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THE MOSQUITO CAN BE MORE DANGEROUS THAN THE MORTAR ROUND

The Obligations of Command

Arthur M. Smith and Craig Hooper

We must be prepared to meet malaria by training as strict and earnest as that against enemy troops. We must be as practiced in our weapons against it as we are with a rifle.

FIELD MARSHAL VISCOUNT SIR ARCHIBALD WAVELL

These words, penned in 1943 by the commander in chief of British forces in Burma during World War II, underline the reality that losses to malaria and other preventable diseases among Allied forces operating in the China-Burma-India theater far exceeded the number of casualties inflicted by enemy action.¹ Today, as the global war on terrorism evolves, a similar failure to appreciate noncombat environmental threats—including mosquitoes and other disease-carrying insect vectors—will once again degrade combat effectiveness of deployed forces. The significance of Field Marshal Wavell's caveat was amply demonstrated in August 2003, when a U.S. Marine Corps team, while conducting stabilization operations in Liberia, was hit by a surprise disease outbreak. Almost 30 percent of the deployed military personnel contracted malaria, dis-

tracting military medical assets already committed to supporting combat operations in Iraq and Afghanistan.

DEPLOYMENT RISKS

Disease and illness will likely generate more casualties than combat during military operations along the African littoral, in South Asia, or on East Asian shores. Up to 75 percent of the casualties suffered in previous conflicts in these regions resulted from disease.² Examination of U.S. Marine casualty data from Vietnam alone reveals that only a third of hospital admissions

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were for wounds incurred as a result of combat action; two-thirds of hospitalized personnel suffered from diseases and, in lesser numbers, nonbattle injuries.

Malaria is a particular risk. Though the mosquito-borne disease has long been eliminated from the United States, it remains, according to the World Health Organization, one of the most significant health threats in the world. *Plasmodium falciparum*, the most severe and life-threatening form of malaria-causing parasite, kills more than a million people a year. The danger to American military personnel is twofold. Malaria victims who have never been previously exposed to malaria-causing parasites are at high risk of suffering acute infections. Symptoms of acute infection begin nine to fourteen days after an infectious mosquito bite; they are characterized by rapid onset of debilitating fever, headache, vomiting, or other flu-like symptoms that can be accompanied by life-threatening complications. If the victim survives a first bout of malaria without treatment, the infection then becomes a persistent health problem. Chronic, longer-term malaria infection causes successive bouts of severe fever that, if still left untreated, results in progressive deterioration and possible death.

The malaria threat is tied to the rate of transmission, and in most cases the transmission rate depends on the local mosquito population. During operations in sub-Saharan Africa, where mosquitoes are very effective malaria “vectors,” malaria infection rates among unprotected troops may be expected to approach 100 percent, and if the infected soldiers are American, without prior exposure to tropical diseases, a high percentage will likely suffer acute infections and experience life-threatening complications that require immediate medical evacuation. These realities could easily render a U.S. military force ineffective without a combat engagement ever taking place.

But malaria and other insect-carried diseases are not the only threats. Military medical-care responsibilities for indigenous civilian populations bearing other communicable diseases unique to their regions could further impact the military medical-evacuation chain. Likewise, although it is not an acute phenomenon, the human immunodeficiency virus (HIV) has profoundly altered the medical risk to troops deployed worldwide. Disease is a constant battlefield threat that, if command engagement and interest are lacking, will endanger America’s ability to project military power.

THE MARINES ENTER LIBERIA

Despite long international experience with expeditionary military engagements in Africa and a thorough understanding of the malaria threat, a significant proportion of Joint Task Force personnel inserted into Liberia in August 2003 (eighty out of 290 who had been ashore) experienced symptoms of malaria. The actual malaria “attack rate” will never be known, since the entire contingent

began anti-malarial treatment soon after medical authorities determined the causal agent. A number of latent, “incubating” infections probably went undetected as asymptomatic soldiers rushed to take anti-malarial medication. At any rate, the outbreak was a blow to combat effectiveness, and though there were no fatalities, several victims developed a dangerous complication, cerebral malaria. In cerebral malaria, the blood vessels that carry blood to the brain are clogged, and victims require mechanical lung ventilator support, intensive-care units, and rapid medical evacuation to survive.

What could explain this debacle? Why did most deployed participants—primarily Marines of the 26th Marine Expeditionary Unit (MEU) Quick Reaction Force from the USS *Iwo Jima* (LHD 7) Amphibious Ready Group (ARG)—become infected?

