THE ACCURACY OF OCCUPATIONAL
 VITAL STATISTICS

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Statistics of mortality and morbidity in different occupational groups are essential for the effective practice of industrial medicine in the major industries. For coal-mining in 1950, the Registrar General (1954) reported a standardized mortality ratio for "hewers and getters", *i.e.*, coalface workers, of 154; and the Ministry of Pensions and National Insurance (1955) reported that the rate of claims by coalminers for sickness benefit was two and a half times the national average. The serious implications of these rates made a careful assessment of their accuracy essential. This paper discusses cooperative studies carried out by the General Register Office, the London School of Hygiene and Tropical Medicine, the Ministry of Pensions and National Insurance, and the National Coal Board Medical Service to examine the accuracy of the reporting of occupation on the various records concerned.

The numerators of occupational mortality and morbidity rates derive from job descriptions on death certificates and claims for sickness benefit respectively. The denominators of the rates come from entries of occupation on Census schedules. Errors may occur in both.

There are many diverse occupations in the coal-mining industry and each may have different names in the various coalfields. Many hundreds of names are listed in the instructions prepared by the General Register Office (1951) and are used for classifying occupations in all three sources of material for mortality and morbidity rates. The occupations are grouped into eight classes, given the codes 040 to 045, 047, and 049 as detailed below.

In the studies reported here, descriptions of occupations on death certificates, on claims for sickness benefit, and on Census schedules have been checked against the best available evidence of actual occupation obtainable from sources within the industry or outside it. The coding actually made on official

documents has been compared with that which would have been made had the full and accurate descriptions of the jobs been available. The "official" occupational classes used by the General Register Office and the "independent" classification we have used are as follows:—

"Official" Classification	G.R.O. Code	"Independent" Classification
Subordinate superintending staff (including overmen, deputies, examiners, foremen)	040	I "Supervisors"
Workers below ground:—		
Coal-cutting and power-loading machine men	041	II "Faceworkers"
Hewers and getters (by hand) (including powered hand tool workers)	042	
Persons conveying material to the shaft	043	
Persons developing underground workings in rock	044	III "Other miners underground"*
Persons repairing and maintaining roads	045	
Other workers below ground	047	
Other workers above ground	049	IV "Surface mine-workers"
Occupations not specific to coal-mining	Other code numbers	V "General occupations"†

*Group III also contains a small number of stationary engine drivers, switchboard attendants, and oilers and greasers of engines and machinery, specified as working underground in mines (and allocated to G.R.O. Codes 910, 918, and 920).

†Group V contains men in occupations not specific to mining, *e.g.*, fitters, electricians, but employed in the coal-mining industry.

Inaccuracies in coding occupations may occur because of incorrect or inadequate description. In particular, where the entry "coal-miner" was made without any further detail, the G.R.O. instructions (based on a belief that most coal-miners have worked on the face at one time) state that such entries should be coded 042, *i.e.*, with "hewers and getters". There is a further difficulty in that the classification of the individual mining occupations according to the eight codes given above is not ideal. Men doing the same work can be classified differently according to the various names given to that work. As one of

*Now of the General Register Office.

many examples, "pan turner" is coded 041, whereas "conveyor belt turner" is coded 043; yet the occupations are essentially the same.

Occupation on Death Certificates

Method of Inquiry.—The Registrar General made available information given in the death certificate for every man dying in England and Wales in 1955 and described on the certificate as a worker in the coal-mining industry. At the same time, the National Coal Board provided details of the last mining occupation of each man who died while still in the Board's employment. Both sets of data were sent to the London School of Hygiene where they were matched as far as possible. Where the deceased man had left National Coal Board employment some time before his death, the Mineworkers' Pension Fund and other records were searched to find the last colliery at which the man worked. When these sources failed, the medical officer of health of the district where the dead man lived was asked to visit the man's last known address to obtain this information. If the last colliery at which the man worked could not be determined, the medical officers of health usually provided some details of the man's last mining occupation. When the last colliery at which a man had been employed was ascertained, a statement of the job last done was obtained as before by enquiry at the pit.

The National Coal Board's (or medical officer of health's) description of the man's occupation is referred to in this paper as the "independent" occupational material in contrast to the "official" G.R.O. information. Both were coded according to the classification of occupations used by the General Register Office (1951). Those men who had left mining and taken up another occupation and were recorded as dying in that occupation were inevitably excluded from this investigation; the General Register Office would not know that these men had once been miners, nor would the National Coal Board know of their death.

