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The Story of a Small Campaign: The Medical Arrangements during the Burma Rebellion, 1931.

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Abstract.—(1) A general description of Burma, its climate and seasons.—(2) The medical experience of former campaigns in Burma.—(3) Medical resources available and methods adopted to preserve the health of the troops, with special reference to accommodation, water supplies, malaria, heat-stroke and venereal disease.

THE Burma rebellion of 1931 was a very small campaign if judged by the number of troops engaged and the battle casualties, but it is of interest, as the operations took place in a notoriously unhealthy jungle country, and owing to the wide dispersal of the troops the medical arrangements differed materially from those employed with large bodies of troops operating in Europe.

Description of Burma.—Burma lies between 10° and 26° North latitude. It is 1,300 miles long, 500 miles broad, and has a total area of 230,000 square miles, or roughly four times the size of England.

There are two main seasons, the wet and the dry. The monsoon lasts from the end of April until October. The rainfall during this period is very great, varying from 200 inches in Arakon to 90 inches in Rangoon; however, the area north of the Toungoo—Thayetmyo line is known as the dry zone. This is a comparative term, as during the monsoon heavy rains occur in this area.

The temperature in Burma is never so high as in parts of India, the average mean being 82° F. Temperatures of 106° and 107° F. are, however, met with at times, and the saturation of the atmosphere is always excessive, and a temperature of 90° F. can be very uncomfortable.

Communications.—The plains are intersected by the Irrawaddy, which is navigable by good-sized river steamers for 900 miles (as far as Bhamo).

A main line of railway runs from Rangoon to Mandalay, and after crossing the rivers by ferry the journey can be resumed as far as Myitkyina. Several branch lines run off this main line, e.g., from Mandalay through Maymyo to Lashio, one westward through Meiktila to Myingyan, and another from Pinmana.

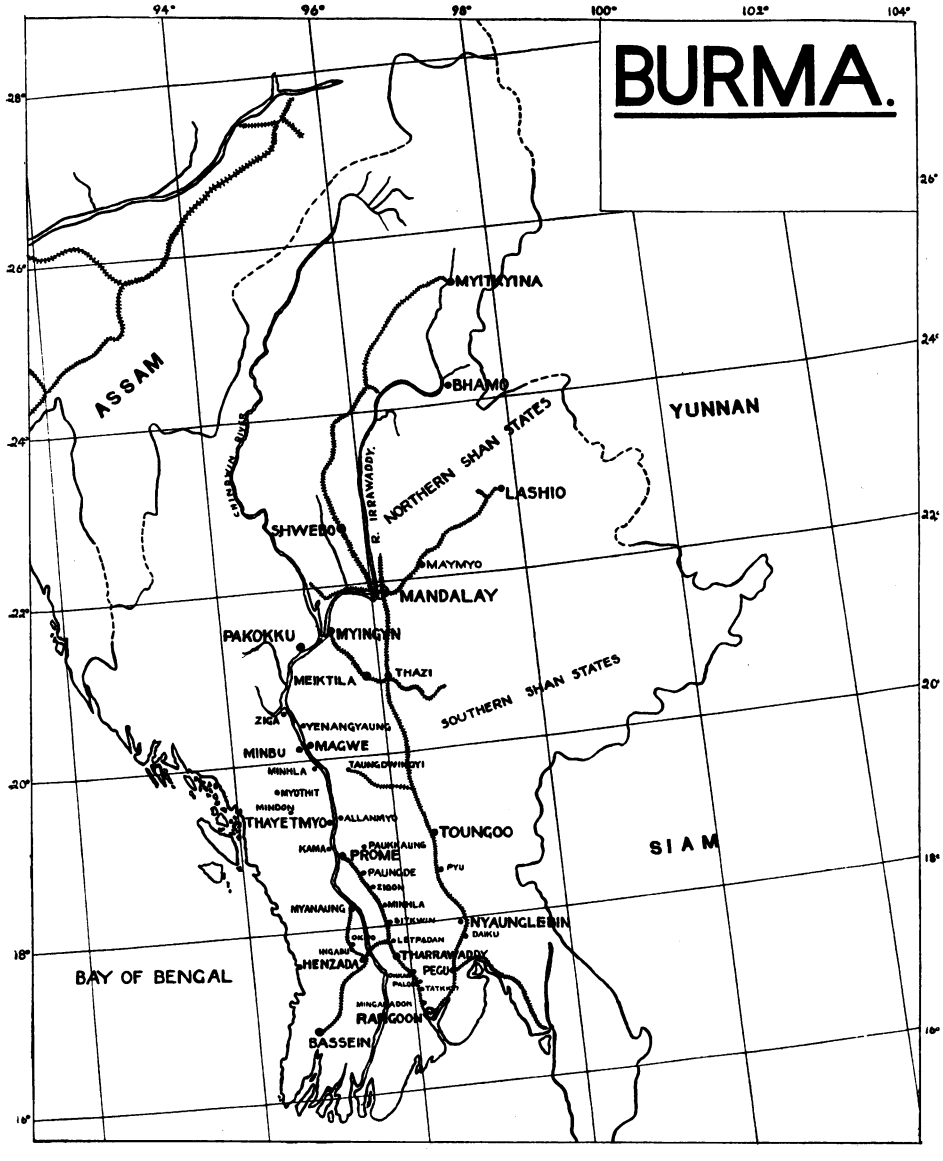
A main line runs from Rangoon to Prome on the river, and on the western side of the river a railway runs from Bassein through Henzada to Myaung.

