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THE MORTALITY FROM CANCER OF THE SKIN AND LIP IN CERTAIN OCCUPATIONS.

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CONTENTS.

INTRODUCTION.

METHOD OF CALCULATION OF PERCENTAGES.

DEATH CERTIFICATES TAKEN FOR EXAMINATION.

RESULTS :

- (1) Cancer of the Skin.
 - (a) Occupational Distribution of Total Mortality.
 - (b) Occupational Distribution according to Anatomical Site.
- (2) Cancer of the Lip.

DISCUSSION :

- Cancer of the Skin.
- Cancer of the Lip.
- Comparison of Cancer of the Skin and of the Lip.

SUMMARY.

THE data given below are derived from an examination of the death certificates of cases of cancer of the skin, lip, penis and scrotum in males from England and Wales for the 34 years 1911 to 1944 inclusive. In the publications of the General Register Office during the period in question (1911 to 1944) cancers of the penis and scrotum were included under the heading "Skin" during 1911 to 1916, and were recorded separately, but under a common heading, "Penis and Scrotum," during 1917 to 1922. In 1923 and subsequently the three forms were recorded under separate headings. For the purposes of this paper, the approximate numbers of deaths from cancer of the penis and scrotum during 1911 to 1916 were ascertained by interpolation from the data for 1917 to 1920. The whole number of certificates examined individually was over 22,000. This study was carried out on the general lines followed in the examination of death certificates of cases of cancer of the lung and larynx (Kennaway and Kennaway, 1936 ; 1947). The data illustrate the social differences in mortality from cancer of an exposed site which was studied by Stevenson (1923), and subsequently by Conrad and Bradford-Hill (1939).

The present paper deals with cases of cancer of the skin and of the lip, numbering 5915, in agricultural workers, miners and quarryers, and the professional classes. These three groups numbered 2,612,748 occupied and retired males aged 14 and over at the time of the last census in 1931. The coal miners form an interesting group for comparison with the professional classes, for the miner's daily bath, often obtained under very adverse conditions, secures cleanliness for about two-thirds of the time, while in other respects his skin receives very rough treatment. The agricultural workers, in contrast to the miners, are those most exposed to sunlight, which is known to be a carcinogenic factor. The populations engaged in these occupations, and their classification by the Registrar-General in orders and sub-orders, are shown in Table I. The data for cancer of the penis and of the scrotum will be dealt with in another paper.

TABLE I.—*Classification of Occupations, and Populations Engaged in Them.*

Class of occupation.	Registrar-General's Orders and Sub-orders.	Number of named and coded occupations.	Male population aged 14 and over, including retired. (1931 census.)
Agriculture	Order II	17	1,200,397
Mining and quarrying	Order III		
Coal and shale mines	Sub-order 1	7	939,378
Metalliferous mines and workings	" " 2	4	15,524
Other mines and quarries, brine and oil wells	" " 3	6	63,147
Professional occupations (excluding clerical staff).	Order XXV	33*	394,302
		67	2,612,748
			Occupied 2,439,509
			Retired 173,239

* In Table II this number is reduced to 28 by the pooling of some of the smaller groups.

METHOD OF CALCULATION OF PERCENTAGES.

In judging of the occupational incidence of any form of cancer it is, of course, necessary to correct for age distribution, for an occupation employing a large proportion of older men will yield more cases of cancer apart from any aetiological factors. The census returns (Registrar-General, 1938) give the age distribution, in 5- and 10-yearly periods, of the whole population of males, and also of those following each one of the recognized occupations, at the time of the census. The number of deaths attributed to cancer of the skin and lip occurring in the whole male population in each of these age groups during the years in question was obtained from the Statistical Reviews of the Registrar-General. By applying the death-rates at ages from cancer of the skin and lip in the general male population to the population at the corresponding age-period in each occupation, the calculated or expected number of deaths in the particular occupation can be obtained, and these can be compared with the number actually recorded. Such a comparison is by no means an exact one for skin cancer, because the death certificates dealt with included all cases with mention of skin cancer whether or not the certifier considered it to be the underlying cause of death. Since 1940 some of the deaths have been classified in the Registrar-General's statistics to an associated disease which the certifier thought more important; and even before that date not every death with mention of skin cancer was classified to that cause by the rules then in use. However, as the next section shows, 11 per cent of the certificates used in this study were

rejected for various reasons, so the correspondence between the expected and recorded deaths in different occupations may be regarded as close enough not to invalidate the conclusions reached, though the ratios of recorded to expected are probably in general rather too low.

The populations taken were those of the 1931 census, which is the last census taken, and is near the middle of the whole period in question.

DEATH CERTIFICATES TAKEN FOR EXAMINATION.