Investigators focused on a number of questions: Was the outbreak due to failure of commanders to ensure that members of the landing force took the prescribed anti-malarial medication, Mefloquine, for the necessary duration of time prior to their insertion into Liberia? Were the deploying forces properly trained to

Failure to control malaria destroyed the combat effectiveness of “Merrill’s Marauders” in Burma, in 1944. The loss rate was unsustainable.

operate in a nation where insect- and water-borne diseases are everyday occurrences? Did the Defense Intelligence Agency’s Armed Forces Medical Intelli-

gence Center fail to warn commanders of the *Iwo Jima* ARG about the locally high rate of malaria transmission? Did Marines, having heard about a rumored association of Mefloquine with violent psychiatric reactions in returning Army Afghanistan veterans in Fort Bragg, North Carolina, willfully avoid their anti-malarial medication? Finally, could the prophylactic (preventive) agent have been manufactured incorrectly?

A consensus conference at the Navy Bureau of Medicine and Surgery on October 9, 2003, revealed that the major contributory factors to the outbreak included insufficient intake of anti-malarial medication and a wholesale failure to employ protective measures.³

Blood samples taken from the 26th MEU showed that only 5 percent of affected personnel regularly took Mefloquine. Blood samples from 133 Marines were tested for Mefloquine levels at the U.S. Centers for Disease Control and Prevention (CDC). Seventy percent contained breakdown products of the drug, itself evidence that some Mefloquine had been taken in the preceding month, but only 14 percent had levels high enough to be effective at the time of insertion into Liberia. Only 5 percent of the samples indicated that the medicine had been taken every week. Analysis of Mefloquine taken from Marines’ pockets revealed that the potency and formulation of the drug were adequate.

Logistical problems were responsible for some of the other failures. For example, the 26th MEU had ordered bulk Permethrin insecticide for uniform treatment before deployment, but the unit did not receive the Permethrin prior to departure from the United States. Instead, the unit received spray cans of the insecticide, which were then used to treat the desert-camouflage uniforms that the troops had worn in their earlier deployment to the Middle East. In Liberia, however, woodland-camouflage uniforms were worn, and only 12 percent of the troops treated those. Only 27 percent reported using the time-released insect repellent issued to them, and, making matters worse, none slept under insecticide-treated mosquito nets. The Liberia expedition was a “man-portable mission,” in which each individual had to carry everything he needed from the transport to the deployment site. Permethrin-treated sleeping nets—a low-tech item previously shown to dramatically cut malaria mortality in West Africa—were not even taken ashore. In addition, many troops were reluctant to use the long-acting insect repellent DEET on the grounds that the repellent was too greasy for hot-weather operations.

The epidemiologic investigation concluded that better malaria-awareness training and wider access to anti-malaria equipment are the best ways to prevent future malaria outbreaks during deployments. Ironically, identical historical lessons, emphasizing the importance of individual, group, and command discipline, have been learned repeatedly since malaria was identified as a major degrading factor in military operations; all appear to have been forgotten. The Navy and Marine Corps have neglected the war fighter’s long and proud disease-fighting legacy.

BURMA 1943

The Burma campaign in 1943 was a particularly brutal sideshow of World War II. But here, fighting under terrible conditions and at the end of a dauntingly long supply line, soldiers served in what can be seen now as a battle laboratory. Their experience laid the tentative foundations for today’s joint, combined, and special warfighting strategies. Unfortunately, the innovative tactics explored in the China-Burma-India theater were ignored for years after the war, and few looked to exploit the innovative warfighting strategies pioneered in this marginally successful theater of operations, much less recognized that the ravages of preventable disease had bogged down the pace of operations.

Wingate’s “Chindits”

Major General Orde Wingate, a commander of the “Chindit Special Force” (and a British military innovator) pioneered a brutal training regimen that quickly shaped soft, poor-quality infantry into a cohesive counterinsurgency-capable

force. Since the Chindits were expected by their commanders to endure all physical challenges, disease prevention was deemphasized.

Even during training, fundamental rules of sanitation and basic anti-malaria precautions were ignored. That neglect caused serious losses; within a period of six weeks one brigade lost over 70 percent of its soldiers to malaria-related hospitalization.

The importance of individual, group, and command discipline has been learned repeatedly since malaria was identified as a major threat to military operations; the lesson appears to have been forgotten.

Wingate, a survivor of cerebral malaria, used his experience to downplay the importance of anti-malarial measures.

One soldier recalled, “In one respect we had the wrong attitude to Malaria; we looked on it as inevitable; we believed that we were all bound to get it every so often. . . . [W]e never treated Malaria as a disease meriting evacuation.”⁴ This prejudice ultimately became a self-fulfilling prophesy.

