

# REGIONAL VARIATIONS IN THE FREQUENCY OF BANTU OESOPHAGEAL CANCER CASES ADMITTED TO HOSPITALS IN SOUTH AFRICA

A. G. OETTLÉ, *Cancer Research Unit of the National Cancer Association of South Africa, South African Institute for Medical Research, Johannesburg*

In a number of centres in Africa it has become apparent that cancer of the oesophagus, once a rare disease in the Bantu, is now very common. References to this increase are all of later date than 1950, as evidenced in South Africa by a succession of reports from the Transvaal,<sup>1,2</sup> East London,<sup>3</sup> Natal,<sup>4</sup> Johannesburg,<sup>5,6</sup> Durban,<sup>7</sup> and the Transkei.<sup>8</sup> Therefore, in 1961, the Executive of the National Cancer Association of South Africa requested the Cancer Research Unit to determine to what extent this trend was general throughout this country or whether it was confined to specific regions.

## *Materials and Methods*

Permission having been obtained from the Directors of Hospital Services in the four provinces, a questionnaire was circulated in July 1962 to superintendents of those South African general hospitals listed in available

registers.\*<sup>9,10</sup> This requested current information on the number of beds available for Bantu patients, records of cases of cancer of the oesophagus by race and sex, whether the disease was thought to be common and, if so, whether any cause was suspected. Details of the diagnostic procedures were not asked for.

The results are open to many errors, resulting from such varied causes as failure to distinguish Bantu from other non-White patients, misdiagnosis, counting of admissions rather than cases (and so failing to distinguish re-admissions), poor recording of diagnoses (e.g. by diagnosis on admission rather than on discharge), and multiple registration of cases where patients have been admitted to several hospitals in succession. The results are presented, nevertheless, because they confirm experience from other sources, such as histological series from diagnostic labora-

\* Omitting mine hospitals, and including nursing homes concerned with non-White patients.

tories, death registers, and personal experience of visits to hospitals in Johannesburg, Pretoria, the Transvaal Lowveld, and the Transkei (for the latter I am indebted to Dr. R. J. W. Burrell). The differences which this survey demonstrates between regions, furthermore, are too great to explain away on random or systematic errors. Crude as our measuring instrument may be, it is evident that the incidence of oesophageal cancer varies profoundly — its relative frequency in the Sir Henry Elliott Hospital, Umtata (40 per 100 beds), for example, being 200 times that recorded from Swaziland (0.2 per 100 beds).

Where hospital statistics did not distinguish Bantu from other non-Europeans, we were obliged to treat all the non-European beds as available for Bantu patients. In such instances the figures will be abnormally low for regions such as the Western Cape, where other races predominate, but this source of error does not appear to be important.

The large hospitals inevitably receive many cases transferred from outlying districts, e.g. at Groote Schuur Hospital in Cape Town the majority of cases of oesophageal cancer are transfers from the Transkei, 600-700 miles away as the crow flies. In such hospitals a correction will have to be made — if only as a mental reservation — until precise figures are available for rates in local residents.

Results have been stated as an annual rate per 100 beds, rather than the traditional 'rate per 1,000 admissions'. The former rate is easier for the average doctor to grasp since it enables him to compare mentally what would be expected in any given hospital, whereas the total number of admissions is an unfamiliar denominator. It also facilitates correction for the weighting effect of special beds, e.g. paediatric, obstetrical or tuberculous, which are seldom distinguishable in figures for total admissions. Thirdly, cases of oesophageal cancer are all likely to be admitted, if only for diagnosis or special feeding before being referred to a larger centre, irrespective of the pressure of other cases on the hospital. Increased turnover of cases other than of oesophageal cancer would result in increased admissions and would affect the denominator if the traditional rate were employed. Thus, in Johannesburg, Baragwanath Hospital, with 2,200 beds and 50,000 admissions, would have an average of 16.1 days per patient, as against an average of only 10.7 days for Coronation Hospital, with 435 beds and 14,816 admissions.