The aim of this selection has been to restrict the inquiry as far as possible to primary malignant growths of the epidermis, and of the lip, and to exclude (i) any tumours possibly congenital (e.g. angiomas and melanomas); (ii) any case, the description of which did not exclude sarcoma, nor cancer of an internal site spreading to the skin, nor metastases in lymph glands involving the skin, e.g. "cancer of the thigh," "cancer of the neck and face," "cancer of the face and antrum." Certificates of persons under 14 years of age were excluded. The forms of words in the certificates taken for examination, and in those rejected, may be summarized thus:

(a) *Retained*.—Cancer, carcinoma, epithelioma, rodent ulcer, malignant growth, malignant disease, malignant papilloma, malignant wart, malignant ulcer, or cancerous ulcer, of any part of the skin.

(b) *Rejected*.—(1) Any new growth qualified by "probable," "doubtful," or "query." (2) Sarcoma. (3) Any growth associated with lupus or attributed to X-rays. (4) Adenoma, adenocarcinoma, angioma, naevus, angio-epithelioma, naevo-carcinoma, pigmented or malignant mole, melanoma, dermoid tumour, xeroderma pigmentosum. (5) Any growth of groin, glands of groin, inguinal region or glands, or iliac glands. (6) Cancer, carcinoma or malignant disease of leg, thigh, hip, genitals, throat, neck, glands of neck, face, neck and face, urethra, anus, "pelvis and buttock," "shoulder and head," "epithelioma of neck," where skin is not mentioned.

This selection reduced the number of certificates for the occupations in question from 6665 to 5915, or by 11 per cent.

RESULTS.

1. *Cancer of the Skin.*

(a) *Occupational distribution of total mortality.*

The lower section of Fig. 1 shows the percentages, arranged in ascending order from left to right, for 41 occupations in which more than 5 deaths from cancer of the skin occurred in the 34-year period; this quite arbitrary limit in number of deaths is drawn to lessen sampling error. The percentage in 15 out of 16 professional occupations selected thus is below 100, while that in 9 out of 13 agricultural occupations is above 100, and in 5 is above 150. The percentage in 6 out of 12 mining occupations is above 100.

Table II shows the populations, and percentages, for each of the 67 occupations of the 5 orders and sub-orders (Table I) arranged in descending order of the percentages for cancer of the skin. More than one-half of the professional classes belong to Social Class I; the miners are about equally divided between

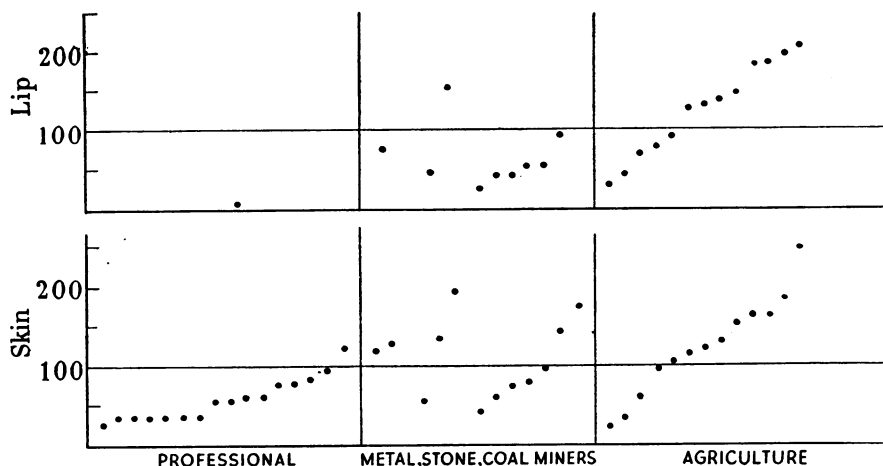


FIG. 1.—Percentages in 41 occupations based on all cases of Cancer of the Lip, and upon cases of Cancer of the Skin numbering more than 5 in any one occupation. Males. 1911 to 1944 inclusive. England and Wales.

Classes III and IV, while the agricultural workers are spread over Classes II to V, with a preponderance of Class IV.

Only one out of 28 professional occupations shows a percentage which is above 100, namely civil engineers and surveyors (121·3), who belong to Social Class I, and this profession appears to show a special liability to cancer of the lip also (p. 11). This occupation (53 deaths) may involve, especially in earlier life, exposure to carcinogenic agents. The occupations of mining engineers, and mechanical and electrical engineers, show no deaths from cancer of the lip, and low percentages for cancer of the skin, but the numbers of deaths (5 and 2 respectively) are small.

