

An Army Doctor's Account of Malaria Prevention during the 1914-18 War

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Abstract

The approach currently used by the British Army to prevent malaria had its origins in the 1914-18 War when many Allied soldiers had to fight in parts of the world where the disease was a serious threat. By identifying the vector less than twenty years earlier, Ronald Ross (1857-1932) had offered another way to prevent the disease besides the prophylactic use of quinine. As a result the relative merits of quinine as prophylaxis and the use of control measures aimed against the anopheline mosquito now had to be taken into account when deciding how best to protect the soldiers.

The letters of Frank Steadman (1880-1943) to his wife, written while he was serving as an Army doctor in Salonika and Palestine, shed light on how these different approaches were implemented in battlefield conditions. They show how Army doctors lost faith in quinine as prophylaxis against malaria and came to rely increasingly on vector control measures instead. The letters also highlight the difficulties faced by the British Army when seeking to destroy the anopheline mosquito either in its adult or its larval form. Whilst some success was achieved when soldiers were based in the same location for long enough to reduce the mosquito population, the situation deteriorated when they had to advance into areas where control measures had not been adopted.

Keywords

Frank Steadman, Ronald Ross, Salonika, Palestine, Malaria, Prevention

Introduction

Malaria prevention in the British Army is based on a combination of health education, chemoprophylaxis, vector control and bite avoidance measures. This approach found its origins in the 1914-18 War when British soldiers fought in operational theatres where malaria played a significant part in the outcome of the military campaigns.

In the latter half of the nineteenth century quinine had been used increasingly as prophylaxis against malaria, but it had to be taken daily, had a very bitter taste and unpleasant side effects, and was not always effective. The discovery of the vector in 1897 by Ronald Ross (1857-1932) while he was serving as a British Army officer in the Indian Medical Service offered an important alternative approach to the prevention of malaria by means of the destruction of the mosquito either in its adult or its larval form.

Malaria experts were, at the outbreak of the 1914-18 War, divided in opinion about the relative merits of these different approaches to malaria prevention. According to Harrison: 'the heated controversy between the supporters of Ross and the extreme advocates of quinine prophylaxis came to a head in the theatres in which the British Army encountered malaria'.¹

The letters from Frank Steadman (1880-1943) to his wife (Figure 1), written while he was serving as a doctor in the Royal Army Medical Corps in Salonika and Palestine between 1916 and 1918, shed new light on how this controversy affected the doctors who were having to deal with the threat of malaria in battlefield conditions. These letters, over 500 in total, represent a rich source of primary historical evidence.²



Figure 1. Frank Steadman with his wife Grace in 1916 before he went overseas.
Author's private collection.

¹ Harrison M. *The Medical War: British Military Medicine in the First World War*. Oxford: Oxford University Press; 2010. p.230.

² Steadman FStJ. Private Papers of Major FStJ Steadman DPH MRCS LRCP Lond. LDSRCS Eng. Imperial War Museums. <https://www.iwm.org.uk/collections/item/object/1030022062> (accessed 20 December 2023).

The debate about quinine

Steadman, who was a Territorial Army doctor serving with the 2nd/5th London Field Ambulance, arrived in Salonika on 8 December 1916. By this time the British Army had come to realise that malaria was a major threat in Salonika as many soldiers had contracted the disease during the summer of that year.³ All troops had been given a daily dose of quinine and the newly arrived Steadman planned to adopt this practice himself. In his letter to his wife dated 29 December 1916 he wrote: 'As in the hot weather, malaria is very prevalent in these parts, I want to put myself on a daily dose of quinine, as a prophylactic measure'.

However, his correspondence reveals a growing uncertainty amongst Army doctors about the effectiveness of quinine in preventing malaria. Many of the medical officers who had served in Salonika during 1916 had had their confidence shaken by the high casualty rates that had occurred despite strict quinine parades.⁴ While he was hospitalised with typhoid fever in the spring of 1917 Steadman spent time discussing the issue with another medical officer, Captain Ritchie, who had had experience of malaria in Salonika the previous year. From Steadman's letter dated 2 April 1917, it is apparent that these discussions convinced him that quinine was ineffective in preventing malaria and he wrote as follows:

In his base hospital last year there were thirteen thousand cases of malaria. Six died in one night! Just think of these figures! One hospital, mind! Now, I have come to an important decision. As you know, when I leave [hospital] I shall be going to one of the most malarial infested spots in the world. In India, for years past it has been the custom for Europeans living in malarious districts to take a daily dose of quinine as a prophylactic measure. It has been the teaching of the medical profession for years. Sir Patrick Manson in his book also recommends it. The army is issuing quinine to the troops in this area throughout the summer; last year it is stated that those battalions that took quinine regularly had 50% less cases of malaria than those who took no quinine.

