MEDICAL HISTORY OF THE SOUTH AFRICAN WAR.
THE INCIDENCE OF DISEASE AMONG THE CIVIL POPULATION OF SOUTH AFRICA PRIOR TO THE WAR, AND CONDITIONS ASSOCIATED WITH THAT INCIDENCE.

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I. GENERAL CONDITIONS.

1. INTRODUCTION.—Sanitation in South Africa was in a very backward condition, the inevitable consequence of the various factors which influenced its recent history. Until the discovery of the diamond fields and, later, of the gold fields of the Rand, communication with South Africa was slow and infrequent; there were few immigrants but those in search of health or of a problematical fortune. The predominant influence was in the hands of the “Dutch” population, descendants of the Dutch or Huguenot settlers of the sixteenth and seventeenth centuries, retaining most of the habits and customs which their forefathers introduced with them when they first landed. As in India before the Mutiny, the white community, so much in contact with the natives and so dependent on them, conformed in some degree to their customs.

Again, the last century was one of great expansion in the various territories of South Africa; pioneers pushed out on every side, and in many of the towns of the Transvaal and Orange River Colony, besides northern Cape Colony, a good many of these pioneers, or their children, are still to be found. The rapid commercial develop-
ment of the country during the last years of the nineteenth century brought a large immigrant population, of whom a large number were of little benefit to the country, and many left South Africa during the war as "undesirables."

From these conditions it has resulted that the standard of sanitation in the older territories and among the majority of the population has been that of the seventeenth century somewhat depreciated by contact with the natives, while in the newer colonies the primitive methods of the pioneers have barely been improved by their replacement by the methods common in the areas from which they came.

Further, over a large part of South Africa expense has always been an obstacle in the way of progress. Natural conditions make sanitary problems more difficult than in Europe and their solution more costly, while, on the other hand, the density of population is so much less that the cost per head must always be considerably greater than in Europe.

2. Physical Features.—As regards the general aspect of the area of operations, from the southern border of the Great Karroo to a line on the north from the junction of the Riet and the Modder Rivers to Aliwal North; from the west coast north of Olifants River to the Stormberg in the east, the country is mainly Karroo, or Karroo and grass, with limited areas of agriculture round the towns (such as Richmond, Victoria West, or Middelburg), and especially in the valley of the Sunday River and its tributaries. North and east of these lines the country is mainly grass veldt, but includes limited agricultural districts, such as that on the Caledon River near Ladybrand, areas on each side of the Natal Government Railway, and others encircling the larger towns. The line dividing the Karroo from the veldt is very nearly that separating the area of less than 20 inches of rain per annum from that of greater rainfall.

South of the Karroo the country is more broken and its nature less regular; barren hills and fertile valleys are interspersed with limited areas of flatter country, more particularly towards the south-east coast-line. North of the line to Delagoa Bay lies the lower "bush veldt" and "low veldt," a wilder and even less populous district than those to the south. The Krokodil Valley and the country bordering on either side are very wild, mountainous, and broken.

3. Water Supply.—Speaking generally, South Africa is not so well watered. It is a country whose permanent rivers are few
in comparison to its area; one member of the well-known chain of negative clauses used proverbially to describe it speaks of "rivers without water." But this implies the second difficulty—the temporary excess of water during the rainy season, which involves the necessity of flood channels in excess of the average requirements.

A very valuable account of the water supplies of South Africa is to be found in the report on "Irrigation in South Africa" by Sir W. Willcocks, K.C.M.G.\(^1\) After pointing out that it is what it was fifty years ago, "a pastoral country importing cereals and dairy produce and even hay from foreign countries," he points out that "the reason for this want of development of the agricultural wealth of the country lies in the fact that the rainfall of the three colonies, with the exception of the extreme south-west corner, is not only erratic and uncertain at the times most opportune for sowing, but is constant and heavy in autumn." Sir W. Willcocks' report deals, of course, with water for agricultural purposes, which differs in many ways from the supply of a potable water, but even from the latter point of view the report is both interesting and valuable.

Sources of Supply.—(1) Surface Water. (a) From a recognised and guarded catchment area. (b) From rivers. (c) From small streams. (d) From dams.

(2) Well water. (a) Shallow. (b) Deep.

(3) Springs.

(4) Rain water.

(1) Surface Water.—(a) Capetown (including its suburbs) before the War was the only place in South Africa which drew its supply from a definite area set apart for the purpose—viz., the plateau and higher slopes of Table Mountain. This area is not indeed entirely protected, as it is open to those climbing the mountain, and a proposal to close the area completely (originating with the Sanitary Authorities, Cape Colony), met with much opposition, and would be difficult to carry out. The supply is ample and of good quality, though during the rainy season it becomes very dark from peaty matters, and when taken on board ship and stored in iron tanks assumes a very ugly colour. The water is very soft and acts rapidly on lead piping.