The high standard of cleanliness maintained by the coal miner at the end of his day's work, and his lack of exposure to sunlight, perhaps compensate for the various injurious factors, of which an account has been given by Knowles (1944), to which his skin is exposed. First-hand descriptions of the coal-miner's life are given in two recent books (Shaw, 1946; Agnew, 1947). But the very much lower incidence upon the professional classes shows that there are still other factors to which the miner is exposed which we cannot yet define. The mortality in the hewers and getters, who carry out much of the most severe work of the mine, is, if anything, lower (97·7 per cent) than it is in the general population. The percentage is below 100 in 5 coal-mining occupations, comprising 828,246 out of the 939,378 men, or 88 per cent of those engaged in the 7 divisions of the industry. The percentage in the whole coal-mining group is 93·2, while in the two other groups it is somewhat higher (metal miners 118·0, other miners and quarriers 101·4), and in all the miners together is 94·4.

The mining occupations offer a wide range of conditions. Some workers (quarriers; chalk, sand, clay and gravel pit workers) may be exposed to sunlight; however, the percentages in these groups show a very wide range (17·4 to 194·4). Other occupations (persons conveying material to the shaft in coal mines) may involve contact with lubricating oils, but actually this class of coal miner shows the lowest figure (46·0).

TABLE II.—Cancer of Skin and Lip. Males. England and Wales. 1911 to 1944. Populations, Social Classes, and Percentages. The Occupations in each Group are arranged in Descending Order of the Percentages for Cancer of the Skin.

Occupation.	Social class.	Population aged 14 and over, 1931 census.	Calculated deaths.		Total registered deaths.		Registered deaths as % of calculated deaths.	
			Skin.	Lip.	Skin.	Lip.	Skin.	Lip.
Professional engineers (civil engineering and surveying)	I	24,352	43.7	..	53	5	121.3	..
Mental attendants	III	12,361	10.8	..	10	2	92.6	..
Professional engineers (mining engineering)	I	3,086	6.2	..	5	..	80.7	..
Church, chapel, cemetery officials	III	5,810	21.1	..	17	4	80.6	..
Architects	I	10,151	21.0	..	17	1	77.6	..
Judges, stipendiary magistrates and barristers	I	3,632	11.7	..	9	..	77.0	..
Veterinary surgeons and practitioners	II	2,421	6.7	..	5	..	74.7	..
Sick nurses	III	4,106	4.1	..	3	..	73.5	..
Subordinate medical service	II	19,531	29.6	..	18	1	60.8	..
Ministers of other religious bodies	I	11,965	36.6	..	22	1	60.0	..
Laboratory attendants	III	8,001	1.7	..	1	..	58.8	..
Analytical and research chemists and other persons engaged in scientific pursuits	I	18,261	12.4	..	7	..	56.5	..
Painters, sculptors, engravers (artists)	II	10,899	21.4	..	12	..	56.0	..
Dentists	I	11,652	16.5	..	6	1	39.7	..
Roman Catholic priests and monks	I	4,060	7.9	..	3	..	38.0	..
Clergymen, Anglican Church	I	22,760	83.4	..	30	1	36.0	..
Teachers (not music teachers)	II	92,259	147.9	..	52	6	35.0	..
Itinerant preachers, Scripture readers, mission workers	II	4,845	11.4	..	4	..	35.0	..
Solicitors	I	17,853	52.2	..	18	1	34.5	..
Librarians, political association officials, industrial and trade association officials, social welfare workers	II	11,969	23.7	..	8	1	33.8	..
Physicians, surgeons and general practitioners	I	29,911	65.4	..	21	1	32.0	..
Teachers of music	II	5,191	13.4	..	4	..	29.7	..
Authors, editors, journalists, publicists	I	16,670	24.0	..	7	2	28.0	..
Chartered, incorporated, etc., accountants	I	14,567	19.1	..	5	..	26.0	..
Professional engineers (mechanical and electrical engineering)	I	12,089	14.6	..	2	..	13.7	..
Other professional occupations	..	1,378	2.3	..	..	..	..	..
Articled pupils and students	I	13,443	1.2	..	..	..	..	..
Ship designers and surveyors	I	1,079	2.3	..	..	..	..	..
Total professional classes	..	394,302	713.1	..	339	27	47.5	..
Social Class I	..	215,531	..	..	..	..	..	..
II	..	147,115	..	..	..	..	..	..
III	..	30,278	..	..	..	..	..	..
Other professional occupations	..	1,378	..	..	..	..	..	..
Total	..	394,302	..	..	..	..	..	..

TABLE II—(cont.).

B.—Mining Occupations.