Yet, in spite of all this, I have decided not to take quinine as a prophylactic. You will guess I have not come to this decision without very carefully thinking it out. In theory, the idea of taking quinine is excellent, but in practice I don't think it works. For example, in one base hospital last year the whole personnel took quinine regularly all the summer, yet 90% went down with malaria. Several had two, three and even four attacks. This Captain Ritchie had three attacks, two of which were the malignant type. Further, on enquiry I find that three battalions who boast they have had 50% less cases of malaria were on the Dojran front, which is much freer from the disease, being up in the hills. The battalions that had a large amount of malaria were down on the Struma valley. They went down like ninepins, whether they took quinine or not.

³ Wenyon CM. The Incidence and Aetiology of Malaria in Macedonia. *Journal of the Royal Army Medical Corps*. 1921; 37: 83-108, 172-192, 264-277 & 352-365.

⁴ Macpherson WG, Mitchell TJ. *History of the Great War based on official documents. Medical Services. General History, Vol. 4*. London: HMSO; 1924. p.108.

Even senior Army doctors, who were particularly expected to stick to the party line, had lost faith in quinine. Colonel Penny, Assistant Director Medical Services and the senior medical officer in Steadman's Division, was evidently one of the doubters:

Colonel Penny, A.D.M.S., one of the most learned soldiers I have met, does not advise quinine as a prophylactic. He does not take it himself. Moreover, there was a meeting of medical officers in this base town here a few days ago to discuss this question; most of these officers had been out here last summer, and helped to deal with the hundred thousand or so cases. They at this meeting came to this conclusion, it is better not to take quinine. A General (Medical) wrote to England to the School of Tropical Medicine, and their experts, like Sir Ronald Ross, Sir Patrick Manson, etc., replied they were doubtful as to whether it was a good thing or not, but that they were not prepared to take the heavy responsibility of recommending the Army not to take it! In consequence, fifteen tons of quinine – a very expensive drug – has been accumulated here.

Not only did Steadman now think that quinine was ineffective in preventing malaria, he and other Army doctors also believed that its use might be making it more difficult to treat malaria when soldiers became infected:

You may say "Why not take quinine just to be on the safe side?" The answer is that those that have seen a lot of cases say that men who have been taking quinine for months do not respond so readily to the drug when they get malaria, so that the disease often goes hardly with them. So you see, I have thought the matter out, and shall reserve my quinine until I get malaria, and then I shall take it in big doses, thirty to forty grains a day. I shall then, I hope, get the maximum benefit from the drug.

In the event Steadman did not have to put these theories to the test because his Division, the 60th London Division, was posted to Palestine in June 1917 (Figure 2). He therefore missed the malaria season in Salonika in which nearly ten per cent of the British Force was hospitalised with malaria in one month, September 1917, despite strenuous efforts to supplement quinine prophylaxis with other preventive measures such as drainage of the marshes and the use of mosquito nets at night.⁵ Unfortunately, although troops were encouraged to use bed nets in Macedonia, 'there were never enough to go round and in 1916 and again in 1917 the supply did not arrive from England until after the beginning of the most dangerous weeks in the summer'.⁶

⁵ Falls C. *History of the Great War based on official documents. Military Operations. Macedonia. Vol. 1.* London: HMSO; 1933 [Republished: Imperial War Museums (IWM); 1996]. p.288.

⁶ Palmer A. *The Gardeners of Salonika: The Macedonian Campaign 1915-1918.* London: Andre Deutsch; 1965. p.143.



Figure 2. Steadman on his horse 'Queenie' in Palestine. Author's private collection.

Steadman's Division joined the Allied Forces in Palestine just after General Sir Edmund Allenby (1861-1936) had taken over command with orders to capture Jerusalem. Allenby had a reputation for taking medical factors into consideration when planning military operations. Of these malaria was by far the most important and also the most difficult to overcome, and he and his commanders were determined to do everything possible to prevent the disease reducing the Expeditionary Force.

Because evidence from Salonika had suggested that quinine was of little use in preventing malaria, in Palestine 'quinine prophylaxis was not employed by compulsion, though units wishing to use it were given facilities to do so'.⁷ In Palestine the main emphasis was directed at bite avoidance and vector control.

⁷ Luce R. War Experiences of a Territorial Medical Officer. *Journal of the Royal Army Medical Corps*. 1937; 68(6): 407-414.

