimum of 10.1266 to a maximum of 13.5606*

the different components of health contributed to health and inequality in health to varying degree, and that relationships to socioeconomic and sociodemographic characteristics varied considerably.

Method

Health status was measured using Danish EQ-5D TTO values [15]. In addition to coefficients for the five dimensions of the EQ-5D instrument, the Danish TTO model includes an indicator for any dysfunctional state (i.e., having moderate or severe problems in any of the five dimensions). This indicator was treated as a sixth dimension [15]. As with most generic HRQL measures [21], the EQ-5D comprises dimensions that represent different aspects of health. For several indices the final health status measure is calculated as a sum of scores for each dimension, i.e., as:

$$Y = \sum_{j=1}^{J} Y_j,$$

where Y_j is the contribution to overall health from dimension j. The EQ-5D fits into this frame, as it can be written as:

$$Y = 1 + \sum_{j=1}^{J} Y_j = \sum_{j=0}^{J} Y_j,$$

with Y_o=1 denoting an endowment of perfect health, and Y_1,.., Y_6 measuring depreciations of this endowment (rather than contributions to health) caused by moderate or severe health problems. The concentration index for Y can be decomposed as a weighted average:

$$C = \sum_{j=0}^{J} w_j C_j = \sum_{j=1}^{J} w_j C_j,$$

where C is the concentration index for Y, C_j the concentration index for Y_j, and w_j a weight attached to the j 'th dimension, estimated as $w_j = \frac{\mu_j}{\mu}$, with μ and μ_j being

the means of Y and Y_j, respectively. The first equality of Eq. 3 is due to [9], the second follows as C_o is equal to zero. The concentration index of Y_j with respect to income can be calculated conveniently by applying the regression [10]:

$$2\sigma_j^2 \left(\frac{Y_j}{\mu} \right) = \alpha_j + \beta_j R + \varepsilon_j,$$

where σ_j^2 is the variance of R and

$$R = \frac{r - 0.5}{n}$$

is the fractional income rank of the n individuals, with r being the unconditional income rank. The estimate of C_j is then equal to the OLS coefficient of the relative rank, $\hat{\beta}_j$, and approximate standard errors and t values are easily obtained form standard statistical packages.

For the purpose of decomposing C by socioeconomic and life-style determinants it is assumed that each health component Y_j (j =1,.., J) is linked to K regressors through a linear regression:

$$Y_j = \tau_j + \sum_{k=1}^{K} \delta_{jk} \chi_k + \varepsilon_j$$

Following the approach of [10] and given the relationship between health and the determinants the concentration index can be decomposed into contributions from the regressors as:

$$C_j = \sum_{k=1}^{K} \frac{\delta_{jk}\mu_k}{\mu_j} C_k + \frac{2}{\mu_j n} \sum_{i=1}^{n} \varepsilon_{j(i)} R_{(i)}$$

$$= \sum_{k=1}^{K} \eta_{jk} C_k + \frac{1}{\mu_j} CG_{\varepsilon_j}.$$

where μ_k and C_k are the mean and concentration index of the k 'th regressor. Applying Eq. 3, the decomposition of C follows as in [19]:

$$C = \sum_{j=1}^{6} w_j C_j$$

$$= \sum_{j=1}^{J} w_j \left[\sum_{k=1}^{K} \frac{\delta_{jk}\mu_k}{\mu_j} C_k + \frac{1}{\mu_j} CG_{\varepsilon_j} \right]$$

$$= \sum_{j=1}^{J} \sum_{k=1}^{K} \frac{\delta_{jk}\mu_k}{\mu} C_k + \sum_{j=1}^{J} \frac{1}{\mu} CG_{\varepsilon_j}$$

$$= C^{PRED} + CG^{RESID}$$

As demonstrated by Lauridsen et al. [19], the contribution from the k 'th regressor to C^{PRED} is then obtained as