(b) River Water.—Many of the larger towns drew their supplies from rivers: Kimberley and Johannesburg from the Vaal; Port

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\(^1\) "Further Correspondence relating to Affairs in South Africa," July, 1902, pp. 37 et seq.
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Elizabeth from Van Sladens River; King Williamstown from the Buffalo River; Durban from the Umbilo and Umlaas; Ladysmith from the Klip River. The supply at Durban was not good: it was muddy and open to pollution. The same may be said of the supply in Maritzburg; that at Ladysmith was very bad. The others named were good supplies from comparatively large streams.

Bloemfontein.—The old supply was from wells. A scheme was inaugurated to replace this older supply by a supply drawn from the Modder River at Sannah’s Post. The waterworks appear to have been opened in May, 1899, and part of the town was supplied with this water, but its use was not compulsory, and the older wells remained in use. Storage and filtration were imperfect. This supply was cut off by the Boers on April 3rd, 1900, and was not again available till May 10th.

Kroonstadt.—The supply was pumped from the Valsch River to some reservoirs at about the highest point adjacent to the town. The river was dammed below the point of intake, and above that point received all the drainage from the slopes north of the town, which were fissured with small dongas which had been used as latrines and rubbish shoots. The result was that the supply after rain was as bad as possible. There was no efficient filtration. There were also the older shallow wells in use in the lower part of the town.

(c) From smaller streams. This is a common source.

The supply is in some instances taken direct from the stream; in other cases it is conveyed for some distance in pipes, or in an open furrow, or the two are combined, piping being used part of the way only. Protection of the catchment area is exceptional. In some instances the furrow is protected, in most it is not, and the water is therefore open to pollution of every description. In some instances the furrow or piping is used to supply secondary reservoirs or dams, from which the supply is distributed. These reservoirs are not well reported on.

(d) From dams or pans. In the more arid districts these form the only sources of supply to the smaller towns, villages, or farms. On the march across the Orange River Colony to Bloemfontein these were at times the only sources of supply. In some cases these dams are filled by furrows from a stream; in most instances they are formed in a slight hollow in the ground to catch and retain the rainfall, which in these cases is the only source from which they are filled. Here, of course, the supply diminishes steadily by use and evaporation during the dry season. These dams
are also used for watering stock. In Cape Colony there are, in the Western Provinces, a good many large reservoirs, some, as in the Verkeerder Vale reservoir (near Touws River Station) largely fed by springs, others from the smaller streams and rivers. On the Stormberg plateau there are a large number of dams and reservoirs (see Sir W. Willcocks' report). These reservoirs are all primarily intended for agricultural purposes, but sources of this type were perforce used for drinking water during the war.

(2) Well Water. — Shallow wells form a common source of supply in all the colonies and are almost without exception unprotected. Those in Bloemfontein and Kroonstadt have been referred to; there were also some wells in Pretoria. All were open to contamination, and some invited it. Many of these are quite shallow, and open to soakage as well as to pollution from matters washed into them (vide Public Health Reports, Cape Colony).

As regards deep wells, Sir W. Willcocks points out that the extraordinary success which has attended deep bores in southwestern Queensland cannot be expected in Cape Colony, as “the subsoil water can only be very local and insignificant in quantity.” He gives the result of the boring operations conducted by the Cape Colony Government since 1890 to the end of 1898 “approximately as follows”:

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Number of holes bored, 2,600.
Successful, about five-sixths.
Unsuccessful, about one-sixth.
Cost of boring—per hole, £17.
Average depth of hole, 60 feet.
Total discharge of water, 26 cubic feet per second.
Discharge per hole, ½ cubic foot per minute (equal to about 6,732 gallons in twenty-four hours).
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Practically all the holes need machinery of some kind to lift the water.
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No information is given as to the time taken to put down these bore-holes—an important point in military work. Later this question will be dealt with in some detail.

A few bore-holes have been made in Cape Colony for the supply of drinking water, and have apparently been satisfactory. Three old (disused) bores on the commonage at Bloemfontein were opened out after our arrival there, and gave a good supply. More use has been made of similar bore-holes in recent years.

(3) Springs.—Springs are not uncommon as a partial supply. In some cases the water is conveyed from them by pipes or in open
furrows. In most cases there is no protection against pollution. The very excellent municipal supply in Pretoria is conveyed in pipes from springs a short distance outside the town, and distributed throughout the town.

(4) Rain Water.—Rain water collected from the roofs of the houses and stored in tanks is not an uncommon supply. In a few instances this forms the only source of supply (such as at Bathurst).

In most cases the total supply of a town comes from more than one source—i.e., wells may supplement the supply conveyed from a distance (as in Bloemfontein, Kroonstadt, and Pretoria). Rain water is in Cape Colony not an infrequent addition to other supplies.

The Public Health Reports, Cape Colony, confirm our experience that the necessity for the provision of a pure supply, or the adequate protection of that supply when obtained, was not recognised by the local authorities, in spite of the strong recommendations of the district surgeons.