As sex was not always distinguished in the replies, the combined figure for both sexes was used for rate calculations. Sex ratios were calculated where details were available.

Because of the inherent deficiencies of the procedure it has not been thought necessary to give the replies of individual hospitals. Instead, hospitals have been grouped in geographical regions possessing some socio-economic or climatic uniformity (Table I). Thus the Western Cape rural group consists of all those magisterial districts where the density of the Bantu population is less than 1 per square mile.

### Results

Replies were obtained from more than 85% of hospitals. The proportion by region is indicated in Table II. The population figures for these districts (1960 census)

have been provided by the Bureau of Census and Statistics (Table III). The results of the hospital survey are also given in Table III and are illustrated in Fig. 1.

A high frequency of oesophageal cancer is evident in all the large urban centres.† The extent varies to which this reflects an increased incidence in local residents or merely indicates transfer of cases. In Johannesburg the majority of cases are residents, in Cape Town the majority are transferred. The rate lies between 4 and 5 per 100 beds

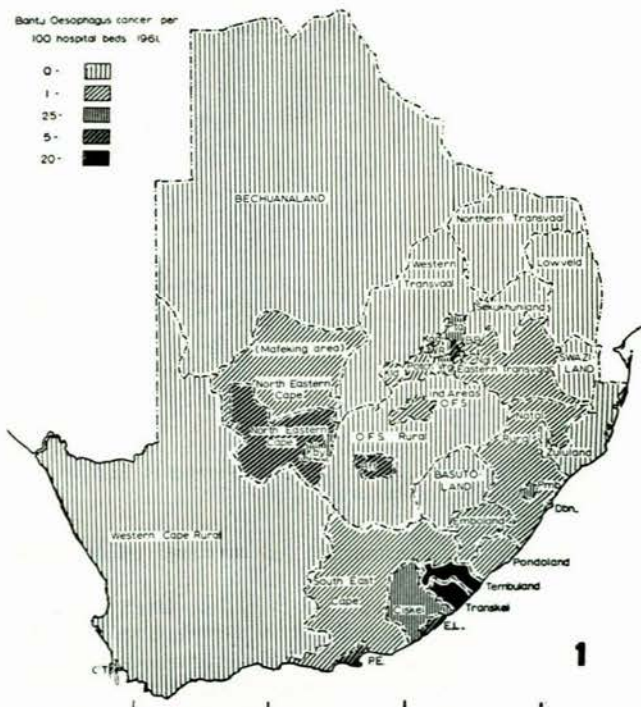
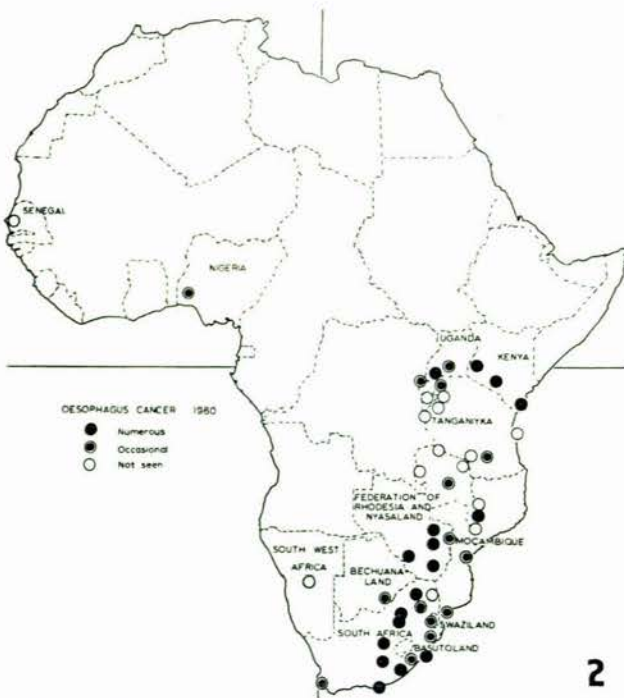


Fig. 1. Frequency of Bantu cases of oesophageal cancer per 100 hospital beds per annum up to 1962 in South Africa and the Protectorates (see Table III).

in Pretoria and Pietermaritzburg, between 5 and 10 in Cape Town, Port Elizabeth, East London and Johannesburg, while Bloemfontein reaches the figure of 12.6. The latter figure was provided by the single thoracic surgeon there, and does not include all cases admitted to hospital. It is identical to that calculated from the figures of the histological laboratory, and so is almost certainly an understatement.

