

and Co., of Stockport, in patiently demonstrating the different processes of manufacture, and subsequently revising the foregoing description. He has also to thank Dr. M. Young for securing the accompanying photographs, and Dr. Edwin Rayner for calling attention to the word "crozing."

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## TYPHOID FEVER IN SOUTH AFRICA: ITS CAUSE AND PREVENTION.

By GEORGE TURNER, M.B., D.P.H.,  
Medical Officer of Health, Transvaal.

DURING the past two years the attention of the public, both lay and medical, has been very naturally directed to the prevalence of typhoid fever in South Africa. I remark, too, that the transference of infection by means of dust storms and flies appears to meet with much support.

It is true I have only been living in South Africa a little over six years, but the nature of my employment, that of medical officer of health, has certainly brought to my notice more cases of typhoid than would occur in the practice of any single medical man.

I have during these years inquired into the causes of typhoid fever in the large towns, in the villages, and in the scattered farm houses from Capetown to Mafeking and from Komati Poort to Port Nolloth.

For twenty-two years I was a medical officer of health in England and during that time I had much experience in regard to the causation and prevention of enteric fever. The experience gained in both hemispheres and under very diverse climatic and social conditions must be my excuse for interfering in this discussion.

I should not, however, venture to trouble you with my opinion on this very important question if I did not feel that the growing tendency to attribute enteric to wind and flies was not becoming a source of danger.

The following remarks must be taken as applying only to South Africa. I have read all or most of the accounts of the dissemination of typhoid by dust in India. I do not know what may happen in India, never having been there, but I do know that the reports are remarkably inconclusive, and I felt while reading them that if the epidemics in question had been investigated by any man accustomed to that work a different conclusion would perhaps have been arrived at. However, I do not wish to press this point.

During six years' experience I have found that the causation of epidemics of enteric in South Africa is practically similar to that which gives rise to the majority of cases in England, namely, a polluted water supply. Beyond the opportunity I have enjoyed of investigating the origin of typhoid in the Cape Colony, I have had more than average advantages in that respect in the Transvaal.

In August, 1900, Lord Roberts employed me to superintend the sanitary arrangements of the towns, camps, hospitals, etc., in the British occupation. I did so in and around Pretoria and Johannesburg, and in the Eastern line as far as Komati Poort and Barberton, and never had reason to suppose that enteric was attributable to either dust or flies. In fact, I have on one occasion only—and that was in the Cape Colony in 1899—had any grounds for supposing that dust was con-

cerned in the production of typhoid, and on that occasion the dust appeared to have acted through the agency of the water used for drinking.

Most of my work in the Transvaal was carried out in association with Professor Simpson, who is a member of the Enteric and Typhoid Committee. I know nothing of the opinions which will be expressed in the report he will make conjointly with Colonel Notter and Colonel Bruce, but I shall be extremely surprised if either dust or flies are given an important place in it, the evidence that water was the chief agent in spreading the disease was so overwhelming.

On p. 382 is a diagram showing the weekly incidence of enteric fever, based on the Pretoria notification returns, compared with the average monthly rainfall. The notifications are made to me at my office, for the rainfall I am indebted to a diagram issued by the Public Works Departments prepared from records kept by Mr. J. Lyall Soutter.

It is to be regretted that I can only compare the rainfall and disease in one year and in one place. I had full notes of some hundreds of cases of typhoid fever—I might probably say thousands—which I had inquired into during my tenure of office as Medical Officer of Health for Cape Colony; unfortunately a fire occurred at my office, and most of my manuscript books were lost. Only those cases recorded in printed reports remain and those I cannot now consult—they are in Capetown.

