to the conception, and stage C because the extent of neonatal jaundice is modified by external factors like exchange transfusion. Since the development of the human mind is a continuous process to which all three stages make their contribution, it is evident that in the final analysis each will modify the outcome in any given case of mental defect. We can merely express an opinion on which of these stages in the history of the individual is of decisive importance in order to focus attention on that stage when seeking preventive measures.

Summary

Aetiological problems are considered in high-grade (feebleminded and educationally subnormal) and low-grade (idiot and imbecile) mental defectives. Psychological, educational, and social factors are generally of greater aetiological significance in the former group and gross brain pathology more often operative in the latter. However, such brain pathology, in "diluted" form, also produces minor degrees of mental defect, while environmental influences have a bearing on severe defect. This is illustrated with reference to phenylketonuria, kernicterus, tuberous sclerosis, and the Sturge–Weber syndrome.

Of 44 educationally subnormal children, 32 (73%) had clinical abnormalities which could at least partially account for, or be related to, their mental retardation. In another 12 high-grade patients who came to necropsy, only 3 had no gross pathological lesions in the brain.

Nearly all low-grade mental defectives show brain abnormalities at necropsy. The cause of these is elucidated in a small minority only. In 200 consecutive hospital admissions of low-grade cases, a known cause operated in 19 (9.5%) and a probable cause in another 8 (4%). Other factors were implicated in 111 (55.5%) and none in the remaining 62 (31%).

Of the 200 cases 46 (23%) were instances of mongolism. The condition is tentatively attributed to a biochemical error in the mother, which becomes more manifest with increasing age and leads to faulty organogenesis in a predisposed foetus. Metabolic studies of mothers should be undertaken in this connexion.

Of the remaining 154 admissions in our series, 122 (79%) had gross physical signs.

Factors productive of mental deficiency are briefly considered in terms of their operation before conception, during pregnancy, and post-natally.

We are grateful to all our colleagues at the Fountain Hospital for help and advice. Dr. E. A. Brown had done some preliminary work on the data which we presented from our records during the period when he held the Isaac Ettinger Clinical Research Fellowship, which is now held by one of us (J. M. B.).

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LUNG CANCER AMONG WHITE SOUTH AFRICANS

BY

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In 1947 I emigrated from Liverpool, where bronchial carcinoma was common, and settled in Port Elizabeth, in the Eastern Cape. South Africa has a white population of just over 3,000,000, and their average family income is over £1,400 a year. The white population receives a high level of medical attention from South Africa's 8,000 doctors. For many years there have been medical schools in Johannesburg, Capetown, and Pretoria, and there are specialist thoracic surgeons in all the main cities. In a busy consultant and hospital practice, however, I was surprised to find that I rarely saw a patient with bronchial carcinoma, though other forms of cancer appeared to be as common as in Britain. The low incidence of bronchial carcinoma apparent in Port Elizabeth was particularly surprising because cigarettes were cheap (3s. for 50 was an average price), and most men appeared to be heavy smokers. Indeed, statistics of cigarette consumption show that the white South African has been by far the heaviest cigarette smoker in the world for many years. In view of the reports from other countries (Doll and Hill, 1950, 1952, 1954, 1956 ; Hammond and Horn, 1954 ; Stocks and Campbell, 1955 ; Medical Research Council, 1957) suggesting that cigarette smoking and lung cancer were associated, I felt that the lung cancer mortality among South Africans was particularly worthy of closer investigation.

Lung Cancer Mortality in South Africa

The incidence of bronchial carcinoma in South Africa was not known exactly before this study, because the South African Bureau of Census grouped together deaths from cancer of the trachea, bronchus, and pleura under the World Health Organization Classification of Diseases code number 162 (before 1949 the code number was 109). I therefore decided to investigate death certificates that had been codified under these numbers. The Minister for the Interior and the Director of the Bureau of Census and Statistics and his staff gave me every assistance. All information on death certificates is filed on Hollerith cards and all cards of the relevant code

number for the 10-year period 1947 to 1956 were decoded. They provided the following information: sex, age, place of death, place of residence, country of birth, occupation, and the number of the death certificate.

