Unseen Enemies:
An Examination of Infectious Diseases and Their Influence upon the Canadian Army in Two Major Campaigns during the First and Second World Wars.

by

Denis Gerard Dubord
B.A., University of Alberta, 1985
M.A., University of Victoria, 2001

A Dissertation Submitted in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in the Department of History

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ABSTRACT

Twice during the first half of the twentieth century, on two separate and distinctly unique wartime campaigns in Europe, the survival of Canadian overseas armies was badly threatened not by enemy guns, but by the menace and ravages of an unseen enemy: infectious disease.

Between the spring of 1915 and the fall of 1918, hundreds of thousands of Canadian soldiers lived and fought in the trenches of the Western Front. The Canadian Expeditionary Force (CEF) faced many tactical challenges in fighting this radical and unknown style of war in the trenches. There were also many medical challenges faced by the Canadian forces during this new era when they soon discovered that the trench environment was highly conducive to the rapid development and spread of infectious disease. In particular, pathogen carrying pests, such as body lice and rats, and

"mysterious" emerging diseases, such as trench fever, would become the bane of existence for many Canadian soldiers. Life in the trenches would prove to be inherently dangerous for reasons other than enemy fire.

Just two and one half decades later, during the Second World War, the Canadian First Division, recently victorious in occupying Sicily, was decimated, not by its German or Italian foes but by an epidemic of the mosquito transmitted infectious disease of malaria. Anti-malaria measures and precautions were well known, but the Canadians would discover that both the application of these practices and the compliance of the rank and file could not be taken for granted.

This work examines the important influence disease vectors and infectious disease had upon the lives and experiences of our soldiers, as well as the conduct and outcomes of two important twentieth century military campaigns conducted by Canada's army between 1914 and 1945. In essence, this study will explore and analyze Canadian attempts, both individual and corporate, to control, possibly defeat or at least come to terms with, its most elusive and silent enemies on the field of battle – infectious diseases.

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ABBREVIATIONS

AAA&QMG	Assistant Adjutant and Quartermaster General
ADMS	Assistant Director of Medical Services
AMCU	Anti-Malaria Control Unit
AMD	Assistant Medical Director
BT	Benign Tertian
CAMC	Canadian Army Medical Corps
CCS	Casualty Clearing Station
CEF	Canadian Expeditionary Force
CMHQ	Canadian Military Headquarters – London
C-in-C	Commander-in-Chief
CO	Commanding Officer
CTR	Canadian Tank Regiment
DADMS	Deputy Assistant Director of Medical Services
DDMS	Deputy Director of Medical Services
DDT	Dichcloro-diphenyl-trichloroethane
DGAMS	Director-General of the Army Medical Services
DEET (or DMP)	Di-methyl phthalate
DMS	Director of Medical Services
FD-AMB	Field Ambulance
FDS	Field Dressing Station
FHS	Field Hygiene Section
GHQ-ME	General Headquarters – Middle East
GOCs-in-C	General Officers Commanding-in-Chief
HQ	Headquarters
MO	Medical Officer
MT	Malignant Tertian
NCO	Non-Commissioned Officer
NYD	Not Yet Diagnosed
OC	Officer Commanding
ORs	Other Ranks
POWs	Prisoners-of-War
RAMC	Royal Army Medical Corps
RASC	Royal Army Service Corps
RCAF	Royal Canadian Air Force
RCAMC	Royal Canadian Army Medical Corps
RCASC	Royal Canadian Army Service Corps
RCR	Royal Canadian Regiment
RMO	Regimental Medical Officer
San-Sec	Sanitary Section
San-Squad	Sanitation Squad
VD	Venereal Disease
2i/c	Second-in-Command

INTRODUCTION

Twice during the first half of the twentieth century, on two separate and unique wartime campaigns in Europe, the survival of Canadian overseas armies was badly threatened not by enemy guns, but by the menace and ravages of an unseen enemy: infectious disease.

Pathogens have nearly always been a soldier's most ubiquitous companion and enemy. Up until early in the previous century, a soldier in any army in every major campaign was more likely to die of infectious disease than of wounds sustained on the field of battle. Certainly, during the late nineteenth and early twentieth centuries, there were many valuable improvements in medicine, science and public health. During the same time, humanity vastly increased its abilities to kill and maim other humans much more efficiently, as well. Although the deadliness of disease to individual soldiers has become relatively reduced, the threat posed to the collective health and efficiency of armies has remained a salient factor in warfare.

On the eve of the Canadian army's arrival in Flanders in 1915, soon after the beginning of the Great War, the more enlightened in the Canadian ranks were aware that, if history repeated itself, the old pattern of disease would recur and more Canadian soldiers would lose their lives to infectious disease during this campaign than to German munitions. After all, in the latter half of the nineteenth century, disease had claimed far more soldiers' lives in the Crimean, American Civil and Franco-Prussian Wars than all other causes combined. During the South African War, at the turn of the twentieth century, the fledgling Canadian military itself had had first hand experience and knowledge of the human costs imposed on armies by infectious disease when the young

dominion sent 7,000 troops to South Africa in support of the British Empire. Although the exact figures are unclear, about 270 of these Canadians died during the war — at least half of them due to infectious disease.[1] The rest of the British-led army fared much worse, losing approximately two-thirds of about 22,000 fatalities to disease.[2]

Issues related to infectious disease were of relatively little concern to most of the belligerents when war broke out in 1914. Fuelled by jingoistic nationalistic fervor, most of the combatants thought the war would be over in a matter of months. Yet, before the end of the first calendar year of the war, the Western Front became deadlocked. Modern industrial capacity and burgeoning populations of unprecedented size combined to help create a situation where armies with equally massive destructive capacity faced each other over a five hundred mile front that stretched from the Swiss border to the North Sea. Unable to outflank their opponents and unwilling to be outflanked, both sides dug into the earth – modern trench warfare had begun.

Between the spring of 1915 and the fall of 1918, hundreds of thousands of Canadian soldiers lived and fought in these trenches of the Western Front. The Canadian Expeditionary Force (CEF) faced many tactical challenges in fighting this radical and unknown style of war. There were also many medical challenges faced by the Canadian forces during this new era when they soon discovered that trench environment was highly conducive to the rapid development and spread of infectious disease. Life in the trenches

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[1] Carman Miller, *Painting the Map Red: Canada and the South African War, 1899-1902* (Montreal and Kingston: McGill-Queen's University Press, 1993), p. 429. Exact Canadian wastage rates were recorded during and immediately after the South African campaign, but are now unavailable as it appears these original documents were destroyed by Canadian army official historians during the late 1940s and early 1950s.

[2] Andrew MacPhail, *Official History of the Canadian Forces in the Great War 1914-1919: The Medical Services* (Ottawa: The King's Printer, 1925), p. 249.

would prove to be inherently dangerous for a reason other than enemy fire.

After the 11 November 1918 Armistice, an accounting of Canadian casualties showed that just nine percent of the Dominion's war fatalities were due to disease.[3] Some contemporary analysts may erroneously claim that this was clear evidence that modern science had triumphed over pestilence. This thinking is faulty because it does not take into account the effects of infectious disease upon the effectiveness and health of the army and its soldiers. Moreover, it does not take into account the fact that a potentially devastating "mystery disease" emerged in the Canadian ranks during the conflict – an ailment called "trench fever." Neither do coldly clinical death statistics speak to the multitude of serious individual and corporate difficulties that were caused by hygiene related issues, such as a potable water shortages and chronic lice infestations among virtually all of our troops. Certainly, understanding the role infectious disease had upon the CEF's soldiers' lives and health is a much more complicated task than merely looking at fatality statistics.[4]

Just two and one half decades later, during the Second World War, in the latter half of August 1943, the Canadian First Division, recently victorious in occupying Sicily, was decimated, not by its German or Italian foes but by an epidemic of the infectious disease malaria. The terrible toll the disease exacted from the entire Allied force in Sicily was staggering. The number of malaria cases in the British Eighth, to which the Division was attached, and the American Seventh Army, which constituted the other half of the Allied invasion force in Sicily, reached a combined total of over 21,000 men, the equivalent of two full divisions, over a seven week period in July and August 1943. This

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[3] MacPhail, *The Medical Services*, pp. 246, 248.
[4] MacPhail, *The Medical Services*, p. 246.

total was over thirty percent greater than the battle casualties sustained during the entire Sicilian Campaign.[5] In terms of frequency, the average monthly incidence of malaria, including suspected malaria, in the British and American Armies was approximately 33 cases for every 1,000 soldiers.[6]

The horrific malaria rates experienced by the British and Americans paled in comparison to those that the Canadian Division suffered while serving alongside them, as the Division's average malaria rate for the entire Sicilian Campaign was thirty percent greater. The health crisis in the Division's ranks hit its peak during the last two weeks of August 1943, with over a thousand new cases of confirmed and suspected malaria among the 15,000 Canadians, reaching a whopping monthly equivalent of approximately seventy cases per 1,000 soldiers, over twice the British and American average during the entire campaign.[7] According to the Royal Canadian Army Medical Corps' final tally, about 1,200 of the Division's soldiers were afflicted by malaria in Sicily.[8]

Incredibly, the actual severity of the Division's malaria epidemic may have even been worse than these figures and rates suggest. First, an unidentified number of Canadian sick, especially in rear areas, were admitted by non-Canadian medical units.[9] Second, due to the policies and diagnostic procedures practiced in some Canadian

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[5] Library and Archives Canada (hereafter LAC), Record Group 24 (hereafter RG 24), Vol. 12617, "Prevention and Treatment of Malaria", "Malaria in the Sicilian Campaign", 21 October 1943.
[6] F.A.E. Crew, *History of the Second World War: The Army Medical Services, Campaigns Vol. III,* (London: Her Majesty's Stationary Office, 1955), pp. 49-50; and "Malaria in the Sicilian Campaign", 21 October 1943.
[7] LAC, RG 24, Volume 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943; W.R. Feasby, ed., *Official History of the Canadian Medical Services 1939-1945, Vol. I: Organization and Campaigns* (Ottawa: Queen's Printer, 1956), p. 147.
[8] "Malarial Summary - First Canadian Division", 10 November 1943.
[9] Crew, *Campaigns Vol. III*, p. 78.

medical formations, many malaria cases were not recorded as such. Thus, the malaria statistics compiled by the Royal Canadian Army Medical Corps (RCAMC) did not, and probably could not, take these considerations into account and, therefore, must be regarded as conservative. Additionally, although he did not overtly provide an explanation, Dr. W.R. Feasby, the RCAMC's official historian, determined that there appeared "to have been some attempt to play down the Canadian incidence of malaria in Sicily."[10] Whether he was referring to diagnostic and/or statistical manipulation or simply suggesting that some individual or individuals later tried to direct attention away from the epidemic is unclear. By any measure, the scope of the Division's malaria outbreak is both striking and remarkable. How could this have happened to an army that had had years to prepare for a known health threat?

When seeking information and answers about the role infectious disease played during both the First World War military campaign in the trenches of north-western Europe and the Second World War campaign in Sicily and Italy, one finds that meaningful and in-depth insights are sorely lacking in our military medical services' official histories. Andrew MacPhail's *Official History of the Canadian Forces in the Great War 1914-1919: The Medical Services*, published in 1925; and W.R. Feasby's two volume *Official History of the Canadian Medical Services 1939-1945*, which was released in the mid-1950s, offer some evidence, but most often these works fail to put disease – inarguably, a major aspect of medicine – into its proper historical context. Moreover, explanations and descriptions of the relationship between the medical services and the Canadian military, of which it was a part, often fall short of providing a sufficient

[10]Feasby, *Organization and Campaigns*, p. 146.

level of detail, profundity and concentration. In essence, Canada's official historians of our medical services are an asset for those seeking understanding, yet they do not provide a solid "big picture" analysis or synthesis. The official histories of the Canadian military's medical services engage the topic on an organizational level, but have not placed it into its larger military or social context.

Unfortunately, the vast majority of other military histories written about Canadian participation in both wars – texts, memoirs, regimental histories and the like – shed little meaningful light upon questions related to the experience of disease and other health-related issues in the nation's military. Interestingly, the relative dearth of meaningful analysis in secondary sources may be partly due to the remarkable fact that most primary documents produced by soldiers, such as manuscripts memoirs, and letters, even extensive collections, are almost all entirely or nearly entirely devoid of anything more than a passing mention of disease and hygiene.

Virtually no mention whatsoever is made regarding infectious disease and its import in the vast majority of secondary sources dealing with the campaigns to be examined in this study. For instance, the official Canadian general military histories of the First and Second World Wars, by G.W.L. Nicholson and C.P. Stacey contain virtually nothing related to infectious disease and its import. Exacerbating this historiographical problem, the majority of historians discussing national defence policy during the past century simply do not directly discuss medical issues and funding at all.[11] Additionally, the vast majority of books that are considered as compulsory or definitive reading for students of the Canadian military history during the First and Second World Wars

[11] For instance, refer to James Eayrs' multi-volume *In Defence of Canada* series.

effectively pay little more than cursory attention to disease and other health related issues. For instance, in all the following: Terry Copp's *Fields of Fire: The Canadians in Normandy*, W.A.B. Douglas and Brereton Greenhous' *Out of the Shadows: Canada in the Second World War*, Jack Granatstein and Desmond Morton's works *Bloody Victory: Canadians and the D-Day Campaign 1944*, Bill McAndrew's *Canadians and the Italian Campaign, 1943-1945* and Stephen J. Harris' otherwise fine and fascinating work, *Canadian Brass: The Making of a Professional Army, 1860-1939*, the related topics of infectious disease and its relationship with our military is either ignored entirely or, at the very least, treated in a frustratingly terse manner.[12] Clearly, for the most part, Canada's military historians appear to have been obsessed with combat and have consistently ignored the fact that all armies have to contend with many other challenges. Sadly, our own military historians have collectively failed to do disease justice, and in the process they have failed to do our nation's soldiers justice.

These deficits are not unique to Canadian military historiography, leading some international historians to recently concur that the "effect of disease upon warfare and that of warfare upon disease patterns, has been historically marginalized."[13] So, in Canada and internationally, an integrated examination of disease, medicine and the military has not received the attention it deserves or requires.

This is not to say that all historians have completely ignored the topic. Fortunately, more military historians have lately begun to take note of the significant

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[12] This list is by no means exhaustive, but its contents demonstrate a long-term neglect of the meaningful study of infectious disease and its role in Canadian military history.
[13] John Charters, "Lice and Louse-Borne Disease in the British Army on the Western Front 1914-1918" (MA diss., University of Birmingham, Center for First World War Studies, 2006), p. 4.

influence that infectious disease has had on war and the soldier. For instance, Mark Harrison's seminal journal article "Medicine and the Culture of Command: the Case of Malaria Control in the British Army During the Two World Wars" has explored the issue from the perspective of, as his title suggests, military command sub-culture. Robert Joy's "Malaria in American Troops in the South and Southwestern Pacific in World War Two" speaks to the pivotal war-winning influence medical scientists have had in entire campaigns. In his books *Fire in the Sky: the Air War in the South Pacific* and *Touched with Fire: The Landwar in the South Pacific*, the American military historian Eric Bergerud not only acknowledges, but fully and convincingly demonstrates, how the experience of tropical disease was instrumental in determining the conduct and outcome of the Allies' struggle with Imperial Japan during the Second World War.

Recently, some Canadian military historians have illustrated that they are an instrumental component of this emerging international trend to pay medical and health issues in the military their due. While they are not the only ones that reflect this, three profoundly exemplary "home-grown" military historians certainly warrant discussion. In his book *Far Eastern Tour: The Canadian Infantry in Korea, 1950- 1953*, Brent Byron Watson provides an in-depth study of how infectious diseases and other health-related issues were pervasively influential in affecting not only the day to day life of soldiers, but also their performance on the field of battle. In his two complementary works, titled *Death Their Enemy: Canadian Medical Practitioners and War* and *The Myriad Challenges of Peace: Canadian Forces Medical Practitioners Since the Second World War*, historian Bill Rawling offers his readers some engaging and thought provoking insights into the crucial and often complicated roles medical practitioners have played in

combating disease in the ranks of Canada's military services. Tim Cook successfully places the inter-related subjects of medicine, health and disease topic into their wider general context in his fascinating 2007 two volume examination of Canada's Great War soldiers, titled *At the Sharp End: Canadians Fighting the Great War, 1914-1916* and *Shock Troops: Canadians Fighting the Great War, 1916-1918*. Effectively, the approaches and products of all three of these Canadian historians have not only ameliorated the paucity of past historiographical short-comings, but they also serve to motivate and inspire other historians to follow similar paths.