$$\sum_{j=1}^{J} \frac{\delta_{jk}\mu_k}{\mu} C_k,$$

while the contribution from the j 'th dimension is obtained as

$$\sum_{k=1}^{K} \frac{\delta_{jk}\mu_k}{\mu} C_k.$$

Data

5,000 persons living in the county of Funen, Denmark, aged 16–80 years were drawn from The Centralized Civil Register to participate in a health survey on health status, health behavior, and socioeconomic background [22]. The sample was stratified with respect to municipalities, such that small and large municipalities would be represented. Within municipalities the respondents were drawn randomly [22]. The county of Funen is situated right in the middle of Denmark, makes up a little less than 10% of the national population, and is considered representative of the Danes [23]. The data were gathered through telephone interviews that took place in the period from October 2000 to April 2001. An external response rate of 68% was obtained [22]. A number of the respondents did not answer all questions relevant for the present study and had to be excluded, leaving a final working sample of 2,915, or 58%.

Descriptive response/nonresponse analysis was carried out by Gundgaard and Sørensen [22] to shred some light on potential differences between the participants and the nonparticipants. It was found that the number of women and men were approximately equal in the working sample. The participants were on average slightly younger than the nonparticipants. Dividing the respondents into age groups showed that the middle-aged are slightly more prone to participate than the younger or older groups [22]. Income was defined as previous year's gross income (gross of tax and deductibles) and measured as a categorical variable with 17 categories. The respondents were ranked according to their income category. Within the categories the respondents were ranked randomly. Descriptive statistics (means and standard deviations) of the data applied are provided as part of **Tables 1** and **2**.

Results

Table 1 shows concentration indices and their t statistics for each of the six dimensions of EQ-5D and the overall EQ-5D scores according to Eq. 4. The average overall EQ-5D score is 0.898, and the corresponding concentration index for the EQ-5D score is estimated to 0.013, indicating that health is concentrated among the higher income groups. The scores for the six dimensions express reductions in health rather than contributions to health. The dimensions with the highest mean reductions in health are Pain/discomfort and Dysfunctional with mean scores of −0.0284 and −0.0455, respectively. All the partial EQ-5D indices are negative and statistically significant, indicating that ill-health is concentrated among the lower income groups. The weight of each component and the contribution from each component's inequality to the inequality of the overall EQ-5D score is reported according to the decomposition in formula Eq. 3. Inequality in favor of the higher income groups is most pronounced for

Abstract

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Abstract
Income-related inequality in health and its relationship to sociodemographic characteristics have received considerable attention in the health economic literature. Recently a method was suggested for decomposing income-related health inequality to contributions from individual characteristics via additive dimensions, and this was applied to a Finnish case based on 15D health scores, where health is considered to be a sum of 15 individual health dimensions. The present study adds to this literature in several ways. First, we apply the decomposition approach to a Danish case which can be benchmarked to the Finnish. Second, we show how to apply the method to EQ-5D scores, which deviate from 15D scores by expressing health as individual depreciations of an equal endowment of perfect health. Third, we add life-style factors to the determinants of income-related health inequality. The empirical part of the study reveals discrepancies which can be attributed to differences between Finland and Denmark and to differences between the construction of 15D and EQ-5D scores. Finally, evidence of impact of life-style factors on income-related health inequality is found.

Keywords
EQ-5D · Health status index · Concentration index · Inequality · Decomposition

Table 3 Regression coefficients of EQ-5D and each of its dimensions (n=2,915)