Roads.—Outside the towns there are very few roads. In fact there is really only one good road which joins Rangoon to Prome, and one other which runs from Mandalay to Maymyo, otherwise they are only tracks impossible for wheeled traffic except in the dry season.

Experiences of former campaigns in Burma have all shown very heavy casualties from disease. The first Burmese War in 1824 ended inconclusively from this cause. The condition of the troops was described as pitiable, and 3,115 of a force of approximately 7,000 men died of disease during the year of the campaign.

During the second Burmese War in 1852-3, although better arrangements were made for the health of the troops, the casualties were very heavy. In the attack of

the fort in Rangoon cholera broke out, and fifty cases occurred the first night, in forty-seven of which the patients died before morning. In a march of twenty-four days carried out by Brigadier-General Sir John Cheape with 1,150 men, 230 men died, of whom 100 died from cholera.



Lower Burma was permanently occupied by the British as a result of this campaign.

As a result of the third Burmese War in 1885, King Thibaw was taken prisoner and deported to India. The first part of this campaign was a mere procession, the troops being moved by river to Mandalay. The final pacification of the country did

not, however, take place until 1889, and by this time 25,000 troops were employed. No official statistics of the sick and mortality rates for these operations were published, but, judging by the cemeteries dotted over Upper Burma, they must have been very heavy.

The recent rebellion broke out when, in the latter months of 1930, dacoities were becoming more and more frequent in the area of Tharawaddy, about sixty miles from Rangoon, and on December 26 the Government of Burma asked for troops to aid the civil power. These were dispatched, and in a few weeks were scattered over numerous posts, extending from Rangoon to Prome.

The trouble spread and it became evident that reinforcements from India would be necessary. Finally, in June, the 12th Infantry Brigade and Auxiliary Troops and Medical Units arrived in Burma. By July the rebellion was in full swing and the troops were scattered in over 60 posts from Shwebo in the north to Bassein in the south.

Medical arrangements.—At the outbreak of the rebellion the medical resources in the country were very limited. Good British and Indian military hospitals existed at Mingaladon, 12 miles from Rangoon, at Mandalay and at Maymyo.

The only mobilization arrangements were that the medical and ordnance equipment of seven sections of field ambulance were in store in Mingaladon and Maymyo, but no transport or personnel were available. Strict orders existed that the equipment must not be used except on mobilization which would take place after ninety days.

Medical staff consisted of an Assistant Director of Medical Services and a Deputy Assistant Director of Pathology who ran the District Laboratory. For reasons of economy Burma had had its sanitary officer withdrawn.

Troops available.—Two British Infantry Regiments, less one Company in the Andamans, and four Indian Infantry Battalions with a Company of Indian Sappers and Miners and an Indian Mountain Battery were doing duty in Burma, but not all of these were available for duty in the field. The big towns and the arsenal at Mingaladon Cantonment could not be left without troops. One of the active battalions of the Burma Rifles stationed at Mandalay was ineffective; the reasons for this illustrate the unhealthy nature of the country.

There are four active battalions of Burma Rifles, two of which serve overseas, one in India, and one in the Malay States.

When a regiment returns from abroad, the men are given furlough in two large batches. To reach their villages these men travel on foot for several hundred miles over most malarious country. The first batch had just got back and to a man were either ill in hospital or attending hospital with malaria, dysentery, venereal disease or skin trouble. Previous experience had shown that at least two months would elapse before the unit was fit. The question of furlough in the unhealthy season had caused much controversy between the Medical Directorate and the Staff, but the season of relief and the necessity of having the men back for the next training season had prevented any change being made.

At the first staff conference, the Civil Government and the heads of the Civil and Military Police being present, it emerged that—the police were unable to cope with the situation and the G.O.C. Burma was asked to supply the troops necessary to aid the Civil Power.

The staff decided that operations must be carried out during the monsoon although the casualties from sickness were likely to be heavy.

At this stage, in addition to the usual sanitary precautions recommended to safeguard the health of the troops, special stress was laid on three points: (1) efficient shelter against the elements; (2) safe water supply; (3) prevention of malaria.

Administrative medical difficulties in the early stages.—The most serious was to

find medical personnel to man the scattered posts. Regiments were broken up into company and platoon posts over, at times, 100 miles. The existing hospitals were depleted to the danger point, but later the D.M.S. in India supplied extra sub-assistant surgeons and Indian hospital corps personnel.

When the possibility of a new brigade from India was mooted an appreciation of the medical situation was sent to Simla. As no evacuation of sick from Burma was contemplated, it was considered that a daily sick rate of five per 1,000 fairly represented the situation and on that basis 200 additional beds for Indian troops and 75 for British troops would be required. A sanitary section was asked for and a D.A.D. of Hygiene to strengthen the staff of the A.D.M.S.

When the new brigade arrived from India in June it was accompanied by 200 beds of No. 3 Indian General Hospital, 100 beds of No. 8 British General Hospital, the personnel and motor ambulances of 28 Field Ambulance, No. 14 Sanitary Section and an experienced D.A.D. of Hygiene.

Utilization of these medical units.—The existing military hospitals were expanded, 100 Indian beds being left at Mingaladon and Rangoon and the Indian military hospitals at Mandalay and Maymyo were also expanded. A complete unit of fifty medical beds was sent into reserve at an old cantonment at Meiktila. Fifty British beds were sent to Maymyo and the British military hospital at Mandalay was extended from twenty-three to fifty beds. The remainder of this unit was sent in reserve to Meiktila.