Interestingly, some contemporary participants and observers – notably, non-historians – in each of the campaigns to be examined in this study, recognized the crucial import of disease and hygiene-related issues. During the First World War, many medical and scientific researchers expressed their grave concerns that conditions were ripe for diseases such as typhus, typhoid and cholera – all of which had time and time again throughout recorded history demonstrated an ability to kill soldiers and the armies in which they served at alarming rates – to take hold once again. Some of these same commentators also noted that "new" diseases were also appearing and thriving in the trenches. Moreover, the prevalence of vermin and pests in these environs – all carriers of various types of diseases and ailments – they added, could easily facilitate the rapid outbreak and speedy spread of countless epidemics among the troops.

For instance, at the time of the Second World War Sicilian and Italian campaigns, malaria's import was recognized by some. In 1942, one civilian made the observation

that malaria was "an enemy more powerful than Japan."[14] Two years later, a British army physician reporting on malaria in North Africa called the disease "an enemy more dangerous than the German."[15] In retrospect, some may think their contentions to be simple hyperbole. Yet, each had ample reason for voicing grave concern for the welfare of Allied soldiers. Recent British experiences had shown these writers that malaria often thrived in wartime conditions. British empire troops had been ravaged by malaria in South Africa during the South African War and thousands more had been afflicted while serving overseas duty in Mesopotamia, Macedonia and East Africa, during the Great War. The Second World War was a much larger and wider conflict, in which massive military and civilian populations were involved. Most importantly, it was apparent to some contemporary observers that the climates in the Pacific, South East Asia, India, the Middle East, Africa and Southern European theatres of war were, and would be, particularly conducive to the massive outbreak of many debilitating diseases, such as malaria.

According to Hans Zinsser, in his classic work *Rats, Lice and History: A Bacteriologist's Classic History of Mankind's Epic Struggle to Conquer the Scourge of Typhus*, throughout much of history soldiers "rarely won wars. They more often mop up after the barrage of epidemics. And typhus, with its brothers and sisters – plague, cholera, typhoid, dysentery – has decided more campaigns than Caesar, Hannibal, Napoleon, and all the inspector generals of history. The epidemics get the blame for

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[14] Justina Hill, Silent Enemies: The Story of the Diseases of War and Their Control, (New York: G. P. Putnam's Sons, 1970), p. 3.
[15] Maj.-Gen. Sir Henry Letheby Tidy, ed., *Inter-Allied Conferences on War Medicine*. (London: Staples Press Ltd., 1947), p. 73.

defeat, the generals the credit for victory."[16] Clearly, infectious diseases and epidemics have played a key role in determining the unpredictable path of history. The influence, and importantly of potential influence, of disease and disease related issues on human experience has not lessened.

This work examines the important influence disease had upon the lives and experiences of our soldiers, as well as the conduct and outcomes of two important twentieth century military campaigns conducted by Canada's army. In essence, this study will explore Canadian attempts, both individual and corporate, to control, possibly defeat or at least come to terms with, its most salient and elusive enemies on the field of battle – infectious diseases.

[16] Hans Zinsser, *Rats, Lice and History: A Bacteriologist's Classic History of Mankind's Epic Struggle to Conquer the Scourge of Typhus* (Boston and New York: Little Brown and Company, 1934), p. 153.

CHAPTER ONE

THE CANADIANS ARRIVE IN THE TRENCHES

After Britain's declaration of war in the summer of 1914, the Canadian government wasted little time in voicing its unmitigated support for King George V and the British Empire. After a massive expansion of its army in the latter half of 1914, the dominion sent almost its entire force to Britain.[17] The 31,000 strong Canadian Expeditionary Force (CEF), which was comprised mainly of militia and volunteer troops, also included several hundred personnel from the Canadian Army Medical Corps (CAMC). After a miserably cold and wet four month's training on Britain's Salisbury Plain, the first large elements of the CEF moved to the front lines of the Western Front in February and early March of 1915.[18] The Canadian force was attached to the British Second Army and occupied a section in the line in Flanders – an area with an exceptionally high water table.[19] Over the next three years, the soldiers of four Canadian combat divisions would fight, live and die in the trenches snaking through the war-torn and blood-soaked landscape of north-west France and Belgium.

During the war, the trench environment fostered many previously unseen and unknown infectious diseases, in addition to facilitating the development and spread of familiar types of pestilence. The pathogens and diseases faced by the Canadians on the

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[17] G.W.L. Nicholson, *Seventy Years of Service: A History of the Royal Canadian Army Medical Corps* (Ottawa: Borealis Press, 1977), p. 69.
[18] Lawrence J Burpee, "The Canadian Army Medical Corps", in *Canada in the Great World War, Volume VI: Special Services, Heroic Deeds, Etc.* (Toronto: United Publishers of Canada, 1921), p. 85.
[19] G.W.L. Nicholson, *Official History of the Canadian Army in the First World War: Canadian Expeditionary Force, 1914-1919* (Ottawa: Queen's Printer, 1964), pp. 49-50.

Western Front posed a unique challenge to the young dominion's army's soldiers, medical personnel, and officers. In order to comprehend Canada's trench war in its entirety, it is vital to have an understanding the trench environment, medical and hygiene organization in the army, the statistical record, and finally, a comprehension of the characteristics, causes and effects of the infectious diseases the CEF experienced in the Western Front's trenches. Equally important is to understand and attempt to measure the effects and changes pestilence precipitated.

The CEF's soldiers, like all soldiers deployed on the trench lines of the Western Front, lived in an inherently stress filled and dangerous environment. Forced underground by the horribly efficient destructive force of machine guns and artillery, soldiers found themselves besieged by the very same trench environment created to help protect them. Virtually all aspects of day to day living became complicated and arduous in the confining, over-crowded and cramped trenches and dugouts. It was usually impossible for soldiers to find adequate shelter from the elements, especially the apparently incessant rain. Yet, this rain "was not enough to wash away the accumulated filth" of the trenches, which included garbage, human waste, and rotting corpses.[20] In every season except for summer, the putrefied rain water would usually collect at the bottom of the trench, forcing many soldiers to sometimes stand for days with the contaminated liquid lapping over their knees and leeching up to their waists.[21] Throughout most of the Great War, many Canadian soldiers felt that they were constantly fighting an up-hill battle – literally. Indeed, the Germans often located their front trenches on high ground, which was not only tactically advantageous, but it helped

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[20] John Ellis, *Eye-Deep in Hell* (London: Croon Helm Ltd., 1976), p. 52.
[21] G.W.L. Nicholson, *Canadian Expeditionary Force, 1914-1919*, p. 125.

facilitate the purposeful draining of water and other accumulated waste fluids from their trenches and directly into the Canadian trenches. During the war, some captured German prisoners-of-war (POWs) informed their British interrogators that the water in their trenches had been "up to their ankles but never up to their knees" thanks to the Kaiser's Imperial Army seeing fit to supply each small section of trench with its own pump.[22]

Throughout all the seasons, with the exception of summer, Canadian soldiers on the Western Front and their cohorts found that sticky, cloying mud was seemingly ubiquitous with every aspect of trench existence. One lower ranking member of the CEF wrote home waxing poetically on the topic: "The mud – and rain – has been our most disagreeable enemy. Mud. Mud, mud, ankle deep, knee deep, hip deep, mud. Mud to walk in, to sit in, sleep in; mud on our clothes, on our equipment, on our rations – mud everywhere."[23] Another Canadian, an officer, in November 1916 described to his loved ones on the home front that life in France for him was far from the conventional romantic notions, writing "[t]alk about mud here though, there is nothing but, mud, mud, mud and more mud and nothing but mud to look forward to until next spring. You should see us coming out of the trenches, plastered from helmet to heel with it, inches thick, even on our hands and face."[24] Later in the year in another letter, the same officer demonstrated his complete disgust with the mire and its effects by explaining that his tunic was "so heavy from the weight of accumulated mud, that it is almost impossible to carry it on my

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[22] LAC, Record Group 9 (hereafter RG 9), Series III, vol. 3615, DMS – London, Disease Misc., file 25-7-1 to 25-7-4, Summary of information … 11th (Reserve) Prussian Infantry ... made prisoners by the Canadian corps on 16th November 1915."
[23] LAC, Manuscript Group 30 (hereafter MG 30), E558, Cecile John French Papers, "Transcript Copies of Letters", letter to home, 8 November 1916.
[24] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 12 November 1916.

shoulders."[25] In retrospect, this officer's batman was likely even more disgusted with the muck because he was charged with the frustrating responsibility of removing it from his superior's tunic. As explained by the officer, "[the batman] just beats [the tunic] up against a post, then attacks it with a big knife blade before he can think of brushing it off."[26] Still, the batman's apparent vigour might make one wonder if there was any cathartic pleasure in the task!

So gummy was the trench muck that many Canadian and British soldiers determined that exposing oneself to the elements was preferable to some other burdens, and quickly disposed of their greatcoats which had become easily transformed into thirty pound back-bending and bone-chilling masses. Incredibly, one British officer stationed in the Somme region reported that one greatcoat was so permeated with mud and waterlogged that it weighed in at a lofty fifty-eight pounds![27] Clearly, to persist in wearing a greatcoat in the trenches could not only result in a soldier over-exerting himself, but also increased the chances of him becoming mired, sinking or even drowning in water-filled shell-holes or trenches.

Existing for weeks at a time with a paucity of sleep, wearing damp or soaking-wet clothes, eating unpalatable and sometimes poorly prepared and frequently cold rations sapped the Canadian soldier's strength and resistance to illness. As unhealthy as mental and physical life in the trenches was for humans, it offered a prime environment for vermin and insects to not only propagate but to prosper. Rats, flies, fleas, lice and all

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[25] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 12 November 1916.
[26] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 17 December, 1916.
[27] Ellis, *Eye-Deep in Hell*, p. 48.

sorts of other irksome and dangerous pests quickly became constant companions of the trench soldier. Combined with the existing conditions of trench life, these undesirable guests helped create surroundings uncommonly conducive to the development and rapid spread of infectious disease.

Relief from the difficult trench conditions was sometimes elusive. Typically, if they were not involved in an active battle, most Canadian soldiers and officers on the Western Front could generally expect a twenty four day rotation schedule – eighteen days in the trenches, followed by six days' rest in rear areas.[28] When temporarily rotated off the front line, rank and file soldiers may have been relatively free of worry from enemy gunfire, but their living conditions were usually only marginally better than those found in the trenches. When stationed in Reserve Areas or Rest Areas, throughout most of the war, Canadian soldiers often slept, ate and performed their daily ablutions in billets. This accommodation could vary greatly in quality, but the majority of billets were notoriously inadequate and uncomfortable, being nothing more than drafty ramshackle barns, shacks and huts with leaky roofs and damp floors – freezing cold in the winter, damp in the spring and autumn and unbearably stuffy in the summer.

Exacerbating the troubles created by the deficient construction and maintenance of the billets were the cleaning arrangements. Before departing a billet, troops were obligated to tidy the location, leaving it in a sanitary state for its next set of occupants, a situation that invariably led to a good deal of friction. In a satirical article appearing in a 1917 edition of *The Brazier*, the Canadian 16th Battalion's newspaper, one soldier wrote: "Billets naturally divide themselves into two classes: 1. the objectionable. 2. The still

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[28] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letters to home, 6 and 26 November 1916.

more objectionable." Tongue firmly planted against the inside of his cheek, he added: "It is a curious fact that a billet is invariably left perfectly clean and is just as invariably found dirty by the incoming troops. The latter profanely wondering if a troop of South Sea islanders were having a cannibalistic war-dance or whether the billet had merely been selected as a city dump."[29]

During the Great War, the organization of the CAMC was modeled on that of Britain's Royal Army Medical Corps (RAMC). The CAMC, like the CEF's combat units, for the most part worked in close cooperation with its British counterparts. Dissimilarities in the two services were few. Still, the existence of one difference caused much consternation among the CAMC's officers when it came to light in 1915. It seems these CAMC officers were paid at the same rate as officers in other branches of the CEF, yet controversy erupted when these Canadian medical officers discovered that they were being paid less than medical officers in the RAMC or in other "Colonial" armies. This situation was finally rectified by the Canadian government in 1918, when CAMC doctors' wages were finally put on par with their medical colleagues in other "British" armies.[30]

The Canadian medical service was kept exceptionally busy from the day its units began to arrive in Europe, until well after trench fighting had ended in 1918. Accordingly, the service expanded quickly during this period. In 1915, its total strength was eleven units – including hospitals, Field Ambulances and Casualty Clearing Stations. By the Armistice in 1918, it had swelled to over thirty-seven units with a bed capacity in

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[29] LAC, RG 9, Series III, Volume 5077, *The Brazier* (newspaper of the Canadian 16th Battalion), 10 February 1917, p. 6.
[30] MacPhail, *The Medical Services*, pp. 349-51.

excess of 40,000, manned by about 16,000 personnel, including nearly 800 nursing sisters.[31] The majority of these Canadian medical staff rendered service to troops engaged on the Western Front[32] and in this locale many of the Canadian medical staff worked at and near the front lines, putting themselves in harm's way. Unlike many of the wars that took place in the latter half of the nineteenth century, during much of the First World War enemy medical personnel were considered as being military assets and as such were not considered by many belligerents as being sacrosanct or innocent participants. This modern condition offended the sensibilities of one jingoistic Canadian medical officer who exclaimed "[w]ith an enemy like the Hun, not even the Red Cross was respected."[33]

Given the maiming efficiency of contemporary weapons and munitions technologies, the main focus of most Canadian medical units, especially on the Western Front, was aimed primarily towards the treatment of battle-casualties.[34] Nonetheless, the CAMC were among the CEF's most vocal advocates of health and hygiene measures. The front line of defence against infectious disease was literally at the front lines. The first goal was prevention. To this end, each regiment in the CEF had at its disposal the exclusive services of a medical officer. In addition to serving in the Regimental Aid Post and directing the treatment of battle casualties, the battalion medical officer was also charged with ensuring that guidelines governing hygiene and sanitation were correctly followed by his battalion's troops. Discouragingly, many medical officers found that

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[31] Burpee, "The Canadian Army Medical Corps", p. 112.
[32] Some CAMC formations, including Hospital units, were located in other theatres of war in support of British military operations, including Mesopotamia and Greece.
[33] Burpee, "The Canadian Army Medical Corps", p. 112.
[34] Bill Rawling, *Death Their Enemy: Canadian Medical Practitioners and War* (Quebec: AGMV Marquis, 2001), p. 71.

they "lacked the authority to enforce regulations"[35], as ultimate authority for the health of the troops fell under the battalion commander's wing. This authority stemmed from the great responsibility all army officers had for the well-being of those under their command, according to the existing Canadian Army's Field Service Regulation which read as follows:

> "The commander of every unit and formation is responsible for the sanitary condition of the quarters of localities occupied by his command, and taking all measures necessary for the preservation of the health of those under him. He is also responsible for seeing that each officer and soldier observes all sanitary orders, and for the good order and cleanliness of that portion of a quarter or locality under his charge, irrespective of the period for which it may be occupied."[36]

Still, it appears that many senior Canadian officers, outside those in the CAMC, placed a low priority on medical or health related matters, especially until the latter half of the war. One CAMC Lieutenant-Colonel would later relate that many senior army officers were "inclined to regard the Medical Corps as a bit of a nuisance, and Medical Officers, not soldiers in any real sense of the term, and not, therefore, inclined to regard the Medical Officers requests as serious."[37] Some of these stubborn battle-centric commanders later learned that, altruism aside, heeding a medical officers' advice was often tactically and strategically sound for maintaining their own commissions. If the medical officer felt the issue was serious enough, he had the option of appealing the issue with higher authorities in the CAMC and seeing that his "advice" was followed. When

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[35] Rawling, *Death Their Enemy*, p. 71.
[36] LAC, RG9, Series III, Vol. 3745, Adami Papers (Misc. Extracts), "Circular Memorandum – issued with 1st Army Routine Order No. 35 of 31 March 1915", Canadian Army's Field Service Regulation Part 2 – section 83(2), (Copied from ADMS 1st Canadian Division, April 1915), p. 1.
[37] Rawling, *Death Their Enemy*, p. 71.

events warranted, the CAMC would gradually "work their way up the ladder", to the CEF's high command if necessary, in order to see that existing medical orders and health measures were enforced by division commanders.[38]

Within these parameters of authority and control & command, the CAMC focused its disease-related efforts in two areas – prevention and treatment. Much of the physical day-to-day preventative work was accomplished by Canadian Sanitation Sections, the first of which was established in 1915. By the war's end in 1918, the CAMC had a total of five Sanitation Sections, each at an ideal establishment strength of twenty-eight officers and men. These formations were charged with implementing and overseeing established hygiene measures in the field.[39] Consequently, Sanitary Sections oversaw a wide-ranging plethora of unenviable salubrious tasks including those related to water and food supplies, bathing and laundry facilities, disposal of refuse, human waste, disinfection, and destruction of vermin and insects.[40] Apparently, not all Canadian battalion officers were keen on having their "fighting soldiers" being ordered about and forced to attend to such onerous tasks by a lowly Sanitary Section member. According to one Canadian hygiene inspector in 1916, it was important to remind all officers that it was not a Sanitary Section's "duty to do the fatigue work, they [were] there to instruct and to inspect."[41] Still, in practice it seems that Sanitary Section personnel were often

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[38] LAC, RG9, Series III, Vol. 3745, Adami Papers (Misc. Extracts), "Circular Memorandum – issued with 1st Army Routine Order No. 35 of 31 March 1915" (Copied from ADMS 1st Canadian Division, April 1915), p. 1; and Rawling, *Death Their Enemy*, pp. 71-2.
[39] Burpee, "The Canadian Army Medical Corps", p. 112.
[40] LAC, RG 9, Series III, Vol. 3748, Adami Papers, No. 3 Sanitary Section, n.d., p. 2.
[41] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 13.