Occupation.	Social class.	Population aged 14 and over, 1981 census.	Calculated deaths.		Total registered deaths.		Registered deaths as % of calculated deaths.		
			Skin.	Lip.	Skin.	Lip.	Skin.	Lip.	
(1) Coal and Shale Mines—									
Owners, agents, managers	II	4,583	12.0	5.5	21	..	175.0	..	
Other workers above ground	IV	106,549	124.1	55.4	175	..	141.0	97.5	
Hewers and getters	III	466,194	512.7	221.6	501	124	97.7	56.0	
Subordinate superintending staff	III	37,994	59.1	26.0	46	14	77.8	54.0	
Persons making and repairing roads	IV	70,875	115.1	52.2	86	20	74.7	38.3	
Other workers below ground	IV	91,425	125.2	55.3	80	24	64.0	43.4	
Persons conveying material to the shaft	IV	161,758	54.4	21.2	25	9	40.0	42.5	
		939,378	1,002.6	437.2	934	245	93.2	56.0	
(2) Metalliferous Mines and Workings—									
Other workers below ground	III	10,610	17.9	..	23	7	128.5	..	
Subordinate superintending staff	III	811	2.4	..	3	1	125.0	..	
Other workers above ground and in open workings	IV	3,895	6.7	..	8	1	119.4	..	
Owners, agents, managers	II	208	1.8	..	..	..	..	..
		15,524	28.8	12.4	34	9	118.0	72.7	
(3) Other Mines and Quarries—									
Subordinate superintending staff	III	1,987	3.6	..	7	..	194.4	..	
Stone miners, quarries	IV	33,458	41.4	18.2	57	28	137.7	153.4	
Owners, agents, managers	II	2,202	4.7	..	5	..	106.4	..	
Other mine and quarry workers	IV	3,146	3.4	Others	2	Others	58.8	Others	
Chalk, clay, sand and gravel-pit workers	IV	15,097	15.3	17.1	8	8	52.3	46.8	
Slate miners, quarries	IV	7,257	11.5	..	2	..	17.4	..	
		63,147	79.9	35.3	81	36	101.4	102.0	
Total mining and quarrying occupations		1,018,049	1,111.3	485.0	1,049	290	94.4	59.8	
Social Class II		6,993							
III		517,596							
IV		493,460							
		1,018,049							

TABLE II—(cont.).
C.—Agricultural Occupations.

Occupation.	Social class.	Population aged 14 and over, 1981 census.	Calculated deaths.		Total registered deaths.		Registered deaths as % of calculated deaths.	
			Skin.	Lip.	Skin.	Lip.	Skin.	Lip.
Gardeners	III	233,979	250.7	273.4	625	194	249.3	71.0
(Gardeners and gardeners' labourers)	..	285,343	328.6	307.8	650	205	198.0	66.6
Farm bailiffs	II	10,749	24.2	11.0	45	15	186.0	137.1
Shepherds	IV	11,352	26.6	12.2	69	25	165.4	205.1
Agricultural labourers	IV	361,097	711.4	327.0	1173	598	165.0	183.0
Estate labourers	V	6,496	16.8	7.5	26	11	154.8	146.9
Persons employed in charge of horses	IV	71,616	68.6	28.2	86	52	131.0	184.5
Agricultural machine, tractor proprietors, etc.	III	8,568	11.6	5.1	14	10	120.7	195.3
Farmers	II	260,374	768.1	348.7	861	250	113.6	71.7
Farm foremen	III	7,262	12.5	5.5	13	7	104.0	126.6
Foresters and woodmen	III	13,386	30.5	14.0	30	18	98.4	128.6
Persons employed in tending cattle, dairying, etc.	IV	63,898	56.6	24.4	35	19	61.8	78.0
Land and estate agents, managers	II	2,743	9.1	4.2	4	4	44.0	95.3
Gardeners' labourers	V	51,364	77.9	34.4	25	11	32.0	32.0
Other agricultural occupations	IV	23,872	32.2	14.1	9	6	23.0	42.7
Farmers' sons and relatives	II	72,885	15.6	5.6	..	..	..	..
Agricultural and forestry pupils	II	1,711	0.21	..	..	..	..	..
Fees and fruit pickers	V	45	0.1	..	..	..	..	..
Total agricultural occupations	..	1,200,397	2,099.7	1,115.3	2,990	1,220	142.4	109.4
Social Class II	..	..	348,462	..	..	..	..	..
III	..	..	263,195	..	..	..	..	..
IV	..	..	531,835	..	..	..	..	..
V	..	..	56,905	..	..	..	..	..
			1,200,397					

All arithmetical work in this table has been carried to one place of decimals because this seemed worth while when the figures were small. The result, however, is that in the totals there are certain large figures carried to one place of decimals (e.g. 1002.6). One hopes that this will not give an impression that a spurious accuracy is being attempted. Such figures are merely retained for consistency and ease of checking. The sampling error, in the registered deaths column particularly, will affect more than the first place of decimals.