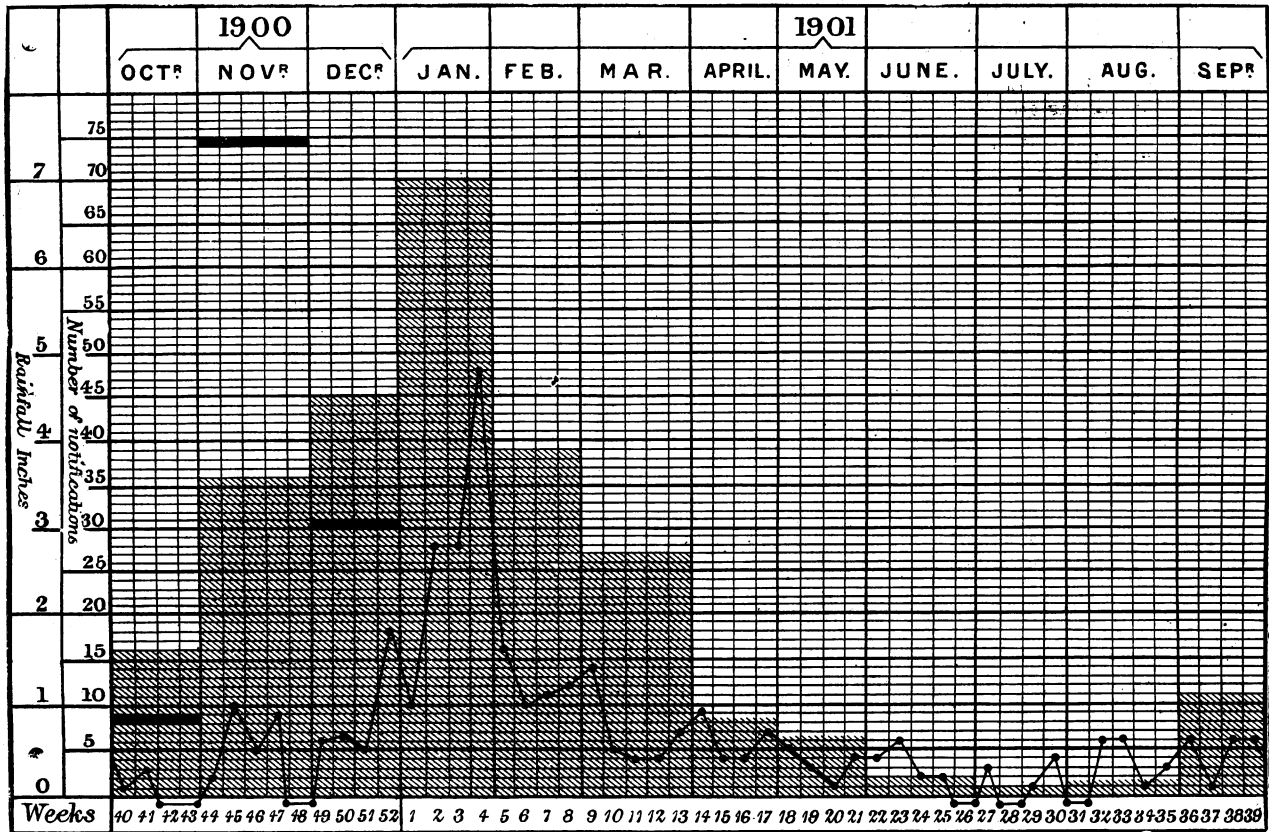
It is true that for some years we have had compulsory notification in the Cape Colony, but during the first period the returns were naturally defective, and for the past two years the war has exercised such a disturbing influence, that it would be a waste of time to work on any figures based on returns made during 1899, 1900, and 1901. I have no doubt that in a few years, working in conjunction with my colleague, Dr. Gregory, much useful information will be obtained on this point. In the meantime I send the official returns relating to one place, Pretoria and for one year—October, 1900, to October, 1901.

There is no intention on my part to deny absolutely the possibility of typhoid infection by means of windborne dust. I should say that such an occurrence is probably possible; at the same time, I deny that it is usual or even frequent.

