Increasing absolute mortality disparities by education in Finland, Norway and Sweden, 1971–2000

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Accepted 22 December 2010
Published Online First 30 January 2011

ABSTRACT

Background and objectives Studies on socioeconomic health disparities often suffer from a lack of uniform data and methodology. Using high quality, census-linked data and sensible inequality measures, this study documents the changes in absolute and relative mortality differences by education in Finland, Norway and Sweden over the period 1971 to 2000.

Methods The age-standardised mortality rates and the population exposures for three educational categories were computed from detailed data provided by the national statistical offices. Mortality disparities by education were assessed using two range measures (rate differences and rate ratios), and two Gini-like measures (the average inter-group difference (AID) and the Gini coefficient (G)). The formulae for the decomposition of the change in the AID into (1) the contribution of change in population composition by education, and (2) the contribution of mortality change were introduced.

Results Mortality decreases were often greater for high than for medium and low education. Both relative and absolute mortality disparities tend to increase over time. The magnitude and timing of the increases in absolute disparities vary by country. Both the rate differences and the AIDs have increased since the 1970s in Norway and Sweden, and since the 1980s in Finland. The contributions of the changes in population composition to the total AID increase were substantial in all countries, and for both sexes. The mortality contributions were substantial for males in Norway and Sweden.

Conclusions The study reports increases in absolute mortality disparity, and its components. This trend needs to be further studied and addressed by policies.

BACKGROUND

The production of country-level mortality data by national statistical agencies allows for the monitoring of inter-country mortality inequalities.[1] However, the monitoring of trends in socioeconomic mortality differences within countries remains a challenging task. Data of reasonable quality are only available for a small number of countries,[2 3] and just a few countries have such data available for long time periods. Existing studies are often hardly comparable due to differences in definitions of socioeconomic categories. In addition, studies differ substantially in terms of the measures of mortality and inter-group mortality inequality.[2 4 5–7] These differences may result in conflicting conclusions about directions of changes in mortality inequalities produced by the same group-specific mortality changes.[4 8 9]

A detailed analysis by Harper and colleagues demonstrated how the observed direction of changes in inter-group health disparities depends on the measure used for quantifying the inequality.[10] It has been suggested that the monitoring of health disparities should be accompanied by an explanation of the meaning and scaling of the inequality measure.[10 11]

In spite of these methodological deficiencies, there is a general consensus about the predominant increase in *relative* socioeconomic mortality disparities in industrialised countries since the 1980s. Such a trend has been found in most studies.[3 12] There is, however, less agreement about the predominant tendency regarding *absolute* mortality inequalities.[2] Depending on mortality measures and countries, the existing studies give conflicting evidence about the direction of change in the absolute mortality differentials. For example, it has been shown that absolute mortality gaps between manual and non-manual classes increased in Finland and England and Wales, but they decreased in Sweden, Norway and Denmark.[2] Another analysis using Norwegian data found that the absolute educational mortality differentials increased during the 1980s and 1990s.[13]

Our study aims to document and analyse the changes in absolute and relative mortality disparities by education in Finland, Norway and Sweden over the period 1971 to 2000. We attempt to overcome some of the acknowledged data and methodological deficiencies by examining the complete series of high quality, census-linked data on mortality by education. The three countries have comparable educational systems, and apply very similar methods in the production of census-linked data on differential mortality. Using these consistent and comparable data across countries, we have produced time series of both the simplest range measures (mortality rate ratios and rate differences), and of absolute and relative Gini-like measures. The two types of inequality measures refer to two different public health aspects of health disparities. While the range measures express the maximum mortality effects of the educational inequalities on individuals, the Gini-like measures reflect the magnitude of educational disparities in mortality within the whole population.[8]

Using the selected measures we address the main research question related to the direction and magnitude of changes in the absolute mortality disparities by education in the three Nordic countries. In addition, new formulae for the decomposition of changes in average inter-group difference (AID) allow us to shed more light on the specifics

related to the contributions of changing population structures and the contributions of changing education-specific mortality rates to overall change in absolute mortality disparity.

Any rise in absolute mortality disparity should be considered an unexpected result since values of the mortality rates are getting lower. From a policy point of view, such rises are also unexpected since Finland, Norway and Sweden are seen as modern welfare states[14] with serious concern for social equality. This concern also extends to health and all three countries have declared as their goal to reduce health inequalities.

