Occupational inequalities in cause-specific and all-cause mortality in Europe

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(Work in progress – please do not cite)

Introduction

In the last decades life expectancy has shown a remarkable - almost linear - increase (Oeppen and Vaupel, 2002). However, substantial differences in mortality are still observed and may even be increasing between socioeconomic groups (Davey Smith et al., 2002; Donkin et al., 2002; Leclerc et al., 2006; Mackenbach et al., 2003). Those inequalities are one of the biggest challenges of societies (Marmot, 2005). Further, they differ considerably between European populations. Such inequalities are unfair, unnecessary and avoidable. Cross country comparisons can help identify the scope for reduction. Europe is a unique region in this respect, as inter country population characteristics as well as history and development between countries differ, and highly reliable and comparable data on mortality and socioeconomic position are available in the majority of the countries. Previous research though, focussed mainly on educational inequalities. Fewer articles analysed occupational class inequalities (Kunst et al., 1998; Mackenbach et al., 1997; Mackenbach et al., 2008) and most analyses here focus on occupational inequalities in the 1980s and 1990s. The aim of this study is to analyse for the first time occupational class inequalities in all-cause mortality and mortality due to several causes of death in Europe at the start of the new millennium. This study – as a part of the Euro-GBD-SE project – contributes to the aim of tackling inequalities in Europe, as it analyses mortality inequalities by occupational class with recent, comprehensive and comparable data from 14 European countries. We present results for all cause mortality, all cancers, all CVD, all external and all other[1].

Data and Methods

We use cross-sectional and longitudinal data obtained from population censuses and mortality registries from 14 European populations around the period 2000-2005. Data were centrally harmonized which enhances cross-country comparability. This data collection contains information on sex, age, occupational class, activity status (economically active vs. inactive), 37 different causes of death, and risk factors from 14 European populations. Those populations range from Denmark, Finland, and Sweden in the North, to Austria, England and Wales, Scotland, France, and Switzerland in Western Europe, Lithuania in Central Europe[2], and Italy – represented by the city Turin and the region of Tuscany - and Spain - represented by the region Basque country and the city Madrid - in the South.

Men from age 30 to 59 are analysed. Women had to be excluded from the analysis as it was not possible to apply an own occupational class to them. Occupational class is based on the

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[1] Further, we analyse two risk factor related groups of causes of death: a) smoking related causes of death containing: COPD (J40-J47), cancer of buccal cavity and cancer of pharynx (C00-C14), cancer of oesophagus (C15), cancer of larynx (C32), and cancer of trachea, bronchus and lung, (C33-34, C39) and b) alcohol related causes of death containing: accidental poisoning by alcohol (X45), alcoholic psychosis, dependence, and abuse (F10), alcoholic cardiomyopathy (I42.6), alcoholic cirrhosis of the liver (K70, K85-K86.0). These results need further analyses and will be added in a later stage of the paper.

[2] Results of Lithuania are going to be included in a later stage of the paper.

EGP scheme (e.g. Erikson and Goldthorpe 1992) and is studied according to upper non-manual (professionals, managers, employees), lower non-manual (clerical, service, sales workers), skilled manual workers, unskilled manual workers, and self-employed and farmers combined. Self-employed and farmers are not shown in the Graphs. Economically inactive persons are excluded from the analyses, as we have only little information on the occupational class of inactive.

In two countries – Switzerland and Austria – we do not have the fourfold classification of occupation. For Austria the classification is: both non-manual workers together, skilled manual workers, unskilled manual workers. For Switzerland the classification is: non-manual workers together and manual workers together.

Causes of death are coded according to ICD10 and contain all cause mortality, mortality of all cancer (C00-D48), all CVD (I00-I99), and all external causes (V01-Y98). All other causes are also included in the analysis.

In order to assess the magnitude of occupational class inequalities, rate ratios (RR)[3] for all-cause and cause-specific mortality are estimated with Poisson regression using upper non-manual workers as the reference category. In Switzerland and Austria, the reference groups are upper and lower non-manual workers combined. As occupational inequalities might be underestimated when combining the highest and second highest classes this result have to be treated cautiously.