In the agricultural group, the general high level of percentages is clear. Six out of 17 occupations, with a population of nearly 700,000, have percentages from 131 to 249; this last figure (gardeners) is the highest of all those recorded in this paper. The contrast between gardeners (249) and gardeners' labourers (32) is obvious. This difference, which appears also in regard to many other diseases, is discussed by the Registrar-General (1938, p. 79, and Table 4D, p. 307), who says, "The separation of agricultural labourers including shepherds from gardeners' and estate labourers, pea and fruit pickers was attempted in No. 93 and 94, Tables 4D, 6A, but the very low mortality figures for Group 94 (gardeners' labourers, estate labourers, pea and fruit pickers) for every cause suggests that the definition of these occupations on death certificates was not as precise as on census schedules, and no reliable conclusions can be drawn from this subdivision." One may suppose that the informant at death registration would often call the deceased a "gardener," when the man himself would have described himself as "gardeners' labourer" at the census. In view of this factor, the result of pooling the figures for the two occupations is shown in Table II; the percentage for cancer of the skin is then 198 in place of 249.

The figures for the registered deaths as percentages of the calculated deaths for each of the three classes (professional 47·5, mining 94·4, agricultural 142·4) have been included in Table II; the result, of course, depends largely upon the population of the larger groups, e.g., the figure for mining (94·4) is influenced by the large number (466,194) of hewers and getters (percentage 97·7).

A study of the social distribution of cancer of the skin in a large number of occupations in England and Wales in 1930-32 has been made by Ryle and Russell (1947).

The mortality from cancer of the skin and of the lip upon these groups of occupations may be examined in another way (Table III), namely by calculating the populations which produce one case of cancer in the period in question. (The factors used in calculating the standardized figures for deaths from cancer of the lip shown in Table III were derived from the census population for males over 14 in 1931, and the published figures for deaths from cancer of the lip in the period 1923-1943. The fact that these factors are applied to the occupational deaths in the period 1911 to 1944 is not thought to introduce an appreciable error.) The age distribution of the various groups must be considered, as an occupation employing a large proportion of older people will show a high incidence of cancer apart from any occupational factors. The results given by the standardized and un-standardized figures are shown in Table III. The number of professional workers producing one death from cancer of the skin (1163; 1549)

TABLE III.—*Occupational Mortality. Cancer of Skin and Lip.*

Occupational group.	Population. Males, occupied and retired, aged 14 and over. 1931 census.	Deaths, 1911 to 1944. Cancer of		Population producing one death from cancer of skin and cancer of lip.			
		Skin.	Lip.	Unstandardized.		Standardized.	
				Skin.	Lip.	Skin.	Lip.
Agriculture	1,200,397	2,990	1,220	401	878	516 = 1·0	1,590 = 1·0
Mining	1,018,049	1,049	290	970	3,510	780 = 1·5	2,872 = 1·8
Professional	394,302	339	27	1,163	14,000	1,549 = 3·0	20,644 = 12·9
Total of above groups	2,612,748	4,378	1,537	597	1,700	660	2,167
General population	14,050,209	19,087	8,481	736	1,657	736	1,657

is about three times as great as the corresponding figure for agriculture (401 ; 516) in both the standardized and unstandardized series, while the miners take an intermediate position (970 ; 780).

(b) *Occupational distribution according to anatomical site.*

The sites of cancer of the skin named on the death certificates were classified as follows :

Lower limb	Head and neck
Upper limb	Face
Trunk	Ear
	Site not stated.

The subdivision of the data into smaller groups, e.g. fingers, hand, forearm, and so on, might seem to give more information, but the sampling errors would be increased, and in such material the assignment to the smaller sites has not been carried out on any uniform system ; e.g. there would be no certainty that some cancers of the fingers had not been classed as of the hand.

The numbers of cancers at these sites in the three groups of occupations, and their percentage distribution, are given in Table IV and Fig. 2. The inferences which can be drawn from such percentages are, of course, very limited, in view of the effect of each item upon the others. The greatest difference between the

TABLE IV.—*Occupational Distribution of Cancers of the Skin, according to Site.*

	Agricultural occupations.			Mining occupations.			Professional occupations.	
	Deaths.	%.		Deaths.	%.		Deaths.	%.
Lower limbs . . .	119	4.0	.	68	6.5	.	32	9.4
Upper limbs . . .	398	13.3	.	50	4.8	.	15	4.4
Trunk	105	3.5	.	65	6.2	.	33	9.7
Head and neck . . .	167	5.6	} 73.5	66	6.3	} 78.1	15	4.4
Face	1524	51.0		578	55.0		169	50.0
Ear	505	16.9		176	16.8		52	15.3
Not sited	172	5.7	.	46	4.4	.	23	6.8
Total	2990	100.0	.	1049	100.0	.	339	100.0

upper and lower limbs is in the agricultural group, where the former gives the higher figure, which result one might attribute to exposure to sunlight. The percentages of head, neck and face together do not differ very much in the three groups, (73.5, 78.1, 69.7). The face may undergo considerable exposure to sunlight in the professional classes.