In some respects, the training befitted the Chindits’ difficult mission. The Chindit Special Force operated as a commando unit, tasked to infiltrate Japanese lines and conduct hit-and-run attacks against exposed railroads and bridges essential to enemy operations. The soldiers were expected to be constantly on the move, fighting without a base and supplied largely by air. The troops were initially provided with anti-malaria equipment—full green battle dress, anti-mosquito cream, head veils, arm-covering cotton gauntlets, and the anti-malarial medicine of the day, Mepacrine—but these force-protection measures crumbled under the extreme operational conditions and because their leaders believed that disease could be overcome by endurance rather than prevention.⁵

Full, extremity-covering uniforms were discarded, offering ample opportunity for malaria-carrying mosquitoes to bite and transmit malaria. The men preferred shorts to long trousers, especially when maneuvering in Burma’s broken terrain; some cut most of the trouser legs from their battle dress. Sleeves were rolled up and uncomfortable arm-covering gauntlets discarded. Anti-mosquito veils were both ineffective and dangerous, offering little protection to sleeping soldiers and restricting vision during night operations.

Chindits rarely had organized and insect-free sleeping quarters. For malaria, this was a critical oversight, since most mosquito bites occur at night, when the insect can feed upon unaware and unresisting hosts. Jungle hammocks provided good shelter from rain and a measure of protection from flies, mosquitoes, and other jungle pests. The mere fact that the hammocks were raised off the ground reduced bites from typhus-carrying ticks and mites. Soldiers recognized that hammocks reduced the rate of typhus and malaria, but again, operational

drawbacks discouraged universal use. The hammock, when enclosed by a portable mosquito net, was difficult to exit in an emergency; further, the jungle hammock and net weighed seven pounds and was bulky. In general, the jungle hammocks, when available, were reserved for the injured and seriously ill.

The principal anti-malarial medication for World War II was Mepacrine (known among American forces as Atabrine). Though it was relatively effective, it was not fully supported at either the command or field level. Mepacrine had to be pressed into service to replace quinine, a time-tested and accepted anti-malarial medication, because by 1943 the Japanese had seized the quinine-

Eighty out of 290 personnel inserted into Liberia in August 2003 experienced symptoms of malaria.

producing areas of Java (Indonesia) and the Philippines. Military medical authorities in India and

Burma were initially cautious about using Mepacrine as a prophylactic or suppressive (symptom-reducing) anti-malarial, fearing that the drug's potential to conceal infection would encourage combat leaders to keep men on duty when they were afflicted with the disease. Some medical leaders were also concerned that overreliance upon Mepacrine would lead troops to neglect other aspects of anti-malarial discipline. But the Chindits' failure to adopt basic habits that usually prevent exposure to malaria-carrying mosquitoes put Mepacrine to the test.

Unfortunately for the troops, suppressive treatment with Mepacrine was not carried out with complete efficiency even when the drug was available. No regular formations and inspections were held to ensure that men took the anti-malarial medication at the times and in the dosages necessary to prevent malaria. Many personnel, in fact, refused to take Mepacrine. A myth that Mepacrine produced sexual impotence or sterility was rampant among all Allied forces. In one battalion the administration of the drug was suspended before troops went into action, because its officers believed the drug would reduce fighting efficiency. Such fallacies had a tendency to spread rapidly, become exaggerated, and gain credibility during circulation.

Deliberate failure to take Mepacrine on a regular and consistent basis led to confidence-eroding "breakthrough infections" when the level of Mepacrine in the blood became too low to control the proliferation of the malaria parasite. One medical officer discovered that the Mepacrine containers of two of his patients who had just died of cerebral malaria still contained the original quota of thirty tablets at a time when they should have been almost empty.

The enormous amount of labor required to reduce local hazards of contaminated water, insect bites, and fungus infections of the skin—indeed the impossibility of preventing them entirely during a long campaign—produced further laxity, bordering upon hostility, toward medical discipline. The admiration of

the line community for its own medical assistants was evidently counterbalanced by indifference and even resentment toward medical advice from the rear.

Command indifference to disease prevention denied soldiers the opportunity to exploit incremental improvements in malaria-prevention technology. Mosquito repellent, oil of citronella, was initially issued in an ineffective and greasy formulation. The uncomfortable repellent fell out of favor, and the Chindits resisted later nongreasy and more effective counterparts. Command elements failed to instill confidence in the new formulation, and no organized inspections were held to demonstrate or ensure proper and regular use of the mosquito repellent.