With this information, and with the assistance of the staff of the Census Bureau, I examined the relevant death certificates, deleting from the lists the few deaths from respiratory cancer other than from bronchial carcinoma and a small percentage of errors in coding (2%). The standard of diagnosis and certification was high, and in 88% of the deaths the diagnosis of bronchial carcinoma had been verified by bronchoscopy and biopsy, by thoracotomy, lobectomy, or pneumonectomy, and very often by necropsy. The remainder had been investigated by *x*-ray studies, often a bronchogram. Special investigations are detailed on the death certificate. In only 15 cases since 1949 was no decision reached on whether the lung cancer was primary or secondary (code number 163). All such cases are queried by the medical assessor. Most of the lung cancer patients had been investigated in the cities, where the hospitals concerned co-operated in permitting me to study the case records of these patients.

In order to calculate the lung cancer mortality rates per 100,000 living, the Census Bureau processed the 1951 census cards and broke down the population figures into Union-born, British immigrant, and other immigrant, in age-groups, for each of the five largest cities, for all other urban and periurban areas taken together, and for the rural districts. None of these figures was previously available. The 1951 census figures provide a good average figure for the population during the period 1947 to 1956, and particularly for immigrants over the age of 45 years, since not many immigrants over that age came to South Africa between 1947 and 1956.

Table I shows for both male and female white South Africans the deaths from all causes, the number of lung cancer deaths, and the lung cancer death rate per 100,000 estimated by the Census Bureau to be living for each of the years 1947 to 1956. It can be seen that the death rate from lung cancer among men per 100,000 living has doubled during the 10-year period.

The increase in lung cancer death rates among males in South Africa is unlikely to be due primarily to improved diagnostic facilities: instead it would seem to be a genuine increase, because the level of medical attention for the white population of all social groups during this period was continuously high, with free hospitalization and treatment for those who could not afford fees as private patients. Had there been a marked change in the standards of diagnosis during these 10 years, this would have been reflected in an increase in the rates for females, but very little increase occurred in these rates during this period. It would therefore seem fair to conclude that most of the increase in recorded lung cancer among men in South Africa during the period 1947–56 has been real.

TABLE I.—*Lung Cancer Rates for White South Africans*

Year	Males			Females			
	Total Deaths	Lung Cancer Deaths	Lung Cancer Death Rate per 100,000 Living	Total Deaths	Lung Cancer Deaths	Lung Cancer Death Rate per 100,000 Living	
1947	12,093	143	11·7	8,917	51	4·2	4·5
1948	12,906	146	11·6	9,511	59	4·7	
1949	13,069	171	13·3	9,598	57	4·5	
1950	12,878	193	14·8	9,839	77	5·9	
1951	13,360	246	18·5	9,949	68	5·1	
1952	12,853	250	18·5	9,315	69	5·1	
1953	13,589	278	20·2	9,976	79	5·7	
1954	14,047	333	23·8	10,059	72	5·1	5·3
1955	13,373	329	23·0	9,640	62	4·3	
1956	14,493	357	24·6	10,488	94	6·5	

The next step was to analyse the deaths due to lung cancer from 1947 to 1956, not only according to age but also according to country of birth and place of residence at the time of death. This analysis was particularly necessary because it was known that the lung cancer rate was higher in the cities than in the country, and also that British immigrants tended to settle in the cities. Without this analysis, it would not have been possible to determine how far a higher lung cancer mortality rate among British immigrants than among Union-born reflected some effect of urbanization and how far it reflected something peculiar to the immigrants. From the information given on the death certificates it was possible to make the required analysis, and the resulting figures, expressed as lung cancer mortality rates per 100,000 living in 1951, are given in Table II.