During 1955, there occurred 4,533 deaths of men aged 20 to 64 who at death were either on the books of the National Coal Board or were described by the informant at death registration as being in a coal-mining occupation. Deaths of other men, *e.g.*, colliery clerks, were excluded if the occupational details given by both "official" and "independent" sources showed that they did not come within the occupational groups detailed above.

The sources from which the data were collected are shown in Table 1. Two descriptions of the mining occupation were provided in all but 139 cases (3.1%). Of these, 21 were reported independently by the National Coal Board, but no death

certificates could be found. Similarly, for 118 deaths only the death certificates were available.

TABLE 1
SOURCES OF INFORMATION ON DEATHS

	No. of Men	%
<i>Occupied Miners</i>		
On N.C.B. colliery books and death certificate provided by G.R.O.	2,641	58.3
On N.C.B. colliery books, but no death certificate provided by G.R.O.	21	0.5
Employed by licensed mines and death certificate provided by G.R.O.	6	0.1
Classified by G.R.O. as occupied miner, but not in N.C.B. colliery occupation, <i>e.g.</i> , checkweighman employed by National Union of Mineworkers	11	0.2
Total occupied miners	2,679	59.1
<i>Retired Miners</i>		
Death certificates provided by G.R.O. and Occupational details provided by N.C.B.	1,293	28.5
Occupational details provided by medical officer of health:		
Complete information	254	5.6
Incomplete information	189	4.2
No further information obtainable	118	2.6
Total retired miners	1,854	40.9
TOTAL	4,533	100

Errors in Job Description of Occupied Men.

Table 2 compares the number of deaths among occupied men according to the "independent" and to the "official" information on occupation. There is reasonably close agreement between the counts for the "supervisors" and for "other miners underground"; but the two sources give quite contrary indications of the total number of deaths among "faceworkers" and "surface mine-workers". The totals for "all mining occupations" are substantially the same and only 1.2% of the officially reported mining deaths were not in coal-mining occupations. Men whose last mining occupation was known from independent information to be on the surface have in many cases been described on death certificates either as "coal-miners" (when, under present G.R.O. convention, they are allocated to the face-worker classification) or as faceworkers.

TABLE 2
DISTRIBUTION OF OCCUPATIONS OF OCCUPIED MEN DYING IN 1955

Occupational Group	Number Reported		Percentage Difference (a) - (b) (a)
	"Official" Data (a)	"Independent" Data (b)	
I: "Supervisors"	203	196	+ 3.4
II: "Faceworkers"	646	466	+ 27.9
III: "Other miners underground"	1,100	1,140	- 3.6
IV: "Surface mine-workers"	390	484	- 24.1
All "mining occupations"	2,339	2,286	+ 2.3
V: "General occupations"	319	372	- 16.6
Total	2,658*	2,658*	—

*Excludes the 21 deaths for which death certificates were not found by the General Register Office.

Occupational History of Retired Miners.—Men leaving the industry may take up other jobs, but may still be described as miners when their deaths are registered. To obtain some estimate of the frequency of such an event, a quasi random 10% sample of the 1,687 deaths among men known to have retired from a "mining occupation" was selected for special follow-up. Local medical officers of health were asked to obtain further information on the occupational history of the selected 168. Table 3 shows that at least 50 (30%) and perhaps up to 78 had in fact held other jobs since leaving the mines. The percentage was higher among faceworkers than among surface workers.

TABLE 3
SAMPLE SURVEY OF OCCUPATIONAL HISTORY OF
RETIRED MINERS DYING IN 1955

	No. of Men	%
No further occupation	90	53.6
Known further occupation	50	29.8
No information about further occupation	28	16.7
Total	168	100

"Independent" information on the jobs of miners dying while still on colliery books but described on death certificates simply as "coal-miners" indicated that they were in fact distributed in proportion to the populations in each occupational group. The coding convention used by the General Register Office had classified these deaths as in the faceworker Group II (Code 042). Among the deaths of retired men, no independent information was available for 118; and for 189 the only statement given by the medical officer of health was "coal-miner". These 307 deaths were therefore redistributed in proportion to the populations of retired men in each occupational group. On the basis of the sample, at least 30% of men were likely to have had a further occupation. The occupational group totals for

TABLE 4
DISTRIBUTION OF OCCUPATIONS OF OCCUPIED AND
RETIRED MINERS DYING IN 1955

Occupational Group	No. Reported		Percentage Difference
	"Official" Data (a)	Adjusted "Independent" Data (b)	
I: "Supervisors"	310	264	+ 14.8
II: "Faceworkers"	1,513	861	+ 43.1
III: "Other miners under- ground"	1,679	1,630	+ 2.9
IV: "Surface mineworkers"	585	722	- 23.4
All "mining occupations"	4,087*	3,477*	+ 14.9

*Excludes the 21 deaths for which death certificates could not be found by the General Register Office.

retired miners were then adjusted to take these findings into account. The addition to the distribution given in Table 2 of the deaths among retired miners adjusted in these ways gives the final comparison of "official" and "independent" enumerations seen in Table 4. The total differs by 15%, and there is a very marked "promotion" effect into the "faceworker" and "supervisor" categories.