If dust infection were the predominating or an important cause of enteric, one would expect to find the disease commence soon after the dusty season began and to cease soon after it finished. As a matter of fact, typhoid cases are least frequently met with just at the period during which dust storms prevail, and are most numerous when, on account of heavy rain, dust is less troublesome. This to my mind is conclusive proof that dust does not exert much injurious influence as regards typhoid.

As regards flies, I can only say that I hold a similar opinion. The possibility of the conveyance of enteric through these pests is undeniable; but in this instance also the supposed cause, the flies, begin to be troublesome long before typhoid prevails, and continue to annoy us long after it has subsided. If the flies were really important agents in the spread of typhoid fever, one would expect that, even if the disease did not commence to prevail soon after these nuisances commenced to be numerous—because it is conceivable that at that time typhoid-infected stools would be rare—yet when once typhoid became common the flies should carry on the infection, which should continue as long as or longer than the flies continued.

This year the typhoid fever is again steadily rising, and I should not be surprised if we suffered severely. When Lord Roberts was in command, all cases amongst the military as well as amongst the civilians were reported to the Health Office. For this the army officers in charge were paid a fee of 2s. 6d. per case. Since Lord Roberts has left notification of cases amongst soldiers has been peremptorily stopped. There may be good and sufficient reason for this; I know nothing of military matters, and never have been able to understand them. Certainly if the cessation of notification will have any beneficial effect on the war, no one would grudge a few civilian lives. In the meantime the only result, so far as I am concerned, is that I am completely in the dark as to the occurrence of disease amongst the people for whose health I am officially responsible. Nothing is more difficult than to discover conclusively



The number of cases of enteric fever notified weekly in Pretoria amongst the civilian population (22,000?) since the Proclamation came into force in October, 1900, until September, 1901. The dark shading represents the average monthly rainfall in Pretoria for nine years, 1892-1900; the thick black line the actual rainfall in October, November, and December, 1900; the thin line represents notifications.

the origin of one or even a few cases of typhoid fever, but multiply the few by ten or twenty, and patient investigation will almost certainly disclose the cause. Thanks to notification of both military and civilian cases last year I was able to trace out two or three commencing epidemics which would have caused much damage and loss of life had I not been in a position to interfere. Professor Simpson and I were working together from the time he arrived in Pretoria until he left for Capetown, and I have no doubt that he will endorse this statement.

Emphatically typhoid in South Africa is almost entirely due to polluted water. It has been said that filters were sent out with the troops, and that typhoid prevailed notwithstanding. I know that the filters were not generally used. At the end of October, 1900, I was making an inspection of a camp with Professor Simpson. We were informed that they had filters, and immediately asked to see them. The boxes containing them were produced: the screws holding down the lids had all the appearance of never having been removed, an opinion which was corroborated by the fact that the apparatus inside was contained in the original wrappings just as they were dispatched from England; I cannot say from memory how often the candles were cracked and how often it was frankly admitted that the filters had never been used systematically. I can only say that there was ample evidence that where the commanding officer had a "fad about water"—an expression once used to me by a military man—the case incidence of typhoid was insignificant. No one wants to minimize the difficulty of providing pure water when on the march. My private opinion is that if the army had been supplied with the best sanitary expert advice on the march from Paardeberg to Bloemfontein, one of two things would have resulted: Either the army would never have reached Bloemfontein; or it would, as it did, have suffered from fever. One or other of these results was inevitable.

Admitting to the full extent that sanitary requirements must give way to military necessity, I am of opinion that much more might have been done to prevent typhoid fever, especially in camp. I remember once inspecting, with Professor Simpson, a camp to which good water had been conveyed by means of a big pipe, at the cost of some hundreds of pounds, yet, with an officer not ten yards away, we saw, in the space of ten minutes, at least six men drink or fill water bottles from a sluit which contained a considerable share of the drainage of Pretoria. I called the officer's attention to the fact and he said, "They will do it." Again, on another occasion, we saw men filling water bottles from a filthy hole because it was about forty yards nearer than a perfectly pure supply. This, too, was done without any attempt at prevention. The answer to any recommendation made by us always was, "They will do it."