For many rural areas, viz. Zululand, the Lowveld, Northern Transvaal, Sekukhuniland, Western Transvaal, Orange Free State, Western Cape, Basutoland, Swaziland, and Bechuanaland Protectorate, the incidence is below 1 per 100 beds. Other regions show a higher frequency. It lies between 1 and 2 in the Eastern Cape, North-Eastern Cape, Eastern Transvaal, rural Natal and Northern Transkei (Emboland and Pondoland). It rises to 2 for the 'remainder of the North-Eastern Cape' and the industrial areas of the Orange Free State gold-mining group; to between 4 and 5 in the Ciskei. In the Southern Transkei

† Except Durban, where oesophageal cancer is nevertheless regarded as common. There the proportion recorded is probably artificially lowered by the large total of hospital beds.



2

Fig. 2. Frequency of cases of oesophageal cancer in Negroes in African hospitals in 1960.

it rises to the extraordinary figure of over 20 cases per 100 beds.

The sex ratio (Table IV) has been calculated where the information was adequate, and shows striking variation with incidence. Where cases are rare there is usually a far greater masculine preponderance than where cases are common. This correlation is not very close, but since the sex ratio changes also with time<sup>11</sup> and with age<sup>9</sup> this variability is not unexpected. In Bloemfontein, however, the disease is still rare in females (ratio 17:1) despite its high frequency there.

#### DISCUSSION

(a) *Influence of attitudes towards Western medicine.* The question will naturally arise what proportion of Bantu patients with oesophageal cancer are likely to present themselves at hospital. In the large cities I believe that almost all will do so. The survey of 1953-55 in Johannesburg<sup>12</sup> showed that 95% would attend hospital whereas, in a uniquely intensive survey of the Transkei, Burrell<sup>8</sup> found that 69.7% of the male cases registered and 48.2% of the female had been to hospital. The Transkei probably is representative of the unsophisticated areas. Unwillingness to attend hospital thus may make the incidence in one area appear to be half that of another with the same true incidence. It cannot, however, explain such differences as those recorded here, where the highest rate is 200 times the lowest.

(b) *Recent nature of epidemic.* There is an abundance of evidence that this high incidence of oesophageal cancer is of recent origin.<sup>11</sup> The incidence seen in areas such as Swaziland, Bechuanaland Protectorate, Basutoland and

Zululand probably represents the original or basal level and all other regions represent areas of increased incidence. Consequently the picture presented here is only of transient validity. In fact it is already clear that in some hospitals the situation has since changed from that reported, e.g. Pietersburg Hospital, which has subsequently encountered a much increased frequency of cases.

(c) *The carcinogenic stimulus is neither peculiarly urban nor peculiarly rural.* High incidence is noted in both rural and urban populations. The urban cases (apart from transfers) cannot be accounted for by recent migrations from rural areas, for in the Johannesburg survey the average length of urbanization of male patients with oesophageal cancer was 19.5 years compared with 16.8 years in controls with cancers of other parts of the body, matched for age. Burrell<sup>8</sup> has registered cases in patients who have never left the Transkei. These facts suggest that the cause or causes are not limited to either town or country, unless it be postulated that entirely different carcinogens are responsible in the different areas — which seems improbable.