DATA

The analysis is based on high quality census-linked data from the statistical offices of Finland, Sweden and Norway. The data were provided in multi-dimensional frequency table format combining deaths and population exposure, and are divided by sex, five-year age groups, educational levels and several other categories over the period 1971 to 2000.

The data for Finland cover the period 1971–2000, which is broken into six five-year sub-periods. For this country, census-based information about individuals' educational status at the censuses of 1970, 1975, 1980, 1985, 1990 and 1995 is linked with the register information about deaths during the five-year calendar periods following each census. For Norway, the same information was obtained using the censuses of 1970, 1980 and 1990, with 10-year follow-up periods after each census. Finally, only the censuses of 1970 and 1990 were available for Sweden. Having determined that 10 years is the longest acceptable follow-up period, it was possible for us to obtain for Sweden mortality series covering the 1970s and 1990s, but not the 1980s.

A key advantage of using education as a measure of social position is that, after a certain age, education remains stable over the life course. In order to ensure better comparability across countries, only three broad educational categories are used: high (tertiary) education, middle (secondary) education, and low (lower than secondary) education. The range of ages is restricted to 40 and beyond. This constraint helps us to avoid potential problems related to changes in the educational status of individuals. This is especially important for Sweden and Norway, because for these countries the census-based education is assumed to be fixed during the long 10-year periods following each census.

The total and education-specific population exposure is calculated from the census population, accounting for the register-based, education-specific deaths and migrations, as described in the next section. Overall, the data for Sweden include 1.72 million deaths and 74.8 million person-years at ages 40 and older. The corresponding data for Finland and Norway include 1.31 and 1.18 million deaths, and 60.5 and 51.2 million person-years of exposure, respectively. Table 1 documents the educational structure of the population exposure across time, and demonstrates a remarkable degree of educational progress. From 1971–75 to 1996–2001, the shares of the high and the middle education categories greatly increased, while the low education category shrank. However, despite the impressive progress made in Finland, Sweden and (especially) Norway are well ahead of Finland in respect to educational attainment.

METHODS

Death rates

Age-specific death rates are computed by sex, educational group, five-year age interval (40–44, 45–49, …., 85+), and five-year calendar period from deaths and population exposures. The Lexis diagram (figure 1) illustrates the computation of the age- and education-specific death rate as a ratio of deaths to population exposure within an elementary Lexis rectangle covering ages x to $x+5$ and calendar years t to $t+5$.

For each educational group, the level of mortality is measured by an age-standardised death rate (SDR) that is calculated from the respective vectors of age-specific death rates by a method of direct standardisation based on the European population standard of the WHO.[15]

Measures of absolute inequality

Two measures are used to quantify the absolute inequality. First, we use the Max–Min range, which is equal to a difference between SDRs for the groups of low and high education. Our second measure is called the average inter-group difference (AID). Elsewhere, it has also been called the 'dispersion measure of mortality'[1] and is very similar to the 'absolute concentration

Table 1 Changes in the educational composition of population at ages over 40 in Finland, Norway and Sweden, from 1971–75 to 1996–2000 (in %)

		Males			Females		
Country	Period	High	Middle	Low	High	Middle	Low
Finland	1971–75	5.88	13.66	80.45	4.04	12.19	83.77
	1976–80	6.91	16.40	76.69	4.77	14.64	80.59
	1981–85	8.33	20.67	71.00	5.87	18.31	75.82
	1986–90	10.12	26.58	63.30	7.44	23.64	68.92
	1991–95	11.70	32.11	56.19	9.09	29.23	61.68
	1996–2000	13.34	37.63	49.03	11.63	34.82	53.56
Sweden	1971–75	6.05	16.83	77.12	3.63	10.86	85.52
	1976–80	7.04	20.24	72.72	4.63	13.33	82.04
	1991–95	16.50	26.29	57.21	15.26	23.54	61.20
	1996–2000	18.72	29.76	51.52	18.11	27.81	54.09
Norway	1971–75	8.37	21.25	70.38	3.38	15.10	81.52
	1976–80	9.54	22.76	67.70	3.98	16.41	79.62
	1981–85	13.27	38.12	48.61	7.61	34.37	58.02
	1986–90	15.81	40.86	43.32	9.47	37.90	52.63
	1991–95	19.30	44.07	36.62	12.82	41.47	45.71
	1996–2000	21.20	46.42	32.39	15.17	44.20	40.63