Occupations on Sickness Benefit Claims

Method of Enquiry.—With the agreement of the National Union of Mineworkers acting on behalf of the men, the Ministry of Pensions and National Insurance provided sufficient information for the Medical Service of the National Coal Board to check whether a sample of men who had spells of sickness ending in 1951 and whose descriptions of their occupations were coded as "coal-mining" by the Ministry, were in fact employed as miners when they became ill. On the advice of the Ministry, no subdivisions of coal-mining occupations have been made. The sample was of roughly 5% of all men who claimed benefit at local offices in Cumberland and in the London (Outer) Region. These offices cover the Cumberland and Kent coalfields whose isolation from other coalfields simplified the tracing of individuals. At all the collieries in the two coalfields the employment records were searched to discover whether each man in the sample was working there in 1951 and, if so, to define his occupation. The job descriptions supplied by the collieries were matched by the Medical Service against the coding made by the Ministry.

Errors in Job Description.—Of the 311 men in the sample, 275 (88%) were found by the local colliery enquiry to have been employed at the relevant time in 1951. A further nine (3%) were known at the collieries but had not been employed there when they made their claims. The remaining 27 (9%) could not be traced at the collieries. Table 5 gives

TABLE 5
OCCUPATIONAL HISTORY OF MEN CLAIMING SICKNESS
BENEFIT IN 1951

	No. of Men	%
<i>Men on colliery books</i>		
Correctly ascribed to mining occupations	263	84.6
Incorrectly ascribed to mining occupations	12	3.9
Not on books at time of claim	9	2.9
Total men on colliery books	284	91.3
<i>Men not found on colliery books</i>		
Probably correctly coded to mining occupations	5	1.6
Probably incorrectly coded to mining occupations	16	5.1
Not otherwise classifiable	6	1.9
Total men not found	27	8.7
TOTAL	311	100

the results of these enquiries. The Ministry made a special examination of their records for the 15 men who had said they were coal-miners and were also shown on their contribution cards as employed in coal-mining but who could not be traced at the collieries.

Of the five men not found but probably correctly ascribed to mining occupations, several appear to have been miners holidaying in the area; one man's name was incorrectly recorded. The untraced 16, who were probably incorrectly described as miners, included eight whose industry was not recorded as coal-mining and three who claimed at offices in Greater London and whose occupations were common to industries other than coal-mining. It would thus appear that, out of the total of 311, probably 37 (12%) and up to 43 or possibly even 48 were incorrectly assigned to mining occupations. No estimate can be made of the numbers of men who claimed benefit while working in the mines but did not enter coal-mining as their occupation.

Occupations on Census Schedules

Method of Enquiry.—Occupational details of all men employed in April, 1951, at three collieries in Derbyshire, Kent, and Northumberland were sent to the General Register Office where a search was made of all the Census schedules for a population of nearly 100,000 in considerable areas surrounding the collieries. Even these areas did not cover all the addresses given by the collieries and a small number of men were excluded from the enquiry. Of the remainder, all but 148 were found and it was thus possible to compare, for 3,745 men, the occupations entered in the Census schedules with those provided by the collieries.

Errors in Job Description.—The allocation of individuals to the code groups used by the General Register Office on the basis of either "official" or "independent" data agreed in less than two-thirds of the comparisons (2,198 out of 3,745). A small number of disagreements (81) were due to errors of coding in the General Register Office. Inadequate descriptions on the Census schedules accounted for another 267 disagreements and more than half of these entries were of "coal-miner" without further specification. The great majority (1,199) of the disagreements arose because occupational descriptions from the two sources, although specific, were discrepant.

Among the population of 100,000, there were 105 men who entered on the Census schedules mining occupations at the particular collieries, but who were not, in fact, employed at those collieries at the time of the Census. There were also 22 men on the books

of the collieries who were entered as unoccupied at the Census.