The main difficulty was how to utilize the Field Ambulances. It could not act normally with the widely scattered posts. At first one section was left at Mingaladon and the remainder went to Meiktila.

The Sanitary Section was a serious problem. As such a unit does not exist in peace time in India, it had been hastily got together; all the Indian personnel were enrolled and put into uniform the day before they left India. Apart from the officer in command and the two R.A.M.C. N.C.O.'s, none had had any previous training. The six British other ranks from British regiments had had no real sanitary training. Half the unit was left at Rangoon under its officer and the remainder sent to Maymyo for training under the D.A.D. of Hygiene. Eventually the unit was very useful in clearing up old cantonments and the British personnel were invaluable for water duties.

Arrangements to deal with sick at the various scattered posts.—At every post a detention hospital was formed, varying from two to sixteen beds. These were in existing buildings, or in excellent matting and thatched buildings provided by the R.E. As the Arsenal and R.E. had no material to equip these hospitals in the early stages it was sent out from existing military hospitals, which then indented to replace the material lent. These military hospitals acted as parents of all detention hospitals, and all returns were rendered through them. The detention hospitals saved much wastage, and experience showed that it was better for a case of malaria to be detained for a few days than to be evacuated with high fever. No deaths occurred from malaria, and I consider that this policy was largely responsible.

Decentralization of control.—Until the arrival of the brigade from India all medical arrangements were directed by the A.D.M.S. from district headquarters. This soon became impossible and all local arrangements were placed in the hands of the senior medical officers at Rangoon and the Thayetmyo area.

Evacuation of cases.—The evacuation of sick and wounded from posts on the railway from Rangoon to Prome presented no difficulties. Trains ran twice daily and good accommodation was reserved on the ordinary trains. When sufficient cases required transfer to hospital, a special bogey coach with lying-down accommodation was available to attach to any ordinary train, and motor ambulances on good roads were available to transfer the cases to the military hospital at Mingaladon. Sick attendants accompanied the trains.

From the opposite side of the river, where all the posts were again on the railway line, evacuation to Rangoon and Mingaladon presented no special difficulties. There were two main detention hospitals: one at Bassein and one at Henzada. From Bassein a comfortable river steamer of the Irrawaddy Flotilla Company ran daily, and reached Rangoon in twelve hours. Cases were met at the docks and conveyed by motor ambulances to the 30-bed hospital at Sale Barracks, Rangoon. This, if full, passed cases on to Mingaladon, twelve miles away, by good road. It was quicker to send cases from Henzada across the river by a big and comfortable steam ferryboat and then entrain them at Tharawa. The whole journey to Mingaladon was accomplished in twelve hours.

Before a general hospital was established at Thayetmyo cases from posts on the river were shipped from these posts in the daily Irrawaddy Flotilla steamers, those from south of Yenangyaung going to Prome, where the boat runs alongside the train, and thence to Mingaladon by train. From posts in the northern sector of the river cases went by boat to Myingyan and thence a six hours' journey by rail to Mandalay. There was a good detention hospital at Myingyan.

From posts on the main Rangoon-Mandalay railway cases went by train to Mandalay or Rangoon—whichever was nearer.

Owing to the operations being confined mainly to the southern sector of the railway, the hospital at Mingaladon had from time to time to be relieved of both British and Indian patients who were comfortably conveyed in special carriages with lying-down accommodation, to Maymyo, a semi-hill station at a height of 3,500 ft., where the temperature is considerably lower, and these patients convalesced well. This journey occupied about twenty hours.

Collection from field posts not on the railway and river.—This was much more difficult, owing to the absence of proper roads. During the monsoon wheeled transport could be used only to a limited extent.

The difficulties are well illustrated by the operations in the Thayetmyo area. This was a very disturbed area and the G.O.C. decided to have a drive through it from north to south. On the south a semi-pukka road ran out to Yemyet, and the Sapper and Miner Company with a Company of the Pioneer Regiment, after strenuous work, often up to their waists in water, made it fit for wheeled traffic out to Mindon. On the north the track, for it was not a road, could not be made fit for any sort of wheeled traffic during the monsoon. Some of our troops on this road which runs west from the river at Minhla were fifty miles from any suitable form of transport, and three columns were to operate south getting ever further from roads and river. The O.C. 28 Field Ambulance, in charge of this area, arranged a series of rest posts along the route to Minhla, thirty-five riding ponies were available which did good work for sick who could sit on a pony. Some cases had to be carried by hand from post to post and accommodated at night at the rest stations where good cover was provided and medical personnel available. Local labour was often employed as stretcher squads. The difficulty was enhanced by the fact that no small party could move without an escort of rifles, as the rebels did not recognize the Red Cross.

Before the Pani Chaung to Mindon was bridged, some cases came down by small country boats through tortuous creeks, and on one occasion a launch found one of these with a delirious officer on board who had then been four days on the journey. On the river were well-organized detention hospitals and a general hospital now functioning at Thayetmyo, where cases could be retained until fit for evacuation by river and rail to established military hospitals.

In the later stages of the sweep through the Pegu Yomas, the rains were over, and my successor informs me that six-wheeled motor ambulances did good work often making their way right over the paddy-fields. Elephants were also used for a short time in the later stages and did good work.

