Contrasting geographical distribution of mortality from pneumoconiosis and chronic bronchitis and emphysema in British coal miners

David Coggon, Hazel Inskip, Paul Winter, Brian Pannett

Abstract

To explore whether the characteristics of coal mine dust that predispose to chronic airways obstruction are the same as those associated with pneumoconiosis, mortality from the two diseases was compared in coal miners in 22 counties of England and Wales during 1979–80 and 1982–90. The proportional mortality ratios (PMRs) for coal workers' pneumoconiosis varied from 135 (95% confidence interval (95% CI) 16–488) in Leicestershire to 3825 (95% CI 1538–7881) in South Glamorgan. The PMRs for chronic bronchitis and emphysema were consistently higher than those in other occupations, but showed much less geographical variation and did not correlate geographically with those for pneumoconiosis. These findings indicate that the pathogenetic mechanisms by which coal mine dust causes chronic bronchitis and emphysema depend on different features of the dust from those producing pneumoconiosis. Also, they suggest that current social security regulations in Britain, which require evidence of pneumoconiosis as a condition of compensation for chronic bronchitis and emphysema in coal miners, may discriminate unfairly against claimants from some regions.

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MRC Environmental Epidemiology Unit, University of Southampton, Southampton General Hospital, Southampton SO16 6YD
D Coggon
H Inskip
P Winter
B Pannett

Correspondence to:
Dr D Coggon, MRC Environmental Epidemiology Unit, University of Southampton, Southampton General Hospital, Southampton SO16 6YD.

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Coal workers' pneumoconiosis has long been recognised as a hazard of work in coal mines. In Britain, risk of the disease varies between coal fields, with particularly high rates in South Wales.[1,2] These differences have been attributed, at least in part, to differences in coal rank and dust concentrations.

More recently it has become clear that chronic bronchitis and emphysema is also an occupational hazard of coal mining, and in Britain it has been classified as a prescribed industrial disease by the Department of Social Security (DSS) since 1993. Levels of forced expiratory volume in one second (FEV_1) in miners have been related to cumulative dust exposure, independent of smoking habits,[3–5] but the underlying pathogenetic mechanisms are not yet clear.

This study was designed to explore whether the characteristics of dust exposure that predispose to airways obstruction are the same as those leading to pneumoconiosis. We have compared the geographical distribution of mortality from the two diseases in coal miners in England and Wales.

Method and results

The Office of Population Censuses and Surveys (OPCS) provided us with information on all deaths in men aged 20–74 in England and Wales during 1979–80 and 1982–90. Data for 1981 were omitted because industrial action in that year by registry office staff made them unreliable. The information obtained included the age at death, underlying cause of death (coded to the ninth revision of the International Classification of Diseases (ICD-9)) and the last full time occupation of the decedent as recorded on the death certificate. Occupations were recorded for 1 656 096 deaths and were coded according to the OPCS 1980 classification of occupations.[6] Coal miners comprised six occupational units (codes 095·7, 098·3, 144, 145, 159·7 and 160·7). For these men, and for all men who died from chronic bronchitis and emphysema (ICD-9 = 491, 492 or 496), we also obtained the county of residence at the time of death.

Proportional mortality ratios (PMRs) for coal workers' pneumoconiosis (ICD-9 = 500), and chronic bronchitis and emphysema were calculated for each county by occupation, with five-year age and social class specific proportions in all occupations combined for the whole of England and Wales as standard. Confidence intervals (CIs) for PMRs were based on the Poisson distribution.

During the study period a total of 49 660 deaths were recorded in coal miners aged 20–74, including 824 from coal workers' pneumoconiosis and 4719 from chronic bronchitis and emphysema. More than 96% of the deaths occurred in the 22 counties listed in the table.

Among these counties, PMRs for coal workers' pneumoconiosis varied from 135 (95% CI 16–488) in Leicestershire to 3825 (95% CI 1538–7881) in South Glamorgan. PMRs tended to be highest in Wales and north west England, and lowest in north east England and the East Midlands.