Vector control measures

During the rapid advance which culminated in the capture of Jerusalem in December 1917 there was relatively little that could be done in the way of vector control. However, Allenby now decided that no further progress northwards was possible until the railway had been advanced and the roads improved to permit the accumulation of supplies and stores in the forward area.⁸ Figure 3 shows Allenby's entry into Jerusalem on 11 December 1917 with Steadman amongst the crowd on the left with hands behind his back and wearing a pith helmet.



Figure 3. General Allenby's formal entry into Jerusalem on 11 December 1917. Author's private collection.

The Official History of the Medical Services during the Great War describes this period between the entry into Jerusalem at the end of 1917 and the final battles as a time of minor military operations and reorganisation, combined with incessant anti-malarial measures and with efforts to stamp out threatened outbreaks of cholera and typhus fever.⁹ The relatively static period in the campaign which resulted therefore gave Steadman and his colleagues both the opportunity and the obligation to instigate vector control measures.

⁸ MacMunn G, Falls C. *History of the Great War based on official documents. Military Operations. Egypt and Palestine, Vol. 1.* London: HMSO; 1928 [Republished: IWM; 1996]. p.302-303.

⁹ Macpherson WG. *History of the Great War based on official documents. Medical Services. General History, Vol. 3.* London: HMSO; 1924. p.457.

Jerusalem

Newly promoted to a post with responsibility for the prevention of disease for about a third of the Expeditionary Force, Steadman seems to have been taken by surprise by the severity of the malaria problem. After the capture of Jerusalem he was sent into the city to carry out a sanitary survey. In his letter dated 2 January 1918 he wrote as follows:

The battle over, I have been sent forward on a most important sanitary survey of the City of Jerusalem. It is most insanitary. I am examining all the buildings, hospitals, and billets etc. occupied by our troops, and reporting on the sanitary state, and drawing up suggestions as to how to deal with the condition present. It is very interesting and responsible work. My investigations have surprised me in one particular manner. I knew I was up against cholera and typhus but, to my surprise, I find that I am up against our old enemy, malaria, as well. I have found hundreds of mosquito larvae in the pools; mosquitoes are breeding everywhere. I have caught a lot of the larvae and am watching them develop in a bottle, to find out whether they are malaria carriers or not.

As part of his assessment of the malaria threat Steadman examined some of the local population to find out how prevalent the disease was in this area. The extent of the malaria threat within the city of Jerusalem soon became apparent. In the city many civilians carried malaria parasites in their bloodstreams which could result in British troops becoming infected through mosquitoes transmitting the disease from the affected civilians. Drastic action was needed to prevent this happening and so the Allied troops were moved out of the city. Steadman explained the rationale for this in his letter dated 5 February 1918:

Today the most famous City in the world is clear of British troops, practically. That is my doing! It was a most responsible decision to make, as it affected all other villages over a big tract of country. It is on account of typhus, cholera and malaria. The boys are far, far safer up on the hills under canvas, although it is very hard to be turned out of their billets. I was very sorry to have to advise it. But malaria is a far, far greater enemy than all the Turks put together. It can easily reduce our splendid battalions to ten men! It is a nasty dangerous type we have here, too, a malignant type which ends fatally in a few hours.

Mosquito squads

Allenby's appreciation of the importance of following the advice of his medical experts would have directly influenced all his subordinates, including Steadman's Corps Commander, General Sir Philip Chetwode (1869-1950). He readily accepted the recommendation in Steadman's report which involved the establishment of mosquito squads, teams trained to hunt for and destroy mosquito larvae, despite the burden of making sufficient manpower available.

With the help of his mosquito squads, Steadman now discovered an important type of breeding site – underground water cisterns – used by the type of mosquito capable of transmitting malaria. This had not previously been considered likely in Palestine although the probable culprit, *Anopheles bifurcatus*, which is now known as *Anopheles*

claviger, had already been encountered at built-in springs within Macedonia.¹⁰ In his letter dated 26 February 1918, Steadman declared that he was now confident he had the full support of his military commander even for a major initiative such as the oiling of the underground water cisterns:

Then the General is as keen on this problem as he can be; he realises the danger thoroughly. He has already told me that he will carry out any advice given to him, to grapple with malaria. I have only to tell him that all cisterns in Palestine must be covered over for it to be done. So you see, as soon as I get the necessary knowledge, I have the necessary power to act. The history of all previous wars in Palestine is the history of the ravages of malaria. Well, I guess history this time is not going to repeat itself! And mind you, this is one of the biggest armies that has fought in Palestine.