With the passage of time, the incidence of malarial fever attacks rose steadily; few men experienced less than three attacks. The majority had as many as seven malarial episodes—and many had to endure malaria attacks while actively engaged with enemy fighters. The fighting efficiency and morale of personnel who had experienced three or four attacks of malaria diminished rapidly. Dysentery, diarrhea, lung infections, and skin diseases were more likely to infect, and after infection to disable completely, a malaria-ridden soldier, compared with a soldier who had not suffered repeated bouts of malarial fevers. Deaths from cerebral malaria and typhus increased during operational deployments. The Special

The realities of malaria could easily render a U.S. military force ineffective without a combat engagement ever taking place.

Force, as a result of its aggressive training and counterinsurgency mission, broke medical discipline, exposing itself to these preventable parasitic dis-

eases. Compounding the failure of disease-prevention measures, members of the Chindit force gave up the suppressive benefits of Mepacrine. The medical officers, facing a situation that appeared insurmountable, gave up, allowing themselves to fall to the low standard set by the men. The casualty rate was enormous. Just two-thirds of the Chindit troops who embarked upon Operation LONGCLOTH in February 1943, a marginally successful four-month incursion into Burma, returned. Ultimately, only six hundred of the three thousand troops who commenced that operation were ever fit for military service again.

From a clinical viewpoint, the Special Force was more severely injured by malaria than by bullets and grenades. Considered tactically, unit battleworthiness was determined more by its state of medical discipline than by courage.⁶ It has been said that the Chindit Special Force met a more dangerous enemy in disease than in the Japanese army. Disease did more damage than the enemy. Even Wingate's substantial legacy of innovation was diminished by his failure in Burma to ensure the health of his men.

Merrill's Marauders

U.S. forces in the China-Burma-India theater had similar problems. Like the British, the Americans relied primarily upon Atabrine (Mepacrine) to suppress and control malaria. The members of Brigadier General Frank Merrill's 5307th Composite Unit (Provisional)—known as "Galahad," or "Merrill's Marauders"—self-administered their anti-malarial medication. Each soldier was expected to take a Mepacrine tablet on a daily basis, conforming to a system already developed for the Pacific theaters. But again, many soldiers failed to follow precisely the protocol required if the medicine was to prevent malaria. Atabrine indiscipline became a particularly potent manifestation of the poor morale common in troops en route to the theater and within units experiencing their first weeks of training in India. Unfortunately, command interest in reinforcing individual Atabrine discipline was also lacking, often neglected until malaria brought training to a standstill. Disease made morale even harder to restore.

The Marauders entered Burma in February 1944 with inadequate collective anti-mosquito protection. As with the Chindit Special Force, little was done to control malaria-carrying mosquitoes. Means by which individuals could limit mosquito exposure—repellants and "mosquito bars" (protected sleeping enclosures)—were unpopular and used by only a handful. Predictably, malarial infection and reinfection were rife during operations in the theater. The theater commander, General Joseph Stilwell, exacerbated morale problems by pressing his men to extend offensive operations and placing restrictions on medical evacuation. Gradually, fatigued and disease-ridden men began to repudiate Atabrine. It was a vicious cycle. The sicker the troops became, the lower the morale. The lower their morale, the less hope there was of restoring Atabrine discipline and curbing malaria.

As reported by a malaria expert on the staff of General Stilwell, the failure to control malaria destroyed combat effectiveness. "It was incumbent upon any medical officer surveying a unit with a current malaria rate of 4,080 attacks/1,000 men per annum; with 7.4% of the men noneffective each week because of Malaria; and 57.3% of the remainder infected during the past year, to consider the unit as unfit for operations before adequate rest period and replacement is provided."⁷ The loss rate was unsustainable.

Few of the original 2,750 combatants endured the entire campaign. At one point, the Marauders were losing seventy to a hundred men daily to malaria, dysentery, and scrub typhus. By August 1944 only two hundred of the original Galahad force remained, and these were utterly worn out.

Thus were the Marauders destroyed, not by mis-leadership, although it played a part in the closing phase of the disaster, nor by the enemy. . . . Their destruction occurred

on the ridges and jungle trails. . . . Of the three causes of the Regiment's collapse, the environment was the underlying cause. The tactical engagement was the precipitating cause; and the invasion of the troops by disease was the final and decisive cause. To an unknown extent the Marauders helped their enemies by their loose sanitary practices, by command ineptness in supporting the medical establishment, and by defiance of Atabrine suppressive discipline. In the end, disease producing parasites Amoebae (Dysentery) and Plasmodia (Malaria), as well as bacteria and Rickettsia (Typhus) organisms, rather than Japanese soldiers, vanquished Merrill's Marauders.⁸

THE RESPONSIBILITY OF COMMAND

In general, mere mention of hygiene and sanitation elicits tolerant but bored amusement from specialists in the combat arms. To this day, many senior officers are unwilling to accept the fact that hygiene is not only a function of discipline but one of the basic factors upon which discipline is built. Personal discipline aggregates to collective discipline; its absence in the individual produces the same absence in the operational unit.