The persistent and continuous pollution of the soil in every inhabited area (which will be referred to in detail later) must be borne in mind in relation to every water supply, except from rain, deep wells, or efficiently protected areas.

4. CENTRES OF POPULATION.—Unlike the Kaffir Kraal, established on a height for security, the Dutch towns are invariably placed along the stream at the bottom of a valley. Each town is surrounded by a circle of townships and farms, the density of population diminishing towards the circumference of the circle. Hence between the areas influenced by the proximity of markets and stores are areas that are very sparsely inhabited, at least by the white population. There is a tendency to speak of these areas as virgin soil, and to assume that such disease as appeared among the troops working in these areas must have been introduced by them. Both assumptions appear to be ill-founded. There is a comparatively large native population scattered over these areas; the Kaffir is a great traveller, and the whole country is seamed with native paths leading from larger centres to the kraals, or from kraal to kraal. The importance of this lies in the probability of the extensive spread of contagion by natives returning home from the mines, a factor which had received some attention before the outbreak of the War.

The older towns are built on a good plan. Parallel streets intersect a second set at right angles, and the town ends on a
definite line of demarcation between town and veldt. The recent towns have barely escaped from the mushroom stage; their plan is the result, not of a definite intention, but of a process of accretion, and there is no uniformity in the type of buildings. A third type indeed is formed by the combination of the old town with modern excrescences. Only one feature was common to all—the absence of any definite sanitary system, including in this a satisfactory water supply as well as an efficient method for the disposal of excreta and slops. The principal sanitary defects are:

(a) The want of a pure water supply, as mentioned above.
(b) Imperfect methods for the disposal of excreta. There are practically only two methods in use—the old cesspool and the tub system.

Cesspools are far from uncommon; in some instances they are apparently considered less harmful because “the soil is very porous.” This is not an advantage where shallow wells are used, or indeed surface water from any source. There are many varieties of the tub system. In a few instances there is a complete system: the tubs are removed under municipal arrangements and the night soil is carted away and buried outside, at some distance from the town. In other instances the night soil is thrown into a sluit outside the town, resulting in pollution of some stream sooner or later. In other instances the removal is not paid for by a sanitary rate, but by a charge for each occasion. This tends to infrequent removals. Again, in other cases no municipal arrangement for removal exists; it is carried out by private contract. In some cases the night soil is buried close to the town, or even in gardens.

In one case at least it is only within recent years that a privy has been held by the municipality to be a necessity for each house, and for some time after that, though erected, many of these privies remained unused, especially by the “poor white.”

The common faults are: Tubs emptied at too long intervals; spilling of the contents; tubs rarely, if ever, cleaned or tarred; and great laxity in the methods of disposal of the night soil.

Special precautions as regards infectious excreta are almost unknown.

(c) Absence of latrine accommodation for the native population.
There is a large native population in every town or village, partly employed as household servants or grooms—that is, in some

1 Public Health Reports, Cape Colony, 1896.
capacity about the dwelling-houses of the white population—and partly as labourers of all classes. Some of these labourers are accommodated in the yards of the places in which they are employed, but a large population live in the native quarter, or, in many cases, in a special native location. Latrine accommodation for household servants in the premises is practically unknown; they have to go elsewhere. But in the towns public latrines for natives are not common and are in no way sufficient, nor so situated as to be within easy distance from all the houses; while, on the other hand, the native prefers the open air. In the native locations, too, accommodation is very deficient and usually entirely absent.

The site of every town is seamed with water channels, the result of the excessive rainfall concentrated during a short period of the year. Many of these are dry during the season of minimum rainfall. These channels are habitually used by the native population as latrines, while rubbish and garbage, and in some cases, as mentioned above, night soil, are deposited in them.

(d) Slop water.

There are practically only two methods of disposal: by the surface drains, or on the ground in the vicinity of the houses. In some few instances, if the householder provides a receptacle at his own expense, the local authority arranges for the emptying of the receptacle. Urine is, as a rule, disposed of like slop water proper; there is no doubt that much finds its way into the surface drains.

Every one of these imperfect methods tends to a constantly increasing pollution of the whole surface of the soil, and to the consequent contamination of all superficial sources of water supply. In addition, the constant presence of large numbers of cattle and horses tend to foul the unpaved and badly made streets.

The smaller the town or village, the worse is the sanitation, while the lowest depth is reached in the farm, where well, privy, and cattle-kraal are all closely placed together. On some farms it appears that no pretence at any sanitary convenience is made; the open veldt suffices for all purposes, and probably in some ways this is really less harmful than a more elaborate arrangement. It is not possible to say that the conditions in the native kraals are worse than those in the small outlying villages or in the native locations, but they are no better.

