Occupational mortality from gastric and duodenal ulcer

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ABSTRACT The pronounced geographical and temporal variations in gastric and duodenal ulcer suggest that important environmental factors must play a part in their aetiology. To determine the nature of possible factors, the Registrar General's decennial supplement and the vital statistics special reports of the United States Department of Health, Education, and Welfare on occupational mortality were analysed for occupation-specific mortality from peptic ulcer. The data disclose a high mortality from both types of ulcer among manual workers and a low mortality among sedentary occupations. This general pattern runs parallel to a low mortality from gastric and duodenal ulcer among the high social classes and a high mortality in the low social classes. Married women displayed a gradient of gastric ulcer mortality increasing from social class 1 to social class 5 but gave no evidence of social class correlation with respect to duodenal ulcer. The significant correlation between mortality from gastric and duodenal ulcer among different occupations could suggest that both types of ulcer hold some of the precipitating environmental risks in common. In duodenal ulcer the varying extent of energy expenditure among different occupations may be responsible for the different risk of contracting duodenal ulcer and dying from it. The association between energy expenditure and peptic ulcer mortality seems to be less important for gastric ulcer where additional factors associated with social class may also be operating.

The incidence of gastric and duodenal ulcer is characterised by pronounced geographical and temporal variations which suggest that important environmental factors must play a part in the aetiology of both diseases.¹⁻⁵ In the search for relevant environmental factors occupational mortality may provide valuable clues. Apart from the time honoured study on occupational factors in the aetiology of peptic ulcers by Doll and his co-workers,⁶ there are a few reports on the influence of occupation.⁷⁻⁹ A widespread belief holds that peptic ulcer is related to emotional stress and, therefore, more likely to occur among managers and other professionals. Though peptic ulcer was shown to be frequent among professionals, foremen, and workers holding responsible positions,^{6,10-12} other evidence seems to suggest the opposite—namely, that peptic ulcer is more common among unskilled labourers and manual occupations.^{7-9,13,14} In their study Doll and his coworkers referred to the Registrar

General's mortality of 1930-2.⁶ The more recent data published on occupational mortality have not been analysed as yet with respect to peptic ulcer. The decennial supplement of the Registrar General of 1951 is remarkable for several reasons.¹⁵ It lists mortality from gastric and duodenal ulcer separately for 425 occupational groups. In the five calendar years 1949-53 gastric and duodenal ulcer were recorded as the cause of death in 4886 and 5424 men aged 20-64, respectively. These figures are twice as high as those of 1959-63 and form a more reliable basis for statistical analyses than the figures of later periods.^{16,17} In 1961 the United States Department of Health, Education, and Welfare published several reports on occupational mortality in the United States based on vital statistics and census data of 1950.¹⁸ The American study was designed similarly to the English model of the decennial supplements. The existence of two different sets of statistics from England and the United States covering the same period gave the additional opportunity to cross check the validity of correlations found between occupation and mortality.

Methods

The present study is based on the Registrar General's decennial supplement of 1951 on occupational mortality in England and Wales and the vital statistics special reports of the United States Department of Health, Education, and Welfare.^{15,18} The rationale, methodology, and limitations to both studies were explained in detail in separate issues preceding the actual statistical tabulations. By testing whether decedents were reported in the same or different occupational categories in the census and on death certificates, it was found that in both countries about 80% of the occupations were reported in the same major category. The percentage distribution by major occupational group from the census and the death certificates differed by less than 1%, despite the fact that only 80% of the population was reported in the same major group in both sources. The errors which account for the discrepancy of the census and mortality data arose from a tendency to omit to mention a former occupation or to use the description "unoccupied" instead of "retired" from a particular occupation. Some discrepancy was due to the lack of correspondence between the "usual" occupation and the "current" occupation reported on the death certificate or in the census. In England there was a tendency to report occupations assignable to social classes 1 and 2 more often at death registration than on the census forms, thus giving rise to an overestimation of death rates in these two classes.