Table 6 gives the total counts of the mining populations in each broad group of the occupational classification. Allocation to the General Register Office codes has been based on occupational descriptions given (a) on Census schedules or (b) on colliery records. The 3,850 men in Column (a) include the 105 not on colliery books and exclude the 22 recorded on the census schedule as unoccupied. The 3,915 men in Column (b) include the 148 who were not found in the General Register Office's search of census records.

TABLE 6
DISTRIBUTIONS OF MINING POPULATIONS BY
OCCUPATION

Occupational Group	Number of Men		Percentage Difference (a) - (b) (a)
	Census Schedules (a)	Colliery Records (b)	
I: "Supervisors"	222	209	+ 5.9
II: "Faceworkers"	1,430	1,358	+ 5.0
III: "Other miners under-ground"	1,307	1,363	- 4.3
IV: "Surface mine-workers"	387	457	- 18.1
All "mining occupations"	3,346	3,387	- 1.2
V: "General occupations"	504	528	- 4.8
Total	3,850	3,915	- 1.7

Although the results from the three collieries were markedly different, the overall bias is one of "promotion" similar in nature but to a lesser degree than that found in death registration. At two of the collieries the proportions of entries on the Census schedules of "coal-miner" without further description were 11% and 4%; and the conventional coding of such entries as "faceworker" substantially increased the "promotion" effect. At the third colliery there was only one entry of this kind and the "promotion" effect was reversed.

Occupations of Retired Miners.—Particular difficulties arise among men who have left the mines, perhaps after a life time's work there, and taken other jobs. The General Register Office therefore searched the Census schedules for those men who died in 1955 and were known to have left the mining industry before the 1951 Census. Census records were found for 31 men who had taken other jobs before the Census. Of these, 20 were correct but 11 men had given their occupation incorrectly as mining. The Census population of "retired miners" is thus likely to have been slightly overestimated; but since "retired miners" form only 2% of the total population of occupied and retired miners between the ages of 20 and 64, this error is relatively unimportant.

Estimates of Mortality and Morbidity Experience

Our studies have shown that there are sources of error in both the numerators and denominators of occupational mortality and morbidity rates. These arise through mistakes in job description by informants, by coding all coal-miners without specified occupation as hewers and getters, and by the inclusion of some retired miners who have taken non-mining jobs among the "coal-miner" deaths. The errors in the total count of the mining population at the Census do not seem to be gross, but there are major errors in the counts of men in particular jobs. The extent of these errors varies so widely between the three collieries examined that we are unable to provide any reliable correcting factor.

The published figures of occupational mortality relate to occupied and retired men. Denominators for these rates can only be obtained from Census material and we have seen that this is somewhat in error for occupied men and may well be more inaccurate for retired men.

In Table 7 we have compared "official" estimates of miners' mortality with estimates based on the adjusted "independent" distribution, given in Table 4, and on unadjusted Census population data. The tentative nature of these mortality estimates must be emphasized. These "official" estimates are based on the 1949-53 recorded deaths.

TABLE 7
MORTALITY EXPERIENCE OF OCCUPIED AND RETIRED COAL-MINERS
(Standardized Mortality Ratios)

	1949-53	1955	
	* (a)	"Official" Data (b)	"Independent" Data (c)
I: "Supervisors"	88	100	86
II: "Face-workers"	148	142	81
III: "Other miners underground"	93	107	104
IV: "Surface mine-workers"	107	109	135
"All mining occupations"	112	117	100

*Registrar General's (1957) Decennial Supplement England and Wales, 1951. Occupational Mortality, Part II.

The agreement between the "official" figures for 1949-53 and 1955 (Columns (a) and (b)) is sufficiently close to suggest that there has been little change in the mortality experience over this period and that the methods used in this survey have been appropriate.

The ratios in Column (c) are the best estimates that we could make, adjusting for change of job among retired miners and after redistribution of deaths reported as occurring in men described simply as coal-miners. These figures have been based on the 1951 Census populations without any further adjustments. Although these rates cannot, therefore, be

entirely reliable, the ranking of the occupational death rates from face to surface appears more likely to represent the true mortality experience than the greatly excessive rate for faceworkers shown in the official data.

Perhaps the most important finding is that the rate for all miners appears to be no greater than that of the general population.

We have also classified the deaths of occupied men according to the National Coal Board convention; except for under-officials, all men, including those in Group V, are allocated to their place of work. Standardized mortality ratios, based on populations by age and occupations supplied by the National Coal Board, are given in Table 8, where the rate for all miners is used as the standard.