The important point is that throughout the whole of South Africa, at least prior to the War, wherever there was a human being there also was a persistent source of pollution both of the soil and water.
The Public Health Reports, Cape Colony, give much interesting information on these points. No report appears to have been issued between 1896 and 1903. The following extract from the report of the Medical Officer of Health, Cape Colony (Dr. Gregory), for 1903 shows that these conditions are not being overlooked by the sanitary authorities, but the difficulties in the way of amendment are very great.

The conditions in Natal differed but little from those in Cape Colony, and, though no reports are available from the Orange Free State and Transvaal, there is no doubt that in these areas also similar conditions existed, so that although the written record is fullest as regards Cape Colony, it is possible to take that as exemplifying the whole.

Extract, Report of the Medical Officer of Health, Cape Colony, 1903, p. 5:—

"(2) GENERAL SANITARY CONDITION OF THE COLONY.

"Printed with this report will be found the annual reports of district surgeons and urban local authorities of the Colony dealing with the health and sanitation of their respective districts during the past year.

"For many years it has been the custom to obtain these reports and to print them for presentation to Parliament, and I am of opinion that on the whole their preparation and publication serve in some degree to direct attention to sanitary defects, and to stimulate interest in sanitary improvement; yet I am bound to confess that they attract less notice than the importance of the subject they deal with deserves. Were they only read and digested by those responsible for the carrying out of local sanitation, much valuable knowledge would be obtained of local conditions and of the almost universal need that exists for their improvement.

"Indeed, a consideration of these reports shows how extensively many of the most fundamental matters of sanitation and the protection of the public health are neglected, chief among which are the protection of water supplies; the disposal of night soil, and refuse; the control of native locations; the prevention of overcrowding; the sanitary regulation of buildings and dwellings; the supervision of slaughtering and the sale of food, and the suppression of infectious diseases.

"Although attention is usually paid to other matters of municipal concern, it is frequently to be noticed that questions of health and sanitation are neglected. I only know of two local authorities
in the Colony which employ a medical officer devoting his whole time to the work of the district—namely, the Municipality of Cape Town and the Board of Health of Kimberley—and even the number of local authorities who retain the services of a medical officer in merely a consulting capacity are few and can be numbered on the fingers. In many cases where such officers are appointed their position is purely a nominal one and their advice is rarely sought, and, if sought, is frequently neglected. Until every urban local Authority has the advice of a competent medical officer of health and acts on that advice, it is scarcely likely that any great advance in the general sanitary condition of urban areas in the Colony will take place."

Foodstuffs, and particularly milk, are not protected from contamination in any way. Most of the market gardening is in the hands of Malays (near Capetown) or of Indians, whose methods of enrichment leave much to be desired. The milk supply is practically not under any control; milk is mainly sold by the bottle, and the empty bottles are washed anyhow and anywhere. The milk always contains a large amount of foreign matter.

II. The Prevalence of Zymotic Disease.

Before the War there was no exact information as to the prevalence of disease in the civil population. Two things contributed to this: the imperfect system for the registration of the causes of death, and the absence of any notification of disease. In none of the colonies was a certificate from a qualified medical man necessary before the registration of a death. In a sparsely populated country such as South Africa, where many cases die (especially among the natives and the poor whites) without having had any medical attendance, it is not possible to make such a certificate obligatory, and even in the towns many of the entries on the register of deaths are, like a very large number of those in the districts, filled up from information received from friends or relatives without any written statement from the medical attendant, if there was one. The consequence is that many of the causes of deaths are registered under general terms, while many in which the cause is described more specifically are equally unreliable. "Fever," or "fever and diarrhoea," is incomplete as a diagnosis; on the other hand, numbers of deaths are shown as from "remittent fever" from districts in which malaria would appear to be unknown.

In the second place, notification of disease was non-existent. In Cape Colony a Public Health Act existed, but it appears to have
been of limited application. In the Public Health Report for 1896 is a copy of the Colonial Secretary's Memorandum to District Magistrates, No. 43, 1896, dated November 30th, 1896, showing the nature of the reports required from district surgeons. Each report is to consist of two parts: part 1 to "deal with the general health and sanitation of the district," part 2 to consist of a series of tables, as follows:

A. Return of zymotic disease.
B. " smallpox and amaas.
C. " expenditure incurred on the suppression of smallpox.
D. " public vaccination.
E. " cases under medical treatment under part 2 of the Contagious Diseases Prevention Act (1885).
F. " expenditure — under that Act.
G. " lepers.
H. " persons in receipt of pauper relief.

Of these, A, B, D, and E were to be prepared by the district surgeon, the others by the resident magistrate.

As regards Table A — return of zymotic diseases — the following diseases were to be included:

- Typhoid or enteric fever.
- Diphtheria.
- Membranous croup.
- Diarrhoea and dysentery.
- Influenza.
- Scarletina.
- Measles.

"And the disease variously called 'Typho-malarial fever,' 'Cape fever,' or 'African typhus.'"