I believe that if a general order appeared that each man was to wear his left boot on his right foot and vice versa the army would be lame in a week, and there is no earthly reason why orders as to drinking water should not be enforced in camp with the same rigor. I do not believe that disregard to ordinary sanitary precautions such as I have described cannot be prevented, or that it is necessary in a military sense.

Let it be clearly understood that I am not casting any reflection on my colleagues in the R.A.M.C. I do not wish to be impertinently patronizing, but two years' intercourse with the army surgeons has caused me to admire that much abused body of men. However, it is no part of my object to point out where mistakes have been made in the Army Medical Service. My object is to cause men to pause before attributing enteric in South Africa at least, to dust and flies. Once this idea has become rooted, investigation, worth speaking of, will cease. It is so easy and often so acceptable to attribute an epidemic to atmospheric influences. It is the lazy man's excuse, the delight of the do-nothing sanitary

authority. Who can as yet control the atmosphere? The wind bloweth where it listeth.

In conclusion I hope, by a simple device in a year or so, to be able to contrast the frequency of typhoid with the comparative prevalence of flies, and also with the average amount of dust blown through a given vertical area.

I am collecting evidence on the subject of typhoid fever and the variations in the condition of the water supply, but as yet it is too soon to publish the results I have obtained.

### AIRBORNE TYPHOID.

BY LIEUTENANT-COLONEL R. H. QUILL, R.A.M.C.,  
Senior Medical Officer, Ceylon.

At the late meeting of our Association, Dr. Leigh Canney read a very interesting paper on the Etiology of Typhoid Fever, in which, while strenuously supporting the proposition that epidemics of typhoid fever are always waterborne, he vigorously denounced those who ventured to believe that such epidemics could sometimes be traced to an airborne origin.

I should like to say, at the outset of the remarks I have to offer on Dr. Canney's proposition, that I, in common, as I believe, with the officers of the R.A.M.C. as a body, hold that epidemics of typhoid fever are chiefly waterborne, and it is to the water supply we first turn our attention when investigating the origin of typhoid cases, occurring sporadically or epidemically. But I am entirely at issue with Dr. Canney when he lays down the hard and fast proposition that typhoid epidemics are invariably waterborne—never airborne.

The subject is one of far-reaching importance, well deserving of full discussion. I will therefore, as briefly as possible, adduce evidence to prove that the waterborne theory will not *always* account for the occurrence of a typhoid epidemic. My facts will be drawn from our experience in connexion with the large camp in this island where Boer prisoners of war are confined.

In August, 1900, a large camp was formed at Diyatalawa, in the hills of Ceylon, for the Boer prisoners of war. The first batch of prisoners arrived on August 9th, and succeeding batches quickly followed, until by the end of December 96 officers and some 5,000 men were under confinement.

On September 21st, 1900, one of the prisoners who had arrived on September 5th reported sick. He was found to be suffering from typhoid fever of probably ten or more days duration. This was the commencement of an epidemic of typhoid among the prisoners, which soon assumed formidable proportions. By the end of December 600 cases had been diagnosed as typhoid fever, and during the same period some 200 cases of simple continued fever occurred, many of which, it is highly probable, were mild cases of typhoid.

We fully satisfied ourselves that this epidemic of typhoid among the prisoners had been imported from South Africa, but in that connexion I refrain from further remarks, as it has nothing to do with the proposition I have set myself to prove.

It is here necessary for my argument that I should briefly describe the relationship which exists between the prisoners' camp and that of the surrounding camp, where is located the military guard.