In order to bring out the difference between the lung cancer mortality rates of Union-born white men and immigrants from England, Wales, and Scotland the actual deaths of British immigrants during the years 1947 to 1956 have been compared with the number of deaths that would have been expected had the British immigrant population been subject to the same lung cancer mortality rate as the Union-born white men in the corresponding five-year age-group and in the same area. The resulting figures, summarized into the two age-groups 45–64 years and 65 and over, are given in Table III. Corresponding figures for male immigrants from other countries are also shown.

From this table the very striking fact emerges that, while the difference between the actual deaths from lung cancer among British male immigrants aged 65 and over and the number of deaths expected had they been subject to the lung cancer mortality experience of Union-born white men is not statistically significant, the lung cancer deaths among British immigrants aged 45–64 were 44% higher than the number of deaths that would have been expected on the same hypothesis—a difference that is highly significant. Moreover, the excess mortality among British male immigrants who died from lung cancer aged 45 to 64 occurred in each of the five largest cities, in the other urban areas, and in the rural areas, and therefore at all levels of urbanization. While British immigrants tend to settle in the cities, as already mentioned, where a higher lung cancer mortality rate than in rural areas normally occurs, the excess mortality among British male immigrants aged 45–64 is clearly not attributable to this factor. On the other hand, the deaths from lung cancer among male immigrants from other countries in both age-groups did not exceed the number expected on the basis of the experience of Union-born white men.

The lung cancer rate per 1,000 deaths is also much higher for British immigrants in the age-group 45–64 years in each of the large cities and in the rest of the country. In South Africa as a whole the lung cancer rate reaches its peak in the 70–74 age group, whereas in England and Wales the peak incidence is in the 65–69 age group (Table II). Eastcott (1956) showed that in New Zealand the peak incidence was also later than in England and Wales. Among British immigrants the rate at age 75–79 is about the same as at age 60–64.

The date of entry into South Africa of British immigrants who died from lung cancer has been

TABLE II.—*White Male Lung Cancer Mortality Rates per* 100,000. *Annual Average,* 1947–56 (*Mortality rates based on fewer than* 10 *deaths during the period* 1947–56 *are enclosed in parentheses*)

	45–	50–	55–	60–	Total 45–64	65–	70–	75–	80–	Total 65+
Johannesburg:										
Union born	19	70	120	180	72	232	320	(199)	(94)	234
British immigrants ..	(48)	115	101	233	117	209	213	238	(179)	213
Other ,, ..	(33)	49	111	139	75	314	170	188	(113)	219
Cape Town:										
Union-born	36	95	79	141	76	190	148	(145)	(39)	153
British immigrants ..	(55)	(93)	228	222	145	191	139	198	(241)	181
Other ,, ..	(31)	(23)	(51)	(145)	56	(56)	(126)	(159)	(133)	112
Durban:										
Union-born	50	78	199	229	111	282	394	(387)	(90)	308
British immigrants ..	(44)	139	286	259	178	307	261	350	305	300
Other ,, ..	(47)	(46)	(139)	(242)	114	(144)	(199)	(211)	(561)	229
Pretoria:										
Union-born	(26)	74	113	127	71	214	(178)	(135)	(47)	169
British immigrants ..	(55)	(52)	(195)	(201)	118	(151)	(157)	(196)	(0)	149
Other ,, ..	(56)	(71)	(0)	(50)	(45)	(53)	(353)	(177)	(114)	179
Port Elizabeth:										
Union-born	(13)	(65)	(65)	(124)	53	(214)	(88)	(331)	(0)	175
British immigrants ..	(43)	(142)	(203)	(130)	125	(236)	(127)	(96)	(377)	(181)
Other ,, ..	(0)	(64)	(0)	(0)	(20)	(0)	(286)	(179)	(370)	(169)
Other urban areas:										
Union-born ..	15	43	55	115	48	114	133	78	58	105
British immigrants ..	45	58	93	95	71	125	134	134	(34)	119
Other ,, ..	(14)	(28)	100	170	68	(67)	90	(115)	(106)	89
Rural areas:										
Union-born	10	19	38	62	30	92	74	68	77	82
British immigrants ..	(0)	(79)	(22)	285	94	(72)	(117)	(30)	(93)	82
Other ,, ..	(0)	(18)	(59)	(109)	(38)	(80)	(203)	(207)	(59)	139
Total:										
Union-born	17	45	63	103	50	125	127	93	65	112
British immigrants ..	44	91	144	187	112	176	168	189	143	172
Other ,, ..	25	38	89	149	67	145	154	165	148	152
Total	20	49	75	120	58	137	142	130	93	132