The classification of occupation used by the Registrar General is that used in connection with the 1951 census. The major headings correspond to industrial classifications, and the subheadings to the occupation—that is, the type of work that a person performs.¹⁵ The American report was based on the intermediate or abbreviated occupational classification published by the United States Bureau of Census.¹⁸ As opposed to the British classification, the American one puts more weight on the status and the skill of the worker than on his or her industrial allocation. The major headings relate to being a professional, craftsman, foreman, operative, or unskilled labourer, and only the subheadings relate to the industrial character of the work. These differences make the comparison between individual occupations from the British and American classification somewhat difficult. For instance, the British occupational group of turners, machine setters, and shipyard metal machinists could be assigned to the American group of mechanics and repairmen, metal craftsmen, or metal operatives. Since much bias may be introduced by trying to rearrange the American classification according to the British (or vice versa), we report the results separately under the headings

used by the governmental agencies of the two different countries.

Each occupational unit was assigned as a whole to one of five social classes: class 1 = professional occupations, class 2 = intermediate occupations, class 3 = skilled occupations, class 4 = partly skilled occupations, and class 5 = unskilled occupations. This classification by the Registrar General is based on general standing within the community, education, and economic circumstances.¹⁵ In the American statistics it was decided to create, on the basis of expert judgement, five socioeconomic classes of occupations, similar in concept to those of the Registrar General.

The Registrar General's decennial supplement also lists mortality of married women arranged according to their husband's occupation and social class. In the present analysis only female mortality of different social classes was analysed. No statistically significant results could be obtained from the female occupational mortality, because only seven (3) of the occupational orders had 30 or more deaths from gastric (duodenal) ulcer attached to them.

In the present analysis only deaths between the ages of 20 and 64 were considered. By applying the age specific death rates from gastric or duodenal ulcer of all men to the census population of one occupational group, the expected number of deaths in the particular occupational group under consideration is calculated. The ratio of observed to expected deaths corresponds to the standardised mortality ratio (SMR) that is normally presented as a percentage. The standard error (SE) of the SMR is $SMR/\sqrt{\text{observed deaths}}$.^{14,15,19} When the SMR differed from its expected value of 100% by more than $1.96 \times SE$, it was considered significant at the $p < 0.05$ level.

Results

Table 1 shows the standard mortality ratios for gastric and duodenal ulcer in men in England and Wales. If the expected value is 100% then an "L" was assigned to those occupational orders with an SMR for both gastric and duodenal ulcer lower than 85%, and an "H" was assigned to those with both values higher than 115%. In England mortality from gastric and duodenal ulcer was low in agricultural occupations; in administrators, directors, and managers; in commercial and finance occupations; and in professional and technical occupations. It was high in painters and decorators and in those engaged in defence service; in entertainment; in personal service; and in unskilled occupations. These results are largely corroborated by the American data which also show a low SMR for professional workers;

Table 1 *Standardised mortality ratio (SMR) and standard error (SE) for gastric and duodenal ulcer in England and Wales*

Occupational order	Gastric ulcer		Duodenal ulcer	
	SMR	SE	SMR	SE
Fishermen	100	45	117	44
L Agricultural occupations	78	5*	63	4*
Mining and quarrying occupations	94	7	82	6*
Workers in ceramics, glass, cement	91	20	81	18
Coal, gas makers, workers in chemicals	100	17	67	13*
Workers in metal manufacture, engineering	96	4	100	4
Textile workers	92	11	126	13*
Leather workers, fur dressers	118	16	100	14
Makers of textile goods and articles of dress	108	16	120	16
Makers of foods, drinks, and tobacco	93	14	82	13
Workers in wood, cane, and cork	104	9	104	9
Makers of, workers in, paper, printers	84	13	102	14
Makers of other products (rubber, plastics)	89	22	105	23
Workers in building and contract	103	6	98	5
H Painters and decorators	119	11	121	10*
L Administrators, directors, managers	45	5*	65	6*
People employed in transport, communications	107	5	105	4
L Commercial, finance, insurance	81	4*	85	4*
L Professional and technical occupations	55	5*	76	6*
H People employed in defence service	156	13*	136	12*
H People engaged in entertainment and sport	162	28*	133	24
H People engaged in personal service	145	9*	122	8*
Clerks, typists	89	6*	109	6
Warehousemen, storekeepers, packers	108	9	99	8
Stationary engine drivers, stokers	84	9	117	10
H Workers in unskilled occupations	153	6*	139	5*
Other and undefined workers	87	17	103	18

*p < 0.05.