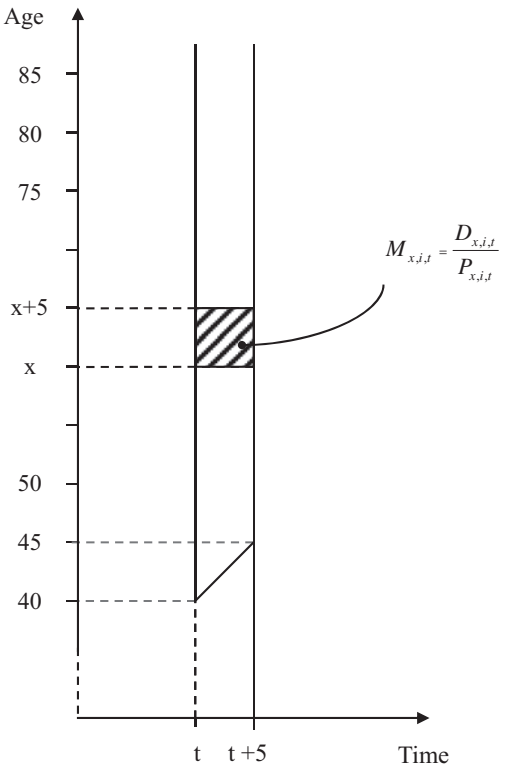

Figure 1 Lexis diagram for the computation of age- and education-specific death rates.

index'.[9] In most of the earlier studies, the measure was defined by means of the Lorenz curve as a measure of deviation between distribution of health (mortality) and distribution of population.[8 10 11] We find it more instructive to use another (and mathematically equivalent) definition stating that this measure is simply an average inter-group difference (AID) that is equal to the population-weighted average of mortality differences between group-specific mortality rates across all pairs of group-specific SDRs:

$$AID_t = \frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}|SDR_{t,i} - SDR_{t,j}|p_{t,i}p_{t,j} \qquad (1)$$

where $p_{t,i}$ and $p_{t,j}$ are the population weights (weights in the total population exposure) for groups i and j ($i, j = 1, 2, \ldots, N$) at time t, respectively.[1 16] In our study, N=3.

Although formula (1) assumes grouped data, it also allows us to see that the AID derived from individual data would be equal to the mean difference between death hazards across all possible pairs of individuals in the population. The SDRs, the Max−Min and AID are measured in deaths per 1000 person-years of exposure.

Thus, the AID expresses the magnitude of educational differences in mortality among all individuals, regardless of their educational labels. Importantly, the AID depends on all groups and takes into account their mortality rates and population weights. In this respect, the AID differs from the Max−Min measure, which depends only on mortality in two extreme educational groups, and which disregards population importance of these groups. The AID increases when the variability in mortality rates increases, and it also increases when the variability in population weights decreases.

Notably, the AID is related to the slope index of inequality, another measure that is commonly used in studies on health disparities (box 1).

Box 1 Relationship between the average inter-group difference and the slope index of inequality

SII is defined as a slope of the regression line connecting group-specific mortality rates to cumulative population shares, corresponding to the population groups.[7–9] According to Wagstaff and colleagues,[9 17] the following equation connects *SII* with the *AID*: $SII = AID/2\sigma_R^2$, where σ_R^2 denotes the population-weighted variance of the cumulative population shares. The variance is $\sigma_R^2 = \sum p_i(R_i - \frac{1}{2})^2$ with the cumulative shares $R_i = p_i/2$ if i=1 and $R_i = \sum_{k=1}^{i-1} p_k + p_i/2$ if i>1. It is assumed that population groups are numbered in ascending or descending order of the socioeconomic ranking.

Measures of relative inequality

Relative inequality across the educational groups is measured by the Max/Min ratio and the Gini coefficient (G). The Max/Min equals the ratio of the SDR for those with low education to the SDR for those with high education.

G is equal to the AID divided by the mean mortality rate (population-weighted average of the group-specific SDRs).[8 18] When multiplied by 100, it expresses the average inter-group difference as a percentage of the mean mortality rate.

