

ANALYSIS OF OCCUPATIONAL MORTALITY IN ENGLAND & WALES, SCOTLAND, NORWAY AND FINLAND

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«Mortalità di origine professionale in Inghilterra, Galles, Scozia, Norvegia e Finlandia».

Allo scopo di confrontare la mortalità di origine professionale in alcuni Paesi, sono stati esaminati ed analizzati i Rapporti Statistici del Regno Unito (Inghilterra, Galles e Scozia), della Finlandia e della Norvegia. Poiché non è stato possibile confrontare le singole occupazioni, sono stati costituiti 25 gruppi occupazionali accoppiando i codici occupazionali usati nei vari Paesi. Né è stato possibile standardizzare indirettamente i dati dei gruppi occupazionali in ogni Paese scegliendo una popolazione comune con una serie standard di tassi di mortalità. Per questa ragione, per ciascuna area la mortalità di origine professionale è stata standardizzata utilizzando tassi di mortalità specifici per età della popolazione del Paese in questione. Il valore del presente studio sta nell'aver identificato l'esistenza in tutti i Paesi presi in considerazione di elevati SMR specifici per occupazione e per patologia, che potranno essere utilizzati per ulteriori e approfondite ricerche sui rischi professionali in questione. Sono stati identificati 2 gruppi occupazionali con SMR costantemente elevati per infortuni, intossicazioni e cause violente; 2 gruppi per neoplasie maligne; 2 gruppi per cancro polmonare; e 3 gruppi per cardiopatie ischemiche. Segue una discussione esauriente sulla metodologia adottata e sui risultati ottenuti.

KEY WORDS: *occupational epidemiology*.

INTRODUCTION

It would be interesting to see if the findings which indicated some occupations as being at higher mortality risk for some diseases in England and Wales in the 1970-72 OPCS Report on Occupational Mortality (19) were similar to the findings of similar reports published in other countries. Finding the same high mortality for a given cause in the

same occupation in different countries would strengthen the evidence for the association between an occupation and a disease, thus indicating a high priority for further investigation. For this reason, mortality statistics from four countries (England and Wales, Scotland, Finland and Norway) were examined and analysed.

SOURCES AND METHODS

The method of analysis was based on occupation-specific and disease-specific standardized mortality ratios (SMRs). In the reports of England and Wales (19), Scotland (21) and Finland (5) the indirect method of standardization was used while

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in the reports from Norway (4, 25) the direct method was used.

The data in England and Wales were based on deaths registered between the beginning of 1970 and the end of 1972 as well as a 10% random sample of the population in the 1971 census (19). The Scottish data included deaths registered from 1969 to 1973 (21). The Finnish Report used the population in the 1970 census and the deaths registered in the period 1971-75 (5). The Norwegian Reports used the population in the 1970 census and the deaths registered in the period 1971-73 (4, 25). All the Reports used the 8th revision of the WHO International Classification of Diseases, Injuries and Causes of Death (16).

In England and Wales, the age specific death rates of the entire population between 15 and 64 years of age were used to compute the expected number of deaths (19). In Scotland, the age specific death rates of the entire population aged 15 and over were used to compute the expected number of deaths (21). In Finland the age specific death rates of the economically active population aged between 35 and 64 years were used to compute the expected number of deaths (5). In Norway, the first Report (4) computed the SMRs with reference to people economically active between 20 and 64 years of age in the 1970 census, and in the second Report (25) adjustment was made for those who were not economically active in 1970 but active in 1960.

The English classification of occupations (22) was used in the England and Wales and in the Scotland Reports (19, 21). Though both Finland and Norway followed the Nordic classification of occupations (1), they modified it for their own national use in such a way that the two national codes were somewhat different (Appendix I).

The Norwegian Report published SMRs for 28 occupational groups only, and this is the most important restriction in our comparative study. We first searched for the occupational codes in the 28 groups and then attempted to match the Norwegian codes with those used in other countries. It was impossible to secure perfect matching with respect to the three different occupational codes. Some overlapping was inevitable and we finally ended up with 25 occupational groups for our study. This is due to the fact that the data from Finland

combined Norwegian groups 14, 20, 22 and 24 together. Our attempt at matching the occupational codes used in various countries is presented in Appendix I. The components of the 25 occupational groups used in this study are presented in Appendix II. Details of the components follow the terminology used in the English classification of occupations (22).