	Mobility	Self-care	Usual activity	Pain, discomfort	Anxiety, depression	Dysfunctional	EQ-5D score
Ln(income)	0.0011	0.0001	0.0016*	0.0044*	0.0011	0.0040**	0.0123**
Men							
31–45 years	−0.0021	−0.0006	−0.0022	−0.0110**	−0.0032	−0.0154***	−0.0345***
46–60 years	−0.0033*	−0.0011	−0.003	−0.0188***	−0.0036	−0.0161***	−0.0458***
61–70 years	0.0011	0.0015	0.0032	0.0007	0.0079	−0.0031	0.0113
71–80 years	0.0035	0.0016	0.0004	0.0012	0.0105*	−0.0089	0.0083
Women							
16–30 years	−0.0011	−0.0004	−0.0028	−0.0019	−0.0074**	−0.0148***	−0.0285**
31–45 years	−0.0011	−0.0009	−0.0032*	−0.0186***	−0.0075**	−0.0252***	−0.0566***
46–60 years	−0.0039*	−0.0027*	−0.0041**	−0.0182***	−0.0051	−0.0235***	−0.0574***
61–70 years	0.0058**	0.0039*	0.0005	−0.0097	−0.0040	−0.0166**	−0.0202
71–80 years	0.0038	−0.0043*	−0.0067**	−0.0029	0.0000	−0.0184**	−0.0285
Low education	−0.0032*	−0.0014	−0.0018	−0.0048	−0.0031	−0.0038	−0.0180
Medium education	−0.0015	−0.0005	−0.0021	−0.0018	−0.0013	−0.0051	−0.0123
Other education	−0.0007	0.0020	−0.0022	−0.0001	−0.0090	−0.0051	−0.0152
Skilled worker	−0.0017	−0.0007	−0.0021	0.0022	0.0009	−0.0017	−0.0032
White-collar worker	−0.0020	−0.0008	0.0000	0.0054	−0.0014	0.0021	0.0033
Self-employed	−0.0003	−0.0003	0.0018	0.0076	0.0000	0.0038	0.0126
Assisting spouse	−0.0010	0.0007	0.0034	0.0073	−0.0003	0.0030	0.0132
Housewife	−0.0066*	0.0000	−0.0053	−0.0062	−0.0154**	−0.0124	−0.0458*
Apprentice	−0.0019	−0.006**	−0.0016	−0.0053	0.0081	−0.0118	−0.0187
Student	−0.0015	−0.0029	0.0014	−0.0040	0.0061	0.0066	0.0056
Retired	−0.0151***	−0.0067***	−0.0109***	−0.0238***	−0.0105***	−0.0205***	−0.0876***
Unemployed	−0.0058*	−0.0034	−0.0115***	−0.0064	−0.0223***	−0.0063	−0.0557***
Other job	−0.0050**	−0.002	−0.0020	−0.0100	−0.0135***	−0.0082	−0.0407***
Cohabitant	−0.0003	0.0003	0.0016	0.0020	0.0023	0.0030	0.0088
Separated	0.0033	−0.0093**	0.0009	−0.0122	−0.0533***	−0.0189	−0.0895**
Divorced	−0.0065***	0.0003	−0.0045**	0.0055	−0.0126***	−0.0036	−0.0213*
Widowed	0.0016	−0.0005	0.0022	0.0061	−0.0058	0.0024	0.0061
Alone	−0.0005	−0.0006	0.0023	0.0022	−0.0008	0.0008	0.0033
Other	−0.0005	0.0030	0.0093	−0.0151	−0.0078	−0.0438*	−0.0549
Daily smoker	−0.0001	0.0004	−0.0009	−0.0099***	−0.0053***	−0.0042*	−0.0200***
High alcohol	0.0009	0.0018	0.0023	−0.0035	−0.0021	−0.0038	−0.0044
Vegetables, cooked	−0.0012	−0.0005	−0.0011	−0.0057**	0.0010	0.0005	−0.0071
Vegetables, raw	0.0008	0.0003	0.0002	0.0033	0.0011	0.0057**	0.0114*
Fruit	0.0008	0.0008	0.0005	−0.0022	0.0001	0.0016	0.0015
No exercises	−0.0131***	−0.0034***	−0.0114***	−0.0333***	−0.0091***	−0.0174***	−0.0878***
Smoker and alcohol	−0.0008	−0.0008	−0.0038	0.0126	−0.0094*	−0.0019	−0.0041
Smoke, alcohol, no exercise	−0.0113**	−0.0062*	0.0051	−0.0087	0.0244***	0.0023	0.0057

*p <*0.10*, **p <*0.05*, ***p <*0.01*

Pain/discomfort and Dysfunctional, and these dimensions are also the most contributing factors to overall inequality.