The prisoners' camp, situated on an undulating slope, is surrounded with a strong fence of barbed wire; outside that fence are inner and outer military guard lines. The "inner guard" consists of a number of sentry boxes at intervals of 100 yards, and placed only some 20 yards from the barbed wire fence. The "outer guard" consists of guard huts occupied by strong guards, placed on rising ground some 200 yards further back. The latrines, urinals, washhouses, and hospitals for the prisoners are all situated close to the barbed wire fence which surrounds the prisoners' camp as a whole.

The guard for the prisoners was formed by the 2nd Battalion King's Royal Rifles, who were a fine healthy body of men. No suspicious fever of any kind, prior to the outbreak among the prisoners, existed among them. The battalion remained in a thoroughly satisfactory healthy condition until October 18th, 1900—that is, for over two months after its arrival at Diyatalawa, and for a month after the first case of typhoid occurred among the prisoners.

On October 18th a man reported sick; he was found to be suffering from fever, which quickly proved to be typhoid. From that date admissions for typhoid among the battalion occurred at short intervals, until by the end of December there had been altogether 24 admissions and 5 deaths.

Now, in attempting to account for this outbreak of typhoid fever among the military guard at Diyatalawa Camp, I commence by advancing the following evidence against the outbreak having been in any sense waterborne.

1. The water supply was obtained from a mountain stream some three miles distant, and was brought into camp by underground iron pipes. The intake in the hills was so isolated that its pollution was, indeed, very remote. On the arrival in camp of the main iron pipes, smaller ones passed directly into four large Pasteur tank filters disposed about the camp in suitable positions, while in each barrack hut portable Pasteur or Berkefeld filters were placed and kept under careful supervision; thus all water used in the camp before its distribution invariably passed through a thoroughly reliable filtering medium. The water prior to filtration was subjected to a weekly chemical analysis, and the report always gave the water a high character; a similar verdict followed frequent bacteriological examinations. There has been no alteration in the water supply or filtering arrangements since the camp was opened, and no case of typhoid fever has occurred among the troops since December, 1900—that is, since the practical cessation of the epidemic among the prisoners of war.

2. No fresh milk was allowed within the camp precincts. When milk was required condensed milk (Milkmaid Brand) was used.

3. All aerated waters used in camp came from the Ceylon Brewery at Newera Eliza, and were identical with those used at that sanatorium. There has been no enteric fever at Newera Eliza.

4. No uncooked food or uncooked vegetables were used in camp.

5. No native hawkers of any kind were allowed to enter the camp.

6. Within the camp there were five or six native shops; these were under strict military supervision. No native drinks of any kind were sold in them. The aerated water sold in them were invariably procured from the Ceylon Brewery at Newera Eliza.

7. All men leaving the camp for purposes of duty or pleasure were obliged to take with them a water bottle filled with filtered water.

8. It is to be remembered that for obvious military reasons the camp was situated in an isolated position in the hills far removed from habitations of any kind.

As the foregoing considerations, in my judgment, completely put out of court a waterborne cause as being responsible for the typhoid outbreak in the military camp, I was driven to the conclusion that the infection was airborne, being derived from the adjoining prisoners-of-war camp, where at the time an epidemic of typhoid fever was raging.

In support of that opinion I submit the following observations:

1. Guard huts, accommodating strong guards, surround the prisoners' lines, and are close to them. This for military reasons is unavoidable.

2. The men on sentry duty are during day and night posted at short intervals almost immediately outside the barbed wire enclosure which separates the prisoners from the military camp. Thus those on sentry duty (a numerous body of men) are in close contact not only with the prisoners, but with their latrines, urinals, and washhouses, all of which, as I have already stated, are situated close to the barbed wire fence. The undesirability on health grounds of the line of sentries being placed so close to the prisoners' camp was fully recognised, but for military reasons it was not found possible to alter the arrangement. From the foregoing remarks it will be obvious that those on duty in the guard huts and sentry boxes must be to a very appreciable extent exposed to the emanations arising from the latrines used by the prisoners of war, especially during the time when the latrines are emptied—a frequent necessity. Now assuming that such emanations contained typhoid organisms—not a very far-fetched hypo-