A study of the distribution of skin cancer according to site in Northern Ireland, in which a different classification of sites is adopted, has been published by Ryle and Russell (1947).

2. *Cancer of Lip.*

Fig. 1 provides a comparison of the percentages for cancer of the skin, and of the lip, selected and arranged in the same way, except that all cancers of the lip are included and not only those shown by occupation yielding more than 5 deaths. The number of fatal cases of cancer of the lip in the professional classes is so small (27 in 34 years in about 400,000 men) that these have been pooled

without calculation of percentages for the individual occupations ; the percentage for the whole group is then 8.4, which is the lowest figure obtained in all the investigations by this method carried out by some of the authors of this paper on cancer of the skin, lung, larynx, bladder and prostate. Fig. 1 and Table II

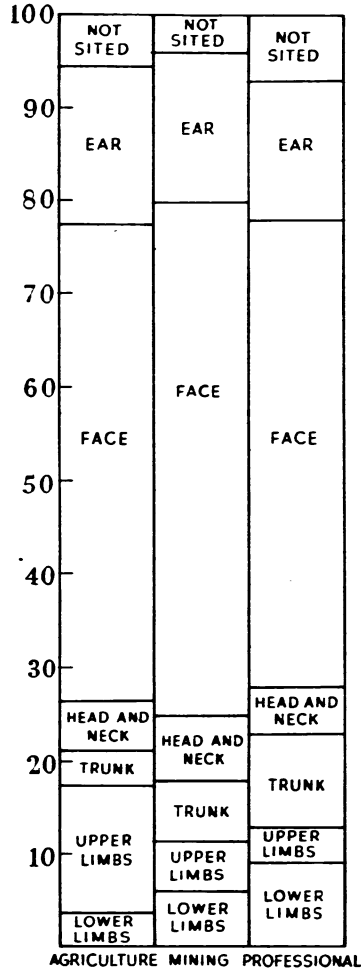


FIG. 2.—Occupational distribution of cancers of the skin according to site.

show that no one of the seven groups of coal and shale miners gives a percentage above 100 ; the figures are low (38.3 to 56.0 per cent) except in one large group which is the most exposed to light (other workers above ground, population 106,549), in which the incidence (97.5 per cent) is approximately the same as in the general population. The numbers in the other branches of mining (metal miners, other mines and quarries) are small for statistical purposes, but one notes that stone miners and quarrymen, many of whom must be exposed to sun-

light, are the only miners showing a percentage (153·4) which is above 100, and that this figure is of the order of that found in open-air workers. Eight of the 13 agricultural occupations represented in Fig. 1 show percentages above 100, the highest figure being 205 (shepherds).

The ratios in the last two columns of Table III show the much greater difference between the professional classes, and the miners and open-air workers, which is revealed by the figures for cancer of the lip in comparison with those for cancer of the skin.

The high incidence of cancer of the lip upon civil engineers and surveyors, in comparison with other professional workers, is shown by the following rough calculation, though the numbers are of course very small (Table V) :

TABLE V.—*Cancer of the Lip in Civil Engineers and Surveyors.*

	Professional Occupations.		Social Class I.
	Population.	Deaths from cancer of lip.	Population producing one death.
Civil engineering and surveying	24,352	5	4,870
Other professions	191,179	8	23,874
	<hr/> 215,531	<hr/> 13	

DISCUSSION.

Cancer of the skin.

The material summarized in Tables II and III, and in Fig. 1 shows that the incidence of fatal cancer of the skin is high upon agricultural workers, and very low upon the professional classes, while the miners take an intermediate position not far removed from that of the general population. The especial liability of the out-door workers is generally supposed to be due to exposure to sunlight (Blum, 1948).

The results given in Table IV and Fig. 2 show that the cancers of the whole region of neck, head, and face together, selected on the basis described above, make up from 70 to 78 per cent of cancers of the skin in all three occupational groups. The face is the only part of the body which is never clothed, and those parts which are shaved receive more thorough cleansing than do any others ; these characters are common to all social classes. The most notable result of this tabulation is the lack of any great difference between the three groups.