As Steadman now had proof that malaria-transmitting mosquitoes could breed in underground water cisterns, he instigated measures to counteract the problem. Paraffin oil needed to be poured over the surface of the water in all the underground cisterns around the villages to prevent the mosquitoes from breeding by killing their larvae. With the agreement of the civilian inhabitants the oiling was now carried out, although it made the water taste unpleasant for a few days. To his profound relief the civilian population proved to be fully supportive of the measures he was introducing. He described this compliance in his letter dated 13 March 1918:

Yesterday I went to Ram Allah to commence a most important experiment. We have decided that the only satisfactory way of dealing with the mosquito larvae – now breeding freely in most places – is to frequently oil the cisterns with paraffin. Oil, as you know, spreads over the surface of the water, and kills the larvae by cutting off their oxygen supply. We have been told, however, by many people, that the inhabitants would strongly object to this oiling, as these cisterns form their only supply of water. Moreover, that even as one man says: you can force the inhabitants to drink oil and water, animals will not!

So I went to Ram Allah to try. I had an interpreter to explain to them why we were doing it. I went with Austen and two or three other men. We were unarmed and just trusted to a cheery smile and greeting of "Sieda" meaning "Good day". They all seemed very pleased for us to put "medicine" on the water to kill those horrid "moustics" and kept asking for more. We found well after well infected with a most dangerous species of Anopheline mosquito. So far, so good! We on each occasion asked the villagers to draw all the water they needed for the day before we applied the oil.

What, however, will they be saying today? The oil will be sure to taste for a day or two. I visited the village this afternoon to superintend the oiling of more cisterns. There are over a hundred in the village, so it takes two or three days to

¹⁰ Wenyon. Incidence and Aetiology of Malaria, 1921 (Note 3). p.175-177.

oil them all. I half expected to be greeted by a hostile army of inhabitants today, but no! All was quiet. So far they are still asking for more "medicine". So I think it is going to work.

Outbreaks

In the summer of 1918 the battle against malaria around Jerusalem reached a critical stage. Steadman continued to make his trips around the countryside looking for mosquito breeding sites and made frequent trips to inspect the work of his mosquito squads who went about destroying larvae before they could hatch into mosquitoes. Meanwhile all available manual labourers were put to work to drain swampy areas to prevent mosquitoes from breeding. However, outbreaks of malaria did still occur and, in his letter dated 19 July 1918, he described how he had investigated one of them:

My anti-malarial work is becoming very interesting and a very severe struggle. The other day my old Division had eight cases of malaria which they said all came from the village of Ain Arik. I went to that village at once and searched every particle of water in it, and found no breeding of any kind. I then searched along some Wadis and found breeding a mile from the village, and close to the camp from which two of these cases had come. Eventually I traced all of the cases to their source.

Steadman wrote critical reports whenever he found evidence that stringent anti-malarial measures had not been taken. These critical reports resulted in senior medical officers being reprimanded for failing to carry out their duty and he became extremely unpopular as a result. However, as the person responsible for the prevention of disease in the 20th Corps area, it was his duty to ensure that everything possible was done to prevent malaria. The account of preventive measures undertaken in the area of the other British Corps in Palestine, the 21st Corps, in 1918 described similarly vigorous anti-mosquito measures and an active campaign against mosquito breeding in wells so Steadman's views were undoubtedly mainstream at that time.¹¹ Attempts were made to get the adverse reports withdrawn and to have him sacked from the Corps Staff. Fortunately, as confirmed in his letter dated 26 July 1918, his medical superiors supported him and insisted that the reports should stand:

Colonel Luce strongly backed me and told the Division that my reports must stand (they had asked for them to be withdrawn). So I feel I have done some real good. My action will certainly improve matters in the Division.

Steadman's letters reveal that, despite all these efforts, cases of malaria did still occur amongst British soldiers, including amongst those who were working for him to combat the disease, and they did on occasion prove fatal. These cases are perhaps the best indication of the loss of manpower that could have occurred within his area of

¹¹ Sewell EP, Macgregor ASM. An Anti-Malaria Campaign in Palestine. An Account of the Preventive Measures undertaken in the 21st Corps Area in 1918. *Journal of the Royal Army Medical Corps*. 1920; 34(3): 204-218.

responsibility if he and his team had not made such strenuous efforts to limit the spread of the disease.