Further, **Table 2** shows concentration indices and *t* statistics for each of the regressors. Both men and women aged 31–45 and 46–60 years are significantly better off than the other age groups with respect to income. Men and women aged 61–70 and 71–80 years are significantly worse off than the rest of the age groups, indicating that income is highest for the middle aged. Low education is distributed among the lower income groups whereas medium education is distributed among the higher income groups. With respect to occupational status, skilled workers, white-collar workers, and self-employed are distributed among the higher income groups, whereas the rest of the occupational groups are distributed among the lower income groups.

Regarding life-style variables the concentration indices for smoking and excessive alcohol consumption are not statistically significant (but present the expected signs, however). Daily consumption of raw vegetables is distributed among the higher income groups, and daily consumption of fruit and a life-style without physical exercises are distributed among the lower income groups. As it is obvious that different life-style factors may interact

with each other, two interaction variables have been constructed: one with smoking and excessive alcohol, and one with smoking, excessive alcohol and no exercises. The concentration indices for these variables are negative, indicating that interactions of unhealthy life-style are distributed among the lower income groups. However, the coefficients are not statistically significant.

Table 3 shows coefficients from the regression analyses according to Eq. 5. Income is positively related to the overall EQ-5D score and to the other dimensions and significantly so for the overall EQ-5D score and Dysfunctional ($p<0.05$). For the overall EQ-5D score men aged 31–45 and 46–60 years and women aged 30 or under, 31–45, and 46–60 years are worse off than the reference group of men aged under 30 or under. The older age groups do not differ significantly from the reference group. This may indicate that persons learn to cope with their disabilities at old age. Educational level and occupational status do not seem to affect health status. Only the retired and the unemployed seem to have a significantly lower health status than the reference group of unskilled workers. It appears that being active in the labor market is of greater importance than the actual job type. Regarding life-style, daily smoking affects the overall EQ-5D score and the Pain/discomfort and Anxiety/depression dimensions negatively. Another important life-style variable is no exercises, which has significantly negative coefficients for all dimensions ($p<0.01$). The interaction variable for smoking, excessive alcohol, and no exercises is negative and significant for the Mobility dimension, indicating an adverse synergetic health effect of bad health in several life-style factors, whereas the opposite is true for the Anxiety/depression scale.

Table 4 shows the contribution from each dimension to the concentration index according to Eq. 7. The predicted concentration index constitutes a large fraction of the observed concentration index leaving only a small fraction as the error residual. This is the case for the overall EQ-5D scores as well as the dimensions. The contributions from the regressors through the dimensions are shown in percentages of the overall predicted concentration index in **Table 5**. The regressors contribute to the overall concentration index with various magnitudes and signs. The largest contributors are income and being retired. Also the qualities of being men and aged 31–45 or 46–60 years are large contributors, however with negative signs. The educational regressors contribute to the overall inequality, especially the residual category of other types of education. Of the life-style variables only a life-style with no exercises contributes considerably to the concentration index. As for the observed concentration indices, the different health dimensions contribute to the overall inequality to varying degree. Pain/discomfort and Dysfunctional are the most important contributors.

Table 4 Decomposition of observed/predicted CI and error CG into the six dimensions (n=2,915)

	Mobility	Self-care	Usual activity	Pain, discomfort	Anxiety, depression	Dysfunctional	EQ-5D score
Predicted CI	0.00113	0.00051	0.00140	0.00333	0.00158	0.00299	0.01094
Observed weighted CI	0.00126	0.00046	0.00159	0.00392	0.00195	0.00382	0.01301
Error CG	0.00013	–0.00005	0.00019	0.00059	0.00037	0.00084	0.00207