"stuck" with the actual performance of much of the physical work or the work would simply not be done.[42]

Being charged with the duty of inspection, Canadian Sanitary Sections were to "report any failure of Units to carry out sanitary precautions."[43] Still, a rather cumbersome chain of command had to be adhered to, where the Officer Commanding the Sanitary Section reported "to the ADMS (Assistant of Medical Services) of the division and through him any recommendations" were then sent back to "the Units concerned."[44] It must be recognized now, as it surely was by virtually all those individuals involved at that time, that these recommendations were just that – "recommendations" – so uniform compliance could neither be assured nor enforced unilaterally or independently by CAMC personnel.

Assigned with overseeing the inarguably unenviable and thankless undertakings of the Sanitary Sections were many of the CAMC's most experienced personnel. In fact, the Canadian No.2 Sanitary Section proudly boasted it had an officer that was a veteran of the 1885 Northwest Rebellion in its ranks.[45] By 1917, every Company sized unit was required to supply a sanitary squad to assist the Sanitary Sections, especially with regards to laborious duties. These squads were augmented by impromptu sanitary fatigues on

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[42] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 13.
[43] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 2.
[44] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 13.
[45] LAC, RG 9, Series III, Vol. 4717, "Historical Reviews", folder 111 - file 2, No. 2 Sanitary Section, n.d..

occasion.[46] Typically, fatigue duty of any variety was meted out as a mild form of punishment. Thus, it's probably very safe to assume that soldiers involved in many squad level sanitation related duties were most likely not very pleased with this type of assignment.

The CAMC's commitment to disease prevention manifested itself early in the war with the establishment of the Canadian Army Hydrological Corps and Advisors on Sanitation. Attached to the Canadian 1st Division and just renamed No.5 Canadian Mobile Laboratory, this unit arrived in France's Bailleul area on the heels of the first contingent of CEF troops on 21 March 1915.[47] The initial unit establishment of three officers and eight Other Ranks (ORs), had the responsibility of performing pathological examinations on "all morbid products from the hospitals, to assist in the diagnosis of disease and ascertain the nature of infection in wounds; to investigate new forms of epidemical sickness, and prevent or check its progress among the military and civil population."[48] In June 1915, No.5 also began attending to the general bacteriological work of the Indian Corps and other British units in the Aire-la Bassee Canal area.[49]

These skill sets with well-honed work ethics that were shared by all its staff, proved to be a potent combination, as No.5's contributions proved to be pivotal for all British, Territorial and Colonial armies, as well as the Americans, both in the theoretical

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[46] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.
[47] J. George Adami, *War Story of the Canadian Army Medical Corps: Volume 1 – The First Contingent (to the Autumn of 1915)* (Toronto: Musson Book Company Ltd for the Canadian War Records Office, circa August 1918), p. 278.
[48] MacPhail, *The Medical Services*, p. 236.
[49] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, p. 1.

and practical prevention and treatment of disease. Throughout the war, No.5's personnel performed at a stellar level and were consistently at the leading edge of innovation and design.[50]

No.5 boasted some of the best and brightest of Canada's infectious disease medical and scientific specialists.[51] When it arrived on the continent in 1915, the Officer Commanding the unit was George G. Nasmith. The Ontarian was widely-recognized and respected as a specialist in sanitation, especially for his successful pre-war work on purifying Toronto's water-supply system. Interestingly, Nasmith was neither a medical nor a military man. Still, Canada's Minister of Militia wisely anticipated the need for Nasmith's practical and organizational skills. Accordingly, within two months of the war breaking out, Nasmith was instated directly into the high rank of Lieutenant-Colonel in the CAMC and placed in charge of No.5.[52]

In its first eight months of operations in the field, the unit's second-in-command was Captain A.C. Rankin. Rankin, a life-long civilian until the outbreak of the war, may have been a newcomer to army life but he was by no means a medical or scientific amateur, having received medical training in McGill and London School of Medicine and amassed three years experience in Pathology and Bacteriology, from McGill and Montreal's Royal Victoria hospital after serving as Bacteriologist and Pathologist in charge of the laboratories of the Department of Public Health in Bangkok, Siam. Early in his career, Rankin was also a Professor of Bacteriology at the University of Alberta and a

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[50] MacPhail, *The Medical Services*, pp. 236; and Nicholson, *Seventy Years of Service*, p. 88.
[51] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Interim Report of No.5 Canadian Mobile Laboratory … until December 31st, 1915", pp. 1-2.
[52] Adami, *War Story of the Canadian Army Medical Corps*, pp. 276-77.

member of the provincial board of health.[53] Serving alongside Rankin was a fellow Canadian, Captain A.W.M. Ellis. Later described by one official historian as "one of the most brilliant of the younger graduates of Toronto University," Ellis served as a Pathologist and Resident Physician with the Rockefeller Institute in New York for several years before enlisting in the CAMC.[54] The solid officer cadre leading No.5 was augmented by many other talented individuals who were well suited to attend to the tasks at hand, including CAMC Staff Sergeant W.J. Phillips, a senior lab attendant who had previously gained much valuable experience in military camps throughout Canada and the United Kingdom.[55]

The fourteen members of No.5 initially found the quarters and working area allotted them by the British were "spacious" and "well lighted" – nicely suited for lab work.[56] Early cooperation between the British and Canadian medical services appeared to be good, as demonstrated by Nasmith's report that he "could not say too much for the courteous and kind way in which all the British officers have treated us."[57] Still, No.5's

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[53] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Interim Report of No.5 Canadian Mobile Laboratory … until December 31st, 1915", pp. 1-2.

[54] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Interim Report of No.5 Canadian Mobile Laboratory … until December 31st, 1915", pp. 1-2.; and Adami, *War Story of the Canadian Army Medical Corps*, p. 278.

[55] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Interim Report of No.5 Canadian Mobile Laboratory … until December 31st, 1915", pp. 1-2; Notably, Dr. Norman Bethune also briefly served with No.5, in 1915; and LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, April 22 1915.

[56] Adami, *War Story of the Canadian Army Medical Corps*, p. 279.

[57] Adami, *War Story of the Canadian Army Medical Corps*, p. 279. Inarguably talented and capable, it appears Nasmith was also an unabashed self-promoter – perhaps with good reason. Yet, to his credit, he heaped more praise upon his senior medical colleagues in No.5, than he did on himself. Nasmith reported at the 1915 that he "wish[ed] to express his appreciation of the work" accomplished by Major Rankin and Captain Ellis whom he proudly deemed were "not only capable but hardworking and enthusiastic as

efforts were initially stymied when much of the unit's equipment was "lost and not recovered for over five weeks after their arrival in France", with Nasmith and his staff finding themselves wasting much valuable time chasing after the seemingly evasive and elusive gear.[58] Fortunately, once recovered, hygiene as well as a bacteriological work was begun in earnest.

In practical terms, the work of No.5 "had a wide scope."[59] In addition to a nearly overwhelming volume of demanding clinical lab and pathology work, No.5 also performed autopsies, examining the efficiency of antiseptics, collecting and analyzing all matters of human consumables, such as milk, water and food.[60] Beer samples were regularly collected from local breweries and examined for contaminants such as heavy metals and arsenic and that the "percentage of alcohol" was adequate and as advertised.[61]

As if that was not enough, Nasmith also became heavily involved in studies related to the newest of horrific weapons being used in modern warfare – poison gas.

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well" as per LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of No.5 Canadian Mobile Laboratory for June 1915", p. 5. Nasmith's early entries in the unit's War Diaries clearly illustrate that he seemed be having the time of his life, reveling in the physical and intellectual challenges incumbent upon him and No.5. Nasmith left the unit and the continent temporarily in late 1915, reportedly returning to Canada temporarily to help tend to his ill wife. Unfortunately, as skilled as they were, Nasmith's successors in No.5, Rankin and Ellis, did not have their predecessor's zeal or a sense of esprit de corps in terms of War Diary writing. Unfortunately, when Nasmith later returned to active duty with the CAMC in 1916, he seems to have lost his verve and drive to record detailed War Diary entries.

[58] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 24 Feb 1915 and 30 March 1915.

[59] Adami, *War Story of the Canadian Army Medical Corps*, p. 280; and LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 1 Sept. 1915.

[60] Adami, *War Story of the Canadian Army Medical Corps*, p. 280; and LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 1 Sept. 1915.

[61] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 11 July 1915, January 7 1916 and 4 June 1916.

Nasmith would later be credited as being one of the first "experts" to observe and record the effect of gas on British troops. At his prompting and under his direction, the entire unit began to conduct a wide variety of experiments examining and measuring the "efficacy of gas masks and helmets."[62] Field testing was also aimed at identifying the composition of the gas being used by the Germans and counter-measures. Some of these tests were conducted on both animals and men, the latter group presumably comprising of "volunteers", with each set being intentionally exposed to different types and various concentrations of poison gas.[63]

Nasmith's interest in poison gas warfare was not altogether motivated by altruistic humanitarianism, as demonstrated by his observation in 1915 that he and his cohorts in No.5 "all spend our spare time since the use of poison gas has been officially approved, making up poison gases of a most virulent description and are developing into the most bloodthirsty variety of German chemist."[64] Nasmith's inspiration to contribute to the allied knowledge of gas warfare was undoubtedly derived in large part from the fact that No.5 and its personnel often operated close enough to the front lines that they were subject to German artillery and poison gas attacks on a regular basis. Also anticipating the possibility that biological weapons could be being developed by the enemy, No.5 also began to attempt to identify chemical agents which might be used to counter the

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[62] Adami, *War Story of the Canadian Army Medical Corps*, p. 280.
[63] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, August 15 1915; and LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of No.5 Canadian Mobile Laboratory for May 1915", p. 1.
[64] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of No.5 Canadian Mobile Laboratory for May 1915", p. 1.

intentional introduction of infectious and potentially infectious materials to the battlefield environment.[65]

In addition to all his other work, No.5's Rankin was heavily involved in malaria related testing.[66] Rankin gathered, bred and tested mosquitoes from larvae for identification purposes, collected copious numbers of blood samples and produced papers on malaria.[67] The Canadian officer had his superlative work ethic and contribution to the army recognized in 1916, when he was Mentioned in Dispatches by the Commander-in-Chief (C-in-C) of the British armies, Sir Douglas Haig.[68] Fortunately, although mosquitoes were endemic to the front, not a single new case of malaria was ever identified on the Western Front by the middle of the war, and the highly contagious disease never became a problem in the Canadian ranks during the Great War.[69] Unfortunately, this situation would not be repeated in the Second World War.

In 1915, as one official historian later recognized, "the need for sanitary and bacteriological experts at the Front [was] very great", not just for the health of the troops in the front line but also to oversee and control "the health conditions of the broad belt of country immediately behind the lines."[70] In civilian inhabited villages and towns near the front, health standards were more often than not rendered chaotic and disorganized by the

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[65] Adami, *War Story of the Canadian Army Medical Corps*, p. 280.
[66] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Interim Report on the Work of No.5 (Canadian) Mobile Laboratory, from the Date of its Opening until December 31st, 1915", p. 6.
[67] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 27 June 1915 and 21 Jan 1916.
[68] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 19 June 1916.
[69] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of Work Done in No.5 (Canadian) Mobile Laboratory during August 1916", p. 1.
[70] Adami, *War Story of the Canadian Army Medical Corps*, pp. 276-77.

war. Still, the recognition of the terrible dilemma faced by these people was lost on some Canadians who saw disease as something that was caused by civilians and not by military activity. In June 1915, one Canadian nursing sister voiced this belief, complaining in a letter home that her encampment was located in France "not far from a dirty little village", rank with "awful smells" and "swarms and swarms of dirty children."[71] Apparently, in a decidedly unflattering manner, at least by modern standards, her concern was for her own safety and that of her comrades, not for the plight of the poor locals.

As a consequence of civilian disease, the Army, not out of a need for altruistic expression, but out of a desire for self-defence, would take on additional responsibility for matters related to sanitation and hygiene, and in particular, quarantining cases of infectious disease in the local civilian populations.[72] Identification of problems and potential problems of these types was within the purview of No.5 and would remain so throughout the course of the conflict.

Nasmith's expertise in water purity was sorely needed very early on in the campaign. Soon after the Canadians' arrival in France it was determined that "almost all" of the wells in the "low-lying Flanders country" were contaminated. "Of forty-four sources examined during June 1915, ninety-three per cent showed the presence of B. coli."[73] Adding to Nasmith's woes, this fouled water was not only threatening the health of soldiers, but was also contributing to "an extensive outbreak of typhoid among the civilian population of Flanders in the autumn of 1914."[74] Eight thousand civilians were infected with the disease and two thousand of these would succumb. Fortunately, before

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[71] LAC, MG 30, E290, Sophie Hoerner Papers, Letter Home, 10 June 1915, p. 3.
[72] Adami, *War Story of the Canadian Army Medical Corps*, pp. 276-77.
[73] Adami, *War Story of the Canadian Army Medical Corps*, p. 280.
[74] Adami, *War Story of the Canadian Army Medical Corps*, p. 280.

the problem became even worse, a massive inoculation program brought the epidemic to an end, and after the summer of 1915 the disease had become "relatively uncommon" in the local civilian populace.[75] Concerns about French, Belgian and English civilians encouraging – albeit unintentionally – the development and spread of minor and major infectious disease became fairly common as the war progressed. Understandably, it was not uncommon for Canadian troops to augment their rations with local products wherever and whenever possible. Officially, this practice was usually strongly discouraged and on may occasions the trading for or purchase of products such as milk, cheese, meat and the like was completely forbidden.[76]

As this chapter has shown, the trench environs of the Western Front were certainly very different from the normal living conditions experienced by the men of the Canadian army before the start of the war. Coming to terms with the elements and the lack of creature comforts was undoubtedly an arduous psychological hurdle. Moreover, the environment posed a serious threat to the physical health of the army. This threat was recognized by some Canadians, many of whom took a proactive approach to controlling, or at least managing, its soldiers' new "home away from home" in order to keep infectious disease from having a significantly detrimental effect on the collective body of the army. The Canadian army had in its ranks a core group of qualified, talented and dedicated medical and scientific personnel that were well versed in anti-disease precautions and measures. In essence, it appeared that a modern medical infrastructure

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[75] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, p. 280.
[76] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 2; and LAC, Adami Papers (Misc. Papers/Misc. Extracts), RG 9, Series III-B-2, Vol. 3745, Report from CSS 1st Division – Major Woodhouse, n.d..

was in place.

Still, despite these advantages, as the first calendar year of the Canadian sojourn on the Western Front came to a close, the personnel of the entire CEF was faced with challenges to its corporate health and well being. Generally, infectious diseases, even those that were well understood, were proving to be difficult and problematic. Adaptive and compatible to thriving in the trench environment, infectious disease and its vectors would soon have the Canadians reeling on a variety of health related fronts. Infectious disease was a foe well-suited for war. It enlisted the aid of allies in spreading its malevolence. Disease was powerful aggressive, relentless, tireless and single-minded in purpose. Moreover, as the Canadians would soon discover, some infectious diseases were also masters of deception and surprise.