Two of my best and most trusted N.C.O.'s have also contracted malaria – one, a young corporal, is such a nice enthusiastic fellow. We are doing pretty well though. Very many marshy districts have been drained, and hundreds of breeding places stamped out. The slightest slackness anywhere means cases of malaria at once. We have had one of those startling cases which we had so often out in Macedonia – a padre well at breakfast dead of malignant malaria in the evening! I feel very proud of the splendid fellows who are fighting so bravely against their deadly enemy. I know the whole Corps area now every inch of it. I know every particle of water in it I believe. I had hoped to stamp out malaria entirely, but I find it is impossible to do quite that. You see some places we have are marshes in "No Man's Land" and some in other places are under enemy observation, so that we get shelled if work is done there in the daytime. Moreover, some of these marshes are out of reach altogether and we get mosquitoes blown into our lines by the wind.

The Allied advance

As a result of all these measures the threat of malaria was kept under reasonable control in the region around Jerusalem, and even in the Jordan Valley, but when the Expeditionary Force resumed its advance northwards it moved into territory recently vacated by the Turks and suffered many cases of malaria. According to the Official History of the Great War: 'the British had advanced from an area wherein every precaution known to science had been taken, straight into one in which little or nothing had been done to fight the mosquito'.¹² Steadman described the effects of this in his letter dated 6 October 1918:

On the night of our advance one battalion of our men had to spend the night in a Wadi which up to that time had been in "No Man's Land" dominated by the enemy's guns, so that we had not been able to do any anti-malarial work there.

No less than fifty-seven primary cases of malaria occurred in that unit in that one night! A few such nights and the whole battalion would have been wiped out by the mosquito! I think you will agree in view of these facts that the Medical Service can fairly claim a large share in this victory of ours. This same battalion had lived nine months in this district with three cases of malaria in the whole of that time. Shows the value of good anti-malarial work, doesn't it?

Luce, writing after the war, also considered that the number of new cases of malaria amongst British troops during the advance demonstrated the success of the preventive measures that they had taken previously. He described how the 'D.A.D.M.S. of the

¹² MacMunn G, Falls C. *History of the Great War based on official documents. Military Operations. Egypt and Palestine, Vol. 2.* London: HMSO; 1930 (Republished: IWM; 1996). p.597.

Corps, Major Steadman, kept an eye on the work of the whole Corps, co-ordinating it and by regular and frequent inspections keeping up its standard'.¹³ Figure 4 shows the medical staff responsible for the health of the 20th Corps.



Figure 4. The medical staff responsible for the health of 20th Corps in Palestine with Major Steadman seated on the left. Author's private collection.

Meanwhile the Turkish Army in Palestine, riddled with malaria, was in a disastrous state.¹⁴ It was rapidly defeated and an estimated 75,000 prisoners taken but there was increasing concern as the number of cases of malaria amongst British troops escalated. Allenby wrote to the Chief of the Imperial General Staff:

Sickness is troubling us. I had the mosquitos [sic] well in hand, and soon the Jordan became almost a summer health resort. Now I am in Turkish territory and malignant malaria is laying a lot of people by the heels. I've a good acting D.M.S. now; one Luce; and he is doing all he can, but his beds are full.¹⁵

Conclusion

Major Frank Steadman's letters give an Army doctor's account of how confidence in the available chemoprophylaxis was lost resulting in increasing emphasis having to be

¹³ Luce. *War Experiences*, 1937 (Note 7). p.411-413.

¹⁴ Woodward DR. *Hell in the Holy Land: World War I in the Middle East*. Lexington, Ky: University Press of Kentucky; 2006. p.189.

¹⁵ Hughes M. *Allenby in Palestine: The Middle East Correspondence of Field Marshal Viscount Allenby, June 1917-October 1919*. Stroud: Sutton Publishing; 2004. p.210.

placed upon vector control and bite avoidance measures. They also show how rigorously these alternative measures then had to be implemented to be effective and they illustrate the crucial part played in successful malaria prevention by military commanders.

As a result of experiences in theatres such as Salonika and Palestine during the 1914-18 War the British Army learned that no single measure can prevent malaria and that a combined approach is essential. This strategy has become increasingly successful with the introduction of more effective anti-malarial drugs and insecticides.

Nevertheless, as the final advance in Palestine in the autumn of 1918 showed, malaria is a particular threat to soldiers when they have to operate in malarial areas where vector control measures have not been strenuously implemented. Preventing malaria in such situations remains a significant challenge for Army doctors even today.

Biographical Details

Simon Miller is a retired Army doctor whose interest in the history of medicine was developed on the course for the Diploma in the History of Medicine at the Society of Apothecaries (DHMSA). This article is based on the dissertation that he submitted for the DHMSA in 2013 and draws on the letters written by his grandfather, Frank Steadman, during the 1914-18 war.

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