H = Both SMR higher than 115.

L = Both SMR lower than 85.

Table 2 *Standardised mortality ratio (SMR) and standard error (SE) for gastric and duodenal ulcer in the United States*

Occupational order	Gastric ulcer		Duodenal ulcer		Work load
	SMR	SE	SMR	SE	
L Professional workers	54	8*	70	10*	1
All other professional, technical, and kindred workers	90	12	98	13	1
L Officials, inspectors, and specified managers	68	7*	79	7*	1
Managers, officials, and proprietors, wholesale and retail trade	84	8	106	10	1
Clerical and kindred workers	96	10	115	11	3
Salesmen and sales clerks, retail trade	102	15	140	18*	3
All other sales workers	92	12	124	15	2
Mechanics and repairmen	97	12	80	11	3
L Foremen	48	10*	84	14	2
H Metal craftsmen	134	13*	129	14*	4
Engine and construction machinery operators	103	18	96	18	2
Cabinetmakers and carpenters	72	11*	95	13	3
All other craftsmen	111	12	137	14*	4
Transportation and public utility workers	100	19	96	20	3
Guards and protective service workers	94	16	181	24*	2
H Painters and plasterers	165	21*	130	20	3
L Metal operatives	64	9*	85	11	5
Drivers and deliverymen	132	13*	104	12	3
Operatives in selected manufacturing industries	76	9*	100	11	4
H Mine operatives and labourers	230	29*	117	22	5
All other operatives	104	14	82	13	4
H Service workers	141	15*	119	14	4
H Labourers in metal manufacturing	215	33*	189	32*	5
H Labourers in other manufacturing	241	30*	152	25*	5
Construction and outdoor labourers	126	14	111	14	5
H Labourers in other non-manufacturing industries	149	12*	136	12*	5
Agricultural workers	96	6	70	5*	2

*p < 0.05.

H = Both SMR higher than 115.

L = Both SMR lower than 85.

officials, inspectors, and managers; and foremen. In American agricultural workers the SMR for duodenal but not gastric ulcer was low. As in England and Wales, the SMR was high in painters and plasterers, service workers, and labourers (unskilled workers) in any industry. In both countries there was a significant linear correlation between the SMR for gastric and duodenal ulcer (figs 1 and 2). The SMR for gastric ulcer indicates a strong gradient increasing from social class 1 to social class 5 (fig 3). Duodenal ulcer displayed a less pronounced social distribution with the same general tendency of prevalence, low in the high social classes and high in the low social classes. These observations apply to both countries. Married women displayed a rise of gastric ulcer mortality moving from the first to the fifth class but gave no evidence of social class correlation with respect to duodenal ulcer (fig 4).

Discussion

The analysis of occupational mortality from gastric and duodenal ulcer shows a high mortality from both among manual workers and a low mortality among sedentary occupations. This general pattern runs parallel to a low mortality from gastric and duodenal ulcer among the high social classes and a high mortality in the low social classes. In addition, there is a high mortality of peptic ulcer among painters and a low mortality among agricultural workers that may not fit the general pattern outlined above. The widespread belief of peptic ulcer being a disease of professionals, managers, and foremen under stress is obviously wrong according to the English and

Fig 2 Linear regression between SMRs for gastric and duodenal ulcer in United States; same data as in table 2.

American statistics for the period 1949–53. In the Registrar General's decennial supplements of 1921 and 1931 duodenal but not gastric ulcer was more evenly distributed among the five social classes.^{20 21} Even in the older statistics, however, the distribution of duodenal ulcer was never so clear cut as to make it a "manager's disease."