Economically inactive persons generally have a higher mortality when compared with active persons (from the same occupational class). In addition, the proportion of inactive is higher in lower occupational classes. Thus if economically inactive persons are excluded from analysis, mortality rates and differences in mortality by occupational class might be underestimated.

Kunst and Groenhof (1998) developed an algorithm to account for inactivity when computing occupational class differences in mortality. This algorithm uses the relative difference of the proportion of inactive men by occupational class, the proportion of inactive in the total population, and the mortality rate ratio of inactive versus active men to estimate a correction factor.

We reproduced this algorithm with data from this project and corrected the RRs which were initially calculated excluding economically inactive men. This algorithm was applied in all countries where information on occupational class was missing for inactive men. In England and Wales, Finland, Italy (Turin) and Spain (Basque) however, information on occupational class was available for inactive and therefore we did not use this algorithm here. Table 3 (Appendix 1) shows sensitivity tests we did with these four countries to evaluate the correction algorithm. Column one for each country shows show the RR calculated without inactive men, columns two and three show corrected RR estimated with different versions of the correction using varying values of the relative difference of inactive, and column four shows the RR including economically inactive persons. When comparing columns one and four we see that excluding economically inactive leads to an underestimation of mortality. Thus an adjustment is needed. The comparison of column three and four shows that the developed correction algorithm seems to work well. The results shown in this paper are corrected as shown in column three

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[3] Confidence intervals will be added in a later stage of the analysis.

Results

Table 1 shows the distribution of men in each occupational class as well as the proportion of economically inactive.

The highest share of upper non-manual workers can be found in the Netherlands, Italy (Tuscany), France and Sweden ranging from over 45% to 30%. While the smallest share of upper non-manual classes can be found in Scotland, England and Wales, Finland and Denmark. In Spain (Madrid) along with Scotland and England and Wales most men work in the lower non-manual class (around 30%). The lowest share of around 10% of people in lower non-manual classes can be found in France, Sweden and the Netherlands. Most skilled manual workers are found in Spain (both populations), Denmark and Austria (30% to over 35% of the population). Populations in England and Wales, the Netherlands and Scotland, with around 15%, have the lowest proportion of skilled manual workers. Sweden, alongside Scotland and England and Wales show the highest share of unskilled manual workers, between 25% and 30%. The lowest share of unskilled manual workers can be found in the urban area of Madrid (Spain) and the region of Tuscany (Italy). In country comparison the by far lowest proportion of unskilled manual workers (6%) can be found in Austria. France and the Netherlands here show the second lowest value with about 15%.

The highest proportion of economically inactive persons is found in Sweden, Italy (Turin) (both around 17%) and Scotland (around 15%). The Scottish value seems to be particularly high, as here unemployed are classified as economically active, which they for example are not in Sweden and Turin.

Table 1: Distribution (%) of persons over occupational classes and economically inactive. Men, 30-59 years

Country	Occupational class					Economically Inactive
	Upper Non-manual	Lower Non-manual	Skilled Manual	Unskilled Manual	Farmers and Self-Employed	
Denmark	18.42	12.49	36.44	20.44	12.21	12.49
Finland	18.19	19.93	26.15	20.78	14.95	11.57
Sweden	29.04	9.11	23.81	31.47	6.57	17.02
Austria	48.23	#	32.18	6.43	13.16	9.05
England & Wales	16.67	29.59	13.73	24.91	15.10	12.86
France	38.11	8.32	26.29	14.73	12.55	7.30
Netherlands	43.51	10.79	14.55	14.89	16.25	9.65
Scotland	15.41	30.27	15.64	25.69	12.99	15.27
Switzerland	56.93	#	17.65	*	25.43	9.85
Lithuania						
Italy (Turin)	22.68	20.23	19.63	19.43	18.03	17.19
Italy (Tuscany)	47.53	15.63	26.35	10.10	0.39	14.97
Spain (Basque)	23.11	14.93	37.03	22.17	2.76	9.45
Spain (Madrid)	26.89	34.69	30.27	7.22	0.92	14.70

Both non-manual categories are combined. * Both manual categories combined.

Figure 1 to 5 (Appendix 1) and Table 2[4] show the results for men from 30-59 years for the 14 observed countries.