Another factor which may be of considerable importance is that the cosmetic effect of cancer of exposed portions of the skin and of the lip may attract attention sooner in richer subjects. Ingram (1947), in a comment on the paper by Ryle and Russell (1947), says : “ Prognosis in skin cancer depends largely upon the size of the lesion, and negligence is probably an important factor in relation to death from this cause. I should, in the ordinary course of events, expect neglect of a symptomless lesion to be higher in unskilled workers and labourers (IV and V of the Registrar-General’s social classes) than in the other groups.” Obviously one cannot assess the quantitative importance of this difference.

Data in equal detail for the distribution of skin cancer in married women whose husbands follow these occupations would be of great interest. The Decennial Supplement for 1931 shows that the comparative mortality from

cancer of the skin upon the Registrar-General's five social classes is similar in men and married women (Table VI), and the same phenomenon is shown by

TABLE VI.—*Social Distribution of Cancer of the Skin Among Men and Married Women.*

Cancer of Skin, 1930–1932. Standardized Mortality Ratio.					
Decennial Supplement, 1931.			Ryle and Russell.		
Social class.	Age 35 to 65.		Group.	Age 20 and upwards.	
	Males.	Married women.		Males.	Married women.
I and II .	72 .	92 .	A .	70 .	75 .
III .	95 .	89 .	B .	102 .	116 .
IV .	116 .	114 .	C .	160 .	152 .
V .	132 .	131 .	.. .	.. .	.. .

3 groups of occupations, A, B and C, showing a similar descent in the social scale, which were studied by Ryle and Russell (1947), using the Registrar-General's figures.

Such material provides a most valuable indication of environmental, as distinct from occupational, factors. For a discussion of this matter see p. 3 of the Decennial Supplement, 1931, Part IIa. The Registrar-General (p. 46) concludes that in the case of cancer of the skin, “. . . most of the differentiation arises from selective factors or from environmental conditions in the homes rather than from the occupations themselves . . . although the employment of a proportion, largest no doubt in Classes IV and V, of married women in textile occupations may be partly responsible for the mortality gradient for skin cancer.”

Cancer of the lip.

Material obtained from death certificates does not allow one to distinguish between cancers arising from the upper or lower lip, or from different portions of either of these. For a discussion of aetiological factors see Lane-Clayton (1930), and Willis (1948), who says (p. 294) “. . . The great preponderance of tumours of the lower lip is explained as due to direct exposure of its mucocutaneous junction to sunlight, while the corresponding part of the upper lip is relatively shaded.” Some factor in addition to exposure to sunlight is required to explain the differences shown in Table VII. Smoking, and especially pipe smoking, is, of course, regarded as another possible factor in the production of cancer of the lip. During the earlier part of the period (1911 to 1944) cigarette smoking was practically restricted to the richer classes, which produce fewest cancers of the lip; data on the change in this matter in recent years have been given elsewhere (Kennaway and Kennaway, 1947). The data collected by Lane-Clayton (1930) from the literature, summarized in Table VII, show the great preponderance of cancers of the lower lip, especially in males. Of 4839 cases where the sex was stated, 93·5 per cent were male. Of 3763 cases where the site was stated, the lower lip was involved in 94·2 per cent. Table VII records the data from 2676 cases in which sex and site for each individual were stated.

Lane-Clayton's data are derived from published series, which might be liable to some kind of selection, but the greater incidence upon males is con-

TABLE VII.—*Cancer of the Lip (Lane-Clayton, 1930).*

	Males.		Females.		
	Number.	%.	Number.	%.	% of Total.
Lower lip	2378	96.4	160	76.2	6.3
Upper lip	88	3.6	50	23.8	36.2
Totals	2466	100	210	100	7.8
	210				
	2676				

firmly by the unselected figures of the Registrar-General. In the years 1923–43 inclusive there were in England and Wales 5897 deaths attributed to cancer of the lip, of which 506, or 8.6 per cent, were in women.

The high incidence of cancer of the lip upon outdoor workers is shown by figures for England and Wales for 1911 to 1913, obtained by Lane-Clayton (1930) from Dr. Stevenson of the General Register Office (Table VIII).

TABLE VIII.—*Cancer of Lip. Males. England and Wales, 1911–13. (Lane-Clayton, 1930).*

	Deaths.	Death rate per million per annum.
All occupied and retired males	750	21.2
Agricultural labourers	128	79.8
Farmers	56	55.0

Comparison of cancer of the skin and of the lip.