This is an extremely comprehensive list, but the value of the return is at once discounted by the following note at the head of the form, which is as follows:

"In the absence of any notification of disease, or of registration of deaths, these numbers can of course be only approximate, but the district surgeon is requested to obtain as complete information as it lies in his power to do."

Perusal of the individual reports shows how little practical value this procedure has. This memorandum also shows that the only expenditure admissible on public-health matters was on the two lines, prevention of small-pox and limitation of contagious disease, and this agrees with one's impression that the public mind is intensely nervous about small-pox and similar disorders, while other diseases receive no attention at all. The threatened importation of plague into Natal in 1898 and the history of the epidemic in Cape Town in 1901 show the anxiety with which such diseases are
regarded, in strong contrast to the laissez-faire with regard to the other zymotic diseases, not of rare, but of daily occurrence.

It is only just, however, to add that the district surgeons were in favour of compulsory notification of disease, and many of them write strongly on the fact that they had no power in public-health matters, and that their recommendations were ignored by the local authority. One gentleman (Carnarvon, 1896) points out that "as the law of the Colony is at present, the district surgeon is prevented from being a member of the respective Town Council." Another (Hay, 1896) states under "Public Health Duties": "(c) The pointing out of numerous 'abuses,' some of the most serious nature, as affecting the water supply, to the local authority, but nothing has been done, and, unfortunately, district surgeons are powerless;" and, further, "(8) There is great need for a good workable Public Health Act, which would give the central health authorities power to compel, where necessary, erring local authorities to do their duty. Until such an Act is on the Statute-book, local authorities—more especially in the case of small country towns, where local prejudices and influence rule the day—will do nothing, at least as far as my experience teaches me, generally falling into an apathetic state, usually about one month after they have been 'duly appointed and gazetted.' As far as this town is concerned, it would appear that, owing to some legal defect, the rules of the Village Management Board cannot be enforced, and, as far as I am aware, no steps have been taken to put matters on a better footing; and so we go on from bad to worse from year to year, each one being a law unto himself, and even the most elementary rules of sanitation not being observed. Diarrhoea and other gastro-enteric affections are, from year to year, becoming more and more prevalent, and more and more of a fatal type.¹ This, I have not the very least doubt, is in a very great measure due to the water supply being so grossly contaminated; what with open water-furrows, numerous cess-pits, and the dirty habits of many of the inhabitants, &c., &c., it would indeed be very strange if it were otherwise."

In Cape Colony a Public Health Act existed, but, as will be gathered from the above, of very limited scope. In Natal no Public Health Act was even on the Statute-book, district surgeons rendered annual reports, but on even more general lines than in Cape Colony.²

¹ These words are not in italics in the original, but deserve special attention.
² A "Public Health Amendment Act" was promulgated in Cape Colony in 1897, but had not time to be of any use before the War.
In some of the larger towns—Cape Town, Kimberley, Durban, Maritzburg, and possibly a few others, a medical officer of health for the city, and in Cape Colony also for the Colony, was appointed, but without those statutory powers which alone render such an appointment of any practical value. There were port medical officers at Cape Town, Durban, &c.

The result of such a system became evident when plague appeared in South Africa. The condition of Cape Town itself appears to have come as a surprise to the local authority (British Medical Journal, 1901, p. 786), a striking example of the deficiency of the sanitary sense in South Africa. And yet in Cape Town some effort had been made to ascertain the prevalence of such diseases as enteric fever and infantile diarrhoea, which are reported on in the Public Health for 1896. Some efforts had also been made to improve the more glaring defects; a drainage scheme of considerable magnitude was in progress, and an excellent water supply had been provided and was carefully watched.

The other coast ports were little, if at all, better in general condition, while the water supply of Cape Town is probably not equalled elsewhere.

Of the up-country towns, Kimberley appears to have been the only one in which a constant endeavour was made to maintain a satisfactory state of things. There was, however, much enteric fever there. Sanitary organisation in the Orange Free State and Transvaal was even less efficient. No Public Health Acts or other legal provision existed, and it does not appear that the district surgeons or their equivalents rendered any systematic reports.

But what information is available shows conclusively the constant presence among the white and coloured population of the four states concerned of enteric fever, dysentery, and—in Cape Colony—diphtheria.

The following extract from the report of the Medical Officer of Health, Cape Colony, for 1903 (Dr. Gregory) shows very well the importance of enteric fever there:

"(6) Enteric Fever.

"Setting aside tuberculosis, probably enteric fever is the most serious of the diseases, due to specific organisms, that prevail in South Africa. This disease constitutes a veritable scourge in many parts of the Colony. To how large an extent it prevails it is difficult to say, inasmuch as, owing to defective notification, our records are
incomplete, and, moreover, there is no doubt that large numbers of cases occur which are never diagnosed, or, indeed, ever come under observation.