Discussion

The present study adds to earlier findings [19] by decomposing EQ-5D scores and by applying a Danish case, while Lauridsen et al. [19] applied 15D values to Finnish data. EQ-5D values are less straightforward to decompose than 15D values as the Danish EQ-5D values, established by Wittrup-Jensen et al. [15], differ from 15D values particularly in two ways. First, EQ-5D defines health as an endowment of perfect health, depreciated by moderate or severe health problems, while 15D is obtained as a sum of 15 health dimension contributions. This implies that inequality of health according to EQ-5D is to be interpreted as a weighted sum of inequality in ill health, rather than inequality in contributions to health, as it is the case for the 15D values. Second, the Danish TTO model includes an indicator for any dysfunctional state. This implies that the contributions from the remaining five dimensions must be interpreted as partial contributions, controlled for the contribution from having any dysfunctional states. Some national TTO models also include a variable for having any dimension scored at the worst state (e.g., the British TTO model [15, 17]). If such a TTO model had been used, this characteristic could have been incorporated in the sixth dimension. Despite these differences in interpretation, the present study shows that it is possible to encompass the EQ-5D into a methodological frame similar to that applied to the 15D by [19].

Earlier findings reported by Lauridsen et al. [19] are largely confirmed by this analysis. That is, health status is a diversified matter, and an overall HRQL index may be too crude to measure health status for specific purposes. Policies combating inequalities in health might not show any changes in the overall index if decreases in inequality in one type of health are offset by increases in another. Therefore it is relevant to know the sources of health status and health inequality. Furthermore, the same factors seem to contribute to overall income-related inequality in Finland and Denmark, as income and being retired are the most important contributing factors. Some discrepancies, however, are found. In contrast to the findings of Lauridsen et al. [19], where Usual activities were found to be the most contributing factor, closely followed by Mental health, the present study found that Pain/discomfort and Dysfunctional were the most important factors. Further, in the Finnish case income is not contributing to inequality to the same degree as in the Danish, as the concentration index for income is somewhat higher in the Danish data than in the Finnish, indicating that income inequality is larger in Denmark than in Finland. Next, the findings of Lauridsen et al. that education plays a role for some of the dimensions and for the overall score is only marginally confirmed. Finally, Lauridsen et al. reported that being retired contributed about twice as much as income, while the two contributions were found to be approximately equal for the present

Table 5 Contribution from each regressor and dimension to CI of EQ-5D: proportion of predicted CI (n=2,915)