For comparison, the male lung cancer deaths (International List Nos. 162 and 163) in England and Wales in 1947–56 per 100,000 men living in 1951 were:

	45–	50–	55–	60–	Total 45–64	65–	70–	75–	80–	Total 65+
Age: Rate per 100,000 ..	57	116	185	233	135	260	228	180	118	219

provided wherever possible by the South African Population Registrar. The majority of those who died between the ages of 45 and 64 years came to South Africa after 1920, but of those who died aged 65 or over more than 80% emigrated from Britain before 1910—that is, before lung cancer also became common in Britain. There had in fact been a heavy immigration of white settlers to South Africa between 1890 and 1920, and 32% of the total deaths of males over 45 years for 1947 to 1956 were among immigrants. Two-thirds of these were from England, Wales, and Scotland, and the remaining third came from all over the world, with 30% from Eastern Europe.

TABLE III.—*Actual and Expected Number of Lung Cancer Deaths,* 1947–56

	British Immigrants				Other Immigrants			
	Aged 45–64		Aged 65+		Aged 45–64		Aged 65+	
	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths
Johannesburg ..	58	44·7	73	82·5	59	67·5	70	75·7
Cape Town ..	48	28·5	49	39·0	18	26·6	19	24·9
Durban ..	62	47·3	89	96·4	19	22·6	20	28·1
Pretoria ..	8	5·5	10	11·2	5	8·6	10	8·9
Port Elizabeth ..	10	4·9	8	7·5	1	2·8	4	4·3
Other urban areas	58	44·9	84	74·8	47	35·3	30	35·8
Rural areas ..	18	6·0	14	13·6	8	3·9	15	8·6
Total ..	262	181·8	327	325·0	157	167·3	168	186·3
χ^2	56·1		5·5		11·7		10·0	
P	<0·000001		Between 0·5 and 0·7		Between 0·1 and 0·2		Between 0·1 and 0·2	

Cigarette Consumption

Statistics of cigarette consumption by white adults in South Africa and by the adult population in other countries, year by year, have been published by Todd (1957). The figures in Table IV are sufficient to show that the white South African has long been the highest consumer of packeted cigarettes in the world.

Moreover, cigarette consumption in South Africa is almost as high for white males in the country areas as in the cities and towns. A nation-wide survey (2,672 adult whites interviewed) carried out in 1954 on smoking habits (Franklin Research (Pty.) Ltd., 1954) showed that, though more men smoked in the cities than in the rural areas, there was little difference between the average number of cigarettes smoked daily by those who did smoke. For instance, 64.7% white males aged over 35 (572 interviewed) smoked packeted cigarettes in the cities and 54% of white males aged over 35 (331 interviewed) in the rural areas. Over the age of 35 the city man who smoked averaged 24.2 cigarettes daily and the country man averaged 23.6 cigarettes daily. In the four provinces the highest cigarette consumption was in the Transvaal, particularly among Afrikaans-speaking men in the towns.