With the matching done and the occupations grouped, it was necessary for us to compute the SMRs from the original data published in the reports. It was impossible to indirectly standardize the data from the occupational groups in every country choosing one common population with a standard set of age specific death rates. For this reason, the occupational mortality was indirectly standardized for each country using the age specific death rates of the population of that country.

RESULTS

Our findings are reported in five tables, Table 1 gives SMRs for all causes of death (ICD 000-999), Table 2 gives SMRs for accidents, poisoning and violence (ICD E800-E999) but the Scottish figures are restricted to accidents (ICD E800-E949) only. Table 3 gives SMRs for all malignant neoplasms (ICD 140-209), but the Finnish figures also include all other neoplasms (ICD 210-239). The SMRs for lung cancer (ICD 162) are shown in Table 4 and those for ischaemic heart disease (ICD 410-414) in Table 5; no information on SMRs for ischaemic heart disease was available for Norway.

In these tables, those SMRs where the number of deaths is less than 20 are omitted and those SMRs computed from incomplete data are shown in brackets. Applying the Bailer and Ederer tables (2) for statistical test, the SMRs at 5% level of significance are indicated by one asterisk and at 1% level of significance by two asterisks.

TABLE 1 - Standardized mortality ratios (SMRs) for all causes of death (ICD 000-999) in the four countries by occupational groups.

Occupational groups	England & Wales	Scotland	Finland	Norway I	Norway II
I	75	86	76	78	71
II	62	65	63	66	60
III	73	81	78	98	87
IV	99	99	95	100	93
V	93	107	105	109	102
VI	110**	84	90	108	102
VII	92	98	109	109	116
VIII	175**	106	103	135**	132**
IX	120**	94	93	99	98
X	107**	98	96	104	104
XI	122**	128**	123**	107	113*
XII	129**	125**	128**	113	147**
XIII	109**	131**	111	102	111
XIV	91	98	96	86	90
XV	108**	116**	102	111**	108**
XVI	104**	134**	100	104	102
XVII	96	110**	100	87	84
XVIII	125**	102	163**	140**	150**
XIX	93	115**	101	101	110
XX	140**	177**	117**	119**	122**
XXI	233**	173**	128*	194**	201**
XXII	144**	149**	131**	132**	130**
XXIII	122**	134**	103	107	107
XXIV	98	127**	102	109	104
XXV	111**	104**	128**	100	94

Norway I = First Norwegian Report (4).
 Norway II = Second Norwegian report (25).

* = Significant at 5% level.

** = Significant at 1% level.

TABLE 2 - Standardized mortality ratios (SMRs) for accidents, poisoning and violence (ICD E800-E999) in the four countries by occupational groups.

Occupational groups	England & Wales	Scotland	Finland	Norway I	Norway II
I	66	48	(55)	46	43
II	60	42	40	—	—
III	64	(69)	(66)	71	65
IV	74	75	(61)	48	48
V	87	85	77	64	72
VI	115*	82	—	65	71
VII	106	109	92	—	—
VIII	290**	207**	127	179**	172**
IX	101	109	(91)	103	98
X	88	80	(85)	90	93
XI	108	103	(117)	103	110
XII	184**	149**	145	120	146**
XIII	66	76	(147)	—	—
XIV	135**	135**	104	137**	134**
XV	126**	124**	93	104	101
XVI	96	122**	86	98	97
XVII	95	113	97	—	—
XVIII	137**	96	—	149*	138*
XIX	62	90	(87)	—	83
XX	143**	254**	157*	107	116
XXI	488**	351**	200**	335**	323**
XXII	150**	124**	136**	286**	275**
XXIII	80	121	111	116	118
XXIV	74	95	105	95	94
XXV	132**	127**	177**	122	122

Norway I = First Norwegian Report (4).
 Norway II = Second Norwegian report (25).

* = Significant at 5% level.

** = Significant at 1% level.

The numbers in brackets () indicate the SMRs computed from incomplete data.

— Indicates that SMRs were omitted where the number of deaths was less than 20.

The Scottish figures are restricted to accidents only (ICD E800-E949).

TABLE 3 - Standardized mortality ratios (SMRs) for all malignant neoplasms (ICD 140-209) in the four countries by occupational groups.