Throughout the operations there was never any breakdown in the evacuation of

sick, and much credit is due to the resource and initiative of all the medical staff responsible for the arrangements. There was never a shortage of hospital beds and, by transfer of special cases and convalescents up country, room could always be made where required. The section of No. 3 Indian General Hospital established in a large barrack room in the old cantonment at Thayetmyo had a British wing where both officers and men could be accommodated, and did excellent work. Later, in the final drive, this hospital was moved southward to Prome, leaving a small unit at Thayetmyo, and now that the monsoon was over became established in excellent tentage.

Measures to preserve the health of the troops in the field.—Accommodation. Indian pattern tents, or indeed any tents, are valueless as shelter against the monsoon rains of Burma; the Burman puts his dwelling upon stilts to be above the water. In some of the posts in the main villages the barracks occupied by the military police were available, but these were never sufficient to house the troops, and in most cases were unfavourably situated in the centre of the villages. Crowds of native women and children lived in close proximity, and in many cases the area was surrounded by the refuse dump of the town.

We insisted that at all these posts huts must be erected, raised above the ground, and thatched to keep out rain. The magnitude of this project was rather staggering at first, but a preliminary survey showed that it was an absolute necessity.

In most of the posts these were admirable in every way; raised about 10 ft. above the ground, the area below made a stronghold by earth walls between double boarding; thatched so that rain was kept out, and with flap windows of matting.

Another valuable feature of these huts was they could be wired for mosquito nets, the use of which was rigidly enforced. Huts were not necessary at all posts, as in some areas court-houses, rest-houses, etc., could be used for small parties. In addition to the huts the usual ablution, latrine and cookhouse accommodation was also provided. The construction was carried out by the P.W.D. acting for the C.R.E. and was well and promptly done.

One other important item to safeguard the health of the troops was also provided in all main posts, and this was drying-rooms for clothing. These were made of corrugated iron, wired to hang clothes and heated by charcoal braziers.

I attribute much of the freedom from sickness to the care that was taken to promote adequate shelter and drying facilities.

Conservancy.—A wide variation exists in the methods of conservancy in the Cantonments of Burma. At our newest Cantonment at Mingaladon there is water-borne sanitation with disposal through a septic tank which acts well. At Mandalay, which is in the dry zone, there is a bucket system of latrines with removal and incineration in the cantonment. At Maymyo, incineration has been tried, but owing to the heavy rains in that area in the monsoon it was found impracticable, hence removal and shallow trenching at an area about two miles from the barracks was adopted. In British barracks the latrines are fly-proofed. For the Indian type of latrine, no satisfactory fly-proofing has yet been devised and crude creosol was used to prevent the fly nuisance.

When field operations began, it was found that all the larger villages on the Rangoon Prome line had a bucket removal system and through the local deputy Commissioner arrangements were made for removal by the Municipal Contractors. All the public village latrines appeared to be grouped round the police barracks and court-house, and the plague of vicious flies was very bad. After much protesting to the civil authorities some latrines were removed, and others closed, but to ensure reasonably safe sanitary conditions we had to supervise these with military personnel. The C.R.E. provided satisfactory latrines at all posts, after some initial difficulty about receptacles. The cost was considerable, although only posts and matting

with a mat roof were supplied, but owing to changes of posts from Indian to British troops—necessitating complete alteration in the type of latrines—the cost was increased. Even in isolated posts latrines were supplied unless occupation was very temporary—deep trench field latrines were used in this case. We insisted that any post occupied for a month should have semi-permanent latrine buildings and a removal system.

In view of the fact that the spread of dysentery is commonly attributed to latrines unprotected from flies, it is interesting that the incidence of dysentery was below that for the Burma District in the preceding year. All the old Cantonments at Shwebo, Meiktila and Thayetmyo, had good stone-built latrines which only required reconditioning; in Meiktila incineration was employed.

When the 12th Infantry Brigade, after the monsoon, went into camp at Prome, incineration was employed.

Owing to the difficulty of using transport, the number of animals at any post was never great. There was, however, a considerable collection of mules from India, at Mandalay, and it was here only that stable litter was accumulated in any quantity. Tight packing in prepared areas was employed for a time, and it was found that if at every dry interval the manure heap was fired and left to smoulder, no flies developed. In Thayetmyo stable litter was disposed of in deep trenches. The Company of Sappers and Miners assisted in the preparation of these trenches.

Water supplies.—All the permanent Cantonments in Burma have now an adequate and safe supply of water either from deep tube wells or from mountain springs collected in safeguarded catchment areas and need give no further concern. Outside these Cantonments no water supply is safe, most of the supply in the country districts being from shallow wells of the worst type. In some of the larger villages the public well was walled in but no sanitarian would regard the water as safe.

In the old Cantonments which we re-occupied, water-supply was also a serious problem. At Shwebo it was from a moderately deep shallow well. The first one tried gave saline water, but a second was opened and deepened and a good supply was secured after treatment. At Thayetmyo, where the old Cantonment was served by many wells scattered through the barracks, the wells had either been filled in or had ceased to yield water, we therefore had resource to the Irrawaddy, now, in the monsoon, a thick muddy stream. Hand pumps were arranged, worked by jail labour, and an ample supply filled the Cantonment tanks. In the final stages of the rebellion when the 12th Infantry Brigade moved south from Thayetmyo to Prome, the river was again our supply.

At Meiktila—which is looked on as one of the health resorts of Burma—where we formerly had many troops, and where during the European War there was a large Turkish prisoner-of-war camp, there was a well-constructed sand filtration installation to deal with the water pumped from a large lake. I had inspected this place more than once before the rebellion. I found the duplicate set of filter beds both in use at once and was told that this was because not enough water would get through if only one was used. I asked what happened when not enough got through the two beds and the old Burman in charge proudly produced a long bamboo pole and demonstrated how by pushing this into the sand layer the flow was at once increased. Under trained supervision these filter beds proved a safe but at times limited supply for the number of troops in the Cantonment.