(d) *Patchy distribution within areas.* Incidence within regions is not necessarily uniform, and certain hospitals stand out as having a higher rate than their neighbours, e.g. St. Konrad's Mission Hospital (60 beds) at Taung, which reported 21 cases in 5 years. In the Transkei Burrell<sup>8</sup> has reported that the condition 'is particularly rife in scattered circumscribed localities'. His detailed regional maps of this phenomenon are awaited with interest. In the meanwhile our register of cancer of the oesophagus in mineworkers<sup>11</sup> indicates that it is common in those from Emboland and Pondoland. Patches of high incidence evidently occur in the Northern Transkei, where the total rate is low.

(e) *Other parts of Africa.* A high incidence of cancer of the oesophagus has recently been recorded from certain regions in Africa (Fig. 2), whereas in other parts the disease continues to be rare. This does not imply that it will always remain rare, for an epidemic may still be brewing in these parts, assuming a similar period of latency. Regions of high incidence are particularly common in Southern Rhodesia (Salisbury, Bulawayo, Rusapi, Fort Victoria), Nyasaland (Blantyre) and Kenya (Nairobi, Kisumu and Mombasa), while in Mozambique (Lourenço Marques, Beira) Uganda (Kampala), Northern Rhodesia (Abercorn, Fort Jameson), and Tanganyika (Dar es Salaam) it remains low (Table V). In West African Negroes there is no evidence of any increase. In the Sudan, however, at Khartoum, in a non-Negro population, Professor Lynch<sup>13</sup> informs me that cancer of the oesophagus is commoner than cancer of the stomach.

(f) *Other races in South Africa.* Mortality figures for Whites, Coloureds and Asians have been obtained from the Department of Census and Statistics for the period 1949-58 for the first two groups, and for 1950-58 for the Asian group. Mortality rates standardized to the United States population of 1950 show that the Coloured male rate is slightly increased, and other information suggests that this represents a genuine increase. The Asian male rate is low and the Asian female rate is slightly increased, as expected in view of the greater

prevalence of betel-chewing in Indian women. Regional studies of mortality reveal that among White males the incidence of oesophageal cancer is very low in the Orange Free State and very high in Natal—a difference that parallels the mortality from lung cancer, probably reflecting the well-known association between oesophageal cancer and smoking.

## CONCLUSION

The striking nature of the regional distribution of this disease, and its epidemic character, provides a most provoking epidemiological problem in cancer aetiology, apart from the humanitarian aspects. The subject demands far more intensive study, and might justify central registration of cancers in South Africa.

The survey has revealed that the record systems of many large hospitals in this country are exceedingly defective. If better kept, they would be treasuries of information of great demographic interest.

## SUMMARY

A questionnaire to South African hospitals revealed differences in the relative frequency of Bantu cases of cancer of the oesophagus which varied more than one-hundredfold between the regions of highest and lowest frequencies.

The maximum frequency occurred in the Southern Transkei, but the disease was also common in all large cities, being commonest in Bloemfontein.

This patchy distribution suggests a carcinogenic exposure that is neither peculiarly rural nor peculiarly urban, to which males are usually but not invariably more heavily exposed than females. The disease is common in other regions of Africa, and the epidemiological features suggest a cause or causes of recent origin and wide but somewhat haphazard distribution.

Among the non-Negroes an increase in cancer of the oesophagus would appear to be occurring among Coloured males, Asian females, and possibly the Sudanese. Among South African Whites provincial differences in mortality from oesophageal cancer have been noted.

## TABLES

TABLE I. RURAL REGIONS DISTINGUISHED IN THIS ANALYSIS, WITH THE CONSTITUENT MAGISTERIAL DISTRICTS

## CAPE PROVINCE

1. *Western Cape* (Gordonia, Namaqualand, Kenhardt, Prieska, Hopetown, Phillipstown, van Rhynsdorp, Calvinia, Williston, Carnarvon, Britstown, De Aar, Victoria West, Richmond, Clanwilliam, Sutherland, Beaufort West, Fraserburg, Murraysburg, Aberdeen, Piketberg, Ceres, Laingsburg, Prince Albert, Willowmore, Steytlerville, Vredenburg, Hopefield, Tulbagh, Malmesbury, Simonstown, Wellington, Paarl, Bellville, Stellenbosch, Somerset West, Caledon, Worcester, Robertson, Montague, Bredasdorp, Swellendam, Ladismith, Heidelberg, Riversdale, Calitzdorp, Mossel Bay, Oudtshoorn, George, Uniondale, Knysna)