Occupational groups	England & Wales	Scotland	Finland	Norway I	Norway II
I	76	(83)	(72)	88	85
II	56	64	67	62	59
III	74	78	(86)	90	84
IV	87	91	(98)	111	99
V	93	108**	101	109	107
VI	106	99	(71)	97	91
VII	86	(113)	105	123	122
VIII	173**	104	100	107	121
IX	104	91	100	96	101
X	103	110	(114)	102	102
XI	121**	133**	(134)**	96	96
XII	124**	124**	119**	125**	134**
XIII	101	123**	(120)	77	90
XIV	92	84	92	81	84
XV	123**	118**	109	115	115
XVI	119**	141**	111**	109	134**
XVII	107**	110**	105	94	90
XVIII	117**	100	—	121	137
XIX	102	119**	(119)	112	129
XX	174**	180**	101	111	119
XXI	221**	194**	—	147*	157**
XXII	120**	129**	153**	128	120
XXIII	135**	129**	120	107	101
XXIV	110**	129**	109	142**	128**
XXV	126**	115**	126**	94	96

Norway I = First Norwegian Report (4).
 Norway II = Second Norwegian report (25).

* = Significant at 5% level.
 ** = Significant at 1% level.
 The numbers in brackets () indicate the SMRs computed from incomplete data.
 — Indicates that SMRs were omitted where the number of deaths was less than 20.
 The Finnish figures include both malignant and benign neoplasms (ICD 140-239).

TABLE 4 - Standardized mortality ratios (SMRs) for lung cancer (ICD 162) in the four countries by occupational groups.

Occupational groups	England & Wales	Scotland	Finland	Norway I	Norway II
I	53	66	86	86	93
II	36	45	—	—	—
III	59	63	(45)	85	77
IV	79	90	(93)	100	94
V	91	104	74	94	85
VI	—	—	—	—	—
VII	—	—	—	—	—
VIII	—	—	—	—	—
IX	114**	95	(80)	101	103
X	113**	117**	(121)	116	111
XI	130**	143**	(123)	—	—
XII	137**	118**	(154)**	165*	162**
XIII	96	125	—	—	—
XIV	84	56	88	56	51
XV	139**	120**	115	141*	133*
XVI	121**	162**	131**	118	118
XVII	113**	105	115	87	90
XVIII	—	—	—	—	—
XIX	108	116	(129)	—	—
XX	182**	218**	112	128	113
XXI	223**	192**	—	—	—
XXII	116**	125**	225**	—	—
XXIII	155**	161**	130	—	—
XXIV	112*	126**	146**	190**	164**
XXV	144**	121**	142**	87	92

Norway I = First Norwegian Report (4).
 Norway II = Second Norwegian report (25).

* = Significant at 5% level.
 ** = Significant at 1% level.
 The numbers in brackets () indicate the SMRs computed from incomplete data.
 — Indicates that SMRs were omitted where the number of deaths was less than 20.

TABLE 5 - Standardized mortality ratios (SMRs) for ischaemic heart diseases (ICD 410-414) in three countries by occupational groups.

Occupational groups	England & Wales	Scotland	Finland	Norway I	Norway II
I	88	100	90	n.a.	n.a.
II	64	76	76	n.a.	n.a.
III	89	(93)	(76)	n.a.	n.a.
IV	118**	109**	(102)	n.a.	n.a.
V	97	110**	113*	n.a.	n.a.
VI	112**	91	(103)	n.a.	n.a.
VII	102	109*	109	n.a.	n.a.
VIII	172**	119*	84	n.a.	n.a.
IX	115**	94	100	n.a.	n.a.
X	108**	107	93	n.a.	n.a.
XI	106**	125**	(120)*	n.a.	n.a.
XII	108**	115**	118**	n.a.	n.a.
XIII	116**	132**	114	n.a.	n.a.
XIV	77	98	97	n.a.	n.a.
XV	107**	115**	108*	n.a.	n.a.
XVI	106**	134**	104	n.a.	n.a.
XVII	95	113	97	n.a.	n.a.
XVIII	—	—	—	n.a.	n.a.
XIX	92	113*	(101)	n.a.	n.a.
XX	116**	151**	103	n.a.	n.a.
XX	116**	151**	103	n.a.	n.a.
XXI	167**	140**	100	n.a.	n.a.
XXII	131**	143**	132*	n.a.	n.a.
XXIII	112**	125**	99	n.a.	n.a.
XXIV	102	128**	106	n.a.	n.a.
XXV	99	97	110*	n.a.	n.a.

Norway I = First Norwegian Report (4).

Norway II = Second Norwegian report (25).

* = Significant at 5% level.

** = Significant at 1% level.

The numbers in brackets () indicate the SMRs computed from incomplete data.