The military arrangements for carrying and purifying water in the field in India have none of the refinements of the Home Army. No water-cart of any kind exists and the old skin mussack is not obsolete, although the kerosene tin has largely taken its place. On the march, in addition to the men's water-bottles, water can only be carried in mule pakhals holding 5 gallons each. Arrangements had to be made for receptacles in which water could be clarified and chlorinated. At every post occupied

for more than fourteen days the C.R.E. supplied galvanized iron tanks, which he purchased in Rangoon. These were arranged in series so that water could first be clarified by alum, or by the special clarifying powder supplied, and then run into another tank for chlorination. In the larger cantonments duplicate batteries of large tanks were provided. Here we experienced our first real difficulty. There was so much mud in the Irrawaddy water that after clarification a deposit of nearly 6 in. was found in the tanks instead of the few inches expected; the outlet pipe had been placed accordingly, but before they would function properly the pipe had to be moved to be a foot above the bottom.

The first lot of tanks supplied had no vent in the bottom to clear out the deposit and others were set up on a solid base, so that the scouring out could not be done until they had been moved on to wooden framework stands. One set of tanks moved from one post to another caused a report to be received that to unscrew the washing-out plug a man had to get into the tank. It was then discovered that the taps had been moved from the outside and screwed on inside to prevent damage in transit. At first alum was used for sedimentation, and later, a special clarifying powder. Our estimate for clarifying powder, which had to be imported from India, was a ton a month to supply all posts where clarification was necessary.

Chlorination gave rise to many difficulties, largely from the poor quality of the bleaching powder supplied. Some tins gave as little as 2% of available chlorine; even the supply in glass bottles varied very much. Both types of container were far too big, and once opened deteriorated rapidly in the hot moist climate of Burma. I strongly advocate the supply of small wide-necked bottles containing not more than a few ounces. It was realized at once that no safe water supply for posts could be ensured if the preparation was left to the regimental authorities, and consequently, the supervision and sterilization of water supplies was undertaken by the medical personnel at each post.

At large cantonments the water arrangements were undertaken by the European personnel of the sanitary section. In the smaller posts it was done by the assistant surgeon, the sub-assistant surgeon, or the nursing orderly of the Indian hospital corps if neither of the first two was available.

These were all especially trained in the use of the Horrock's box, and the work was well and faithfully done.

Within a few weeks of the opening of the campaign the district was short of Horrock's boxes and Lt.-Col. Tabuteau had improvised sets which were carried in a small japanned tin box bought for one rupee eight annas in the Bazaar, enamelled tin mugs graduated on the inside as measures, and the necessary reagents in bottles. These served the purpose well. When a small post moved suddenly, or a body of troops was on a raid, tanks could not be carried. If the number of troops was greater than could be supplied from the pakhals, Willesden canvas tanks were supplied which could be readily carried on pack mules and set up on the ground with wooden pegs, and these answered well. No post or body of troops ever had to drink unprepared water, and to this must be attributed their freedom from water-borne diseases. The report of the health of the Army in India shows for Burma a decrease in dysentery from the previous year when the troops were all in cantonments.

Twenty-two cases of the enteric group of fevers occurred in the troops in the Thayetmyo area, and two in one other district, but an extensive investigation failed to trace this to water supply or to a carrier amongst the cooks or water-carriers. It was, of course, not possible entirely to prevent Indian troops buying food from the inhabitants. These were the only areas in which an outbreak of the enteric group of fevers occurred.

There were no cases of cholera, and this should be compared with former campaigns over the same area. This, in spite of the fact that cases were occurring amongst the civil population in the areas occupied by troops.

These results show that carefully supervised water purification, even if the methods are crude, can reduce water-borne diseases to the vanishing point.

Malaria.—A study of the previous campaigns and a knowledge of the incidence of the disease in the jungle of Burma led us to expect that a serious loss of man-power would occur if the troops were employed in the jungle in the monsoon period. Malaria is always present; it is at its worst during the periods just before and, especially, just after the monsoon, when the drying-up process is going on. Some of the posts that we occupied had a very bad reputation. For instance, Mindon, close to the Arakan Yomas, was reputed to be so bad that the local inhabitants deserted it in the worst period of the year. The employees of the timber firms, whose work lies in the jungle, suffer much from malaria.

In the training battalion of the Burma Rifles many recruits are rejected on account of massive malarial spleens, and we always treated every recruit by quinine for two months after arrival at the Depôt. Apart from fresh infections, exposure and wetting constantly predisposed the troops to relapses, as most of them had been previously infected.

It was consequently decided that: (i) Mosquito nets should be used at night wherever possible. (ii) Prophylactic quinine should be given. (iii) Repellents should be available for use by all troops. This was in addition to the other orders such as those forbidding the wearing of shorts after sunset, etc.

Every man possesses a mosquito net, and in Burma these are used in all cantonments all the year round; the men are therefore accustomed to them and like them for the protection from irritating bites. The nets are of good quality and are meant for use with a bedstead or charpoy. A special bivouac type was promised from India, but did not arrive in my time. All the huts occupied and all buildings taken over were wired by the R.E. for the suspension of these nets. Difficulties were experienced; where no bedsteads or charpoys were available and the men lay on the floor it was reported they could not be used; however, a lengthening of the hanging tapes soon overcame this. Even in the small Indian 160 lb. tent they can be used for every man if they are trained to it; we had carried out such training during the previous cold weather and proved to all ranks that it could be done. Nets were therefore used wherever possible, and it was only parties doing night operations that could not be so protected. Some of the immunity from malaria must have been due to their use.