Mortality from chronic bronchitis and emphysema in coal miners was consistently higher than that in all occupations combined, but the geographical variation was much less

Mortality from coal workers' pneumoconiosis and chronic bronchitis and emphysema by county

				Chronic bronchitis and emphysema					
	Coal workers' pneumoconiosis in coal miners			*Coal miners*			*All occupations*		
County	*Deaths*	*PMR*	*(95% CI)*	*Deaths*	*PMR*	*(95% CI)*	*Deaths*	*PMR*	*(95% CI)*
South Glamorgan	7	3825	(1538–7881)	10	157	(75–289)	570	89	(82–97)
Lancashire	21	2521	(1558–3860)	33	121	(83–170)	3131	116	(112–120)
Mid Glamorgan	239	2420	(2123–2748)	567	166	(153–180)	1395	120	(114–127)
Dyfed	38	2407	(1702–3306)	89	157	(126–194)	678	101	(93–109)
Merseyside	38	2397	(1696–3293)	58	118	(90–153)	3101	105	(102–109)
Kent	15	1676	(938–2764)	41	128	(92–174)	2045	88	(84–92)
West Midlands	14	1667	(911–2796)	45	166	(121–222)	5382	106	(103–108)
Avon	5	1269	(412–2962)	25	223	(144–330)	1281	90	(85–95)
West Glamorgan	24	1255	(803–1870)	92	134	(108–164)	735	94	(88–102)
West Yorkshire	73	1014	(794–1275)	402	153	(138–168)	4268	110	(106–113)
Warwickshire	13	963	(513–1647)	58	131	(99–169)	737	94	(87–101)
Gwent	30	926	(624–1324)	191	157	(136–181)	893	101	(94–108)
Clwyd	13	889	(473–1521)	59	136	(104–176)	718	95	(89–103)
Durham	47	538	(395–715)	417	142	(128–156)	1396	107	(101–113)
Greater Manchester	23	526	(333–791)	216	153	(133–174)	5904	115	(112–118)
South Yorkshire	62	499	(383–640)	737	158	(147–170)	3037	114	(110–118)
Staffordshire	25	489	(316–722)	266	150	(133–169)	2068	112	(107–117)
Derbyshire	27	461	(303–671)	256	121	(106–136)	1729	100	(95–105)
Nottinghamshire	38	461	(326–633)	407	137	(124–151)	1965	110	(105–115)
Tyne and Wear	32	423	(289–597)	311	121	(108–136)	2554	103	(99–107)
Northumberland	7	146	(59–300)	199	127	(110–146)	612	101	(83–109)
Leicestershire	2	135	(16–488)	52	96	(72–127)	1146	88	(83–93)

than for pneumoconiosis. Apart from Avon (PMR = 223) and Leicestershire (PMR = 96), PMRs for chronic bronchitis and emphysema by county were all in the range 115–170. Furthermore, there was no relation between the PMRs for chronic bronchitis and emphysema and coal workers' pneumoconiosis in miners by county ($r = 0{\cdot}22$, 95% CI $-0{\cdot}22$ to $0{\cdot}59$). For example, in Lancashire and Merseyside, which had high rates of pneumoconiosis, the PMRs for chronic bronchitis and emphysema were only 121 and 118, whereas in South Yorkshire and Staffordshire, where pneumoconiosis was less common, they were 158 and 150.

Comment

Our findings accord with those of earlier studies in indicating a high rate of chronic bronchitis and emphysema in coal miners[3 5] and considerable geographical variation in their risk of pneumoconiosis.[1 2] The absence of any geographical correlation between PMRs for the two diseases suggests that the characteristics of coal mine dust that influence development of the two diseases are different. It has been proposed that the higher prevalence of pneumoconiosis in collieries with high coal rank is explained by their having had higher mass concentrations of respirable dust. If so, our data would suggest that risk of chronic bronchitis and emphysema is not directly determined by this measure of exposure. Perhaps the development of bronchitis and emphysema depends more on larger particles of dust that deposit in the trachobronchial region.[7] Alternatively, the association of pneumoconiosis with coal rank may depend on some other mechanism.

As well as raising questions about pathogenesis, our observation has practical implications for the DSS industrial injuries scheme. Currently, a condition of compensation for chronic bronchitis and emphysema is the demonstration of pneumoconiosis (ILO category 1/1 or higher) on chest *x* ray film. This is required as evidence of significant exposure to coal dust. If, however, the propensity of dust to cause pneumoconiosis depends on different features from those that lead to airways obstruction, then this requirement may discriminate unfairly against miners from some parts of the country.

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