On the basis of the national average levels of cigarette consumption, the higher lung cancer mortality of British male immigrants in South Africa, compared with white Union-born men of corresponding age, is not to be attributed to greater consumption of cigarettes by the former. It will, of course, be necessary to confirm that

the British immigrants, both those who died from lung cancer and those who did not, in fact smoked no more than the Union-born men, and an inquiry into this is under way. On the assumption, however, that the ratio of the national levels of cigarette consumption per head in South Africa and Britain is not unrepresentative of the ratio of past cigarette consumption by Union-born men and British immigrant men dying of lung cancer, it is natural to ask whether the excess lung cancer mortality of the latter group could be due to differences between the tobaccos used in the manufacture of cigarettes in South Africa and Britain respectively.

For many years almost all the tobacco used in the manufacture of cigarettes in South Africa has been flue-cured tobacco grown in South Africa and Rhodesia. In Britain before the last war cigarettes were mainly made from flue-cured tobacco grown in the U.S.A. While flue-cured tobacco thus formed the basis of cigarettes in both countries in which the tobacco was grown, the insecticides used and the chemical constituents of the leaf and of the resulting smoke have not been entirely identical.

U.S. flue-cured tobacco, however, also forms the basis of cigarettes smoked in the U.S.A., and the lung cancer mortality rates in that country are much less than in Britain. Indeed, according to the figures of Dr. Case (1958) the male mortality rates from cancer of the respiratory system in the U.S.A. are not very different from those in South Africa. Further, many of the British immigrants who died from lung cancer came to South Africa in their twenties, and those who had smoked cigarettes before emigrating would have smoked British cigarettes for only a few years. Moreover, British immigrants who died at the age of 65 or over and who smoked cigarettes prior to leaving Britain would have smoked cigarettes generally similar to those smoked by later British immigrants who died at a younger age from lung cancer, and there were no obvious changes in British cigarettes between 1910 and 1920 likely to account for the different lung cancer mortality among the two groups of British immigrants in relation to that of Union-born men. For these reasons it would seem that differences between the tobacco smoked in the form of cigarettes in South Africa and Britain are unlikely to be an important factor in explaining the differences between the lung cancer mortality of the different groups.

Further, there were greater differences between the tobacco used in cigarettes manufactured in other European countries before the last war—where, for example, air-cured tobacco was widely used—and the tobacco used in the manufacture of South African cigarettes than there were between the tobacco used in the manufacture of South African and British cigarettes. Consequently, if differences in the tobacco were important, it might be expected that a considerable difference in one direction or the other would have been found between the lung cancer mortality experience of Union-born men and of male immigrants from countries other than Britain. Yet the differences between the lung cancer mortality among these two groups are, as already shown, not significant. The most likely conclusion would seem to be that the effect, if any, of cigarettes smoked by both British and other immigrants prior to emigration differed little from the effect of cigarettes smoked by Union-born men at the same age.

In South Africa, rural as well as urban males are heavy consumers of cigarettes. Consequently, the higher lung cancer mortality rate in the large South African cities, and particularly Durban, compared with the rate in rural areas is not to be explained by the differences in the level of cigarette consumption. The slightly higher urban cigarette consumption could account for only a small part of the very much higher lung cancer rate in the urban areas.

When the smoking habits in different countries are examined in detail, many differences are inevitably found. Hammond (1958), for example, has drawn attention to differences in the length of butt to which cigarettes are smoked in the U.S.A. and the Netherlands, and Doll, Hill, Gray, and Parr (1959) have made a similar study in Britain. In South Africa two recent independent surveys have been made of cigarette butts. In a Transvaal survey 2,194 filter-tipped butts gave an average length of 26 mm. and 671 plain and cork-tipped non-filter butts an average length of 24 mm. In the Cape, 1,480 filter-tipped butts gave an average length of 25 mm. and 603 plain and cork-tipped non-filter butts an average length of 23 mm. Though the butt lengths are longer on average than those reported in Britain, there is a higher cigarette consumption among white South Africans than in Britain.