CHAPTER TWO

A MODICUM OF STATISTICS AND A PLETHORA OF INFECTIOUS DISEASES IN THE TRENCHES OF THE WESTERN FRONT

Before embarking on identifying the infectious diseases of the trench warfare and exploring the causes and the effects of each, it is necessary to come to terms with the problematic nature of the available statistical evidence. After the conclusion of the war, many contemporary military observers may have surmised that the CEF had not only vanquished "the Hun" but had also effectively defeated fatal disease. Indeed, at first glance, the available statistics appear to support this conclusion. When comparing the total number of deaths reported due to wounds and disease, 51,678 soldiers of the CEF died as a direct result of wounds sustained in battle, whereas just 4,960 appear to have died as a result of disease, or just 8.7 percent of the total fatalities. The cumulative death rate in the CEF for all causes was reported as 135.7 per 1000 soldiers. 123.6 per 1000 were battle casualties and 11.86 per 1000 were disease-related.[77]

However, are these statistical rates more a measure of how well disease was controlled or a testament to the killing efficiency of machine guns, artillery, and chemical weapons? Perhaps those that were stricken with infectious disease received exceptional treatment. Perhaps the favourable battle/disease fatality ratio could be interpreted to suggest that diseased soldiers were well cared for but battle-casualties were badly treated.[78] The number of conclusions that can be drawn from fatality rates alone can range from the apparently insightful to the seemingly absurd.

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[77] MacPhail, *The Medical Services*, p. 247.
[78] MacPhail, *The Medical Services*, p. 247.

This issue clearly illustrates that interpretation of statistical data is a complicated task and that over-reliance on any statistics for interpretative value is folly. This is not only due to the potential pitfalls of misinterpretation as we have seen, but due to problems that may exist in the raw data from which the statistics are formulated--and the raw data used by the CAMC and the RAMC were definitely flawed. According to official historians T.J. Mitchell and G.M. Smith "the science of recording and preparing statistics in war is intricate."[79] Unfortunately, at the beginning of the war the British, and by association the Canadians, had absolutely no organization in place to direct or collect casualty or medical statistics.[80] Hasty arrangements to correct this situation were initiated but the data collection system was fraught with many troubles. These confounding problems are numerous and not necessarily mutually exclusive. At the very least, they all served to create difficulty in collecting and reporting cases of infectious disease, and at the very worst, made the task virtually impossible.

The first of these problems is related to the size and scope of the war. Massive numbers of soldiers were deployed in numerous far-flung locations. Additionally, in the Canadian military, there was a great deal of movement by both combat and some medical units — on and off the line and from sector to sector.[81]

On the Western Front in particular, wounded, injured and ill patients were rarely

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[79] T.J. Mitchell and G.M. Smith, *History of the Great War - Medical Services: Casualties and Medical Statistics of the Great War* (London: The Imperial War Museum, n.d.), p. x.
[80] Mitchell and Smith, *Casualties and Medical Statistics of the Great War*, p. x.
[81] Generally, contingent upon activity in any given sector of the front, the smaller the CAMC unit the higher the frequency of moves. Additionally, there was much more movement of personnel between units of the CAMC than there was between personnel in Canadian combat units. In the interests of sharing and exchanging medical and/or scientific knowledge and expertise, temporary and long-term secondments of Canadian medical officers to other "British" units was common, especially in the later half of the war.

under the care of a single medical officer and frequently transferred from one medical formation to another to yet another, depending on the diagnosis, treatment and prognosis, for both injuries and diseases. On a related note, throughout the entire course of the war, Canada and its allies reciprocally treated each other's sick and wounded. As well, although it was not common practice, depending on the nature of a Canadian soldier's wounds and/or illness, he could receive treatment or spend recovery time at civilian-run or manned facilities.

Understandably, the ability of a medical officer to report illnesses correctly was confounded by highly motivated soldiers who did not seek medical care for infectious diseases. A multitude of reasons and rationales existed among soldiers that would fit into this incalculable category. Invariably, although ailing, some soldiers would want to "tough it out" so as to not be taken out of the fight and/or be separated from their comrades-in-arms. Other soldiers may have avoided seeking treatment solely in order to better conform to the pervasively held gender ideal of manliness, not wanting to perceive themselves or be perceived as being "soft." In some of these cases, this tactic was functional in terms of maintaining an effective fighting force, in that some minor sicknesses required nothing but time to cure. Unfortunately, these avoidance practices could result in the needless propagation of disease via cross-infection, an/or an individual soldier's untreated illness could eventually develop or transform into a larger and more serious problem.

Another motivator for steering clear of daily sick parade was certainly due to the contemporary attitudes some Canadian soldiers, like many members of the general public, held towards modern medicine and its practitioners, and especially medical

personnel in the military. Of course, these attitudes would range from a mild to profound dislike and distrust. An indication of this phenomenon is illustrated in an October 1915 issue of *The Listening Post*.[82] In the "Medical Detail Weekly Grouse", a contributor writing under the pseudonym "Drone" satirically related to his chums in the 7th Canadian Infantry Battalion:

> "A doctor in the army and a doctor in civilian life are alike in one respect only; they are persons to be strictly avoided. A doctor in civilian life may possibly be a gentlemen. That is if he is not a doctor of medicine, whilst a doctor in the army is a [deleted by censor]. When a doctor leaves the civilian life for the military, he becomes a different person altogether. Just like Dr. Jekyll and Mr. Hyde."[83]

An even more simple explanation of sick parade evasion by some soldiers may have merely been a product of human nature – specifically, the avoidance of unnecessary pain and/or treatments with other adverse side-effects. A popular belief held by many Canadian and other "British" soldiers was that a trip to sick parade would inevitably lead to some sort of treatment—no matter how needless or discomforting—if for no other reason than to keep up appearances. It was widely thought that if an attending Regimental medical officer could not or did not easily determine a diagnosis, or he did not identify any serious ailment, he would simply see that the "patient" ingested "under

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[82] *The Listening Post* was a newspaper produced by and for the soldiers of the 7th Canadian Infantry Battalion. Like all official newspapers distributed to the troops, the publication was subjected to official vetting at various stages of its production, with the final edition being censored by the Battalion's Officer Commanding and the Chief Censor of the 1st Canadian Division, as per LAC, RG 9, Series III, Vol. 5079, "*The Listening Post*", 7th Canadian Infantry Battalion , p. 1. Despite the vetting process, the candor and candid nature seen in some trench newspapers is surprising. Still, it is evident that there existed some consternation that any censorship was taking place, as per LAC, RG 9, Series III, Vol. 5080, Unit newspapers, Printed Material, "*Now and Then*", No. 1 Canadian Field Ambulance, 15 December 1915, p. 5.

[83] LAC, RG 9, Series III, Vol. 5079, "*The Listening Post*", 7th Canadian Infantry Battalion , p. 4. (brackets in original)

supervision", what one Canadian soldier described as a perceived "panacea for all ailments", the highly dreaded No.9 pill – "the terror of a sick parade."[84] The No.9 had a distinctive, yet gentle, laxative effect – not enough to incapacitate a man, but enough to nurture a definite aversion to the medical officer and an avoidance of future sick parades unless it was absolutely necessary.[85]

Besides having to deal with legitimately sick soldiers unwilling to present themselves, conversely, medical officers also had to deal with suspected malingerers that may have feigned illness in order to get a short break from the rigours of trench life or to dodge their military duties altogether.[86] Medical officers were very well aware of the existence of "shirkers" and most took great pains to insure they were not duped into becoming unwilling accomplices to these "scrimshakers." It is now commonly recognized that so great was the desire among some soldiers to get away from the realities of trench life that they would resort to intentionally wounding themselves. However, it is quite apparent that "self inflicted" injuries were not always so easily identifiable. At the CAMC's General Hospital stationed in Salonika, it was suspected that many soldiers had either intentionally exposed themselves to infectious disease, in

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[84] LAC, RG 9, Series III, Vol. 5078, Unit Newspapers, Printed Material, "*The Dead Horse Corner Gazette*" (4th Battalion), No. 2, December 1915. p. 23; and LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller, n.d,, p. 114.

[85] Tim Cook, *At the Sharp End: Canadians Fighting the Great War, 1914-1916*, Volume One (Toronto: Viking Canada, 2007), p. 240.

[86] R.J. Manion, *A Surgeon in Arms* (London: D Appleton and Company, 1918), pp. 104-5; this situation created other difficulties for many medical officers, who were torn between the ethical dilemma of identifying malingerers and ensuring that truly sick men got the treatment they needed to recuperate.

this case malaria, or were faking the symptoms normally associated with the disease.[87]

The great and sometimes life-threatening lengths some shirkers would go to is not only mind-boggling, but indicative of the high level of desperation some of these soldiers may have felt. When discussing the "great nuisance" rats posed in the Canadian trenches in 1917, a senior officer in the CAMC related that "[p]oison has been proposed [to kill the rats], but we have enough self-inflicted wounds already, and there is a general objection therefore to use poison."[88]

The subject of malingering provided fodder to a soldier with the Canadian 24th Battalion who, in July 1916, penned a humorous trench newspaper article titled "Advice to those about to go Sick." He offered some sage "guidance" to potential shirkers including: "be sure there is to be a working party before you go sick", "if you want a high temperature, don't eat phosphorus …", and as a parting suggestion "For further advice see my publications How to Get a High Temperature and How to get a Very High Temperature."[89]

One Canadian nursing sister, serving with the CAMC in France, related to her family "back home" that "[t]hey [the patients] are all crazy to get to England, even for a day; say they would go back to the trenches with a light heart if they could only see England again."[90] Intentionally creating the conditions to make this happen was not uncommon. One Canadian soldier later wrote that "morning sick parade at the Medical

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[87] Kenneth Cameron, *History of No. 1 General Hospital 1914-1919* (Sackville, NB: Tribune Press, 1938), p. 133.
[88] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.
[89] LAC, RG 9, Series III, Vol. 5080, Unit newspapers, Printed Material, ""*The Vics Patrol (24th Battalion) – Trench Edition*", 15 July 1916, p. 10.
[90] LAC, MG 30, E290, Sophie Hoerner Papers, Letter Home, 10 June 1915, p. 3.

Officer's hut often produced strange cases of illness." Just before reporting, some soldiers would remove the cordite from a rifle cartridge and chew it to "produce a pallor, quickened heart action and frothing at the mouth", while some others would encourage the appearance of skin infections by tightly wrapping copper coins over top of flea bites and similar skin striations. Still, the medical officers became experts at identifying "these and many other tricks" and in such cases deftly prescribed what was described as "medicine with extra duty." Thus, "the 'work your ticket' racket was quickly ended", according to one CEF soldier.[91]

Sadly, it must be recognized that many of self-inflicted wounds and diseases were not the product of simple malingering or shirking but of serious mental strain and battle exhaustion. So desperate was one Canadian soldier, one of his comrades observed, that he "scrounged around the incinerator and found a can of beef which had spoiled. To eat it meant ptomaine poisoning, but he was willing to take a chance, because it meant going to a hospital and getting away from it all. His nerves could stand it no longer. … were soldiers such as this "cowards? … not at all. Some of these men had proven their bravery time after time. They were simply 'fed up'."[92]

To complicate the meaningfulness of available statistical data regarding infectious disease even further, "very often the keeping of medical records and returns fell to men neither familiar with such work nor conscious of its importance."[93] Certainly, tedious clerical tasks, such as filing statistical reports, would have a tendency to become a very

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[91] LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller , n.d, p. 113.
[92] LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller , n.d, p. 114.
[93] Mitchell and Smith, *Casualties and Medical Statistics of the Great War*, p. 62.

low priority for many CAMC personnel in particular for those who were over-worked, under-motivated, or merely apathetic; and especially during periods of high battle casualty intake. Although no concrete evidence presently is available, it appears to be reasonably likely that there would have been some "cooking of the books" or intentional falsification of the infectious disease related statistics at or near the points of collection. Regular army and medical unit officers wanting to mitigate or cover up their own mistakes and shortfalls, clearly would have had the opportunity to "correct" the record before forwarding returns to their superiors.

Not only skewing infectious disease statistics, but increasing the danger pestilence posed for the CEF, was the predisposition many of its replacement soldiers had to develop serious infectious disease and other medical maladies. In 1916, Special Inspector-General Colonel Herbert A. Bruce[94], reported to the federal government that "[m]any soldiers were arriving in England from Canada medically unfit; who should have never been enlisted."[95] Supporting Bruce's findings was a study in which impromptu medical examinations that were conducted upon a single draft of 254 soldiers sent from Canada in June 1916. Upon their arrival in Britain, fifty-seven of these men were deemed "unfits" requiring discharge.[96] These volunteer soldiers, whose spirit was willing

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[94] In July 1916, Bruce, an accomplished and internationally recognized Toronto surgeon, was appointed by the Minister of Militia, Sir Sam Hughes, to conduct an investigation into the affairs of the CAMC. Hughes' motivation to launch this investigation is unclear, but ostensibly he had done so in response to numerous criticisms of the Canadian medical service that had been circulating in Ottawa. Bruce's report completed on 20 September 1916.

[95] Herbert A. Bruce, *Politics and the Canadian Army Medical Corps* (Toronto, William Briggs, 1919), p. 44.

[96] Bruce, *Politics and the Canadian Army Medical Corps*, p. 44; In the latter half of the war, undoubtedly prompted in part by Bruce's findings, and mainly due to the "experience ... showing that placing newly arrived troops in established camps frequently

but flesh was weak, presented with a wide variety of ailments and conditions that would undoubtedly make them prime candidates for daily sick parades. Some of these soldiers were grossly underweight, had under-developed musculature or suffered from pre-existing conditions that compromised both their physical abilities and their immune systems. A "large number" had asthma.[97] Ironically, some of these asthma sufferers divulged "that they had left England years ago because they were unable to live in that country" due to the breathing difficulties they encountered whilst living there.[98] Others in this draft of soldiers had tuberculosis, leading Bruce to logically conclude they constituted a "menace to the troops with whom they had been in close contact in crowded huts and transports."[99] Incredibly, one of these Canadian men had been enlisted despite having experienced "partial paralysis of his entire left side" for years.[100]

Another factor which invariably distorted the statistical record was related to medical diagnosis. Many of Canadian medical officers, especially those working in or close to the trenches, were often under terrific pressure in arduous conditions. This environment must have increased the difficulty of correctly diagnosing many diseases and determining the cause of deaths—in the case of infectious disease, a complicated and subjective process at the best of times. Further complicating this issue was a simple, yet troublesome truth: wounded soldiers can get sick and sick soldiers can be wounded. For

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introduced infectious diseases among those ready for the draft.", a system was introduced for placing troops arriving in Britain from Canada directly into segregated camps, where they were held for four weeks of quarantined drill and physical conditioning exercises. Following this, soldiers were placed directly into their reserve units for more specific technical training. MacPhail, *The Medical Services*, pp. 272-3.

[97] Bruce, *Politics and the Canadian Army Medical Corps*, pp. 44.

[98] Bruce, *Politics and the Canadian Army Medical Corps*, pp. 44-45.

[99] Bruce, *Politics and the Canadian Army Medical Corps*, pp. 45.

[100] Bruce, *Politics and the Canadian Army Medical Corps*, pp. 46.

instance, if a soldier suffering a serious shrapnel wound was operated upon and one week later became infected with gas gangrene and died, was his death reported as due to enemy action or a result of infection? No firm rules were adopted for recording the cause of such common deaths during the first year of the war.

In August 1916, recognizing that the accurate reporting of infectious disease was required in order to properly evaluate current conditions and determine future actions, the CAMC attempted to bolster and clarify its policies regarding the "Notification of Infectious Disease." It was made clear that in all Canadian medical units all cases of infectious disease would be reported on a daily basis to the CAMC's Deputy Director of Medical Services (DDMS) or the Assistant Director of Medical Services (ADMS). Reporting CAMC units were to including all the following particulars for every patient: unit number, rank, name, and diagnosis.[101]

For the remainder of the war, many other changes and improvements were attempted to make the system more manageable and precise, but many problems persisted in the reporting and diagnosis of disease. Setting out criteria is one thing, but ensuring that that criteria are being followed is quite another. In a demonstration that policy and practice are distinctive concepts one needs merely to consider an exchange of memorandums which took place domestically in late 1917. An ADMS informed a CAMC medical officer that: "Your attention is invited to the fact that sufficient care is not being used in making diagnoses correspond with the list of diseases which has been issued to all medical officers. Instructions are hereby being issued that in all instances

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[101] LAC, RG 9, Series III, Vol. 4540/46, DMS files, folder 1 – file 11, "Circular Memorandum No.5 – Notification of infectious Diseases, DMS Reserve Army, 3 August 1916.

diagnoses should conform to the nomenclature laid down."[102] In response, the medical officer wrote that this instruction was impossible to follow because "he had no Army Nomenclature List of diseases."[103] If this simple task could not be accomplished with a military unit based in Quebec, how could it reasonably be expected to be adhered to in medical units being battered by German artillery fire on the Western Front?