— Indicates that SMRs were omitted where the number of deaths was less than 20.

n.a. = data not available.

have low SMRs. The SMRs for accidents, neoplasms and ischaemic heart diseases are high in group XXI (deck and engine room crew workers), XXII (miners and quarrymen) and XII (caretakers, postal workers and labourers not elsewhere classified). Malignant neoplasms and ischaemic heart diseases but not accidents contribute to the high SMRs in group XI (painters and beauty care workers). The SMRs for lung cancer are high in group XII and XXIV (chemical and similar workers). The high SMRs for all the diseases considered present in group XX (stevedores and dock labourers) are more obvious in England and Wales and Scotland compared with Finland and Norway. The high SMRs in group VIII (ships officers and pilots) are more obvious in England and Wales, Norway and Scotland compared with Finland. For ischaemic heart diseases some occupational groups have high SMRs in England and Wales, but not in the other countries. For all the diseases considered SMRs were particularly low in groups I, II and III composed of various categories of professional workers.

DISCUSSION

There are a number of limitations in this study which must be taken into account, the first being the comparability between occupations in different countries. In fact the same occupation may differ in the various countries as regards working process, environmental conditions and even social status. Thus, matching the occupational codes used in various countries may lead to misclassification. As many statistical tests were performed in the analysis, it is inevitable that some significant results arise simply due to chance. Nevertheless, when the SMRs for a cause of death is significant for the same occupation in every country examined, this fact can hardly be explained by chance alone. Therefore the limitations mentioned do not diminish the value of the study whose purpose

It is interesting to note from the tables, that some occupational groups have high SMRs in all the countries examined and some

was to identify high occupation-specific and disease-specific SMRs in all the countries studied.

As it was not possible to examine mortality for single occupations, but for 25 broad groups, it was not possible to hypothesize specific hazards related to single occupations. Another problem present in routinely collected statistics is the lack of environmental data and the impossibility to separate the direct influence of the occupation from the indirect influence of life style (18, 23).

Many of the occupations found to have a higher mortality for lung cancer have a high percentage of smokers (20). Also, an environment polluted by dust, gases and chemical fumes (9, 14, 29) could explain the high mortality found for lung cancer among chemical workers, iron and metalware workers and miners. Various substances used in some chemical processes have been found to be associated with a higher risk for lung cancer among chemical industry workers (8, 9, 10, 24, 26).

However, the role that smoking plays in enhancing an occupational hazard is not clear (6). Cigarette smoking may enhance the effect of other carcinogens, destroying the ciliary epithelium, with resulting difficulty in clearing sputum which may contain a variety of inhaled carcinogens (17). The reports examined did not contain data about smoking habits, thus it is not possible to know to what extent smoking or other confounding variables were responsible for the high SMRs for lung cancer found in some occupations.

The high SMRs for ischaemic heart diseases found among miners and quarrymen, deck and engine room crew workers, ships officers and pilots and truck drivers could be due to the presence in these jobs of coronary risk factors such as smoking, stress, increased levels of serum cholesterol and high blood pressure (3, 7, 13, 15, 27, 30).

That occupations such as deck and engine room crew workers, mining, farming forestry, fishery and construction work had high SMRs for accidents is not surprising. However, it is interesting to observe from the death certificate whether the accident occurred at work and the relationship between the kind of accident and the job. From the English report (19) it can be seen that truck drivers had a high mortality from road accidents, ships officers from accidental poisoning and transport accidents not involving motor vehicles. Fatal falls were more common among construction workers and window cleaners. Overturning farm tractors was the principal single cause of death from accidents among farmers. New regulations for tractor cabs requiring the fitting of safety frames is an example of how occupational mortality statistics could be used for prevention (28). A remarkable number of crane accidents associated with fastening loads to cranes could be prevented by means of technical measures (11, 12).

In conclusion, our aim was not to find definite causal relationships but consistent evidence of associations between occupations and diseases for further investigation. A broad analysis such as this one could be useful as a first step before any retrospective or prospective study is carried out to investigate the causal relationship between a certain job and a certain cause of death.

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SUMMARY

In order to compare the occupational mortality in a number of countries, statistical reports from England and Wales, Scotland, Finland and Norway were examined and

analysed. As it was impossible to make comparisons on individual occupations, 25 occupational groups were constituted, matching the occupational codes used in the various countries. It was also impossible to standardize indirectly the data from the occupational groups in every country choosing one common population with a standard set of age specific death rates. For this reason, for each country the occupational mortality was indirectly standardized using the age specific death rates of the population of that country.

The value of this study lies in identifying high occupation-specific and disease-specific standardized mortality ratios present in all the countries studied for further thorough investigation of the occupational hazards in question.