There is a general reason to believe that the relative mortality disparity by education is unlikely to decrease over long observation periods (box 2).

Decomposition of AID change

Formula (1) can be rewritten in the following simplified form:

$$AID_t = \sum_{l=1}^{L} \xi_{t,l} \cdot \pi_{t,l} \qquad (2)$$

In (2), index l runs across all unique combinations of i and j. The total number of such combinations $L=N(N-1)/2$. If N=3, the number of unique combinations of i and j is equal to 3 (L=3): l=1 (i=1, j=2); l=2; (i=1, j=3); l=3 (i=2, j=3). For a given l corresponding to certain values of i and j: $\xi_{t,l} = |SDR_{t,i} - SDR_{t,j}|$ and $\pi_{t,l} = p_{t,i}p_{t,j}$.

Expression (2) makes it easy to split a difference in AID values between time points t_1 and t_2 into additive contributions produced by respective changes in mortality and in population

Box 2 Condition of increase in a relative inequality measure

If the value of a relative inequality measure is $z_1 = A/B$, and after additive mortality reductions of the numerator and denominator that are equal to a and b, respectively, the new value of the measure is $z_2 = (A - a)/(B - b)$, then $z_2 < z_1$ only if $a > z_1 b$.

This means, for example, that the *Max/Min* ratio that is equal to two can become lower only if the absolute reduction of SDR_{low} is more than twice as large as the absolute reduction of SDR_{high}, which is quite unlikely in cases in which mortality reductions are not very small. Similar logic applies to *G*. Indeed, it is unlikely that the absolute reduction in the mean *difference* between group-specific *SDR*s is substantially greater than the absolute reduction of the mean *SDR*.

composition: $AID_{t_2} - AID_{t_1} = \Delta SDR_{t_1,t_2} + \Delta p_{t_1,t_2}$

The components can be obtained by following Kitagawa's decomposition[19 20]:

$$\Delta SDR_{t_1,t_2} = \frac{1}{2}\left[\sum_{l=1}^{L} \pi_{t_1,l}(\xi_{t_2,l} - \xi_{t_1,l}) + \sum_{l=1}^{L} \pi_{t_2,l}(\xi_{t_2,l} - \xi_{t_1,l})\right] \quad (2a)$$

$$\Delta p_{t_1,t_2} = \frac{1}{2}\left[\sum_{l=1}^{L} \xi_{t_1,l}(\pi_{t_2,l} - \pi_{t_1,l}) + \sum_{l=1}^{L} \xi_{t_2,l}(\pi_{t_2,l} - \pi_{t_1,l})\right] \quad (2b)$$

RESULTS

Differential trends in overall and group-specific death rates

Table 2 presents the main outcomes of the study. A predominant trend across the three countries and educational categories was a mortality decrease over the three decades of observation. There were notable variations in the magnitude of declines in total and group-specific mortality levels. Finland experienced the greatest total mortality reduction. Sweden, which began the period studied with lower mortality than the other countries, experienced a slower absolute decrease in mortality. Less educated Swedish males saw no progress during the 1970s. During the 1990s, mortality decreased in all groups, but at a slower pace among people with low levels of education. In all education groups and for both sexes, the slowest health improvements took place in Norway. No, or only very slight decreases in mortality can be observed for highly educated males between 1976–80 and 1981–85, and for highly educated females during the 1970s. In addition, there was stagnation in mortality among males and females with low levels of education in the 1980s. In Finland, mortality declines across different education groups were much more systematic than in the other two countries (table 2).

A substantial amount of time was needed for the low education groups to reach the mortality levels experienced by the high education groups in 1971–75 (table 2). It was not until the second half of the 1990s that less educated Finnish males reached the mortality level experienced by their highly educated counterparts in the early 1970s. The corresponding time lag is less significant among Finnish females, as the less educated

Table 2 Trends in total and education-specific age-standardised death rates (SDR), and in four measures of mortality inequality at ages over 40 in Finland, Norway and Sweden from 1971–76 to 1996–2000