Mortality of manual workers is higher than for non-manual workers in all countries and for all causes of death analysed. Table 2 also shows that rate ratios of mortality of all causes range from 1.7 in Italy (Tuscany) to 3.4 in Denmark. We find the known pattern of lower mortality inequalities in Southern European countries compared to Western and Northern

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[4] Preliminary table, ASMR and CIs will be included in a later stage.

Europe. Generally, mortality from cancer shows a weaker social gradient compared to all other causes of death, with rate ratios from 1.4 in England and Wales to 2.4 in France. Mortality from cardiovascular diseases is considerably higher in Northern European countries, with rate ratios around 3.8 in Denmark and 2.89 in Finland, than in all other regions. This is especially true for the Southern European countries, showing rate ratios between 1.4 and 2.

In the Northern European countries the gradient between classes is more pronounced in Finland and Denmark than in Sweden. The excess mortality found among skilled and unskilled manual workers, when compared with both non manual workers is very similar in Denmark and Finland, but less pronounced in Sweden. CVD mortality is especially prevalent in Finland with a rate ratio of 3.1 compared to ratios of 2.7 and 2.1 in Denmark and Sweden.

In Western Europe (and for some causes of death overall in Europe) France and Scotland show stronger mortality gradients (especially in mortality form cancer and CVD mortality) than the other countries. When comparing lower non-manual and skilled manual workers, France does not show the distinct gradient from lower to higher mortality for all cause and all external mortality. Here rate ratios are higher for lower non-manual workers (2.4 for all cause and 2.5 for all external) than for skilled manual workers (2.2 for all cause and 2.7 for all external). This pattern is not consistent in between all other groups of causes of death. In CVD mortality rate ratios are similar for skilled and unskilled manual workers (around 2.7). In Scotland in contrast, we find a stepwise increase of the relative difference of mortality for the three lower occupational classes. England and Wales shows higher rate ratios for skilled (1.36) than for unskilled (1.21) manual workers in cancer mortality. Further, there is no gradient between upper and lower manual classes in CVD mortality.

Southern European countries have relatively small inequalities in cancer and CVD mortality. The mortality difference from all cause mortality between non-manual and manual workers is there, ranging from 1.7 in Tuscany to 1.9 in the Basque country, but is none the less lower than in most other European countries. The same holds true for the other causes of death.

Table 2: Relative Risks mortality from all causes and several causes of death

	All Cause	All Cancer	All CVD	All External	All Other
North					
Denmark¤					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.44	1.15	1.57	1.58	1.48
Skilled Manual	2.41	1.57	2.07	2.86	2.61
Unskilled Manual	3.37	1.94	2.71	3.79	4.41
Finland					
Upper Non-manual	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Lower Non-manual	*1.50*	*1.37*	*1.59*	*1.41*	*1.64*
Skilled Manual	*2.20*	*1.73*	*2.24*	*2.35*	*2.49*
Unskilled Manual	*2.89*	*2.00*	*3.05*	*3.20*	*3.31*
Sweden¤					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.39	1.21	1.50	1.27	1.97
Skilled Manual	1.63	1.35	1.56	1.88	2.12
Unskilled Manual	1.94	1.45	2.09	2.07	3.06
West					
Austria					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	#	#	#	#	#
Skilled Manual	1.79	1.55	1.50	1.83	2.67
Unskilled Manual	2.14	2.27	1.88	1.73	4.73