Two occupational groups have been identified as having consistently high standardized mortality ratios for accidents, poisoning and violent causes; two groups for malignant neoplasms; two groups for lung cancer and three groups for ischaemic heart diseases. A thorough discussion on the methodology used and the results obtained follows.

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APPENDIX I - *Matching of the occupational codes used in various countries.*

Occupational groups	Norwegian groups	Norwegian code	Finnish code	English code
I	1	00 01, 02 07 08 0X 31	00, 01 02 06 07 09 21	195-203, 220, 218 204, 205, 219 213 214 209-212, 215-217 149, 150
II	2	06 03	05 03	192-194 181-182
III	3	03 05 10, 11	03 05 10, 11	181-182 184-191 173-180
IV	4	20, 21, 29	12-15	138-142
V	5	30, 33	20, 23	143-147
VI	6	66 67 74 96-98	56 57 64 87, 89	123 127-128 49-51 169, 172
VII	7	09 32	08 22	206-208 148
VIII	8	60	50	115
IX	9	62 63, 65 90 XI	— 53, 55 80 90	117 118, 119, 124-126, 131, 132, 134 151-153 221
X	10	69 76 80 82 99 84 86	59 66 70 72 89 — 76	135 24-30 85-87 78-81 172 82 136, 137
XI	11	78 94	68 84	99-101 167
XII	12	42 93 68 89	— 83 58 79	— 165, 166 129-130 106-114
XIII	13	72 70 71	62 60 61	60-63 64-73 74-77
XIV	14, 20, 22, 24	40, 41, 43, 44	3	1-6
XV	15	64 87	54 77	120-122 102-105
XVI	16	75	650-659	31-48
XVII	17	77	670-679	55-59

APPENDIX I - *continued*

Occupational groups	Norwegian groups	Norwegian code	Finnish code	English code
XVIII	18	91 92 04	81 82 032-037	154-159, 161-163 160, 164 183
XIX	19	81 85 95	71 75 85	13-17 89-92 168
XX	21	88	78	133
XXI	23	61	51	116
XXII	25	50-52, 59	4	7-10
XXIII	26	73	63	18-23
XXIV	27	83	73	11, 12, 83, 84
XXV	28	79	690-699	93-98

APPENDIX II - *Components of the occupational groups with reference to the english code.*

Occupational groups	Components	English code
I	Professional technologists Chemical, physical and biological scientists Religious workers Jurists Other professionals Financial agents and salesmen	195-203, 220, 218 204, 205, 219 213 214 209-212, 215-217 149, 150
II	University and school teachers	192-194
III	Medical workers Other professional health care workers Administrators and managers	181-182 184-191 173-180
IV	Clerical workers	138-142
V	Shop keepers and shop assistants	143-147
VI	Transport supervisors Telecommunications Precision mechanics Sportsmen, photographers & other services	123 127, 128 49-51 169, 172
VII	Artistic and literary workers Commercial travellers and agents	206-208 148
VIII	Ships officers and pilots	115
IX	Air transport workers Surface transport workers Public safety workers Members of the armed forces	117 118, 119, 124-126, 131, 132, 134 151-153 221

APPENDIX II - *continued*

Occupational groups	Components	English code
X	Workers in transport & communications unclassified	135
	Electrical and electronic workers	24-30
	Printing workers	85-87
	Food workers	78-81
	Service not elsewhere classified (n.e.c.)	172
	Tobacco workers	82
	Packers and storekeepers	136-137
XI	Painters	99-101
	Beauty care workers	167
XII	Caretakers	165, 166
	Postal workers	129-130
	Labourers not elsewhere classified	106-114
XIII	Leather workers	60-63
	Textile workers	64-73
	Clothing workers	74-77
XIV	Farmers, foresters and fishermen	1-6
XV	Road transport drivers	120-122
	Machine and motor power plant operators	102-105
XVI	Iron and metalware workers	31-48
XVII	Wood workers	55-59
XVIII	Hotel, restaurant and domestic workers	154-159, 161-163
	Waiters	160, 164
	Nursing care	183
XIX	Glass and ceramic workers	13-17
	Makers of other products	89-92
	Laundry workers	168
XX	Stevedores and dock labourers	133
XXI	Deck and engine room crew workers	116
XXII	Miners and quarrymen	7-10
XXIII	Smelting, metallurgic and foundry workers	18-23
XXIV	Chemical and similar workers	11, 12, 83, 84
XXV	Construction workers	93-98