TABLE IV.—*Packeted Cigarettes Smoked per Adult per Annum*

	1920	1925	1930	1935	1940	1945	1950	1955
South Africa (white population) ..	1,540	1,500	2,100	2,090	2,500	3,180	3,630	3,510
U.S.A.	610	1,000	1,370	1,450	1,820	2,560	3,250	3,280
Irish Republic ..	640	710	930	1,210	1,440	1,550	2,510	2,620
U.K.	1,080	1,080	1,380	1,590	2,020	2,600	2,160	2,500

Atmospheric Pollution

The increasing lung cancer mortality rate among the South-African-born follows the rapid industrialization and growth of the cities during the past 40 years. The lung cancer rate in the large cities is very much higher than in the rural areas, except among the British immigrants, who have a comparatively high rate in the rural districts. It has been thought in the past that the larger South African cities had a relatively clean atmosphere in comparison with cities in other countries. However, Table V shows that Johannesburg, Pretoria, and Durban in some respects have a polluted atmosphere comparable to industrialized areas in Britain. Furthermore, the pollution is increasing; for instance, smoke pollution in the centre of Pretoria

TABLE V.—*Measurements of Air Pollution in South Africa and in England*

	Smoke in mg./cubic Metre		Insoluble Solid Deposits in g. per Month on 1-ft Diameter Circle	
	Summer	Winter	Summer	Winter
Pretoria	0·12	0·23	0·27	0·27
Johannesburg:				
City	0·17	0·29	0·60	0·41
Suburbs ..	0·08	0·18	0·23	0·14
Durban	0·13	0·18	0·36	0·28
Leicester (England)	0·06	0·13	0·14	0·20
London:				
Kensington ..	0·12	0·24	0·22	0·28
St. Pancras ..	0·16	0·30	0·21	0·24

Note.—The Pretoria values are the result of four years' observation on a grid of six stations. The Johannesburg values are given for both the city and the suburbs; the higher wind velocity in summer increases the dust from the mine dumps. The Durban values are averaged from three stations, of which one is almost outside the town proper. The British values are from the "Atmospheric Bulletin, 1958," of the Fuel Research Station of the D.S.I.R.

has increased by 20% per annum during the last four years (personal communication from E. C. Halliday, of the Physical Research Laboratories, C.S.I.R.).

Durban

The male lung cancer death rate in Durban is higher than the corresponding rate in any other city in South Africa for both Union-born and British immigrants, and the male immigrants from Britain who resided in Durban have the highest lung cancer incidence of all groups in South Africa. Between the ages of 45 and 64 years during the five-year period 1952 to 1956 more than 1 in 9 (40 out of 339), and in 1956 more than 1 in 6 (12 out of 69), of all male deaths among the British immigrants in Durban were from lung cancer. During the 10-year period 1947 to 1956 the death rate from lung cancer among British immigrants in Durban between the ages of 45 and 64 years was more than five times higher than the rate among the South-African-born living in rural districts, and twice as high as the rate in British immigrants who had settled in the small towns and rural areas (Table II).

The high mortality from lung cancer in Durban in both Union-born and British immigrants compared with other areas can hardly be attributed to higher cigarette consumption, because the consumption per head is not higher in Durban than in the other cities. The Survey of Family Expenditure (1955) carried out by the Bureau of Census in 1955 showed that a Johannesburg family spent on average 49.5s.; a Durban family 47.2s.; and a Capetown family 46.3s. a month on cigarettes, cigars, and tobacco. The 1954 smoking survey (Franklin Research (Pty.) Ltd., 1954) also showed that the white Durban male smoked no more than his equivalent age and race group in the other large cities. There is a small chromium factory in Durban, but it has few white employees, and, though chromium dust is known to be a cause of lung cancer, this factory is not responsible for the high mortality from lung cancer, as none of the lung cancer patients had worked there.

Durban has a hot humid climate and little wind; it has fewer sunny days in the year than the other South African cities. The smoke in Durban per cubic metre compares with districts of London (Table V). The smog does not show the large diurnal variations it does in Johannesburg and Pretoria. Port Elizabeth, on the other hand, is renowned for its wind, and this keeps the air clear. Capetown's wind, which has been called the "Cape Doctor," does not blow as continuously as Port Elizabeth's.