Prophylaxis.—No one could gauge how long this rebellion was going to last; it might be a few months; it might be a year or two. In the early stages the troops were all too few to deal with the situation and at this stage it was doubtful if we could succeed in protecting the men by nets at night. Mosquito-proof quarters were out of the question and larger measures of dealing with the mosquitoes in the posts were impossible. Quinine prophylaxis therefore seemed indicated. European officials whose work lies in the jungle of Burma had no doubt about its value. The question of whether malaria would merely be masked and relapse cases more frequent was regarded as of little immediate importance. It was necessary to maintain men at duty; consequently quinine was given under strict medical supervision, in 10 gr. doses, to every man in a post outside normal cantonments.

Up till October, 1931, quinine prophylaxis alone was employed and the incidence of malaria per 1,000 was only a decimal point in excess of the figures for Burma in the previous year, when the troops were in normal cantonments. At this stage the work of Colonel James on the use of plasmoquine as a prophylactic was receiving publicity and my successor decided that it was worth a trial. My successor, Colonel Hanafin, points out that the figures for Thayetmyo are to some extent fallacious, as in many cases the diagnosis was only clinical and there is a strong tendency in these circumstances to regard any short pyrexia as malaria. The change

from quinine to plasmoquine also complicated the figures, but it was found that amongst equal bodies of men, half taking quinine and half plasmoquine, the result is slightly but distinctly in favour of quinine.

Later, a small reconnaissance party made a tour of a very malarious district known as the Pegu Yomas—and at a very malarious time of the year—with the A.D.M.S.; a careful trial of the two methods was made, and the result was strongly in favour of plasmoquine.

Shortly afterwards an extensive sweeping operation of this area was carried out, and acting on the experience gained from the reconnaissance, plasmoquine was used instead of quinine. The A.D.M.S. pointed out to the General Staff that even with prophylaxis a high incidence of malaria was likely, and actually forecasted the daily numbers of sick to be expected from it. The General Staff decided that military necessity overcame the medical situation and the loss of man-power would have to be faced. The estimate of casualties made by the A.D.M.S. proved to be almost mathematically correct. This drive was successful and ended the rebellion, as most of the leaders and their followers were killed or captured.

The D.M.S., in his report of the health of the Army in India for 1931, refers to malaria prophylaxis in Burma as follows:—

> "In addition both quinine and plasmoquine were used as prophylactics on alternate bodies of troops, even though it was realized that there would probably be an increase in relapse malaria in the following year. The results were satisfactory in that the Force did not suffer to any appreciable extent, but the anticipated increase in relapse cases has occurred, at least among Indian troops."

The relapse figures for British troops for March, April and May, 1932, were below the figures for all India. For Indian troops who had served in Burma, relapse cases were 17·6 compared with 2·9 per 1,000 for all India in March, 1932, 16·5 compared with 4·4 for all India for April, and 6·7 compared with 6·9 for May. It appears to me that if treatment with quinine or plasmoquine had been continued for two months after the troops left the malarious area, this increase might have been obviated.

The total figures for malaria in Burma for the year of the rebellion showed an increase over 1930 from 40·19 per 1,000 to 66·34 per 1,000 for British troops. For Indian troops the incidence rose from 31·75 to 149·41 per 1,000.

Use of repellents.—For sentries, and during the frequent night operations in the jungle, bamber oil was used. The men have great faith in this, and like it if only for the freedom which it confers from the irritation of insect bites. At first small parties carried bamber oil in bulk in bottles or tins for general use, but an individual supply was judged to be necessary, and the 12th Infantry Brigade indented for 4,000 4-oz. bottles for the purpose. Though these bottles could have been provided by the medical store depôt at Rangoon, it was felt that constant replacements would be necessary, as men would be inclined to throw them away when empty; metal rifle-oil bottles were therefore obtained from Arsenal and 200 were issued to each regiment to be used by sentries and parties on night raids.

The rebels, who were tattooed to confer invulnerability, were under the impression that our men used bamber oil as a charm.

Diagnosis of malaria.—It may be contended that diagnosis may have often been fallacious in the absence of laboratory proof. This had been anticipated, for when the medical necessities had been represented to Simla, additional microscopes had been asked for and supplied, and the more important detention hospitals had clinical side rooms, the necessary stains, etc., being supplied from the district laboratory. All assistant surgeons and sub-assistant surgeons are trained in the identification of the malarial parasite. Nevertheless the diagnosis must of necessity often have been clinical, but, in spite of the tendency of sub-assistant surgeons to regard any short pyrexia as malaria, I do not think that the figures are seriously wrong.

In cantonments in peace the tendency is to regard cases of malaria as relapses in order to safeguard the good name of the cantonment. During active field operations, however, the tendency was to regard every case as a fresh infection. It was probably thus that some exaggeration of the incidence of malaria occurred, for relapses must have been frequent in a body of men, most of whom had previously suffered from the disease.

Venereal disease.—Venereal disease has always been a trouble to medical authorities in Burma, and in peace times it provides the highest ratio per 1,000 of any district under the Indian Government.