In 1917, in recognition of the continuing problematic issues surrounding collection and reporting, the entire statistical system was revamped by the RAMC. However, according to Mitchell and Smith, some "mistakes" and "inaccuracies", and the submission of "incomplete records" continued, which detracted from the historical statistician's ability to complete some calculations reliably.[104]

The opportunity to correctly collect raw data regarding the exact incidence of infectious disease in the trenches has been lost forever. So for all the inherent weakness the available statistics have, what choice does an historian have but to use the statistical results created from them anyway? The question lies not only in whether or not they are used, but in how they are used. The statistics, especially those related to disease, may not be precise, but if interpretive care and caution are practiced, the relative importance of many infectious diseases may be suggested. In this regard, the Canadian statistical record

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[102] LAC, RG 24, vol. 4497, file 54-5-58, Memo from ADMS, Military district No. 4 (Montreal) to the Medical Officer 1st Depot Battalion, 1st Quebec Reg., 18 December 1917, p. 1.

[103] LAC, RG 24, vol. 4497, file 54-5-58, Memo from ADMS, Military district No. 4 (Montreal) to the Medical Officer 1st Depot Battalion, 1st Quebec Reg., 18 December 1917, p. 1.

[104] Mitchell and Smith, *Casualties and Medical Statistics of the Great War*, p. 62.; confirming the number of Canadian war fatalities for post-war statisticians was by no means simple, but it was a process that was made possible by comparing enrolment lists with discharge and missing rolls. In this manner, reconciliation was not dependant upon the data collected in the field during the war. Therefore, these particular figures must be accepted to be relatively robust, even if the disease incidence rates are not.

is indeed impressive. According to the CAMC's official history, the total number of Canadian cases admitted to medical facilities for treatment in all theatres was 539,690. Of these, 144,606 cases were battle casualties and the remaining 395,084 cases were due to disease. As the total number of soldiers deployed overseas was 418,052, the rate of admission due to disease was 945.05 per thousand.[105] Of course, this does not suggest that nearly every soldier was admitted to hospital at least once during the duration of the war, as some individual soldiers may have been admitted several times for any number of diseases.[106] What it does suggest is that there was indeed a good deal of serious disease among the ranks on the Western Front— albeit rarely fatal. Additionally, for reasons previously discussed regarding weaknesses in reporting procedures, it is safe to assume that the fatality rates, and especially the wastage rates, attributed to disease were likely higher than this tally suggests.

Statistical issues aside, the use of an analytical framework is beneficial in order to facilitate a clearer understanding of the diseases which afflicted the soldiers of the CEF during their time in the trenches of the Western Front. To this end, infectious diseases encountered by the Canadians deployed on the Western Front may be grouped into four main categories. These are: Simple, Ordinary, Familiar and Unexpected. Infectious diseases in each of these four categories shall be identified and characteristics, causes, effects and counter-measures shall be discussed.[107]

"Simple" infectious diseases, typically included such conditions as the common

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[105] MacPhail, *The Medical Services*, p. 247.
[106] MacPhail, *The Medical Services*, p. 247.
[107] The nomenclature and categorization of infectious diseases used in this work is derived in large part from a system used by the British official historians Mitchell and Smith in *Casualties and Medical Statistics of the Great War*.

cold, minor septic infections, minor skin diseases, minor ear and eye infections, tonsillitis, chicken-pox and mumps.[108] Simple diseases as experienced by the Canadians on the Western Front, can best be described as ailments that were seen domestically on a regular basis. Some Simple diseases were relatively easy to treat and rarely fatal, while others such as chicken pox and mumps could result in permanent disabilities or death when contracted by adults. Trench life not only increased the likelihood of soldiers contracting simple diseases, but could often exacerbate the duration and effect of the illnesses as well. Moreover, a soldier contracting one of these simple infectious diseases would not be able to perform his duties at peak efficiency, if at all. Particularly in the cases of more debilitating simple diseases, such as the measles, chicken pox and mumps, proper treatment necessitated the sick soldier be evacuated to a convalescent facility in a rear area.

Given the close-quarters of trench living, and for that matter virtually all environments, the importance of acting on minor breakouts of these infectious diseases is self evident, but before the start of the twentieth century it was not a standard practice. Fortunately, germ theory had had an effect on many modern medical and public health practices by 1914. Accordingly, the CAMC's focus, like that in all other armies on the Western Front, the underlying principle was to segregate and evacuate all infectious cases as soon as possible after they were identified.[109] It was recognized that the outbreak of a few cases of disease could not be avoided, but the principle of prevention could be

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[108] MacPhail, *The Medical Services*, pp. 273-4.
[109] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 1.

adhered to by controlling all infectious disease outbreaks and thwarting cross infection.[110]

"Ordinary" infectious diseases, like Simple ones, also occurred domestically but could be fatal on occasion. Of course, Ordinary diseases could also be more contagious, debilitating, complicated and long-lasting, not to mention more likely to be fatal than Simple diseases, in the Western Front's trench environment. During the war, Ordinary diseases included[111] tuberculosis (3123 cases/176 deaths), measles (2186 cases/30 deaths), scarlet fever (271 cases/4 deaths), rheumatic fever (1258 cases/2 deaths), diphtheria (1701 cases/18 deaths).[112] There were 4712 cases of pneumonia, of which 1261 were fatal. Pre-1918 strains of influenza can also be included in this category, due to their lack of strength and destructiveness when compared to the bane of "Spanish flu."[113]

Like Simple infectious diseases, the chances of contracting Ordinary diseases were known to increase when one was in close proximity with an afflicted person. Accordingly, when soldiers were afflicted with contagious Ordinary diseases they would be quickly segregated for treatment. Normally, Common and Ordinary diseases formed the bulk of civilian and military illnesses during peacetime.[114]

Smallpox, which had been a scourge of army and civilian populations throughout much of written history, created no problems whatsoever for the Canadians. Public health campaigns during the latter quarter of the nineteenth and the beginning of the

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[110] LAC, RG 9, Series III, Vol. 3612, Diphtheria, 25-3-4 vol. 3, n.d..
[111] These statistics apply to all CEF personnel in all operational theatres for the entire war, unless otherwise stated.
[112] MacPhail, *The Medical Services*, p. 273.
[113] Most of the strains of influenza in circulation before the deadly Spanish Flu epidemic began in 1918 were generally considered to be of relatively minor inconvenience and consequence.
[114] Mitchell and Smith, *Casualties and Medical Statistics of the Great War*, pp. 59, 64.

twentieth centuries had been significantly positive, with the disease effectively becoming an extreme rarity domestically. It was reported in late 1915 that ninety-eight percent of the soldiers in the Canadian Army had been inoculated for smallpox.[115] It is safe to conclude that this preventative disease strategy was a resounding victory, as it appears that not a single Canadian soldier contracted smallpox during the course of the war.

Venereal disease (VD), predominantly gonorrhea and syphilis, can be classified as an Ordinary disease. It is important to note that during the war there were at least 66,000 reported cases of this preventable disease treated by the CAMC and the vast majority of these infections were contracted by Canadian soldiers stationed on or near the Western Front or in Britain.[116] Certainly, this epidemic endangered the lives of other ill or wounded soldiers by tying up medical supplies, personnel and hospital beds.

An Ordinary disease particularly worthy of note was cerebro-spinal meningitis, popularly known at the beginning of the twentieth century as "spotted fever." This infectious disease proved to be fatal for over half of the Canadians that contracted it. Cerebro-spinal meningitis was extremely difficult to diagnose clinically, as some soldiers would first present themselves to their medical officer complaining of little more than a simple sore throat and then quite suddenly become comatose and die. Usually an afflicted patient would have other symptoms develop as well, including extreme headache, achy and stiff muscles, especially of the neck, elevated temperatures, vomiting,

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[115] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 1.
[116] Rawling, *Death Their Enemy*, p. 74.

delirium and subsequently coma.[117]

Most of the CAMC's personnel were not familiar with cerebro-spinal meningitis when it made its first made its appearance in the ranks of the CEF in late September 1914, when the army was forming in Valcartier, Quebec. Within a matter of days four cases were reported. Owing to the highly infectious nature of the disease, a supply of treatment serum was hastily obtained through an American source and loaded onto a ship carrying part of the first Canadian contingent to Britain. Apparently, the serum was never to be seen again.[118]

Shortly after the Canadians had arrived in England, there was an outbreak of cerebro-spinal meningitis among the civilian population in the Salisbury Plain area. The medical services' official historian, Andrew MacPhail would later claim that "[t]hese sporadic cases were magnified to an epidemic by the Canadian newspapers, whose correspondents in the early days did not always obtain a proper perspective."[119] Evidently, the British military and civilian medical authorities lacked "proper perspective" as well, because they became sufficiently alarmed to form a committee, with the goal of looking into what many contemporaries perceived were not "sporadic cases", but an epidemic. After a short investigation, the British committee came to the determination that the Canadians "did introduce a virulent strain of the meningococcus,

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[117] LAC, RG 9. Series III, Vol. 3612, Director of Medical Services (DMS) Canadian Contingents, file 25-3-1, SC Fever, Memorandum on Cerebro-Spinal Fever among Troops, issued by the War Office, March 1917, p.1.
[118] MacPhail, *The Medical Services*, p. 257; the loss of the serum was of little consequence, as it was later determined that the serum procured from the American supplier had little effect on this particular strain. MacPhail, *The Medical Services*, p. 260.
[119] MacPhail, *The Medical Services*, p. 258.

and were in some degree responsible for its spread."[120] The Canadian government and military vehemently and strenuously denied the British conclusions.[121]

Although this disagreement did create some palpable friction, it redoubled Canadian efforts to control similar outbreaks throughout the remainder of the war and spurred the CAMC to spearhead research into the prevention and treatment of cerebro-spinal meningitis. Other than identifying, isolating and treating those displaying outward symptoms of the disease, one of the first steps in preventing or controlling outbreaks was to identify carriers of cerebro-spinal meningitis. To this end, limited screening of Canadian troops was commenced in 1916. This process, which consisted of the bacteriological examination of swabs of the nasopharynx, was useful, but not fool proof in identifying spotted fever carriers. However, those so identified would be immediately segregated, most often in a Casualty Clearing Station well clear of the front lines. Many of these carriers were shocked and perplexed to be in this predicament, as most of them would usually not display any outward symptoms of the disease themselves, nor had they ever developed spotted fever. Until approximately the fall of 1916, carriers would undergo a two week treatment regime of inhaling chloramine vapour, the very same treatment given to those afflicted with the disease, and not be released back to active duty until two successive swabs at intervals of several days showed they were free from

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[120] Kenneth Cameron, *History of No. 1 General Hospital 1914-1919*, p. 133; and MacPhail, *The Medical Services*, p. 258.

[121] It is interesting to note that this was neither the first nor the last time that Canadians were accused of bad behavior and/or encouraging the propagating of infectious disease. In 1915, at a CAMC operated hospital located in Britain, up to 500 Canadian troops, many of them ambulatory were "placed under an armed guard" to prevent "the men from wandering about the country" and among other things, exposing themselves and others to venereal disease; Cameron, *No. 1 Canadian General Hospital*, p. 118, 135.

infection.[122] In addition, the CAMC ordered that "all close contacts , i.e. those who have slept within 4 yards" of cerebro-spinal meningitis patients were to be "rigidly isolated" from their cohorts until a bacteriological examination was returned as negative.[123]

As the winter of 1916 approached, a season that was known to be conducive to outbreaks of the disease, the number of carriers was found to be quite high which caused "much uneasiness" within the ranks of the CAMC "who fear[ed] an extensive outbreak." There had been many previous problems with the supply of chloramine at various times during the war, a fact that likely added to their concerns.[124] Fortunately, the anticipated large-scale outbreak did not occur.

In 1917, treatment and prevention of cerebro-spinal meningitis had progressed and become even more aggressive. Once a case was identified and the patient or carrier isolated, it was required that the complete "disinfection of the patient's urine, clothing, bedding, feeding utensils, and quarters" be immediately performed. All possible contacts were separately segregated and pending results of their bacteriological swab, these men were treated with "nasal insufflation and gargles twice a day under medical supervision."[125] This preventative treatment was undoubtedly onerous, and it certainly made sense that medical supervision was necessary, as the insufflation process required

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[122] LAC, RG 9, Series III, Vol. 4540, DMS files, folder 1 – file 11, "Circular Memorandum No.5 – Procedure on the Occurrence of Infectious Disease, DMS Reserve Army", 12 August 1916, p. 2.
[123] LAC, RG 9, Series III, Vol. 4540, DMS files, folder 1 – file 11, "Circular Memorandum No.5 – Procedure on the Occurrence of Infectious Disease, DMS Reserve Army", 12 August 1916, pp. 1-2.
[124] LAC, RG 9, Series III, Vol. 3612, Director of Medical Services (DMS) Canadian Contingents, file 25-3-1, SC Fever, Prevention of Cerebro-Spinal Fever memorandum, 29 November 1916, n.p..
[125] LAC, RG 9. Series III, Vol. 3612, Director of Medical Services (DMS) Canadian Contingents, file 25-3-1, SC Fever, Memorandum on Cerebro-Spinal Fever among Troops, issued by the War Office, March 1917, p.1.

one to "snuff up through the nostrils" an antiseptic solution consisting of a small amount of permanganate of potash and sodium chloride mixed with water, which was held for an unspecified time and then expelled via the mouth. Afterwards more of the solution was gargled. The Director of Medical Services (DMS) also insisted the MOs overseeing this procedure should also "practice this disinfection of the upper respiratory tract several times per day."[126] This action would have undoubtedly caused much consternation in doctors assigned this task and yet created a modicum of satisfaction among some of the soldiers subjected to the same treatment under the medical officer's watchful eye.

In addition to undergoing chloramine and/or insufflation therapies, patients suffering from cerebro-spinal meningitis had to undergo painful and potentially dangerous treatment. Anti-meningococcic serum was injected intra-spinally, after the removal of an equal amount of spinal fluid. In 1917, the Canadian Contingent's DMS helpfully recommended that "experience has shown that the best results are obtained when this is done under a general anesthetic."[127]

Cases of cerebro-spinal meningitis in the CEF's ranks continued to crop up occasionally throughout the remainder of the war and researchers found that the cold and wet conditions common in the trenches during the winter seemed to bring about a more virulent type of the disease. Approximately 400 Canadian troops contracted cerebro-spinal meningitis and it was fatal for just over half of them.[128]

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[126] LAC, RG 9. Series III, Vol. 3612, Director of Medical Services (DMS) Canadian Contingents, file 25-3-1, SC Fever, Memorandum on Cerebro-Spinal Fever among Troops, issued by the War Office, March 1917, p.1.
[127] LAC, RG 9. Series III, Vol. 3612, Director of Medical Services (DMS) Canadian Contingents, file 25-3-1, SC Fever, Memorandum on Cerebro-Spinal Fever among Troops, issued by the War Office, March 1917, p. 2.
[128] MacPhail, *The Medical Services*, p. 260.

"Familiar" infectious diseases are those which were uncommon domestically, yet known to have been the cause of massive epidemics in armies. These diseases were of particular concern to the CAMC because they had the potential to thrive in the trench environment. Generally, these diseases had all long been the subject of studies conducted by many scientists and health professionals, in both civilian and military spheres. As such, the Familiar disease's aetiologies and more importantly, preventative measures and treatments were recognized – at least by many personnel in the medical services.[129] Familiar diseases typically caused high wastage and/or high mortality, and as a result could have a significant effect upon an army's battle readiness. This dangerous potential had been well demonstrated many times in the preceding century.

Familiar infectious diseases included most water-borne intestinal infectious diseases, including Intestinal diseases such as enteric fever (also known as typhoid fever or simply typhoid), dysentery, cholera and malaria.