"Enteric fever is essentially a disease of uncleanliness and bad sanitation, and its prevalence is therefore a forcible indication of the extent to which these matters are neglected in this Colony. During the year 1903 many outbreaks of typhoid occurred in many districts of the Colony, in fact in all with the exception of twenty; 1,785 cases were notified to the Medical Officer of Health, under the provisions of the 29th section of the Public Health Amendment Act. Of these, 1,131 were Europeans, and 654 coloured; this disproportion between Europeans and coloured clearly indicates that cases among the latter are not being reported.

"Mortality from the Disease.

"Unfortunately the statistics of deaths registered during the year 1903 are not yet available, but a consideration of those for the calendar year 1902 will equally serve the purpose of showing the extent to which this disease prevails in the Colony.

"During that year in the thirty-five chief towns of the Colony the population, calculated on the basis of the two last censuses, 1891 and 1904, was 388,875, of which 209,146 were Europeans, and 179,729 were natives and coloured.

"During the year 343 deaths from enteric occurred, 136 being among Europeans and 207 among coloured. These figures give a rate of mortality of 6·50 per 10,000 for Europeans, and 11·52 for coloured, or of 8·82 per 10,000 for all races.

"These figures may be compared with those obtaining in England and Wales, which during the decennial period 1881-1890, amounted in the case of all 'fevers' to 2·35 per 10,000, the mortality for enteric fever alone being only 1·96 per 10,000.

"Every case of enteric fever has its origin in some previous case of the disease, and the manner in which it is spread may be taken as being one or the other of the following:—

"(a) Contaminated water.

"(b) Contaminated milk.

"(c) Commensal infection of persons living in the same house, owing to want of care and cleanliness in dealing with the excreta and discharges from an infected person in the house.

"(d) From excreta and other infected matters conveyed by flies or dust."
"Of these methods of spread, probably that of polluted water is the commonest. It is true that in this Colony we do not often see widespread outbreaks of the disease due to polluted water, but this may arise from the fact that in many communities a large percentage of the inhabitants have at some time of their lives suffered from this disease, so that a large portion of them must be more or less immunised against its invasion and able to withstand its attacks. For there are many places in the Colony which, although small communities, are practically never without cases of the disease."

Dr. Gregory gives particulars of two "typical outbreaks" of water-borne disease, and further examples may be found in the text of the reports from district surgeons.

There is little information regarding the prevalence in the Dutch Colonies, but Bloemfontein, Harrismith, and Johannesburg had become notorious on account of the prevalence of enteric fever, and it undoubtedly occurred to a considerable extent throughout both these colonies, while there is evidence of a considerable increase in prevalence during recent years. There is no evidence to show that the prevalence in the Dutch was in any degree less than in the English colonies, concerning which more information is available, while the conditions were similar. Johannesburg was credited with being the centre from which natives disseminated enteric fever and dysentery throughout South Africa, but the conditions were rather exceptional and cannot be taken as indicating the general state throughout the Transvaal.

The incidence of enteric fever and its death-rate in proportion to the population cannot be obtained. Inspection of the registers of deaths in some cases, and examination of the records of civil hospitals in others, show in these individual instances that the recorded incidence is smaller than might have been expected. But, as has been shown above, the registry of deaths is not to be depended on, while hospital records deal only with a limited number of the cases that do occur.

But, after all, the important point in this connection is that a large number of cases of enteric fever did occur year after year in every district of the four colonies, and that the conditions were such as to produce a constant specific infection of the area in which the cases occurred, with a probability of wider dissemination of the contagion.

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1 Tabulated statements of the number of cases in various towns are for this reason of very little value.
The comparison of the incidence of enteric fever in the Boer population with that among the English troops is a separate question—one of much interest from an academic standpoint, but to which only a partial answer can be given. Such imperfect information as we have suggests that the incidence of enteric fever before the War among the permanent inhabitants of South Africa, and probably especially among the Boers, was considerably less than among the English garrison. Probably this is a special case of what appears to be a general rule, that the recorded incidence among the natives of a country in which enteric fever is endemic is less than among immigrants into that country. This rule may, of course, only be an expression of our ignorance regarding the actual incidence among the aforesaid natives, in whom larval forms will usually escape observation.

But under war conditions the incidence among the Boers in the early stages of the War was much increased. Whether it equalled or even approached the incidence among our troops cannot be said. But there is no doubt that they suffered severely in their own laagers at Magersfontein, Paardeberg, and elsewhere, in places where, as a body, they were the first occupants of the ground.

At Magersfontein enteric fever appears to have broken out among the Boers about the same time that it appeared in the garrison at Kimberley and in Lord Methuen's force at Modder River, while a severe epidemic occurred among the prisoners at Simonstown (apparently the result of infection in the laager at Paardeberg, which was synchronous with the beginning of the epidemic in Bloemfontein). But at later periods the Boers appear to have suffered from enteric fever to a smaller extent than our troops. This was probably attributable to several factors: first, that those most susceptible were attacked in the earlier stages; secondly, that their reinforcements were almost entirely drawn from the South African colonies; and, lastly, that they were aggregated in smaller masses, and occupied the same positions for a much shorter time.