England & Wales					
Upper Non-manual	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Lower Non-manual	*1.24*	*1.13*	*1.08*	*1.03*	*2.16*
Skilled Manual	*1.80*	*1.51*	*1.85*	*1.11*	*3.28*
Unskilled Manual	*2.15*	*1.36*	*2.23*	*2.09*	*4.51*
France					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	2.36	1.79	1.86	2.49	3.76
Skilled Manual	2.24	1.86	2.65	1.92	3.04
Unskilled Manual	2.90	2.44	2.78	2.59	4.13
Netherlands					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.37	1.20	1.76	1.28	1.24
Skilled Manual	1.57	1.20	1.98	1.66	1.76
Unskilled Manual	2.16	1.68	2.42	2.51	2.65
Scotland					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.63	1.28	1.72	1.07	2.76
Skilled Manual	2.10	1.39	1.93	2.00	3.93
Unskilled Manual	3.27	2.08	3.12	2.84	5.88
Switzerland[¤]					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	#	#	#	#	#
Skilled Manual	2.00	1.95	1.79	1.89	2.44
Unskilled Manual	*	*	*	*	*
Central					
Lithuania					
Upper Non-manual					
Lower Non-manual					
Skilled Manual					
Unskilled Manual					
South					
Italy (Turin)					
Upper Non-manual	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Lower Non-manual	*1.35*	*1.41*	*1.09*	*0.89*	*2.41*
Skilled Manual	*1.68*	*1.83*	*1.29*	*1.09*	*2.84*
Unskilled Manual	*2.04*	*1.98*	*1.41*	*1.51*	*4.55*
Italy (Tuscany)					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.32	1.44	0.97	0.96	1.81
Skilled Manual	1.57	1.39	1.28	1.68	2.43
Unskilled Manual	1.74	1.50	1.44	1.62	3.01
Spain (Basque)					
Upper Non-manual	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Lower Non-manual	*1.46*	*1.30*	*1.55*	*1.65*	*1.71*
Skilled Manual	*1.69*	*1.41*	*1.62*	*2.62*	*2.10*
Unskilled Manual	*1.92*	*1.56*	*1.76*	*2.44*	*2.93*
Spain (Madrid)					
Upper Non-manual	1.00	1.00	1.00	1.00	1.00
Lower Non-manual	1.51	1.21	1.65	1.61	1.90
Skilled Manual	1.70	1.49	1.44	2.13	2.08
Unskilled Manual	2.26	1.93	1.81	1.91	3.45

[#] Both non-manual categories are combined. * Both manual categories combined. [¤] RR are additionally corrected, as age was given at baseline and we analysed age at death. *Irregular*: RR directly calculated, as most inactive can be assigned to an occupational class.

Discussion

Occupational inequalities in all cause and cause-specific mortality were observed in all countries studied. However, inequalities are larger in Western Europe and Northern Europe as compared to Southern Europe. The variation and magnitude of occupational inequalities do not comply with those observed for educational inequalities (see e.g. Mackenbach, Stirbu et al. 2008). Further, the "classification of those not working is an important point to consider in the study of social inequalities" (Leclerc, Chastang et al. 2006), as the exclusion of economically inactive persons probably leads to an underestimation of these inequalities.

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Appendix 1

Figure 1: RR for all cause mortality by occupational class, men, age 30-59
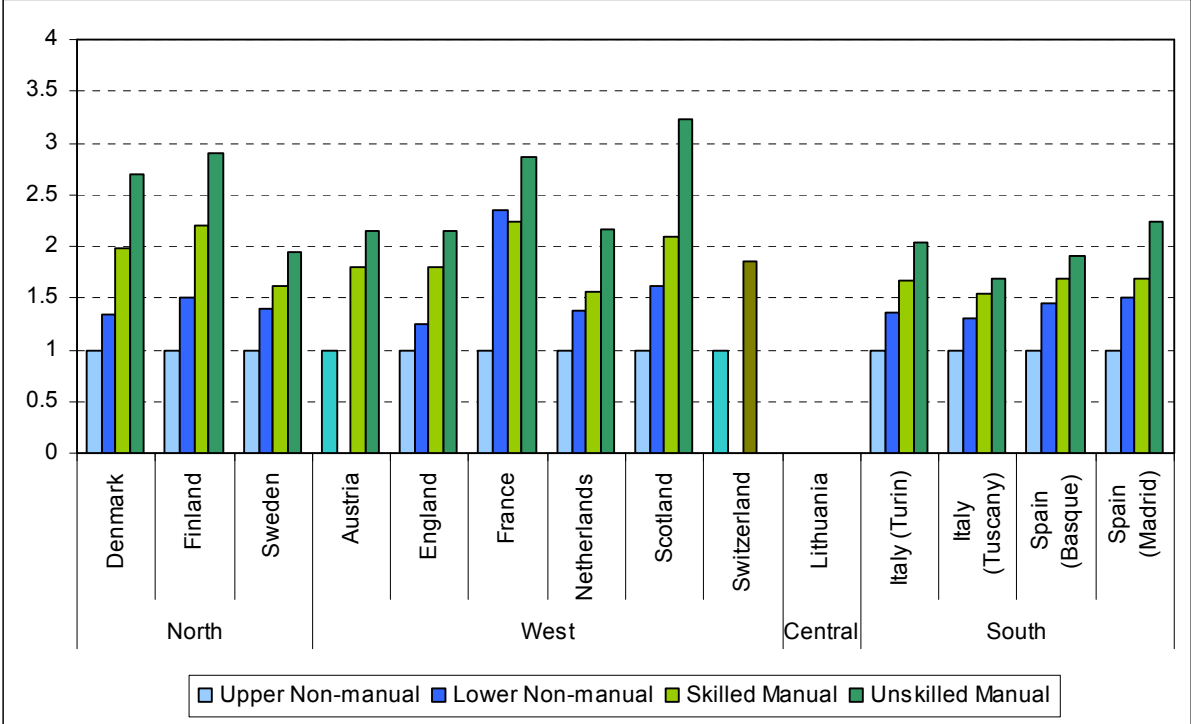