Other Factors

The Union-born citizens of Durban and Port Elizabeth are chiefly of British stock. This enables a broad comparison to be made of the lung cancer mortality experience of Union-born descendants of British immigrants, of British immigrants to South Africa during the 20 or so years up to 1910, and of British immigrants since 1920, on the assumption that the experience of these three groups is approximately represented by the figures for Union-born, British immigrants aged 65 and over, and British immigrants aged 45–64 respectively. As already mentioned, Table II shows that the first two sets of figures are very close but that there are wide differences between the first and third sets of figures. On the other hand, there is considerable similarity in the lung cancer mortality experience of Union-born men of Afrikaner stock (represented particularly in the Union-born men in "Other Urban Areas" and "Rural Areas") and British immigrants aged 65 and over, between whom there might be expected to be greater genotypic differences.

The histories of the British immigrants who died from bronchial carcinoma, their smoking habits, occupations, length of residence in South Africa, past respiratory history, etc., will be analysed in a subsequent paper and compared with the Union-born men who died from lung cancer. It is interesting to note here, however, that most of the British immigrants came from cities rather than the rural areas in Britain. It should also be added that many of the patients, Union-born and immigrant, who died from lung cancer had suffered from recurrent bronchitis.

Conclusions

The conclusions which appear to emerge from this study include the following:

1. White male South Africans have long been the heaviest cigarette smokers in the world, and yet they have a relatively low lung cancer mortality rate.

2. British male immigrants to South Africa who died between the ages of 45 and 64 had a much higher lung cancer rate than either white Union-born men or male immigrants from other countries for the same age groups. As most of the British immigrants came to South Africa before reaching middle age, British cigarettes are likely to have formed only a small percentage of the total cigarettes smoked by those dying of lung cancer at these ages. It is therefore unlikely that the difference in lung cancer mortality experience in these age groups is attributable to differences between South African and British cigarettes; and this would seem to be broadly confirmed by the fact that the lung cancer mortality rate in the U.S.A. is much lower than the rate in Britain, though the same type of tobacco formed the basis of cigarettes in both countries.

3. The excess lung cancer mortality among British male immigrants, as compared with Union-born white men, is found only in those dying of lung cancer under the age of 65. Above that age there is no significant difference between the lung cancer mortality rates in the two groups. This suggests, therefore, that the greater liability of the more recent British immigrants to lung cancer is a relatively new phenomenon, and that the immigrants were exposed to the aetiological factor or factors concerned before they left Britain.

4. The higher incidence of lung cancer among residents in South African towns, and in Durban particularly, as compared with the incidence among residents in rural areas, would seem to be strong evidence that atmospheric pollution is an important factor. If so, it is equally likely that the higher incidence among the more recent British immigrants may again be connected with the atmospheric pollution to which they were exposed before emigrating. It is also a matter of interest that a preliminary New Zealand study showed that there was a higher rate of lung cancer among British immigrants there than in the New-Zealand-born (Eastcott, 1956).

Bronchial carcinoma must result from the total effect of genetic and environmental factors, and it is clear that the environmental factors are chiefly responsible for the present high incidence of the disease. There is evidence from other studies that cigarette smoking is such a factor. However, the relatively low incidence of lung cancer generally among the heavy-smoking South African men, the higher and rapidly rising incidence in the growing cities, and the high incidence in the younger age group of immigrants from Britain, found in the present study, suggest that the air pollution which occurs in modern industrial life—smoke, smog, traffic fumes,

etc.—may be a major factor responsible for the alarming increase of lung cancer in South Africa and Britain, and presumably elsewhere.