	Mobility	Self-care	Usual activity	Pain, discomfort	Anxiety depression	Dysfunctional	EQ-5D score
ln(income)	4.72	0.45	6.42	17.98	4.66	16.41	50.63
Men							
31–45 years	−1.48	−0.41	−1.55	−7.67	−2.27	−10.74	−24.12
46–60 years	−2.06	−0.66	−1.85	−11.78	−2.29	−10.10	−28.74
61–70 years	−0.06	−0.08	−0.18	−0.04	−0.43	0.17	−0.62
71–80 years	−0.39	−0.18	−0.05	−0.14	−1.20	1.01	−0.94
Women							
16–30 years	0.58	0.24	1.52	1.01	3.93	7.91	15.19
31–45 years	−0.13	−0.11	−0.39	−2.25	−0.91	−3.06	−6.85
46–60 years	−0.10	−0.06	−0.10	−0.44	−0.12	−0.57	−1.39
61–70 years	−1.60	−1.07	−0.13	2.68	1.12	4.61	5.60
71–80 years	−0.74	0.84	1.31	0.57	0.00	3.57	5.55
Low education	0.30	0.12	0.16	0.44	0.28	0.35	1.65
Medium education	−0.74	−0.25	−1.02	−0.88	−0.63	−2.48	−6.00
Other education	0.52	−1.44	1.64	0.08	6.57	3.70	11.07
Skilled worker	−0.63	−0.24	−0.78	0.80	0.31	−0.62	−1.17
White-collar worker	−2.06	−0.80	0.02	5.59	−1.5	2.21	3.46
Self-employed	−0.07	−0.08	0.44	1.86	0.01	0.94	3.09
Assisting spouse	0.01	−0.01	−0.05	−0.10	0.00	−0.04	−0.18
Housewife	0.56	0.00	0.45	0.53	1.31	1.06	3.90
Apprentice	0.16	0.51	0.14	0.45	−0.69	1.00	1.58
Student	1.01	1.97	−0.94	2.70	−4.08	−4.44	−3.78
Retired	11.14	4.93	8.04	17.52	7.71	15.08	64.42
Unemployed	0.42	0.25	0.83	0.46	1.62	0.46	4.04
Other job	−0.26	−0.10	−0.11	−0.53	−0.71	−0.43	−2.14
Cohabitant	−0.03	0.03	0.16	0.21	0.24	0.31	0.91
Separated	0.02	−0.07	0.01	−0.09	−0.38	−0.13	−0.63
Divorced	−0.19	0.01	−0.13	0.16	−0.38	−0.11	−0.64
Widowed	−0.24	0.07	−0.34	−0.94	0.89	−0.37	−0.94
Alone	0.36	0.45	−1.60	−1.50	0.52	−0.53	−2.3
Other	0.00	0.00	−0.01	0.01	0.01	0.03	0.04
Daily smoker	0.01	−0.03	0.06	0.68	0.36	0.29	1.37
High alcohol	0.02	0.03	0.04	−0.06	−0.04	−0.07	−0.08
Vegetables, cooked	−0.07	−0.03	−0.06	−0.32	0.05	0.03	−0.39
Vegetables, raw	0.08	0.03	0.02	0.35	0.11	0.60	1.20
Fruit	−0.08	−0.08	−0.05	0.24	−0.01	−0.17	−0.16
No exercises	1.11	0.29	0.96	2.82	0.77	1.47	7.43
Smoker and alcohol	0.01	0.01	0.05	−0.17	0.13	0.03	0.06
Smoke, alcohol, no exercise	0.24	0.13	−0.11	0.18	−0.51	−0.05	−0.12
Predicted CI	10.34	4.65	12.82	30.42	14.47	27.31	100

study. These differences may be attributed to national differences and to differences between 15D and EQ-5D.

The present study further added to the investigation of Lauridsen et al. [19] by including life-style variables as regressors. It is well documented that smoking, alcohol habits, and diet and activity patterns have an important effect on health [24, 25, 26, 27]. Smoking and especially a sedentary life-style were the most important life-style factors in the health regression models and the largest contributors to inequality. Although life-style behavior is sometimes rooted in firmly cemented cultural habits, the possibilities of health policy initiatives might still have better chances of altering life-style than socioeconomic and sociodemographic conditions. Interaction terms were included, as the effect of different life-style factors may act synergistically [25, 28]. The interaction terms of smoking, alcohol, and sedentary behavior did not play a major role in the health regression models. However, they did contribute to the overall inequality, indicating that overall health inequality is a complicated pattern of life-style aspects and other socioeconomic and sociodemographic circumstances.

The decomposition approach has also been applied in an unpublished study by Lauridsen and Gundgaard with the SF-36

summary scores for physical and mental health. The results from the present study appear to be rather robust, as the results in the unpublished study showed the same tendencies. The most central findings are that income-related inequality in health is related mainly to lack of participation in the labor market, to income and to age distribution. Other socioeconomic and demographic determinants as well as life-style factors do have some importance, but to a lesser degree.

Conclusion

The dimensions contributing most to overall EQ-5D income-related health inequality are pain/discomfort and being dysfunctional. Contributions from socioeconomic and life-style variables vary considerably. The most important factors are lack of participation in the labor market, income, and the age distribution. Of the life-style variables only a life-style with no exercises contributes considerably to the inequality. This implies that policy initiatives aiming at reducing income related health inequality will be more successful if directed toward specific aspects of health or certain socioeconomic characteristics and life-style factors. The results are robust in the sense that similar patterns were found in previous studies using 15D scores on Finnish data and SF-36 scores on Danish data, although discrepancies are found in relation to the former, which may be attributed to national differences and to conceptual differences between the scoring systems.

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