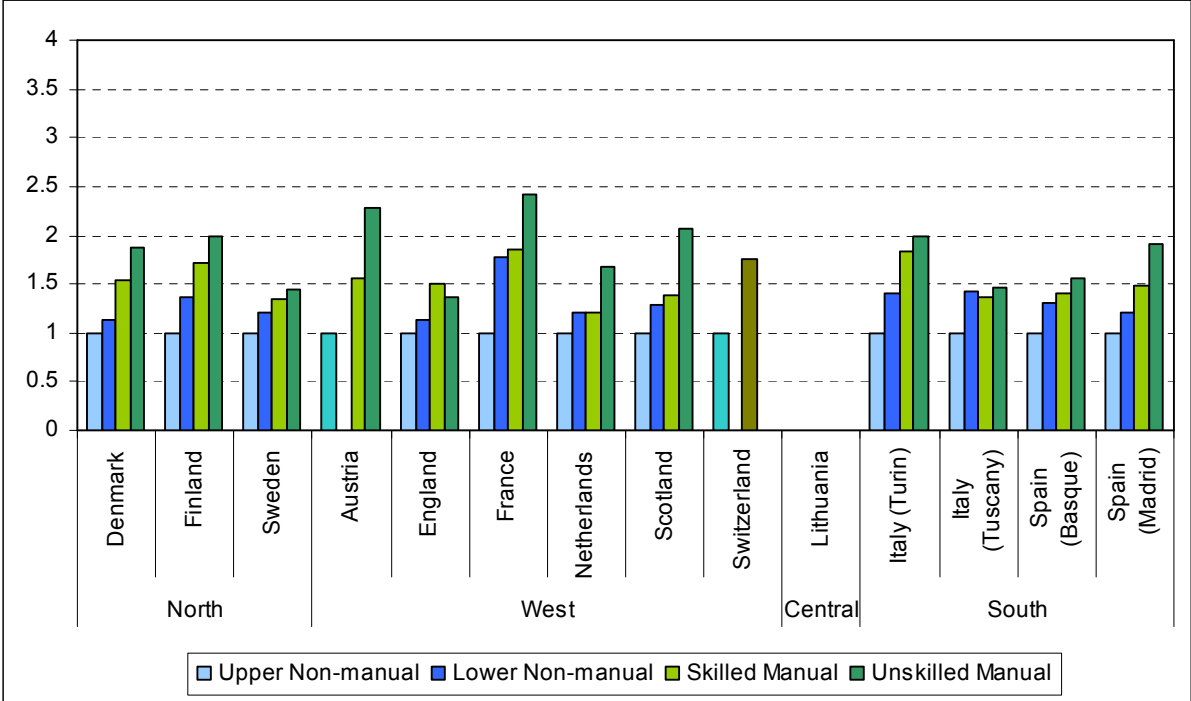**Figure 2: RR for all cancer mortality by occupational class, men, age 30-59**