		SDR*					Inequality measures			
							Relative		Absolute	
Country	Period	Total	High	Mid	Low	Weighed mean	Max/Min	G (%)	Max–Min*	AID*
Males										
Finland	1971–75	33.41	24.72	27.59	34.68	33.13	1.40	3.85	9.96	1.28
	1976–80	30.72	22.37	25.37	32.12	30.34	1.44	4.61	9.75	1.40
	1981–85	27.95	20.73	24.21	29.32	27.55	1.41	4.78	8.59	1.32
	1986–90	26.12	18.66	22.75	27.76	25.51	1.49	6.02	9.11	1.54
	1991–95	23.79	16.41	20.70	25.72	23.02	1.57	7.30	9.31	1.68
	1996–2000	21.56	14.34	19.03	23.80	20.74	1.66	8.36	9.46	1.73
Sweden	1971–75	24.08	19.55	21.54	24.60	23.78	1.26	2.75	5.05	0.65
	1976–80	23.96	18.87	21.18	24.70	23.58	1.31	3.60	5.83	0.85
	1991–95	19.32	14.50	17.17	20.79	18.80	1.43	6.67	6.29	1.25
	1996–2000	17.64	12.99	15.42	19.43	17.03	1.50	8.05	6.44	1.37
Norway	1971–75	23.27	18.69	22.00	24.00	23.13	1.28	2.90	5.32	0.67
	1976–80	22.48	17.59	21.52	23.32	22.36	1.33	3.28	5.72	0.73
	1981–85	21.94	17.81	20.42	23.74	21.69	1.33	5.20	5.93	1.13
	1986–90	21.42	16.41	19.94	23.80	21.05	1.45	6.73	7.39	1.42
	1991–95	19.96	15.23	18.75	22.70	19.52	1.49	7.51	7.48	1.47
	1996–2000	18.31	13.59	17.16	21.50	17.81	1.58	8.69	7.91	1.55
Females										
Finland	1971–75	19.13	15.14	14.93	19.64	18.88	1.32	3.36	4.71	0.63
	1976–80	16.38	12.71	13.75	16.84	16.19	1.32	3.28	4.12	0.53
	1981–85	14.89	11.70	12.79	15.33	14.65	1.31	3.59	3.62	0.53
	1986–90	14.43	11.22	12.58	14.97	14.13	1.33	4.28	3.75	0.61
	1991–95	13.37	10.13	11.56	14.08	12.98	1.39	5.50	3.95	0.71
	1996–2000	12.07	9.23	10.51	12.98	11.69	1.41	6.38	3.75	0.75
Sweden	1971–75	15.61	12.10	12.86	15.78	15.33	1.30	2.54	3.68	0.39
	1976–80	14.66	11.05	11.69	14.89	14.28	1.35	3.50	3.83	0.50
	1991–95	12.01	9.09	9.97	12.71	11.51	1.40	6.64	3.62	0.76
	1996–2000	11.31	8.15	9.18	12.31	10.69	1.51	8.71	4.16	0.93
Norway	1971–75	14.81	10.98	12.09	15.27	14.64	1.39	3.52	4.29	0.52
	1976–80	13.57	11.08	11.83	13.92	13.46	1.26	2.73	2.84	0.37
	1981–85	12.61	10.14	11.25	13.42	12.42	1.32	4.88	3.28	0.61
	1986–90	12.43	9.73	11.01	13.45	12.17	1.38	5.89	3.72	0.72
	1991–95	11.88	9.31	10.72	13.08	11.62	1.41	6.40	3.77	0.74
	1996–2000	11.25	8.69	10.10	12.75	10.96	1.47	7.47	4.06	0.82

*Per 1000 person-years.

caught up with the initial level seen among highly educated females in 1981–85. For Swedish females and for both sexes in Norway, SDRs for the low education group in 1996–2000 were still higher than SDRs for the high education group in 1971–75.

In all three countries and for both sexes, the steepest relative decreases in SDRs can be observed among the highly educated males and females. Despite having much higher starting SDR values, the absolute mortality reductions among the groups with low education in many cases did not exceed the corresponding decreases among the groups with high or middle education. For example, between 1981–85 and 1996–2000, the greatest absolute mortality reduction in Finland was made by males and females with high levels of education. For males in Sweden and Norway, and for females in Sweden, the biggest absolute SDR decreases over the period 1971–2000 also occurred among those with high education (table 2). In all countries and for both sexes, the absolute SDR decreases were greater for those with high education than for those with middle education.