Up to the turn of the twentieth century, typhoid fever was the most dreaded and deadliest killer of soldiers. This Familiar disease was known to be caused by acutely infectious bacteria. Its victims developed overt symptoms – typically, chills followed by high fever (medically termed as pyrexia), nausea and diarrhoea – within weeks of ingesting bacterially contaminated food or water. During the South African War, enteric/typhoid fever accounted for nearly two thirds of Canadian casualties and the CEF made a determined effort to see that history did not repeat itself in the trenches of France and Belgium.[130] Accordingly, preventative measures were strenuously implemented.

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[129] Mitchell and Smith, *Casualties and Medical Statistics of the Great War*, p. 60.
[130] During Canada's involvement in the South African War, Canadian soldiers, like their British cohorts, experienced a high incidence of typhoid and dysentery which not only

In March 1915, while awaiting redeployment from the Salisbury Plains to the continent, the potential danger of typhoid fever was alluded to in the Canadian's Routine Army Orders, when officers were reminded that: "Troops should also be trained in the necessity of not handling food with hands that have been polluted by soil or filth of any kind, and arrangements for cleansing the hands before meals must he made as far as possible."[131] There can be little doubt that this advice was sage – at least under ideal and controlled conditions. However, even the most simple ablutions were difficult to accomplish in the less than salubrious conditions present in the Canadian camp in Britain and would prove to be completely impractical in the trench environment.

It appears that the water supply in Britain was relatively pure, as very few cases of intestinal related diseases were reported to have occurred in the ranks of the Canadians on the Salisbury Plains. However, immediately after the Canadian 1st Division was deployed to Flanders, it was anticipated that the water contamination was an issue that would have to be dealt with quickly and effectively. Accordingly, the first task taken on by No.5 Canadian Mobile Laboratory was to test wells for bacteria and other impurities, in civilian and military occupied areas near the front lines. The results were disappointing, but came as no surprise to the CAMC. In June 1915, the Officer Commanding No.5 reported that the water wells which supplied virtually all the available

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inundated field ambulance and hospital wards but filled its military cemeteries as well. About sixty-five percent of all the Canadian deaths during the South African campaign were attributed to disease, as per Nicholson, *Seventy Years of Service*, p. 49; British losses were marginally higher, at 70%, as per Nicholson, *Seventy Years of Service*, p. 16. Sadly, the vast majority of Canadian and British Army deaths could have been averted by simply applying well-known hygienic measures and supplying the troops with potable water[130], as per Nicholson, *Seventy Years of Service*, p. 49.

[131] LAC, RG9, Series III, Vol. 3745, Adami Papers (Misc. Extracts), "Circular Memorandum – issued with 1st Army Routine Order No. 35 of 31 March 1915", "copied from ADMS 1st Canadian Division, April 1915", p. 1.

water in the area recently occupied by the CEF were "almost all contaminated." Of the forty-four wells examined ninety-three percent showed extremely high coliform bacteria counts.[132]

Boiling water was an effective way to kill off most typhoid-infecting bacteria and render moderately polluted well water relatively safe to drink. However, as No.5's OC also explained, some preventative measures, although perfectly sound in theory, were shown to be less than effective in practice, especially in the ranks of some Canadian formations. It seems that one un-named unit was supplied with recently boiled water which was stored in biscuit tins. Upon this group's return from duty, the soldiers found the water to be still hot and some of the less enlightened of their number decided to draw cool "raw water" from the nearby supply well and added it to the hot water to make it more pleasant to drink. Of the twenty five men that consumed this water, the doctor reported, thirteen "developed diarrhoea" the next day.[133]

No.5's conclusion was clearly laid out, as was the import of not ignoring water-related issues. Nasmith stated "[it] is very evident that bacilli capable of producing these diseases are being excreted by the billion daily, some of which must undoubtedly gain access to the water supplies of our men. There is absolutely nothing to stand between the men and disease but sterilization of the water in some form or another. It is impossible to exercise too great care in this problem."[134]

To cope with water impurity problems, policies were immediately adopted which

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[132] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, p. 3.
[133] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, p. 4.
[134] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, pp. 4-5.

saw that moderately contaminated wells were "shock-treated" and then water drawn from these sources would be treated with chlorine-based products.[135] Whenever possible, severely polluted wells were simply banned from use. After a short period of confusion regarding responsibility for the control and management of the fresh water supply in Canadian trenches, the Canadian Sanitary Sections were charged as overseers. Among their other hygiene related duties, these units monitored water quality by testing samples taken from water-carts on a daily basis.[136] Battalion medical officers also became required to conduct independent water testing.[137]

By the end of 1915, the DDMS for the Canadian Contingent wrote that he was quite satisfied with the state of Canadian anti-typhoid measures and practices. In his war diary, the senior CAMC officer reported that 100 percent of Canadian troops and 99.6 percent of British troops serving with the Canadian Corps had been inoculated for typhoid and that all incoming Canadian reinforcements were also being inoculated.[138] This inoculation was one of the first introductions to army life seen by most new enlistees to the CEF, one Canadian soldier despaired, informing his relatives that the anti-typhoid "shot" made him very sick for three days, which, he added, was "hardly pleasant."[139]

The DDMS also recorded that "all" the drinking water used by the CEF, whether drawn from lakes, ponds, springs or wells, was chlorinated "under permanent

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[135] Throughout the war, Chloride of Lime was normally the product of choice for treating contaminated or potentially contaminated water.
[136] Burpee, "The Canadian Army Medical Corps", p. 110.
[137] Rawling, *Death Their Enemy*, p. 72.
[138] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 1.
[139] LAC, MG 30, E558, Cecile John French Papers, "Transcript Copies of Letters, Letter to home, 24 July 1916.

supervision" and that new wells were being dug in the 1st Division's locale "in anticipation of the summer." Human waste was being dealt with in an orderly and hygienic manner, the DDMS also relayed, claiming that "the bucket latrine system, with cresol solution, is in universal use in trenches and the rest camps." These buckets, he continued, were being regularly transported to rear area encampments and billet areas where the contents were being incinerated, along with all other refuse.[140] Certainly, the DDMS had little difficultly in reporting that the environs under his purview were in a highly salubrious state. In retrospect, one must recognize the direct benefit such a report might garner for a man of his rank and position. Likewise, a negative report could call into question his suitability and ability to continue to lead.

Regardless of his motivations, other high ranking CAMC officers shared, at least officially, the DDMS' positive assessment of Canadian hygienic practices and conditions at the Front. His direct superior, the DMS of Canadian Contingents, had several months earlier responded to an inquiry from Major General W.G. Gwatkin, Chief of General Staff with the Department of Militia and Defence. The exact reason for Ottawa's informal inquiry is unknown, but it would appear that Gwatkin had been made aware of complaints made by the British about trenches they had recently taken over from Canadians. The DMS reported that one of his underlings had recently inspected Canadian trenches and had assured him that "all he saw was scrupulously clean." Not only that, he added, but "the Sanitary Section with the 1st Division, is much better that any English one that he had seen, so that I am afraid the complaint about the condition of

[140] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 1.

the trenches is like the new cook, always complaining about the old cook having left the kitchen in a dirty condition."[141]

The Canadian DMS would certainly have been further gratified by the efficiency and efficacy of the CAMC after all the delegates at the 1916 Allied Forces Sanitary Commission[142] meeting agreed that the sanitation practices in "the British armies", Canada included, were "superior to that of any other (western ally) country." Further, they "were strongly of the opinion that the British soldier is personally cleaner that their own soldiers." While the Serbian and French delegates stated that they were impressed with the British hygienic practice of incinerating faeces, they next revealed that there were some not so subtle limits to their flattery, when they further explained "that it would be absolutely impossible to induce their men to even handle such material."[143]

As complimentary as non-British commission members were of "British" army practices, it was agreed that the relative freedom from infectious disease presently being enjoyed by all their armies had "bred a carelessness of sanitation in all ranks", with typhoid and other water-borne diseases all increasing in incidence weekly. Accordingly, all delegates confirmed that every effort had to be made "to minimize the further spread of infectious disease."[144]

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[141] It is remarkable that the DMS and the DDMS were both based in England, and apparently both rarely visited the continent, much less the trenches on the Western Front. LAC, RG9, Series III, Vol. 3706, file 25-1-0, letter from DMS, Canadian Contingents, to Major General WG Gwatkin, Department of Militia and Defence, 1 September 1915.
[142] This commission met on an annual basis from 1915 to 1918. During this period, its membership included French, Italian, Russian, Serbian, British and, in the last two years, American representatives.
[143] LAC, RG9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 4.
[144] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission Meeting March-April 1916, p. 1.

The commission's last conclusion cannot be termed prophetic, but it was certainly sage. The incidence of intestinal related disorders and diseases began to increase in Canadian units—albeit slowly. Concern over the escalation grew in the upper ranks as well, leading to all Canadian units on the Western Front receiving the following reiterated order on August 1916: "Officers Commanding battalion sectors in the front line are responsible for the administration of all units as well as of parties of the RR, RAMC, Signals etc., which may be located in their respective sectors, especially as regards sanitation and cleanliness of quarters."[145] Evidently, the effect of this renewed commitment in the upper echelon was less than adequate.

In October 1916, the DMS responsible for the Reserve Army area behind the front lines distributed a report to all Canadian Corps units complaining that "the sanitation of this Area is not up to the standard required for the maintenance of health." The evidence he provided to support his claim is convincing, citing that soldiers had been "seen drinking from a sewage infected well … while a plainly labeled well giving an excellent drinking water was only 20 yards away." Another well was "found to be full of decomposing food and rubbish." The voiding habits of some Canadians were also brought into question, as "men were found regularly urinating beside a well, ... [u]sing shell holes as latrines and not burying excreta." The DMS also pointed out that some field cookers were "surrounded with manure" and that many billets were extremely "dirty." This "neglect", he contended, was "widespread", showing that "the very great majority of officers are quite unaware of their responsibilities in this matter … and "the sanitary instruction and inspection by medical Officers of units leave much to be

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[145] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, order issued by General Staff HQ 1st Canadian Division all Canadian Corps formations, 14 August 1916.

desired."[146]

The DMS's understandably scathing criticism of attitudes and practices towards hygiene in the Canadian ranks came one day after he had reported there had been a distinct increase in the incidence of enteric fever and dysentery the previous month in both the British and Canadian armies. He granted that 96 new cases of dysentery and 84 cases of typhoid fever were "not a great number considering the strength of the Army, but the cases tend to increase each week."[147] He further explained the sanitation at the front line and immediately behind it was "crude in the extreme" and in some trenches "cannot be said to exist" as "it is not possible for troops to keep themselves or their food uncontaminated by mud which is constantly being infected with every kind of filth." Still, he insisted that it was of the utmost importance that "all officers and men be again warned of the danger of neglecting elementary sanitary precautions in the matter of burial of food, refuse and faeces even in the firing line."[148] He also warned that massive intestinal disease outbreaks were almost sure to occur, thereby endangering operations in the field of battle.

The DMS's findings did not fall on deaf ears, as he ignited a flurry of activity throughout the upper echelons of the CEF, including the CAMC. Within two days of his initial report, the Assistant Adjutant and Quartermaster General (AA&QMG) for the Canadian Corps ordered that all Division and Brigade level officers were to ensure that

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[146] LAC, RG 9, Series III, Vol. 4542, Sanitation Reports, folder 4, file 15, ADMS 1st Canadian Division, "Memo from DMS, Reserve Army, to various units", 8 October 1916.
[147] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, DMS Reserve Army "A" Report, 7 October 1916 (emphasis provided in original).
[148] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, DMS Reserve Army "A" Report, 7 October 1916.

constant inspections were to be maintained in order to ensure "that all Sanitary precautions are being taken."[149]

Less than a week later, Colonel A.E. Ross, the ADMS for the Canadian 1st Division reported to the Division's AA&QMG on the increased incidence of typhoid and para-typhoid fevers. He stated that sanitation conditions in the trenches were so poor that "constant inspection" was now required.[150] The biggest problem was dealing the hundreds, if not thousands of tons of human excrement. Since their arrival on the continent in 1915, the Canadian Sanitation Sections and battalion medical officers co-operated in working to ensure that every unit, including those in the trenches, were disposing of their human waste properly. The importance of this seems evident, not only for reasons of health but aesthetics. Until mid-1916, Canadian and British troops deployed in the trenches were encouraged to use latrine buckets and then bury these buckets when they were filled. Unfortunately, the burying of this waste material was often done within yards of the trench. Some soldiers adopted a rather unrefined process of excreta disposal which was even more ill-suited for the trenches. As one British soldier later lamented, he and his cohorts had "descended to primal men … (meeting) … the demands of nature ... as quickly as possible in the handiest and deepest shell hole."[151] Of course, one must recognize that adopting this method may have been more prudent than making a trip to the nearest latrine – especially when under the ever-present threat of attracting enemy fire.

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[149] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, Memo from DAA and QMG, Canadian Corps, 9 October 1916.
[150] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.
[151] Ellis, *Eye-Deep in Hell*, p. 52.

By this time, long-term static warfare combined with massing of men in a confined area and environment created several hygiene problems related to burying excrement and other garbage. As Ross observed: "Every collection of tins and refuse buried in or near our front trench has been dug up by shells as often as it is buried."[152] The ground behind the trenches literally became saturated with the effluvium. Even worse, these contents of the excreta pits were prone to being flung far and wide if hit by an artillery round, exposing and spreading disease causing bacteria. In response to this problem Canadian units received notification that "it is desirable--nearly necessary--that human faeces in the Canadian Corps area be incinerated."[153] Unfortunately, this goal was difficult to attain, as the materials required to accomplish it were largely unavailable and any burning within three miles of the trenches was rendered impractical due to the enemy artillery fire it tended to attract. Ross bemoaned this situation, reaching the unfortunate conclusion that "it must be realized that we cannot protect the men by the class of sanitation possible" in the front lines.[154]

The Canadian ADMS also identified another long-term hygiene problem that was continuing to create great health risk for the CEF. On his recent visit to the Canadian front line near Courcelette, Ross was shocked to find Canadian troops freely drinking untreated and untested water from the village's taps. Inexplicably, he pondered, every one of the German prisoners refused to drink the same water pouring through these taps. Ross then related that the reason seemed obvious to many of the Canadians: "a hue and

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[152] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.
[153] Rawling, *Death Their Enemy*, p. 73.
[154] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.

cry arose that it was poisoned water. An examination showed the water to be greatly contaminated but I believe the refusal was due to the training in the German Army that nothing but chlorinated water must be used."[155] Evidently, at least at this point in time, the hygiene training and/or discipline in the German ranks was superior to that seen in parts of the CEF.

Considering the unsanitary behavior exhibited by the Canadian troops in Courcelette and the fact that in soldiers "cannot be prevented from using water from shell holes near the front line trenches", Ross concluded that "our present system is encouraging the men to drink untreated water."[156] He reasoned that as Canadian soldiers could not be convinced, by any means, to consume only treated water that the only prudent plan of action was to initiate compulsory inoculation against typhoid and para-typhoid and put forth his contention that the CEF "must lay the responsibility for Intestinal diseases on the shoulders of those who hesitate to demand compulsory inoculation."[157] Evidently, although "compulsory" inoculation for typhoid had been in place for some time, para-typhoid strains were inexplicably not.

For some hygiene aware individuals, the issue of water purity had been a salient one from the moment Canadians had first laid foot on the continent in 1915. Nasmith, the No.5 Canadian Mobile Laboratory's Officer Commanding, would figure prominently

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[155] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.
[156] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.
[157] In retrospect, the lack of compulsory inoculation in the CEF appears to be ludicrous, especially since it was determined in 1916 that several new strains and particularly virulent strains of typhoid and para-typhoid appeared on the Western Front, necessitating the development and use of more resilient vaccines; MacPhail, *The Medical Services*, p. 256; and LAC, RG 9, Series III, Vol. 4542, ADMS 1st Cdn Div, memorandum from ADMS 1st Canadian Division to AA and QMG 1st Cdn Div, 13 October 1916.

in the establishment and maintenance of responsible water practices. In April 1915, Nasmith developed and promoted "a suggested method of filtering water in large quantities on the field – 4,000 gals per hour per single motor unit."[158] This method was badly needed as the wells which supplied the majority of the water in the CEF's area was "almost all contaminated", with B. Coli in particular.[159] The situation had not improved a few months later, when in July 1915, one Sanitary Section officer reported to the ADMS of the First Canadian Division that "many of the wells were dry or drying up and of those still effective few were in good condition." "Chlorination", he sagely remarked, "may make a drinkable water safe, but it cannot make a drinking water out of sewage, and many of the wells about here have more sewage in them than can be made safe."[160]

According to Canadian nursing sister Sophie Hoerner, one of her incoming patients told her that arriving in the hospital was "just like coming from hell to heaven" due to the "thirst they suffered from." In this case, the soldier refused to drink the water he had been supplied with in the trenches because he feared it had been intentionally poisoned by the Germans, who he claimed "threw their dead into ponds."[161] Another Canadian soldier, aptly and vividly described his experience with "trench water" early in the war:

> "A little stream of water trickles under our front line. It is slimy and covered with scum. Its odor is horrible. But it has been hours since we have had a drink. With our teeth we hold back the scum and gag as the water goes down our throats. The next day we make an attack. As we climb out of the trenches we see the little stream in No Man's Land.