The data from the decennial supplement and special report partly support some of the older studies which, however, were based on a much lower number of cases. Ihre and Müller in their series also noted an appreciably lower proportion of ulcers among intellectuals.⁸ The occupational survey carried out by Doll and his colleagues showed a high prevalence of peptic ulcer among doctors, executives, and foremen and a low incidence among agricultural workers and sedentary workers such as civil servants, scientists, and draughtsmen.⁶ The data reported by Pulvertaft and Langman also suggested that duodenal ulcer was more common among unskilled workers.^{13 14}

A straightforward interpretation of the results would indicate that it is physical work itself that somehow increases the risk of dying from peptic ulcer. To maintain a balanced energy turnover someone with increased energy consumption during work needs more food. It may be speculated that any steady increase in food consumption (not just a temporary one as in gaining weight) leads to some structural changes in the upper gastrointestinal tract that makes it more susceptible to developing a peptic ulcer. The measurement of average daily energy expenditure in the individual occupation has many difficulties.^{22–24} Though it may be easy to measure

Fig 1 Linear regression between SMRs for gastric and duodenal ulcer in England and Wales; same data as in table 1.

Fig 3 SMR ($\pm$ standard error) for gastric and duodenal ulcer in the five social classes, 1 and 5 corresponding to highest and lowest social class.

the energy expenditure associated with specific activities such as drilling, shovelling, or hewing, a determination of the actual daily workload is limited by recording the time distribution spent on different activities during a workday rather than on the exact values of different activities.²²⁻²⁴ People nominally having the same occupation may nevertheless differ largely in the actual amount of energy they spend during their working hours. Matters become even more complicated when allied occupations are grouped into one occupational order. Assigning different rates of daily energy expenditures to different occupational orders, therefore, cannot be more than an intelligent guess. Based on a table published by Passmore and Draper,²² we have tried to assign ranks between 1 and 5 to the occupations in the abbreviated American classification of

Fig 4 SMR ($\pm$ standard error) for gastric and duodenal ulcer in married women in England and Wales plotted against their husbands' social class.

occupations. It may well be that some of our ranks underestimate or overestimate the true workload by one degree—for example, metal craftsmen deserving rank 3 instead of 4. In the present context they are not introduced as scientific proof but rather to illustrate the possibility that energy expenditure might be one environmental factor associated with the risk of developing peptic ulcer (fig 5).

The data of figure 5 may look convincing with respect to duodenal ulcer. Two important exceptions should be noted, however. Firstly, security guards show an unduly high prevalence of gastric and duodenal ulcer. In the American and English civilian defence service this may reflect the selective transfer of individuals who have developed disability due to peptic ulcer to less strenuous occupations. This explanation, however, does not apply to the British armed forces, which also showed increased mortality from both types of ulcer (in the American occupational mortality statistics, the armed forces were not included). Secondly, despite a presumably high energy expenditure in British miners,²⁵ they have a low mortality rate resulting from duodenal ulcer.

The association between energy expenditure and mortality seems to be stronger with duodenal than with gastric ulcer. The significant correlation between occupational mortality from gastric and duodenal ulcer could suggest that both ulcer types hold some of the precipitating environmental risks in common. Though on average the SMR for gastric ulcer also increases with increased workload, the gastric ulcer data show a pronounced scatter, indicating that additional factors must play a part. These factors seem to be related to the social status, and two hints support this contention. Firstly, the SMR for gastric

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Fig 5 SMR for gastric and duodenal ulcer plotted against workload of different occupations assigned a rank value between 1 (low) and 5 (high); same data as in table 2.

ulcer is more strongly associated with the social gradient than duodenal ulcer. Secondly, whereas the social class gradient is unequivocally preserved in the female mortality from gastric ulcer, it no longer exists in duodenal ulcer. This again may indicate that in duodenal ulcer the social gradient predominantly reflects the amount of physical work that, unlike the social gradient, is not transferred to married women.

In conclusion, the analysis of the occupational mortality in England and Wales and in the United States shows that mortality from both types of ulcer is rare among sedentary occupations and frequent among occupations associated with manual work. In duodenal ulcer the varying extent of energy expenditure among different occupations may be responsible for the different risk of contracting duodenal ulcer and dying from it. In gastric ulcer additional factors somehow associated with the social class seem also to be operating.

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