Except during these war periods dysentery of a bacillary type has not been of importance in the medical history of South Africa. It was, as a rule, mild and amenable to treatment, though differing from the acute dysentery of India, in that ipecacuanha had but little effect. Nor was it commonly followed by hepatic complications.

Malarial fevers are prevalent in the low coast-belt of Natal, the "Bushveldt" of the Northern Transvaal, and to a less extent in the Western Transvaal towards the Limpopo, in the De Kaap
Valley at Barberton, and more particularly in the Krokodil Valley, especially at Komati Poort, where their extreme prevalence was to some extent due to the very unsatisfactory sanitary conditions prevailing there. Deaths from remittent fever or from "typho-malarial" fever are reported from various parts of Cape Colony. At Graaff Reinet in 1896 forty-five deaths were reported from remittent fever, which was said to be "epidemic as in other years." It is important to note that no mention of enteric fever is made in this report. At East London "typho-malarial" fever is reported as common on the "West Bank." One is prepared to admit that an occasional death from malarial fever contracted elsewhere (Zululand, Portuguese East Africa, &c.) may occur, but there is absolutely no evidence that malarial fever of a severe type exists anywhere in Cape Colony. One can only conclude that here, as elsewhere, the diagnosis of remittent fever has been made where the disease was enteric fever. In this connection an article in The Journal of the American Medical Association of January 9th, 1904, by Dr. J. S. Fulton, M.D., is most important as showing that the so-called mortality from malarial fever in the Southern States of America is in fact due to enteric fever.

Certain so-called "anomalous" forms of fever prevail throughout the country. These are variously named; "Typho-malarial" fever," "Cape fever," and "South African typhus" are apparently taken as synonymous (vide supra). We have also "Kimberley fever," "camp fever," and, generally, "low fever." Some of the cases of Kimberley or camp fever would appear to be in fact Mediterranean fever, which has also been recognised at Phillipolis in the Orange River Colony (vide articles by Lieutenant-Colonel Birt in the Journal of the Royal Army Medical Corps). "Typho-malarial" fever, it may be assumed, is invariably enteric fever, although not of a classical type. The others are in our nomenclature usually grouped under the unsatisfactory heading of "simple continued fever." No doubt they include many of the milder forms of enteric fever, and cases of paratyphoid; besides indeterminate febrile affections, some possibly of no specific origin. But it would appear that these forms of mild, usually non-fatal fevers offer a promising field for investigation.

Pneumonia is occasionally prevalent, and at times in epidemic form, especially on the higher veldt, as at Kimberley, where it was attributed to dust. One finds, however, that cases of "pneumotyphoid" are reported from various centres, so that here again is a way in which the true incidence of enteric fever is obscured.
Pneumonia has not been common among the garrison of South Africa, which, however, was stationed at lower altitudes than those in which this disease has usually been observed.

The important facts with regard to the sanitary condition of the area of operation during the late War are then:

1. The general sanitation of the whole area was extremely bad.
2. Enteric fever and dysentery were endemic throughout the whole area.

III. Climatic Conditions.

(a) Barometric Pressure. — The variations in this due to meteorological conditions are slight, and need no remark. But the lowered pressure due to altitude was believed by many to have some influence on the health. The area of operations (except during the later period in Cape Colony) was over 3,000 ft. above the sea level as a minimum, and indeed the greater part was over 4,000 ft., rising in the Eastern Transvaal at Belfast to over 5,000 ft. above the sea. Even under peace conditions the high altitude was blamed, probably unjustly, as a cause of cardiac irritability, especially as combined with the stimulating effects of the climate (not forgetting other stimulants—alcohol and tea or coffee), and it was the habit of those dwellers on the high veldt who could afford it to spend part at least of the hot season in the moister and more soothing climate of the coast of the Cape Peninsula, and the spring and autumn on the Natal coast. There was undoubtedly a good deal of cardiac irritability and of palpitation among the troops during our operations on the higher areas, but there were, in addition to the altitude, the fatigues and privations of war which cannot be separated from the effects of altitude.

Temperature. — Away from the coast-belt the extreme temperatures, both annual and diurnal, vary considerably. In January, the hottest month, the isotherms form a wonderfully regular system of concentric ellipses, whose major axis is situated at a little more than 24° east longitude, inclined slightly from east to west. In this month the isotherm of 92·5° runs from the Vaal at 24° east longitude (its most southerly point) slightly to the west of Kimberley, and through the west of the Orange Free State and the Transvaal. The isotherm of 90° runs parallel to the former at a distance of about 100 miles, and the three following isotherms, those of 87·5°, 85·0°, and 82·5°, run also parallel, but at diminishing dis-

1 From Dr. Buchan's maps in Bartholomew's Meteorological Atlas.
tances. Practically the whole of the area of operations in the Transvaal and Orange Free State, northern Cape Colony, and northern Natal is included between the January isotherm of 92°5′ and 82°5′.