The recent embarrassing experience with malaria during Liberian operations once again demonstrated the historically validated and fundamental axiom that training in the prevention of disease must be given top priority and be treated like any other battle exercise aimed at attainment of an objective with the least casualties. Training must be sufficiently intensive to ensure that all personnel can be relied upon to maintain personal hygiene, unsupervised, during any period of active operations. Without this, morale and fighting effectiveness will crumble.

Malaria is a particular challenge; aside from the intake of suppressive medications, strict anti-malaria discipline must be enforced during training periods, and any breach sanctioned. If compliance with expected anti-malarial measures proves unwieldy or unrealistic, a unit commander is obliged to facilitate the development of an engineering or medical solution. In operational theaters where malaria is endemic, administration of anti-malarial medication and compliance with personal and collective force protective measures can be ensured by evening inspections at the first indication of sundown, when mosquitoes are most active. Such measures of personnel protection from mosquito-borne illnesses must be practiced repeatedly until their observance becomes a conditioned reflex.

The importance of effective command discipline was validated by yet another historical example from the jungles of Burma during World War II. Like Wingate's Special Force and others, the British South East Asia Command's Fourteenth Army, in general, faced significant losses to malaria. A new commander, then Lieutenant General Sir William Slim, took over determined to

enforce vigorously a malaria-control program in the Fourteenth Army. As he later recalled in his memoirs, “In 1943 for every man evacuated with wounds, we had 120 evacuated sick. The annual malaria rate alone was 84 percent per annum of the total strength of the Army, and was still higher among the forward troops. A similar calculation showed me that in a matter of months, at this rate, my army would have melted away.”⁹

Lieutenant General Slim saw correctly that more than half the battle against disease is fought not by doctors but by regimental officers. Those in direct, regular contact with the troops are best placed to ensure that personal anti-mosquito measures are observed and that daily doses of anti-malarial drug are taken. General Slim initiated surprise checks in which every man in the unit was examined. If men had not taken the drug, and if the overall results of blood tests for the medication within the unit were less than 95 percent positive, Slim “sacked the commander. I only had to sack three; by then the rest had got my meaning.” Because of this emphasis from the top,

slowly, but with increasing rapidity, “as all of us, commanders, doctors, regimental officers, staff officers and [noncommissioned officers] united in the drive against sickness, results began to appear. On the chart that hung on my wall, the curves of admissions to hospitals and Malaria in forward treatment units sank lower and lower until in 1945 the sickness rate for the whole 14th Army was one per thousand per day.”¹⁰

As the recent incident in Liberia demonstrates, the global war on terrorism may become completely paralyzed without a wholesale commitment of leadership, “from the top,” to the environmental protection of the troops. Flesh and blood remain the central element of all weapons systems. The will and physical capability to fight remain the crucial factors in any equation for victory. If commanders are unable to recall the hard medical lessons learned in previous conflicts, and fail to ensure the health of their soldiers, how can America expect to confront bioweaponry or other, more dangerous infectious threats?

Standards of hygiene and sanitation are not only indicative of discipline within a unit but are direct personal reflections upon the leadership capabilities of commanding officers and their staffs. Regular care and maintenance of vehicles are essential to trouble-free operation; so it is with human resources during combat deployments. Unless the war fighter’s welfare receives constant attention, sickness and ill health are bound to ensue. In units where hygiene and sanitation are poor or lacking, commanding officers have neglected the interest and welfare of their soldiers, and their fitness for command is to be questioned.

NOTES

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2. National Research Council, *The Navy and Marine Corps in Regional Conflict in the 21st Century* (Washington, D.C.: National Academy, 1996), p. 90.
3. *Malaria Outbreak among Members of JTF Liberia Consensus Conference Report*, 9 October 2003, available at www-nehc.med.navy.mil/downloads/prevmed/JTFMalaria.pdf.
4. Stone, p. 210.
5. *Ibid.*, pp. 272–73.
6. *Ibid.*, p. 243.
7. *Ibid.*, p. 296.
8. *Ibid.*, pp. 395–96.
9. Field Marshal Sir William Slim, *Defeat into Victory* (London: Cassell, 1956), p. 173.
10. *Ibid.*