2. *South-Eastern Cape* (Colesberg, Hanover, Venterstad, Albert, Aliwal North, Lady Grey, Barkly East, Maclear, Steynsburg, Wodehouse, Indwe, Elliot, Molteno, Middelburg, Maraisburg, Sterkstroom, Tarka(stad), Graaff-Reinet, Cradock, Pearston, Jansenville, Somerset East, Bedford, Adelaide, Albany, Uitenhage, Kirkwood, Alexandria, Bathurst, Humansdorp)

3. *Ciskei* (Peddie, Fort Beaufort, Stockenström, Victoria East,

Keiskama Hoek, Middeldrift, King William's Town, Stutterheim, Cathcart, Glen Grey, Queenstown, Herschel, Komgha)

4. *Transkei proper* (Butterworth, Idutywa, Kentani, Nqamakwe, Tsomo, Willowvale)

5. *Tembuland* (Elliotdale, Engcobo, Mquanduli, St. Marks, Umtata, Xalanga)

6. *Pondoland* (Bizana, Flagstaff, Libode, Lusikisiki, Ngqeleni, Port St. Johns, Tabankulu)

7. *Emboland (Griqualand East)* (Matatiele, Mt. Ayliff, Mt. Currie, Mt. Fletcher, Mt. Frere, Qumbu, Tsolo, Umzimkulu)

8. *North-Eastern Cape (Mafeking region)* (Mafeking, Vryburg, Kuruman, Taung)

9. *North-Eastern Cape (Kimberley region)* (Postmasburg, Barkly West, Hay, Herbert, Warrenton)

## NATAL

1. *Natal* (Newcastle, Utrecht, Paulpietersburg, Ngotshe, Vryheid, Babanango, Dundee, Kliprivier, Bergville, Msinga, Weenen, Kranskop, Estcourt, Umvoti, Lions River, New Hanover, Ndwedwe, Mapumulo, Impendle, Inanda, Lower Tugela, Camperdown, Pinetown, Underberg, Polela, Richmond, Umlazi, Ixopo, Alfred, Umzinto, Port Shepstone)

2. *Zululand* (Eshowe, Hlabisa, Ingwavuma, Lower Umfolozi, Mahlabatini, Mtongjaneni, Mtunzini, Nkandla, Nongoma, Nqutu, Ubombo)

## TRANSVAAL

1. *Eastern Transvaal* (Witbank, Belfast, Carolina, Heidelberg, Bethal, Ermelo, Standerton, Volksrust, Amersfoort, Wakkerstroom, Piet Retief, Delmas)

2. *Lowveld* (Letaba, Pilgrim's Rest, Nelspruit, Barberton)

3. *Sekukhuniland* (Bronkhorstspuit, Groblersdal, Lydenburg, Middelburg)

4. *Northern Transvaal* (Potgietersrust, Pietersburg, Soutpansberg, Sibasa)

5. *Western Transvaal* (Waterberg, Warmbad, Brits, Rustenburg, Marico, Lichtenburg, Ventersdorp, Delareyville, Schweizer-Reneke, Wolmaransstad, Bloemhof, Christiana)

## ORANGE FREE STATE

1. *Orange Free State* (Sasolburg, Parys, Vredefort, Viljoens, Kroon, Bothaville, Koppies, Heilbron, Frankfort, Vrede, Reitz-Lindley, Wesselsbron, Hoopstad, Boshof, Bulfontein, Theunissen, Virginia, Ventersburg, Senekal, Bethlehem, Harrismith, Brandfort, Winburg, Marquard, Ficksburg, Fouriesburg, Clocolan, Ladybrand, Thaba N'chu, Jacobsdal, Fauresmith, Edenburg, Reddersburg, Dewetsdorp, Wepener, Trompsburg, Philippolis, Bethulie, Rouxville, Smithfield, Zastron)