As a result of the aforementioned differences in the pace of health improvements, the absolute mortality gap between the high and middle education groups increased in all the countries studied, and for both sexes. The mortality gap between the low and high education groups decreased slightly for males in Finland, and increased substantially for males in Sweden and, especially, in Norway. The same mortality gap decreased for females in Finland and Norway, and increased for females in Sweden.

The mortality gap between the low and middle education groups—both of which are larger than the high education group—is especially important for the total population. Over the whole period of observation, this gap decreased for males and females in Finland, and for females in Norway; while it increased for males in Sweden and Norway, and for females in Sweden.

Trends in relative mortality disparity

Table 2 suggests that the relative mortality disparity, as reflected by Max/Min and G, increased over the three decades. However, while the increase in the Max/Min ratios was very modest, the two- to three-fold growth of G values was striking.

In 1996–2000, the highest Max/Min values were observed in Finland (for males) and Sweden (for females). The maximum G values were observed in Norway (for males) and Sweden (for females).

Trends in absolute mortality disparity

Compared to the measures of relative disparity, the changes in measures of absolute disparity are somewhat less consistent (table 2). Between 1971–75 and 1996–2000, the Max–Min difference decreased for both sexes in Finland, and for females in Norway. However, the Max–Min difference increased for both sexes in Sweden and for males in Norway. It is important to note that, after 1976–80, the Max–Min for females in Norway increased systematically. A similar increase in the Max–Min difference was also observed among Finnish males after 1981–85. Among Finnish females, the increase in the Max–Min difference from 1981–85 to 1991–95 was replaced by the decline from 1991–95 to 1996–2000. In 1996–2000, the absolute disparity was still the highest among Finnish males, whereas among Finnish females it remained slightly lower than in the other two countries.

Between 1971–75 and 1996–2000, the AID increased in all countries and for both sexes. Due to higher initial levels of mortality, Finland started with higher values of AID, but the increase in the AID in Finland was also somewhat less pronounced than in the other two countries. Before the mid-1980s, the AID was increasing at a moderate pace among Finnish males, while among Finnish females, the AID was actually decreasing. However, between 1981–85 and 1996–2000, the AID in Finland moderately increased both for males and females (table 2). In Sweden and Norway, AID values were increasing systematically (almost two-fold increase between 1971–75 and 1996–2000). In 1996–2000, the highest AID values were observed for males in Finland and for females in Sweden.

Decomposition of changes in the average inter-group difference

While the reasons for changes in Max–Min differences are obvious, the corresponding temporal changes in AID are less easy to explain due to the more complex nature of this measure. They depend on the changes in both inter-group mortality differences and in inter-group differences in sizes of population groups.

The decomposition of the total change in the AID (according to formulae (2a) and (2b)) demonstrates the relative importance of the mortality and the compositional components (table 3).

Over the period of observation, the variance of the group-specific population weights decreased due to the contraction of the low education group, and the broadening of the middle and high education groups (table 1). Consequently, in all countries and for both sexes, the population composition produced positive contributions to the total AID increase. Mortality changes produced small positive or negative contributions for females in all three countries, and for males in Finland. At the same time, the contributions of mortality changes were substantial among males in Norway and Sweden. Further analysis (not shown here) suggests that the positive mortality components were mostly related to the widening of the mortality differences between the low and middle education groups.

DISCUSSION

This study systematically evaluated long-term changes in absolute and relative educational inequality in mortality in Finland, Norway and Sweden. Education-specific mortality was computed from uniform data originating from the population registers. There are good reasons to think that the educational categories and the corresponding mortality disparities are comparable between the countries.

Table 3 Contributions of changes in mortality and of changes in educational structure (compositional component) to the total increases in AIDs in Finland, Sweden and Norway

	Finland	Sweden	Norway
Males			
1971–75 (1981–85 for Finland)	1.318	0.653	0.672
1996–2000	1.734	1.371	1.548
Total increase	0.417	0.718	0.876
due to mortality	0.039	0.248	0.532
due to population comp.	0.378	0.470	0.344
Females			
1971–75 (1981–85 for Finland)	0.526	0.389	0.516
1996–2000	0.746	0.930	0.819
Total increase	0.220	0.542	0.304
due to mortality	0.000	0.064	−0.081
due to population comp.	0.220	0.478	0.385

For each country, sex, and five-year time period between 1971–75 and 1996–2000, the education-specific SDRs and the corresponding population exposure weights were calculated. This information allowed us (and would allow anyone else) to quantify changes in educational mortality disparities by means of preferred inequality measures. For the assessment of the temporal changes in mortality disparities, we applied the range and the Gini-like measures.