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[158] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 24 April 1915.
[159] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of No.5 Canadian Mobile Laboratory for June 1915", p. 3.
[160] Adami, *War Story of the Canadian Army Medical Corps*, p. 224.
[161] LAC, MG 30, E290, Sophie Hoerner Papers, Letter Home, 22 August 1915, p. 1.

> Lying in the water are the bloated bodies of Germans who have been there for months. Can one ever forget how that water tasted?"[162]

In the absence of salubrious local supply, getting treated and potable water to the front lines was a logistical nightmare. Water carts moving potable water to the front lines were clearly not a solution that could be relied upon exclusively. In late 1915, it was discovered by a Canadian Sanitary Section that the systems of treatment and shipment were faulty as "not more than one pint of [potable] water per day per man" was getting through – a situation that could only be solved by piping fresh water to the trenches until piping was laid.[163]

Many of the great concerns related to potentially infectious water, up to and including 1916, helped to fuel positive changes in the CEF's water policies the following year. Treated potable water was carried up to the front line in empty petrol-tins to augment the water from wells in the neighbourhoods of the trenches, which continued to be used, only if absolutely necessary, after chlorination. Soldiers rotating into the line were required to carry in a liberal supply of drinking water from designated sources.[164] At strong points, a store of de-contaminated water was maintained – ideally in used SRD rum jars, as storage in tin or metal cans tended to create "objectionable tastes" to develop. In areas that were relatively static, pipes brought water right up to the front lines from

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[162] LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller , n.d, preface.
[163] LAC, RG 9, Series III, Vol. 3748, Adami Papers, No.2 Canadian Sanitary Section, selected excerpts transcript of War Diary, 12 October 1915.
[164] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 1.

reservoirs in the rear area.[165] So important was maintaining water quality and quantity, that damaged water pipes were replaced or repaired nearly as quickly as electrical and signal wires, by 1917.[166]

Of course, water purity was still not just an issue in the trenches. Canadian soldiers in some Reserve Areas enjoyed a modern utility system that distributed potable water from large storage tanks to hydrants and taps.[167] Other soldiers in Reserve Areas not serviced in this manner relied on water carts[168] brought up to the area, as local wells were avoided if possible.[169] In Rest Area encampments and billets, each 500 men had a 100 gallon water cart assigned them, with one man put on "Water Detail." This soldier, notably not from the ranks of the CAMC, was responsible for the drawing and purification of water[170], and in addition to keeping the cart in good repair and clean, also kept well documented records of where the water source was located and when the water

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[165] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 2.
[166] Adami, *War Story of the Canadian Army Medical Corps*, p. 223.
[167] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, pp. 5-6.
[168] The French army had been using water carts for several years, but this form of supply was the subject of many a French soldier's derision. The French military used straight chlorine to render water potable. The trouble was that the cart water was more often than not grossly overdosed with the chemical, causing many French soldiers to refuse to drink from it.
[169] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 4.
[170] Remarkably, a CAMC Sanitary Advisor reported that Chloride of Lime continued to be used in 1917, despite the availability of more sophisticated water filtering and cleansing systems. These newer systems, he explained, were "practically never used because they soon deteriorate and get out of repair and generally on the rough roads tear the water cart tanks all to pieces", as per LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 6.

was last tested and treated. All Water Details were overseen by the local Sanitation Section. A driver was also assigned to the cart to look after and care for the horses.[171]

In 1917, the forward-thinking Canadian ADMS had his way and all Canadian soldiers of all ranks were required to undergo compulsory inoculation and vaccination for the most serious of water-borne diseases: typhoid, smallpox, dysentery and cholera. Non-compliant soldiers could expect to be put "on the peg" (arrested) and subject to court martial should they refuse to be vaccinated or to submit to blood examinations, primarily to detect VD.[172] Of course, inoculation was not fool-proof and in an effort to contain an outbreak of the disease, some troops were inoculated two times per year for typhoid in 1917.[173]

Regardless of the inoculation schedule, efforts were re-doubled and organizational improvements were made, perhaps in part because of many Canadian doctors voicing their concern that many recovered soldiers remained carriers well after all overt symptoms of typhoid were long gone.[174] In May 1917, a CAMC Sanitary Advisor reported that sullage and ablution water from the trenches was being collected in tins and carried to areas well back from the front lines. Refuse was collected in sandbags and buried at least 200 feet from the trenches or carried back to the rest areas by the ration

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[171] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, pp. 5-6.
[172] LAC, RG 9, Series III, Vol. 3745, Adami Papers (Misc. Papers/Misc. Extracts), Report "Compulsory Inoculation and Vaccination in CEF." Dec 1917. Although typhoid vaccination was made a mandatory requirement for all Canadian soldiers in 1917, it remained optional in the British army for the duration of the war.
[173] LAC, RG 9, Series III, Vol. 3612, 25-3-5 vol. 1, Enteric Fever, n.p. 1917.
[174] LAC, RG 9, Series III, Vol. 3612, 25-3-5 vol. 1, Enteric Fever, n.p. 1917.

parties and burned.[175] Urine and faeces collected in petrol drums and mixed with liberal amounts of Chloride of Lime (also known as calcium hypochlorite), was usually removed on a nightly basis and buried "inside of 200 ft of the trenches generally."[176] Bodies were most often evacuated to cemeteries at least 1000 yards from the front line and buried under "three feet of earth at least when possible."[177]

Besides risking the purity of local rivers and streams, exposed and untreated excreta and other products of static warfare attracted insect carriers of disease – especially flies. It had long been recognized that the incineration of human waste, horse manure and refuse was the best method to control the fly population.[178] However, as has been established, destroying waste in this manner was often neither feasible nor practical, especially in and near the trenches. Consequently, the Canadian Corps experimented with various chemical solutions to limit fly breeding. One such product was simply called "C" solution. Intended to be sprayed, it was touted by the British Division's Deputy Assistant Director of Medical Services (DADMS) "to exercise a very beneficial

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[175] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 2.
[176] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 2.
[177] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 3.
[178] LAC, RG9, Series III, Vol. 3745, Adami Papers (Misc. Extracts), "Circular Memorandum – issued with 1st Army Routine Order No. 35 of 31 March 1915" (Copied from ADMS 1st Canadian Division, April 1915), pp. 1-2; and LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.

effect on preventing the breeding of flies in the dead bodies of men and animals."[179] "C" solution's composition is uncertain, although one month after the Canadian experiment had begun, the British DMS deemed it appropriate to inform the Canadian DDMS that the mixture "should be plainly marked 'poison' and 'inflammable'."[180] He also kindly advised that "C" was proving to be "irritating to the skin and eyes so should sprayed in the direction of the wind."[181] It appears the Canadians found the efficacy of using this and similar fly destroying insecticides was limited, as the following year the burning of waste was endorsed as being the best fly control strategy.[182]

The control of flies was an essential component in maintaining a healthy food supply and the sanitary organization of kitchens, in themselves cornerstones of Canadian infectious disease measures, especially against typhoid and other intestinal disorders.[183] Early in the war, Canadian field cooks received little or no training, other than that provided by sympathetic and patriotic-minded English, French and Belgian women. However, within short order, in the interest of promoting hygiene, the CAMC's medical officers, Sanitation Sections and No.5 Mobile Laboratory were all involved in regulating

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[179] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Canadian Division, Sanitation Reports, folder 4, file 15, "Use of 'C' solution" memorandum from DMS to DDMS Canadian Corps, 9 September 1916.
[180] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Canadian Division, Sanitation Reports, folder 4, file 15, "Use of 'C' solution" memorandum from DMS to DDMS Canadian Corps, 9 September 1916.
[181] LAC, RG 9, Series III, Vol. 4542, ADMS 1st Canadian Division, Sanitation Reports, folder 4, file 15, "Use of 'C' solution" memorandum from DMS to DDMS Canadian Corps, 9 September 1916.
[182] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.
[183] LAC, RG9, Series III, Vol. 3745, Adami Papers (Misc. Extracts), "Circular Memorandum – issued with 1st Army Routine Order No. 35 of 31 March 1915" (Copied from ADMS 1st Canadian Division, April 1915), p. 1.

and supervising virtually every aspect of army kitchens and food preparation. To prevent or minimize the contamination of food with pathogens, No.5 Mobile Laboratory began to test all the cooks assigned to battalion kitchens in an attempt to identify typhoid carriers.[184] Sanitation Section personnel saw that all kitchen staff kept themselves clean and ensured that all food preparation areas, kitchen utensils, pots and dishes were properly sterilized. The quality of the food supply used for the preparation of rations was also closely observed. Of course, battalion kitchens used a great deal of water, and the water used in these facilities was rendered disease free by the proper use of Chloride of Lime. According to some trench soldiers, however, the addition of this purifying agent significantly lowered the consumption of the many cooks' already unpalatable creations.[185]

The efforts of the Sanitary Sections, the CAMC and the CEF's senior commanders towards implementing and enforcing anti-typhoid measures are commendable. During the entire war, in all theatres, just over 400 Canadian soldiers reportedly contracted typhoid fevers, and of those, only four percent ended fatally.[186] The hygiene and water purity measures instituted for typhoid also had a positive effect on preventing other Familiar water-borne infectious diseases—proven army destroyers—from large scale outbreaks, including dysentery and cholera. Two other infamous and nefarious Familiar infectious diseases, typhus and malaria, never took hold in the Canadian trenches of the Western Front, although outbreaks in other theatres of the

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[184] MacPhail, *The Medical Services*, p. 236.
[185] Ellis, *Eye-Deep in Hell*, p. 130.
[186] MacPhail, *The Medical Services*, p. 255.

war not only occurred, but were common.[187]

"Unexpected" is a fitting descriptor for the fourth and last category of infectious disease found in the Canadian trenches during the First World War. In general, Unexpected diseases are those which had never before been identified, had unknown aetiology, and/or occurred on an unprecedented scale during the war on the Western Front. Unexpected infectious diseases included infective jaundice, trench mouth, anaerobic bacterial infections (such as trench foot, tetanus and gas gangrene), the "Spanish" strain of influenza, and trench fever.

Jaundice was well known by the medical community as it was often a symptom accompanying other more serious conditions. However, during the South African War Canadian medical personnel were introduced to a novel variety of the illness which presented like jaundice but appeared to be highly infectious in nature, rather than symptomatic. Thousands of British and Dominion troops were afflicted with this enigmatic disease, which created high wastage rates but relatively few fatalities. The aetiology of the disease, which would be called infective jaundice, remained a mystery for the world's medical and scientific communities until 1915, when Japanese scientists confirmed that the disease was caused by a particular spirochaete that infected its host's liver. A short time later, the two vectors for the pathogen were discovered to be human and rat urine.[188]

Precautions were put into place, but effective rat control in the trench environment was elusive. The resilient rodents found the trenches to be an ideal and bountiful environment--well suited for massive propagation. With voracious appetites

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[187] Rawling, *Death Their Enemy*, p. 71.
[188] MacPhail, *The Medical Services*, p. 262.

and fearless vigour, the rats raided soldier's food, contaminating entire stocks in the process. Virtually all trench soldiers found the constant presence of the rats to be irksome and profoundly disturbing, primarily because the rats were not fussy eaters, often dining on corpses in various stages of decay. Even the living were not immune to unwanted attention from the bold rodents. The rats would commonly "give very nasty bites", sometimes sneaking a gnaw from sleeping soldiers and according to one British soldier "they would eat a wounded man if he couldn't defend himself."[189] This type of story was not the product of hyperbole, as one Canadian officer related in a letter to his relatives that he had seen some brazen rats "almost as large as cats." One daring rat, he continued, "calmly ran right across the table we were eating from."[190]

Rats continued to be a problem throughout the war, despite the best efforts of soldiers to kill them at every opportunity. Cats, ferrets and dogs were used to hunt them or to at least keep them at bay. Often times, these "ratters" were not fed anything they could not catch, which certainly would have motivated activity. Still, as one Canadian officer observed, some of the "loathsome" rats would "die in unsearchable (sic) places and add to the odors of the dugout."[191]

Traps were tried, but were found to be "of little use."[192] Poison was determined to be effective, but it was far from practical for several reasons, the chief one being of course that rat toxins were not specific to the vermin and were persistent—not a good

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[189] Ellis, *Eye-Deep in Hell*, p. 52; and LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 12 November 1916.
[190] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 26 November 1916.
[191] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 2 January 1917.
[192] Adami, *War Story of the Canadian Army Medical Corps*, pp. 220-21.

circumstance for the other mammals sharing the trench. Besides, as has been previously discussed, many Canadian officers were uneasy with the prospect of the soldier's having access to a substance which would easily facilitate self-inflicted sicknesses.[193]

Frustration often leads to innovation and this was certainly the case with the rat dilemma. Biological warfare on these omnipresent rodents was considered, but quickly rejected. Although it was not specifically described or named in the available documents, it appears that some newly developed bacterial agent was found to be a potent rat killer. The trouble was, as one CAMC officer explained, medical personnel were "afraid" of the introduction of this bacteria, as it was known to be closely related to infections which caused potentially fatal intestinal illnesses in humans.[194] Accordingly, its use in the short-term was rejected. Still, it was reasoned that "if the plague were to come on the scene" this biological agent option might become a viable option "to meet the rat pest."[195]

The animal vector for infective jaundice may not have been completely controlled but human cross-infection was markedly curtailed thanks to the sanitation and other hygiene measures put in place to combat Intestinal diseases. Unfortunately, viable statistics relating to infective jaundice do not appear in the available sources. However, it is clear that the rate of infection was much less than what had been seen in the British and

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[193] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.
[194] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, pp. 3and 7.
[195] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.

Canadian ranks during the South African War.[196]

Another Unexpected infectious disease was trench mouth. This disturbing ailment was practically unknown before the First World War, but it soon began to make its presence known in the trenches by literally eating away at its victim's gums. The CAMC's medical doctors and dentists were initially stymied, although they correctly suspected that this unusual disease was spread through infected human saliva. Preventative measures were quickly and strenuously enacted. Dishwashing equipment and practices in battalion kitchens were subject to more regular inspection. The Canadians and their British cohorts on the continent also worked with local authorities to control and regulate the civilian-run *estaminets*, vigorously ensuring that proprietors would properly sterilize all drinking vessels between each customer use.[197] CAMC dentists also began universal dental examinations in order to identify those soldiers requiring treatment.[198]

Trench mouth was eventually checked by the vigorous efforts of the CAMC, strict enforcement by commanders, and probably by the motivation soldiers may have developed after seeing firsthand the results of this inarguably distasteful and disfiguring illness. It is worthy of note that the aetiological investigations of Captain F.B. Bowman, a Canadian medical officer and pathologist with No.5 Mobile Laboratory, led to the

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[196] MacPhail, *The Medical Services*, p. 261-2.
[197] It is unclear if another suggestion made by the Sanitary Advisor to help curb Trench Mouth was adopted by the CAMC and the CEF. He recommended the adoption of "the French method of carrying each soldier his own cup … with him always."; LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 14.
[198] Nicholson, *Seventy Years of Service*, p. 88; and MacPhail, *The Medical Services*, pp. 270-1.

eventual discovery of the bacterial organism which caused trench mouth. Over ten thousand Canadian cases of this disease were recorded during the war.[199]

The abysmally unhygienic conditions present in the Canadian trenches resulted in the appearance of other Unexpected diseases. Anaerobic bacterial infections most commonly occurred when bacterium were allowed to enter the body through a break in the skin. Of course, bacteria was nothing new and these types of infections had existed from the dawn of human history. However, the soil in Flanders and Northwest France became a toxic mess of unprecedented virulence, composed of massive amounts of rotting garbage, excrement, persistent poison gases, decomposing bodies. To make matters worse, all these contaminants were stirred and brought to the surface by shelling and trench construction. Due to the highly infectious qualities of the soil on the Western Front, anaerobic infections were more likely and more deadly than ever before. Any break in a trench soldier's skin, whether a simple cut, abrasion or even an exposed blister, that allowed even the most minute amount of this virulent soil into his body could have dire consequences. Thus, danger extended beyond the operating room.