Rangoon is a large and cosmopolitan seaport, where the disease abounds, but even in towns up country, such as Mandalay and Maymyo, it is very prevalent. Most of the native population receive no treatment—or, at the very best, inefficient treatment—for the disease.

The absence of caste amongst the Burmans and the freedom which their women enjoy assists in the propagation of the disease. The British troops suffer most, but while the true Indian regiments have little or none, the low caste followers always provide many cases and the local Burma Rifles suffer considerably from venereal disease: this appears to exist in remote villages, as many cases occur amongst the furlough men.

The methods adopted to safeguard the troops do not differ materially from those in use elsewhere. Early treatment rooms are provided in all barracks and established at all posts where the disease was likely to occur. British troops are provided with prophylactic packets, but this is not at present sanctioned for Indian troops. Special representations on this point were made to headquarters, and at a later date these packets were sanctioned for the Burma Rifles, who have no caste prejudices against their use. The local police authorities assist by closing houses and deporting those who spread infection. Where brothels abound we found no value in putting houses or streets out of bounds, for the inhabitants simply migrate and roadside infection is common.

Unfortunately, the incidence of venereal disease amongst British troops threatened to assume serious proportions when the brigade from India arrived. The British regiment which accompanied that brigade had only left Burma the previous year and had been stationed in a part of India where access to women was difficult. They unfortunately knew their way about Burma and the detachments in Mandalay and Meiktila suffered heavily. Had it not been for this increase in venereal disease the sick statistics for British troops during the rebellion would have been better than for the preceding years.

Extra accommodation for such cases had to be provided at the British Military Hospital, Maymyo, and the increase amongst Indian troops necessitated the transfer of cases from Mingaladon to Maymyo to provide accommodation.

Heat stroke.—The medical history of previous campaigns stress the number of officers and men lost from heat stroke. My experience of the troops for the preceding three years in Burma had been that heat stroke rarely, if ever, occurred, and it required some self-discipline to maintain the heat stroke centres as laid down by Simla. The conditions encountered during active operations in the jungle during the monsoon were different from life in cantonments, consequently heat stroke precautions had to be formulated—the issue of ice to every post was recommended to the G.O.C., and the A.D.S. and T. succeeded in supplying ice to every post in the field. This was a really fine achievement, for in some cases the ice travelled by train, boat and pack for hundreds of miles, and the wastage was necessarily enormous. A few cases of mild heat exhaustion occurred, but no deaths therefrom; the ice was, however, much appreciated by all ranks. The excellent huts provided and the suitable army type of the barracks occupied in old cantonments were factors in the immunity of the men from the effects of heat.

It may be said that the troops that were principally employed in the operations, being Indian, were not so liable to suffer from heat; but the Burma Rifles are recruited almost entirely from hill tribes of Chins and Kachins who do not appreciate the hot weather in the plains of Burma, yet they were immune from heat stroke. In all huts and buildings occupied by British troops punkahs were installed, and in Toungoo we had electric fans.

Prophylactic inoculations.—The protection of the troops from the enteric group of fevers by inoculation with T.A.B. at the outbreak of hostilities was good, amounting to about 99%. The breaking up of the troops into small scattered bodies soon made it difficult to maintain this high figure of protection, and orders had to be issued to ensure the reinoculation of men as they became due. The difficulty was increased by the fact that some units arrived from India without medical history sheets and some time was lost in procuring them. The results were, however, quite satisfactory and no difficulty was experienced later.

Plague and cholera.—As both these diseases are ever present in Burma, plague and cholera vaccine were kept ready at outposts.

A certain restraint has always to be maintained to prevent young medical officers from rushing at plague inoculation on hearing of a case in the neighbourhood. In peace time a case hardly ever occurs in barracks, and we inoculate all troops only if a case occurs amongst the men or plague-infected rats are found in barracks. If this attitude was not adopted inoculation for this disease would be continuous, In one instance, in the Thayetmyo area, a company of troops had to be inoculated, as plague-infected rats were found in barracks, and in another when a case of plague occurred in a baker at Meiktila.

Tetanus.—This is fairly prevalent in Burma, and every post was provided with antitetanic serum for those wounded, whether in action or by accident, and no case occurred.

Rabies.—This is unfortunately very common in Burma. There is a Pasteur Institute in Rangoon where treatment can be given. Just before the rebellion we had obtained sanction from the Government of India to establish a branch institute in the British Military Hospital, Maymyo; hence there was no difficulty in providing treatment for troops either in lower or upper Burma within twenty-four hours of being bitten. No case occurred.

Rations.—A potent factor in maintaining the health of the troops was good and generous rations. Although conditions were not recognized as active service, Simla sanctioned the issue of rations on the field service scale to all Indian troops in the field posts and of rations on the winter scale to certain troops, such as pioneers doing strenuous work in the wet on the roads.

Special precautions have to be taken in Burma to prevent beriberi amongst troops who are exclusive rice eaters. Some years before, Major G. Wilson, R.A.M.C., discovered that this disease, which was very prevalent, could be prevented by issuing half a ration of rice and half of atta (the coarse Indian flour of the country). At first the rice-eating troops, who did not know how to make chupattis, did not like it, but soon they got accustomed to it and the disease ceased. That an exclusively rice diet could cause the disease was confirmed the previous year when a new unit arrived from India, and, unaware of local orders, did not draw the atta ration. Several cases of beriberi soon appeared in hospital at Mandalay, and the previous experience enabled us to detect the cause and remedy it at once with a result that no more cases occurred. This modification of the ration was therefore insisted on from the first with the new troops, and no cases of beriberi occurred.