As expected, the relative mortality disparities between educational groups substantially increased in all countries, and for both sexes. We also found that the absolute mortality disparities tended to increase as well. It is surprising that this tendency—which runs counter to the stated goals of the WHO's 'Health for All' strategy [21]—is observed in these rather egalitarian societies, which are known for their low mortality levels, as well as for their public health policies, including pro-equality initiatives.[14 22]

The increase in absolute mortality disparities was found to vary by country and sex. In Finland, the rise in disparities started later, and was less notable than in the other two countries, especially for females. During the periods 1971–75 and 1981–85, which mark the initial stage of the cardiovascular revolution in this country,[23] a sharp reduction in mortality was accompanied by decreasing or stable absolute disparities. It would appear to be the case that, after mortality had been lowered to a certain level, further health progress became less socially equal.

The study revealed that there are certain disagreements regarding the direction of changes in different inequality measures across various country–period combinations. These inconsistencies are especially pronounced between Max–Min and AID measures. They are determined by differences in definitions and mathematical properties of the Gini-like and the range measures.[8] The Gini-like measures accounting for mortality variation across all population groups reflect the total amount of the inter-group mortality inequality. These measures also consider inter-group differences in population size. At the same time, widely used Max–Min measure refers only to the part of the total mortality inequality, which is attributable to the mortality differences between two extreme population groups. Thus, the Gini-like measures based on the entire mortality distribution provide a more complete picture of the mortality inequality.

Probably, the simplest way to interpret an increase in AID is to think that the mortality–hazard difference between two 'average' individuals belonging to different groups increases. The gradual equalisation in size of the educational groups contributed substantially to the growth in AIDs in all three countries. It is also likely that further improvements in education will continue to push this inequality measure upwards. At the same time, the mortality components of the changes in AIDs were important for males in Norway and Sweden and were positive but much smaller than the corresponding compositional components for females in Sweden and males in Finland.

So far, the mortality component in these two countries was mainly dependent on the widening of the mortality gap between the two biggest groups: the middle and the low education groups. At the same time, the gap between the high and the middle education groups was increasing in all countries, and for both sexes. In the future, this mortality gap could turn into an important factor in the increase of AIDs if it continues widening and if the middle and high education groups continue to expand in size.

What is already known on this subject

- There is a lack of data highlighting long-term changes in socioeconomic mortality disparities that are comparable across countries.
- There is inconsistent evidence on the direction and components of changes in absolute mortality disparities.

What this study adds

- The study provides consistent and uniformly calculated education-specific mortality estimates and measures of mortality disparity over the last three decades of the 20th century. It shows that mortality reductions in the middle and the low education groups were often smaller than those in the high education group.
- The study reveals notable increases in absolute mortality disparities for both sexes in Finland, Sweden and Norway.
- The study provides decompositions which demonstrate that decreasing inter-group differences in population sizes made significant contributions to the growth of absolute mortality disparities in all three countries and for both sexes, whereas widening of the inter-group mortality differences made substantial contributions only for males in Sweden and Norway.

The growing health divergence in all three countries suggests some structural changes in these Nordic countries. These may cause living conditions and lifestyles to differ more and more between educational groups (and possibly in general within the national populations), including the ability to benefit from the cardiovascular revolution and to be successful in the new fight against multiple pathologies at advanced ages.[24 25] The policy, in all three countries, to increase access to secondary and higher education for all children, has not reduced mortality disparities by education, but has been a good policy nevertheless, also for health. The policy implication of the growing mortality gap is that health policy makers must be concerned about social inequalities at large. The high mortality of people with poor education is, in no small part, linked to their poorer social careers with more hazardous jobs, lower income, poorer housing and recreation opportunities and less control over life circumstances. The determinants of this unfavourable situation need to be studied in a more detailed way and then addressed by adequate policies.

Acknowledgements We are grateful to Statistics Finland, Statistics Sweden and Statistics Norway for providing us with high quality, census-linked data. This study is a part of the Vanguard Project at the Max Planck Institute for Demographic Research. We are grateful to the two reviewers for their useful comments on the manuscript.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

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