In February the isotherm of 92°5′ has receded to the north, the distances between the next three isotherms have increased, while the isotherms further south have become more crowded together. But the general parallelism is maintained, while in the later months the diminution in temperature from the central area towards the coast becomes more irregular, though the narrow and fairly regular ellipse of the January isotherms is still represented by a flatter and less regular elliptical formation whose major axis has shifted further east.

July is the coldest month; here the isotherm of 70°5′ passes slightly to the south of Johannesburg; that of 70° to the north of Kroonstadt, and slopes gradually north-east to pass to the north of Komati Poort, while to the south of this line the temperature gradually falls, but irregularly, to the coast, where the lowest isotherm, that of 55°, cuts off the western coast provinces, including the Cape Peninsula, from the rest of the Colony.

Putting this more generally, the annual isotherm of 83°5′ passes from a little to the north of Vryburg to a little to the south of Johannesburg, and from that point passes to the north-east, leaving Lydenburg outside it. The annual isotherm of 72°5′ follows the Rogge Veldt and Nieuwveldt ranges eastward along the Winterberg to the Stormberg range, and thence sweeps north-east through the eastern provinces and Natal to the south of Maritzburg.

From the above general statement it will be seen that the average temperature over the area in which the troops were working was sufficiently elevated to render active operations somewhat arduous during the hot season. Further, there is very little cloud, and the actual sun heat is considerably in excess of that represented by the figures quoted above. This of course applies most strongly to the upland continental climate, where the sudden fall of temperature after sunset is very marked, especially during the cold season, and the intermediate stages between it and the beginning or end of the hot weather. Unless some precaution in the way of additional clothing is possible, this sudden change is likely to give rise to a chill.

On the open veldt there is usually some little breeze which tempers the heat, but in the valleys, especially during the rainy season, the heat is oppressive, and the fall of temperature at night
much less marked. In Pretoria, the difference even of 200 feet between the town and the hospital camp on the veldt to the east made an appreciable difference in the temperature.

**Wind and Dust.**—Even the strongest advocates of South Africa as the health resort for each and every disease confess that the dust is a great objection. In the cold season anti-cyclonic conditions prevail over the high ground of the Orange River Colony and Transvaal, and the winds are gentle and without much lifting power. Hence the dust is mainly that due to traffic, which is carried up slowly into the air to form a persistent haze, but does not travel far. In the hot season the opposite is the case: the prevailing barometric pressure is lower over the higher areas, the weather is less settled, and the wind tends to blow in gusts, and at an angle with the ground. The result is that every place where the surface of the soil is soft and loose supplies its quantum of dust, and in a really good dust-storm even comparatively large particles of grit are carried with sufficient force to be unpleasantly felt on the face and neck. The distance to which the smaller particles may be carried is probably considerable, but such a storm is usually followed by rain, which clears the air, so that the effective radius of a dust-storm for the conveyance of infective material must be influenced by the violence of the wind and the angle it makes with the ground, together with the interval between its passage over the infected area and the time when the rain falls at any other place in its onward track, which is somewhat cyclonic.

**(d) Rainfall.**—The Cape of Good Hope Meteorological Commission Report for 1897 contains a very full discussion of the rainfall of South Africa between 1885 and 1894 by Dr. Alexander Buchan, M.A., LL.D., F.R.S.E., and a map by Mr. Struben showing the distribution of the summer and winter rains, besides a series of diagrams showing the distribution of the rainfall throughout the year in representative districts, mainly of Cape Colony.

It is sufficient to indicate generally the amounts of the total annual rainfall over the area of operations. To the east of a sinuous line running from near Grahamstown through Cradock and to the east of Colesberg to Kimberley and Vryburg, the annual rainfall is over 20 inches. A second more strongly curved line encircling the south-western border of Basutoland, sweeping through the Orange River Colony about midway between Bloemfontein and Ladybrand, Kroonstad and Harrismith, turns to the west of Johannesburg, and thence passes at a sharp angle to the eastward between Johannesburg and Pretoria. To the east of this
line the annual rainfall is between 30 and 40 inches; that is, over the greater part of the theatre of war the rainfall was at least 30 inches per annum.

In connection with this, the seasonal distribution has to be taken into account. Turning to Mr. Struben's map, we find that the line along which the rainfall during the summer months, October to March, is approximately equal to that of the winter months, April to September, runs from near Ladysmith, Cape Colony, northwards as far as Fraserburg and then turns north-west. From the same starting point, it runs almost due east to reach the coast north of Port Elizabeth. To the north and east of this line the proportion of rain that falls during the summer is greater than that during the winter; to the south and west the converse occurs. A line of the same general shape with its angle about Fraserburg Road Station marks off an area to the north and east in which over 70 per cent. of the total annual rainfall occurs during the summer months, and it was in this area that our troops were mainly employed.

(To be continued.)