The regulation regarding the issue of rum had been modified, and it is not allowed without the sanction of the Government of India. Extra tea and sugar can be issued on medical recommendation in inclement weather. Officers

Commanding objected to the extra tea, and pointed out that something was wanted which could be issued to men immediately they returned tired and soaked after a march through jungle and swamp. Sanction was, however, obtained, and with certain safeguards rum was to be issued on the recommendation of the local medical staff. This was much appreciated, and I am satisfied that it did nothing but good.

Disinfection.—With the very numerous scattered small posts this was a real difficulty, but the field service dress of the Indian soldier in the hot weather is not bulky and could be boiled.

All our fixed Cantonments had steam disinfectors. At Mingaladon a fine Alliott and Manlove disinfector, and at Mandalay and Maymyo portable Thresh disinfectors. No. 14 Sanitary Section brought with them a portable Thresh which was retained for use at Sale Barracks, Rangoon. When the troops first moved to Thayetmyo a Leleans' sac used for demonstration at our sanitary training centre was sent, but it was reported not to work well. The boiler was a local product and not very efficient. However, when a plague scare occurred in that area, a good steam disinfector was placed at our disposal by the local jail. Disinfestation of the troops was never necessary. Water was abundant if not very pure, and the troops washed frequently. There was no trench or dug-out work, and woollen underclothing was not used.

Snake bite.—Burma is infested with deadly snakes, and provision had to be made for immediate treatment of snake-bite. Antivenine was available at every post, and with every moving body of troops. Ice boxes were available for the storage of this and other sera and vaccines.

Poisoned weapons.—Information was received by the Intelligence Department that poisoned weapons might be used by the rebels. In the Andaman Islands the almost extinct race of Jarrowers still use poisoned arrows, and they were also stated to be used by the inhabitants of the unadministered territory known as "the triangle" in northern Burma. Authorities were consulted and it emerged that the substance used was the resin of a tree called hymaseik (*Anticaris toxicaria*), and that it might be smeared on bamboo stakes, palisades, or on arrows. Specimens were obtained and experiments were carried out in the brigade laboratory at Mingaladon. These showed that it is a very potent poison when injected into wounds. No cases of wounds by any poisoned weapons were met with during the rebellion.

Foot trouble.—Sore feet on the march were very rare and the infrequency was attributed by one senior medical officer to the fact that on night marches through the jungle, which often amounted to twenty miles in a night, the men wore their rubber gymnasium shoes. Whatever they wore was bound to be wet through almost at once, and the thin gymnasium shoes were probably more comfortable than boots.

Gas gangrene.—This was seen in several cases. One officer lost his leg from it and his life was apparently saved by Welchii serum. The accepted principle of early primary or secondary suture proved their value. Every officer and man was in possession of a first field dressing of the old type. The Director of Medical Services in India increased the surgical facilities by bringing the surgical equipment at Mingaladon and Mandalay up to the requirements of a first-class operating centre.

The surgical equipment of the field units from India though they fell far short of what is now provided in the field equipment of the Home Army was, nevertheless, a great improvement upon that of a few years ago. A very good operating room was established by No. 3 Indian General Hospital at Thayetmyo.

The widespread posts necessitated the issue of large numbers of medical companions and surgical haversacks. The field ambulance equipment was heavily drawn on at first in this respect, until the medical store depot at Rangoon obtained additional supplies.

Boxes containing a complete medical and surgical equipment were held ready at hospitals for immediate issue when new posts were occupied, and there was never any shortage of drugs or dressings. Stretchers would have been insufficient to deal with heavy battle casualties, but in the jungle blanket stretchers could always be improvised with bamboo poles.

Laboratory equipment.—Additional microscopes were demanded and supplied from India so that main posts could verify the diagnosis of malaria. Stains, etc., were supplied from our district laboratory.

In addition to special sanitary instructions issued to all medical personnel, the G.O.C. issued a special order to all officers commanding posts, which drew special attention to their responsibility for the health of the troops, and it was only the very friendly co-operation between the fighting troops and the medical service that rendered possible any success that attended the efforts to maintain the troops efficient throughout a very difficult period.

No good results could, however, have been obtained but for the splendid way the D.M.S. at Simla responded to every request, in spite of the fact that the situation in India at that time was strained, and personnel and equipment could be spared only with great difficulty.

Much valuable help was also given in sanitary and pathological matters by the Assistant-Director of Hygiene and Pathology at Army Headquarters.

This account may be of interest in showing that the health of troops in a tropical country can be maintained at such a level as to permit of successful military operations even in the unhealthy season.

In the report on the health of the Indian Army for 1931 the D.M.S. for India in referring to the health of Burma, says:

"No particular group of diseases were involved and it is considered that the health of the troops was satisfactorily maintained under very adverse conditions."

The average constantly sick rate for Indian other ranks in the Thayetmyo area where the most active operations were in progress in August was (in round figures) 25 per 1,000. In September, 27; in October, 33; November, 25; and December, 24 per 1,000.

During the same months the numbers on barrack treatment, i.e., attending for treatment, but not in hospital, were (in round figures) August, 27; September, 26; October 31; November, 32; December, 24 per 1,000.

For British troops in this area the figures were even better. The average strength was small, but the constantly sick in hospital rate was under two per 1,000 for the five months and the constantly sick attending hospital rate was under six per 1,000. If venereal disease could have been eliminated amongst British troops the figures would be almost nil.