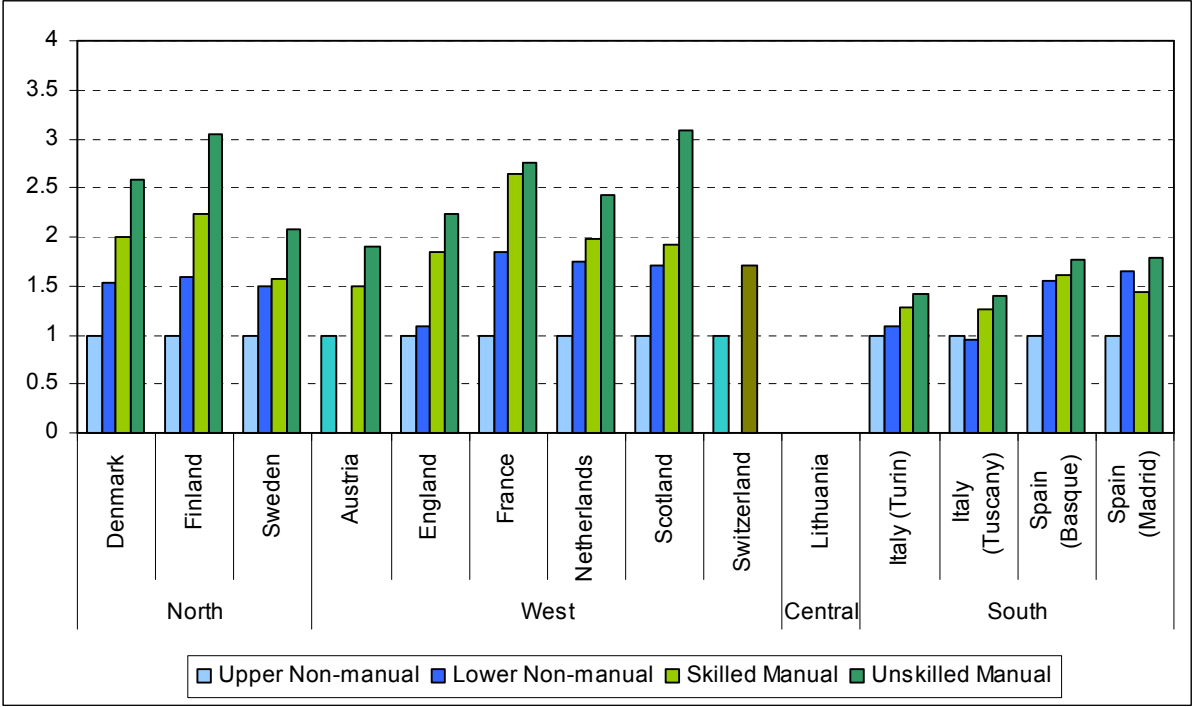**Figure 3: RR for all CVD mortality by occupational class, men, age 30-59**