TABLE II. PROPORTION OF GENERAL HOSPITALS REPORTING ADEQUATELY

(Replies stating that information was not available, or that all cases were transferred, are not counted)

## SOUTH AFRICAN RURAL HOSPITALS

	Hospitals reporting	Total	Percentage
CAPE PROVINCE			
1. Western Cape .. ..	29	38	76
2. South-Eastern Cape .. ..	17	21	81
3. Ciskei .. ..	9	9	100
4. Transkei proper .. ..	1	1	100
5. Tembuland .. ..	4	5	80
6. Pondoland .. ..	1	3	33
7. Emboland .. ..	9	9	100
8. North-Eastern Cape Mafeking region .. ..	7	7	100
9. North-Eastern Cape Kimberley region .. ..	4	5	80
	81	98	83
	—	—	—

	Hospitals reporting	Total	Percentage
<b>NATAL</b>			
1. Natal rural			
Industrial .. ..	11	12	92
Remainder .. ..	33	36	92
2. Zululand .. ..	17	18	94
	61	66	92
	—	—	—
<b>TRANSVAAL</b>			
1. Eastern Transvaal .. ..	6	7	86
2. Lowveld .. ..	11	11	100
3. Sekukhuniland .. ..	4	6	67
4. Northern Transvaal .. ..	7	8	88
5. Western Transvaal .. ..	10	12	83
	38	44	86
	—	—	—
<b>ORANGE FREE STATE</b>			
1. Orange Free State .. ..	21	23	91
<b>TOTAL RURAL .. ..</b>	<b>201</b>	<b>231</b>	<b>87</b>

## SOUTH AFRICAN URBAN HOSPITALS

<b>CAPE PROVINCE</b>			
1. Cape Town .. ..	4	4	100
2. Port Elizabeth .. ..	1	1	100
3. East London .. ..	1	1	100
4. Kimberley .. ..	1	1	100
<b>NATAL</b>			
1. Durban .. ..	2	4	50
2. Pietermaritzburg .. ..	1	1	100
<b>TRANSVAAL</b>			
1. Johannesburg .. ..	4	4	100
2. Pretoria .. ..	3	3	100
3. Nigel .. ..	1	1	100
4. Springs .. ..	0	1	0
5. Boksburg-Benoni-Brakpan .. ..	1	1	100
6. Germiston .. ..	1	1	100
7. Roodepoort .. ..	1	1	100
8. Krugersdorp .. ..	1	1	100
9. Potchefstroom .. ..	1	1	100
10. Klerksdorp .. ..	1	1	100
11. Vereeniging-Vanderbijlpark .. ..	1	1	100
<b>ORANGE FREE STATE</b>			
1. Bloemfontein .. ..	1	1	100
2. Industrial areas			
Kroonstad .. ..	3	3	100
Welkom .. ..			
Odendaalsrus .. ..			
<b>TOTAL URBAN .. ..</b>	<b>29</b>	<b>32</b>	<b>90.63</b>

## SOUTH AFRICAN TUBERCULOSIS HOSPITALS

Government tuberculosis hospitals .. ..	7	7	100
---	---	---	-----

## PROTECTORATES

1. Basutoland .. ..	10	14	71
2. Swaziland .. ..	5	7	71
3. Bechuanaland Protectorate .. ..	8	12	67
<b>TOTAL PROTECTORATES .. ..</b>	<b>23</b>	<b>33</b>	<b>70</b>
<b>TOTAL SOUTH AFRICAN .. ..</b>	<b>260</b>	<b>303</b>	<b>86</b>

TABLE III. RESULTS OF SURVEY: POPULATIONS OF REGIONS ACCORDING TO 1960 CENSUS, NUMBER OF NON-WHITE BEDS IN HOSPITALS COOPERATING, AND CASES OF OESOPHAGEAL CANCER REPORTED, WITH ANNUAL NUMBER AND RATE PER 100 BEDS PER ANNUM