The data given in Fig. 1 and Table II, and especially in the two last columns of Table III, show differences between the three occupational groups which are greater in the case of cancer of the lip than in that of cancer of the skin. These results, derived from certain selected occupations, may be compared with those given by the Registrar-General for the social distribution of these cancers in the whole male population (Table IX), which show a much steeper social gradient in the case of cancer of the lip than in that of cancer of the skin. The results

TABLE IX.—*Comparative Social Incidence of Cancer of the Skin and of the Lip. (Registrar-General, 1927, 1938.)*

Social class	Standardized Mortality Ratio.*				
	Males. England and Wales.				
	I.	II.	III.	IV.	V.
	Ages 20–65. 1921–23.				
Cancer of skin	63	73	100	120	150
Cancer of lip	30	50	70	140	170
	Ages 35–65. 1930–32.				
Cancer of skin	†(59)	75	95	116	133
Cancer of lip	†—	56	68	147	183

* Figures for 1921–23 are based on those for all occupied and retired males, while those for 1930–32 are based on those for all males (i.e. including unoccupied).

† Ratios based on less than 20 registered deaths are shown in brackets, or if both the registered and standard deaths are less than ten, omitted.

reported in the present paper are an attempt to carry this analysis further by a study of occupations providing different environmental conditions. The ratios of the populations producing one death from cancer of the skin, or of the lip (Table III), namely,

	Agriculture.	Mining.	Professional occupations.
Cancer of skin	1.0 .	1.5 .	3.0
Cancer of lip	1.0 .	1.8 .	12.9

indicate that in cancer of the lip, some anti-carcinogenic factors, very much more powerful than the protection from sunlight which the miner's life affords, are active among the professional classes. Ingram's "negligence factor" (see above) must be borne in mind, and also the susceptibility of the lip to defective supply of vitamin B₂ (riboflavin).

The predominantly high incidence of cancer of the skin upon agricultural workers is shown by the fact that these occupations employ 1,200,397 men, and of these, 1,021,857, or 91 per cent, follow occupations in which the percentage for skin cancer is above 100, while the corresponding population in the case of cancer of the lip is 489,526, or 43 per cent. This difference is due to the low incidence of cancer of the lip on the large populations of gardeners and farmers (total 545,717), and it is noteworthy that these occupations show the greatest difference in the incidence of these two forms of cancer. Of the 14 agricultural occupations which produce any cancers of the lip, 11 show agreement in regard to cancer of the skin and of the lip in that both percentages are either below, or above, 100. This suggests that the aetiological factors are to some extent the same in some occupations. The 3 occupations showing discrepancy in this respect are :—

	Registered per cent of calculated deaths.	
	Cancer of skin.	Cancer of lip.
Gardeners and gardeners' labourers	198.0 .	66.6
Farmers	113.6 .	71.7
Foresters and woodmen	98.4 .	128.6

Registered deaths as percentages of calculated deaths for skin cancer in the three main occupational groups considered (professional, mining, agricultural) are fairly evenly spread about the figure of 100 (47.5, 94.4, 142.4), but the corresponding percentages for cancer of the lip are much lower (though in the same order) (8.4, 59.8, 109.4). The fact that the highest of these is 109.4 raises the question, "What are the other occupational groups which show a percentage of over 100 for cancer of the lip?" The investigation will be pursued in this direction.

SUMMARY.

A study has been made of the death certificates of cases of cancer of the skin, and lip, in males engaged in agriculture, mining and professional occupations in England and Wales during 1911 to 1944. The mortality is highest in agricultural workers, and lowest in the professional classes, while the miners take an intermediate position. The special liability of outdoor workers to cancer of the skin and lip is generally attributed to exposure to sunlight, but the

data given here show that other factors are involved also. The incidence upon the coal miner is of especial interest in view of the cleanliness secured by his daily bath, and of his minimal exposure to sunlight. In occupations in which 88 per cent of the coal-mining population are engaged the liability to cancer of the skin is less than it is in the general population. Only one occupation of Social Class I (civil engineers and surveyors) shows a mortality from cancer of the skin higher than that in the whole population; hence these results illustrate the social distribution of cancer of exposed sites discovered by Stevenson. The comparative distribution of cancer upon the various parts of the skin does not show any great differences in the three groups; from 70 to 80 per cent of these cancers are situated on the head and neck. The difference between the professional classes on the one hand, and the miners and agricultural workers on the other, is much greater in the case of cancer of the lip than in that of cancer of the skin. The agricultural occupations in which the ratio of registered to calculated deaths is greater than 1 contain 91 per cent of the population in the case of cancer of the skin, and 43 per cent in that of cancer of the lip. Only 27 deaths from cancer of the lip were recorded in 34 years in men of the professional classes, who number about 400,000. Various aetiological factors are discussed.

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