Figure 4: RR for all external cause mortality by occupational class, men, age 30-59
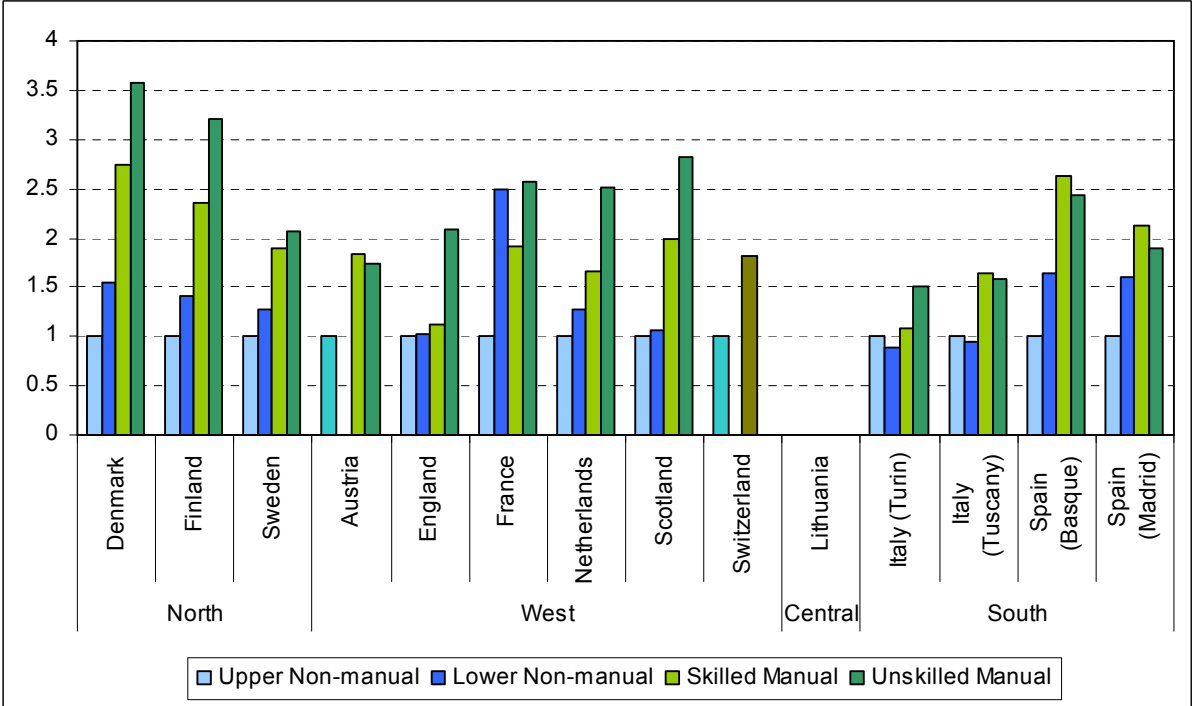
Figure 5: RR for all other causes mortality by occupational class, men, age 30-59
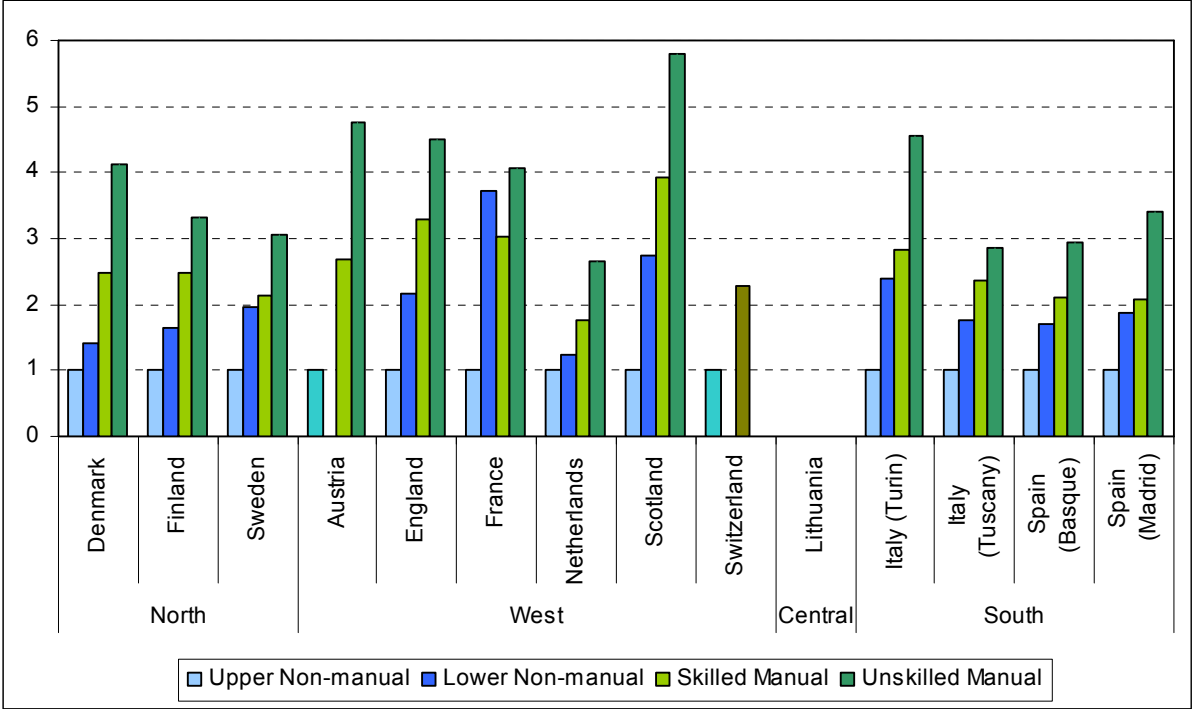
Table 3: RR of mortality from all-cause and cause specific mortality; calculated without inactive, corrected with different values for the relative difference of inactive and with including inactive