	Population 1960	Total beds reporting	Total cases reported	Annual cases reported	Cases per 100 beds
<b>SOUTH AFRICAN RURAL HOSPITALS</b>					
<b>CAPE PROVINCE</b>					
1. Western Cape .. ..	134,834	878	21	6.9	0.8
2. South-Eastern Cape .. ..	369,057	535	14	7	1.3
3. Ciskei .. ..	458,625	785	89	35.4	4.5
4. Transkei .. ..	281,347	97	40	20	25.8
5. Tembuland .. ..	328,158	198	239	50.3	25.4
6. Pondoland .. ..	402,734	60	1	0.6	1.0
7. Emboland .. ..	388,945	565	12	8.5	1.5
8. North-Eastern Cape Mafeking region .. ..	215,707	371	21	4.2	1.1
9. North-Eastern Cape Kimberley region .. ..	68,359	53	5	3	5.7
<b>NATAL</b>					
1. Natal .. ..	1,357,236	3,667	73	36.8	1.0
General .. ..		3,090	69	33.5	1.1
Industrial .. ..		577	4	3.3	0.6
2. Zululand .. ..	550,195	2,002	30	10.4	0.5
<b>TRANSVAAL</b>					
1. Eastern Transvaal .. ..	526,874	599	11	6.5	1.1
2. Lowveld .. ..	450,641	895	5	2.5	0.3
3. Sekukhuniland .. ..	372,475	1,136	10	7	0.6
4. Northern Transvaal .. ..	712,587	1,108	9	6.7	0.6
5. Western Transvaal .. ..	604,238	774	9	5.0	0.7
<b>ORANGE FREE STATE</b>					
1. Orange Free State .. ..	822,813	943	8	5.8	0.8
<b>SOUTH AFRICAN URBAN HOSPITALS</b>					
<b>CAPE PROVINCE</b>					
1. Cape Town .. ..	65,635	610	201	34	5.6
2. Port Elizabeth .. ..	135,547	440	36	21.8	5.0
3. East London .. ..	108,609	241	14	14	5.8
4. Kimberley .. ..	36,134	91	5	3	3.3
<b>NATAL</b>					
1. Durban .. ..	174,825	2,020	119	19.3	1.0
2. Pietermaritzburg .. ..	96,128	525	124	24.8	4.7
<b>TRANSVAAL</b>					
1. Johannesburg .. ..	645,268	2,874	186	186	6.5
2. Pretoria .. ..	299,037	839	33	33	3.9
3. Nigel .. ..	37,870	45	2	0.7	1.5
4. Boksburg-Benoni .. ..	175,328	302	12	6	2.0
5. Germiston .. ..	154,886	145	4	13	0.9
6. Roodepoort .. ..	67,337	102	3	1	1.0
7. Krugersdorp .. ..	129,159	139	2	2	1.4
8. Potchefstroom .. ..	51,400	60	1	1	1.7
9. Klerksdorp .. ..	113,800	244	5	2.5	1.0
10. Vereeniging-Vanderbijlpark .. ..	145,915	107	23	4.6	4.3
<b>ORANGE FREE STATE</b>					
1. Bloemfontein .. ..	96,995	163	36	20.5	12.6
2. Industrial areas: .. ..	164,078	241	16	4.9	2.9
Kroonstad .. ..	60,817	175	9	2.3	1.3
Welkom .. ..	74,493	36	5	1.7	4.6
Odendaalsrus .. ..	28,768	30	2	1	3.3
<b>SOUTH AFRICAN TUBERCULOSIS HOSPITALS</b>					
Government tuberculosis hospitals .. ..		2,610	48	10.2	1.8
<b>PROTECTORATES</b>					
1. Basutoland approx. 750,000 .. ..		667	5	2.0	0.3
2. Swaziland approx. 250,000 .. ..		554	4	1.0	0.2
3. Bechuanaland Protectorate approx. 350,000 .. ..		683	3	3.0	0.4