Summary

Analysis of the 1947–56 male lung cancer deaths in South Africa by age, country of birth, and place of residence has shown that among those dying aged 45 to 64 (but not among those dying aged 65 and over) British immigrants have had much higher lung cancer mortality rates than Union-born men or immigrants from other countries. Further, among all three categories in South Africa—Union-born men, British male immigrants, and male immigrants from other countries—the lung cancer mortality rates have increased approximately with the level of urbanization and industrialization. Neither the differences between the lung cancer mortality rates of these three groups nor the urban/rural gradient can be attributed to differences in smoking habits. Instead, both would seem to have been due to the exposure of the men concerned to different degrees of atmospheric pollution. The excess lung cancer mortality among British immigrants aged 45–64 would seem to have been due to their exposure in Britain to some form of atmospheric pollution to which those emigrating before 1910 had not been subject. The urban/rural lung cancer mortality gradient in South Africa would appear to reflect the increasing atmospheric pollution that is encountered in passing from rural areas to areas of increasing industrialization.

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In his Annual Report for 1958 on Industrial Health, published on July 29, the Chief Inspector of Factories refers to the constant watch that is kept on health problems which may have their origin anywhere in industry. In the main, this is done by the Medical Branch in conjunction with the general inspectorate and other specialist branches; additional information is obtained from members of the medical professions specializing in industrial health. But, the Chief Inspector feels, "There are members of the medical profession outside this specialized field who could add to the available knowledge on health hazards by reporting to the Medical Branch cases of interest coming to their notice in which occupational factors may be involved." This is the second occasion on which a separate report on industrial health has been published. As before, it reviews the events of the year, and describes significant cases of industrial diseases, poisoning, and gassing. Special chapters deal with occupational cancer, and with a survey on medical supervision which was carried out in more than 200 factories. (H.M.S.O., Cmnd. 811, price 3s. 6d. net.)

RESULTS OF SURGICAL TREATMENT OF CANCER OF THE STOMACH

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In the Soviet Union the treatment of cancer of the stomach is one of the most vital problems of oncology, for it is the commonest malignant tumour, constituting about 30% of all malignant growths. So far surgery has been the only method of treatment. The names of A. G. Savinich, E. L. Beresov, B. V. Petrovsky, and V. I. Kazansky have been especially associated with the surgical treatment of cancer of the stomach in the Soviet Union, but many problems remain unsolved. Late results of the treatment are very unsatisfactory.

The experience in our clinic is very small, but a critical review of the late results of treatment allows certain conclusions to be drawn. During the period 1952 to December 1, 1958, 722 cases of cancer of the stomach were treated (Trapeznikov, 1957)—451 underwent radical operations (Table I), 254 had non-radical operations (laparotomy, palliative anastomosis, gastrostomy), and in 17 other operations were performed. The resectability rate was 62.4%.

In 66 of the 298 resections of the lower part of the stomach the so-called combined operation was performed (with resection of the adjacent organs). This was also done in 56 of the 123 patients submitted to total gastrectomy. The resections of the lower part of

TABLE I

	No. of Cases	Died After Operation
Partial resection of lower part ..	298	20 (6·7%)
,, ,, ,, upper ,, ..	30	10 } (24·1%)
Total gastrectomy	123	27 }
Total ..	451	57 (12·6%)

the stomach were of the Polya–Reichel type, but in a number of cases anastomosis was performed according to Finsterer (13 patients) and Billroth I (21 patients). As a rule gastrectomy was completed by the construction of an anastomosis between the oesophagus and the jejunum on a long loop, with an interintestinal anastomosis by the method of Braun (1892–3). Under favourable anatomical conditions (with a mobile duodenum and a long end of the abdominal oesophagus) anastomosis was performed between the oesophagus and the duodenum (23 patients). Gastrectomy was preferably done through the abdominal approach, but when the tumour infiltrated the oesophagus a left thoracic approach was employed. A follow-up was made in 440 (97.5%) of the 451 patients on whom radical operations had been performed, and 33% of the patients survived for five or more years after the operation. This figure is similar to that obtained by other authors (Berkson, Walters, Gray, and Priestley, 1952).

A number of questions arise. First, whether extension of the operation to include resection of the adjacent organs improves the results. In our clinic the