	Basque				England and Wales				Finland				Turin			
	without inactive	corrected Mortality data	corrected NHS data	with inactive	without inactive	corrected Mortality data	corrected NHS data	with inactive	without inactive	corrected Mortality data	corrected NHS data	with inactive	without inactive	corrected Mortality data	corrected NHS data	with inactive
Total Mortality																
Upper Non-Manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower Non-Manual	1.41	1.57	1.53	1.46	1.09	1.16	1.22	1.24	1.43	1.50	1.57	1.50	1.20	1.40	1.34	1.35
Skilled Manual	1.62	1.84	1.85	1.69	1.39	1.64	1.68	1.80	2.06	2.21	2.39	2.20	1.44	1.81	1.70	1.68
Unskilled Manual	1.87	2.17	2.27	1.92	1.70	2.24	2.22	2.15	2.73	3.13	3.38	2.89	1.69	2.21	2.14	2.04
Self-Employed and Farmers	1.78	1.90	1.80	1.87	1.34	1.46	1.36	1.48	1.40	1.75	1.41	1.59	1.29	1.39	1.30	1.42
Cancer																
Upper Non-Manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower Non-Manual	1.33	1.43	1.41	1.30	1.01	1.06	1.10	1.13	1.31	1.35	1.39	1.37	1.30	1.46	1.41	1.41
Skilled Manual	1.39	1.53	1.54	1.41	1.20	1.34	1.36	1.51	1.55	1.62	1.70	1.73	1.58	1.87	1.79	1.83
Unskilled Manual	1.60	1.78	1.85	1.56	1.01	1.22	1.21	1.36	1.81	1.98	2.08	2.00	1.69	2.07	2.03	1.98
Self-Employed and Farmers	1.39	1.45	1.40	1.39	1.03	1.09	1.04	1.19	1.09	1.26	1.10	1.26	1.09	1.16	1.10	1.19
CVD																
Upper Non-Manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower Non-Manual	1.49	1.63	1.60	1.55	0.99	1.05	1.10	1.08	1.49	1.56	1.64	1.59	1.07	1.17	1.14	1.09
Skilled Manual	1.60	1.78	1.79	1.62	1.50	1.73	1.76	1.85	2.00	2.15	2.33	2.24	1.28	1.47	1.42	1.29
Unskilled Manual	1.74	1.97	2.05	1.76	1.95	2.48	2.47	2.23	2.74	3.17	3.43	3.05	1.25	1.47	1.44	1.41
Self-Employed and Farmers	1.71	1.80	1.73	1.85	1.38	1.48	1.40	1.52	1.51	1.90	1.52	1.79	1.27	1.33	1.28	1.28
External CODs																
Upper Non-Manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower Non-Manual	1.57	1.70	1.67	1.65	0.85	0.91	0.96	1.03	1.37	1.42	1.48	1.41	0.88	0.97	0.94	0.89
Skilled Manual	2.37	2.62	2.63	2.62	0.97	1.13	1.15	1.11	2.35	2.49	2.65	2.35	1.01	1.17	1.12	1.09
Unskilled Manual	2.34	2.63	2.72	2.44	1.79	2.33	2.31	2.09	3.14	3.52	3.75	3.20	1.41	1.68	1.65	1.51
Self-Employed and Farmers	2.60	2.73	2.62	2.83	1.72	1.86	1.75	1.97	1.59	1.91	1.60	1.66	1.57	1.65	1.58	1.59
Other CODs																
Upper Non-Manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower Non-Manual	1.45	1.79	1.71	1.71	2.05	2.30	2.52	2.16	1.63	1.75	1.87	1.64	1.58	2.25	2.00	2.41
Skilled Manual	1.83	2.37	2.37	2.10	2.57	3.43	3.55	3.28	2.47	2.74	3.07	2.49	1.92	3.18	2.75	2.84
Unskilled Manual	2.60	3.49	3.76	2.93	3.91	6.25	6.15	4.51	3.43	4.21	4.69	3.31	3.06	5.49	5.06	4.55
Self-Employed and Farmers	2.63	2.99	2.69	2.85	2.12	2.47	2.18	1.85	1.41	1.95	1.44	1.60	1.69	2.04	1.75	2.52