TABLE 8
MORTALITY EXPERIENCE OF OCCUPIED MINERS IN 1955
(Standardized mortality ratios: All miners = 100)

Under-officials	..	..	..	88
Workers at the face	..	..	..	82
Workers elsewhere underground	..	..	..	102
Workers on the surface	..	..	..	122

It must be remembered that these estimates relate to occupied miners only and are comparisons within the mining industry; nevertheless, they are probably the most reliable indices of the relative mortality risks and they confirm the conclusions obtained from using the conventional methods on "independent" data.

The number of claims for sickness benefit made by coal-miners appears to have been overstated by about 15%. Adjustment by this amount would reduce the rate of claims for sickness benefit from two and a half times the national average to about 2.1 times, but no allowance has been made here for the inaccuracies in the Census population nor for any men who claimed benefit while occupied in coal-mining, but did not say so on their claim. It is thus likely that the true claim rate is close to the official figure.

Discussion of Results

The reported excess in mortality among "hewers and getters" in the coal-mines can be largely explained by errors in job description by informants at the time of registration of death and by the coding convention which puts all men described simply as "coal-miners" into the faceworker category. The multiplicity of terms describing similar jobs also causes confusion between "faceworkers" and "other miners underground". Such errors are numerically important even for men who die while still on the books of the National Coal Board. Of all miners dying between the ages of 20 and 64, 41%

were described as "retired", and among them greater difficulties arise. When a man retires he tends to regard his "former occupation" as the one in which he spent the greater part of his working life and it is only natural that he be similarly regarded by his relatives. This will affect the calculation of death rates in two ways. First, if the man's last job was in the mining industry but not at the coalface, he may be described either wrongly as a "hewer and getter" or as a "coal-miner". In either event he will be coded as a faceworker and the hewers and getters' death rate will be correspondingly increased. If the man had held another job between leaving coal-mining and death and he was wrongly described as a worker in the coal industry, the death rate for all miners will be inflated. It has been shown that both these discrepancies have occurred.

There is some evidence that errors in the same direction occurred at the time of the Census, but they are unlikely to have such an effect on the calculation of death rates in mining occupations. To some extent, an overestimate of the face-worker population will compensate for the excessive reporting of deaths in that category.

Unfortunately, no precise correction for these sources of error could be made in this study, but the ranking of estimated death risks from face to surface workers is readily explicable by occupational selection, transfer, and wastage on physical grounds. There seems little or no evidence in favour of a death rate much above the national level; in fact, the faceworkers have a relatively favourable mortality rate compared with other underground and surface mine-workers. As long as death rates are based on the last occupation followed, this result is to be expected; a man who works at the coalface requires to be robust for the strenuous work involved. Only a man of good physique is likely to undertake such work; and should he become less fit he would be expected to move to lighter work.

The rate of claims to sickness benefit by miners reported by the Ministry of Pensions and National Insurance appears to be substantially correct. It is more than twice as great as the national average, but this does not mean that miners are twice as unhealthy as other employed men. Indeed, their spells of absence are shorter than average. The heavy physical demands of mining mean that an illness which would not incapacitate a clerk may seriously handicap a miner.

These results do not deny the risks to health inherent in arduous occupations such as coal-mining. But they do emphasize the urgency of current studies on occupational classification and on alternative measures of health hazards in relation to occupation.

Summary

A survey has been made of the accuracy of job description on records used for the calculation of indices of occupational mortality and morbidity.

The statement of last occupation in the mining industry made by the informant at death registration for men dying in 1955 has been compared with information obtained independently either from the National Coal Board or through local enquiries.

The statements of occupation on claims for sickness benefit and on the Census schedules made in 1951 in certain mining areas have been compared with the employment records at local collieries.

Evidence is presented which suggests that the death rate for "hewers and getters" reported by the Registrar General is inflated both by inaccurate descriptions by informants of men not employed as faceworkers as "hewers and getters" and the coding convention which assigns all men described simply as "coal-miners" to that category. Men who have taken up other jobs after retiring from mining occupations are also frequently described as "retired coal-miners". On the other hand, similar inaccuracies in the Census population estimates for specific categories of mineworkers tend to reduce the net error in death rates.

The mortality rate of faceworkers estimated on the basis of the independent occupational description of deaths would appear to be less than that of other underground workers whose rate is, in turn, less than that of surface workers.

The death rate for all miners in 1955 was unlikely to be greater than the national rate for all males.

Taking the industry as a whole, the total counts of claims for sickness benefit and at the Census do not appear to be greatly in error. The reported excess of sickness claims of two and a half times the national average is likely to be substantially correct.

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