It was these uniquely horrid qualities of the Western Front's soils that helped create another medical surprise. This Unexpected disease was called trench foot (also known as immersion foot). Trench foot, which could develop in as little a single day, was caused by "continued cold wetness ... with added secondary infection from the soil."[200] The disease had first visited the British in late 1914 and they developed preventative measures before the Canadians arrived in Flanders. Nevertheless, over 150

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[199] MacPhail, *The Medical Services*, pp. 235-6.
[200] MacPhail, *The Medical Services*, p. 269.

Canadians were afflicted during a three day period in early December, 1915.[201] This object lesson in the dangers of ignoring proper hygiene may have worked as a catalyst to get the CEF serious about the matter. Prevention was virtually guaranteed if the proper precautions were followed as frequently as possible or practicable. These included a procedure of drying of one's feet, then rubbing a "grease made of whale oil before putting on dry socks."[202] Discipline was shown to be a key component in prevention. Accordingly, the hygiene measures were enforced through lectures and daily inspections conducted by battalion officers and MOs, with good result. Individuals contracting the disease risked the loss of their leave, not to mention having to face the possible debridement of affected flesh and bone.[203] Officers in command of Canadian units deemed to have an excessive infection rate were put on notice or dismissed. There were nearly 5,000 cases of trench foot in the CEF during the war, two of which were fatal.[204]

Another indirect cause of anaerobic infection was scabies. The scabies parasite, which created incredible itchiness and mind-numbing pain for its soldier hosts, was novel to most medical officers who "failed to recognize its early appearance" in the trenches.[205] Many Canadian soldiers considered scabies to be the bane of their existence, as illustrated in this budding Canadian soldier-poet's creative contribution to a November 1918 edition of *The Tank Tattler*:

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[201] Nicholson, *Canadian Expeditionary Force*, p. 127.
[202] MacPhail, *The Medical Services*, p. 269.
[203] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 2.
[204] MacPhail, *The Medical Services*, p. 270.
[205] MacPhail, *The Medical Services*, p. 275.

The trench's fleas are bonnie
Where early fa's the shell;
But it's here that scabies hoard
Gave me their itching true;
Gave me their ichichy true;
Which ne'er forget will be;
And for scabies blue and hoary
I've learned to swear like hell.[206]

Scratching the parasites may have offered fleeting relief, but it could often lead to skin striations and serious secondary infections. In the second half of the war, the number of cases of scabies grew remarkably in the Canadian and British ranks and it became evident that large scale prevention and treatment of the disease was required. As a result, the CAMC established specialized mobile bathing and treatment units.[207] There were nearly 10,000 cases of scabies in the CEF, but large scale relief from the disease was eventually facilitated by better personal hygiene, especially the disinfection of clothing and blankets.[208]

Tetanus and gas gangrene were infectious bacterial diseases that were most frequently introduced to a trench soldier's body via wounds or simple lesions. Although these infections were likely to manifest symptoms in post-operative circumstances and not in the battle line, they can still be classified as Unexpected trench diseases due to their cause--not to mention their unprecedented massive occurrence and potentially lethal nature. Machine gun and artillery fire claimed more Canadian lives than any other cause on the Western Front. If not killed outright, battle wounded soldiers could die or be permanently disabled, not just due to the original trauma, but because of secondary post-

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[206] LAC, RG 9, Series III, Vol. 5080, Unit newspapers, Printed Material, *The Tank Tattler, the Newspaper of the First Cdn. Tank Battalion,* November 1918, p. 13.
[207] LAC, RG 9, Series III, Vol. 1820, file S-2-14, untitled report, n.p.., n.d..
[208] MacPhail, *The Medical Services*, pp. 274-5.

operative infections such as tetanus and gas gangrene. Bullets and shell fragments tended to drive bits of bacterially contaminated uniforms and soil deep into the wounds they created. Gas gangrene was also a common result of neglected or serious cases of trench foot.[209]

In 1914 and early 1915, Canadian medical officers were both surprised and alarmed by the high incidence of post-operative tetanus.[210] Equally worrying, the death rates for those afflicted were over fifty percent. Fortunately, in 1915, prophylactic inoculation was commenced and the occurrence of tetanus was effectively controlled.[211] Unfortunately, for many soldiers a similar preventative measure was unavailable to combat gas gangrene and it remained a serious threat to life and limb in wounded soldiers. Secondary infections of gas gangrene posed serious difficulties to the era's medical officers. As potent antibiotics remained to be discovered, treatment was difficult and often aggressive debridement was the only viable option.

Any discussion of infectious disease during the First World War must acknowledge the terrible influenza pandemic of 1918-1919—the so-called "Spanish flu."[212] Influenza was nothing new but the Spanish strain, which began to be seen in early to mid 1918, had incredibly virulent and lethal qualities previously unseen in

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[209] MacPhail, *The Medical Services*, pp. 269-70.
[210] MacPhail, *The Medical Services*, pp. 105-6; and W.G. Macpherson (ed.), *History of the Great War - Medical Services: Pathology* (London: His Majesty's Stationary Office, 1923), pp. 169-70: just prior to the war, tetanus mortality rates in the British armed services was in excess of eighty-five percent. This rate dropped to under 40 percent towards the end of the war.
[211] Macpherson, *History of the Great War - Medical Services: Pathology*, pp. 169-70.
[212] Mars (pseud.), "The Plague of the Spanish Lady", *Army Quarterly and Defence Journal*, Vol. 129, No. 2 (April 1999), p. 190; the actual source of the influenza epidemic is now acknowledged to have been an American Army base in Kansas — not Madrid, Spain, as was originally thought and conventionally maintained.

modern history. Influenza's pathogen was a mystery to medical scientists and practitioners, as the existence of viruses and their nature had yet to be discovered. Yet, the disease was known to be infectious. The crowded and unhealthy environment seen in the trenches facilitated the rapid spread of the virus through the ranks of all armies. Troops returning to their homes after the Armistice unwittingly helped the disease to ravage the globe. In excess of twenty million deaths were attributable to the Spanish flu world wide.[213] In the CEF, 46,000 cases of influenza were reported and of these 776 deaths were attributed to the illness, leading Andrew MacPhail to conclude that "of the infectious diseases influenza was the most prevalent and the most fatal" of the war.[214] Domestically, in Canada, about one sixth of the population contracted the Spanish flu and up to 50,000 died because of the infectious disease.[215]

As this chapter has amply demonstrated, one does not require a high degree of precision in the available statistical evidence in order to recognize that the threats and challenges posed by infectious diseases upon the CEF were extensive and real. Additionally, although knowing the etiology of these diseases was important during the Great War, this did not guarantee that effective anti-disease strategies could and would be formulated and then followed. Furthermore, our medical service personnel – regardless of their skill, commitment and determination – could not carry this battle alone. To win a victory, even a qualified one, over any of the trench environment's plethora of pathogens

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[213] Mars, 'The Plague of the Spanish Lady", p. 191.
[214] MacPhail, *The Medical Services*, p. 271. Canadian rates appear to be similar to those experienced in other armies.
[215] According to the 1911 Federal Census, the pre-war population of Canada was 7.2 million; And Desmond Morton and J.L. Granatstein, *Marching to Armageddon: Canadians and the Great War 1914-1919* (Toronto: Lester and Orpen Dennys Ltd., 1989), p. 235.

and vectors, virtually the entire army had to comply with hygiene and health-related regulations and guidelines. Most importantly, in order to adopt an effective campaign against any disease or disease vector, the support of the army's senior commanders was crucial.

A fine example highlighting the health-related personal and organizational challenges faced by the Canadian army and its leadership during the First World War may be seen in an Unexpected infectious disease which would eventually be called trench fever. This disease was virtually unknown when, shortly after Canadian soldiers arrived in Flanders in early 1915, some Canadian soldiers began reporting for sick parade presenting a set of particularly perplexing and intriguing symptoms. Several years would pass before trench fever was uncloaked and its vector – body lice – was even conclusively identified.

The cause of trench fever may have been elusive and mysterious but, as the next chapters shall clearly illustrate, for nearly all Canadian soldiers on the Western Front the painful and uncomfortable experience of playing host to infectious lice would become all too familiar very quickly. The prevention of this mysterious, debilitating and dangerous disease would require the unending attention of the CAMC and test the limits of the entire CEF for the remainder of the war.

CHAPTER THREE

THE EMERGENCE OF TWO SEEMINGLY UNRELATED ENEMIES: "THE LOUSE" AND "SO-CALLED TRENCH FEVER"

When the call to arms first sounded during the summer of 1914, Thomas Brenton Smith immediately signed up, joining the CAMC's 1st Canadian Casualty Clearing Station. While the unit was still forming at Valcartier, Quebec, much to Smith and his fellow soldier's chagrin, they discovered in their midst "that most annoying of all vermin, the louse."[216] Smith later reported that the pest problem continued to persist, as illustrated by hordes of body lice found "teeming" on the clothing of several men during the CCS's trans-Atlantic crossing.[217]

Although body lice (or "clothes lice") were not unknown to the average Canadian in 1914, the experience of playing unwilling host to these parasitic insects was not only unfamiliar, but physically and mentally unsettling as well, for virtually all of the Casualty Clearing Station's personnel. Few of these men would or could have imagined that they and all other soldiers fighting on the Western Front would have the six-legged uninvited and unwanted hitchhikers as ubiquitous companions for years to come. Like the vast majority of other pests, lice (especially body lice) thrived in the less than salubrious war environment, becoming the bane of existence for the preponderance of Canada's overseas

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[216] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 254.; Smith, who would climb to the rank of Staff Sergeant over the ensuing five years, also became the unit's unofficial historian and storyteller.

[217] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, pp. 254-5.

soldiers during the First World War.

Lice found on humans are termed to be "sucking lice" (or *Anoplura*), not to be mistaken with other insects that may share the "lice" moniker, but are not even part of the same family of insects. Non-sucking, non-human inhabiting "lice" include fish lice, bird lice, louse flies, book lice, dust lice, bark lice, wood lice and plant lice. Body lice are utterly dependant upon human blood for sustenance. Although related, the lice found on humans are unique to those lice which also feed on the blood of other animals, as most lice show a strong tendency to feed off a single species or at least a very closely related set of species. For instance, although our genetic makeup is remarkably similar to that of orangutans, chimpanzees and bonobos, the parasitic lice that we may host are specific to our human species.[218]

There are three varieties of human lice: pubic lice (*Phthirus pubis linnaeus*), head lice (*Pediculus humanus capitus*) and those encountered early on by Thomas Smith and his cohorts, body lice (*Pediculus humanus humanus*). As their respective scientific names indicate, body and head lice are varieties of a single species, whereas pubic lice are of an altogether different species and genus. The common names of each of these sucking lice indicates the area of the human body which they normally prefer to inhabit, by no means do the lice necessarily remain in their namesake areas. For instance, body lice can and do inhabit any external surface of the body, except the head. Head lice and pubic lice, although preferring their specified locales, may in some circumstances be found on all other parts of the body.[219]

Throughout the war, the body louse was by far the most common of all the

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[218] John Smart, *Lice,* 4th edition (London: Pitman Press, 1969), pp. 1-2.
[219] Smart, *Lice,* pp. 1-2.

sucking lice found on Canadian soldiers. It appears to be the best adapted of all Anoplura to prosper in wartime, being larger, more tolerant to adverse changes in temperature and able to survive without food for a longer period of time.[220]

Body lice also breed at a faster rate than their Anoplura brethren. Prolific propagators, an adult female body louse is capable of laying up to twelve fertilized eggs per day and over a hundred in her life time. Eggs, which are also commonly referred to as "nits", are just under a millimeter length and have a diameter of about a third of a millimeter. Laid individually, the eggs are generally placed in the seams of its unwilling host's clothing and are affixed to the clothing fibers by a cement-like excretion. Being a yellowish-brown hue, these nits were nearly perfectly camouflaged for melting in with the Canadian army uniform.[221]

The incubation period for body lice eggs is variable, ranging anywhere between six and fourteen days, depending on the ambient temperature at the nit's site. After hatching, the louse nymph is similar in appearance to that of adults, except it is smaller. The nymph begins to eat immediately after its birth, grows quickly, shedding its outer shell three times within eight to sixteen days after hatching and reaching its full adult size of between three and four millimeters – about the size of a sesame seed. The ability to breed follows in less than half a day. In total, the normal lifespan of the body louse is about one month, but in ideal conditions *Pediculus humanus humanus* can live, thrive and survive for up to eight weeks.[222]

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[220] Smart, *Lice*, pp. 2-4.
[221] Smart, *Lice*, p. 5-7; and LAC, RG 9, Series III, Vol. 4512, Sanitation Reports, Folder 4, File 15, "The Louse Problem at the Western Front" by Lance-Serjeant AD Peacock (RAMC), His Majesty's Stationary Office, London, 1916, pp. 9-10.
[222] Smart, *Lice*, p. 5-7; and "The Louse Problem at the Western Front", pp. 9-10.

Of course, one of the major determinants of a louse longevity centers around its food supply and evolution has endowed body lice with a well-honed ability to feed prestigiously. Body lice rely solely on human bodies for sustenance – more specifically, human blood. In order to facilitate this, a louse first uses its spiny legs to attach itself to any skin surface on its host's body. The skin surface is then pierced with retractable needle-like pincers located near the louse's head and saliva, which inhibits clotting and aids ingestion via a sucking tube, is introduced to the wound. Relative to other insects, a louse's stomach is "of very large capacity."[223] Adult body lice are "voracious" and "wasteful" eaters, often undigested blood being passed directly through the louse's digestive tract and being excreted from its anus, whilst feeding. Sometimes this tendency to over-feed results in the rupture of the louse's bacteria-filled gut, which leads to the louse's untimely and early demise, usually within hours.[224]

Movement for lice is largely dependant on temperature. Studies have shown that body lice are optimally active at a temperature of thirty degrees Celsius – normally the same temperature as a human's clothed skin surface. Lice may remain "comfortable" at room temperatures, although activity rapidly decreases when the temperature drops much lower.[225] Still, a well motivated louse is no slouch. In ideal conditions, most body lice can travel up about nine inches or so per minute, albeit rarely in a straight line.[226]

Many factors may contribute to the likelihood of a person becoming infested with lice. Physical contact with louse-infested people and or louse-infested material, such as

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[223] Body lice usually take up to one milligram of blood per feeding, and "may suck for twenty minutes at one time", "The Louse Problem at the Western Front", pp. 9, 10.
[224] Smart, *Lice*, p. 5; and "The Louse Problem at the Western Front", p. 10.
[225] Smart, *Lice*, p. 5-7.
[226] Smart, *Lice*, p. 5-7.

clothing and other personal items, facilitates the migration of the parasites.[227] Those people unable or unwilling to frequently wash and/or change their clothing are certainly more prone to becoming a popular host.[228] Infestations usually number about ten to twenty body lice per person, although many more extreme cases have been recorded.[229]

A notable and unique characteristic of sucking lice compared with the vast majority of other parasitic pests, is that they not only feed from their host, but under normal circumstances live every aspect of their entire lives on or at least in very close proximity to the host. Other crawling blood-suckers, such as bedbugs, ticks, and fleas treat the human body as a place on which to quickly feed, but not one on which to exclusively live and breed. Thus, lice can be viewed as not merely unwelcome visitors, but also as unwanted freeloaders that never want to leave. The "one-stop life-style" practiced by the body lice would exacerbate the difficulty for those Canadian soldiers either hosting and combating the vermin – both on an individual and a corporate level.

Discomfort aside, lice infestations were recognized to be associated with typhus outbreaks. Yet, in the comprehensive ninety page *Manual of Elementary Military Hygiene*, the RAMC and CAMC's guidebook for disease prevention and sanitation procedures, which was first published in 1912 and then reprinted in 1914, there is absolutely no mention of typhus. Neither is there any discussion of the treatment and prevention of louse infestation, nor disinfestation facilities and procedures in the army hygiene manual.

These oversights and omissions by the RAMC's military and medical authorities

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[227] Smart, *Lice*, pp. 8-10.
[228] Smart, *Lice*, pp. 8-10.
[229] Smart, *Lice*, pp. 11-12.

were not picayune matters. Typhus was known to be a highly infectious disease, which had "run riot throughout Europe and … into the remotest corners of the civilized world."[230] More popularly known as "ship fever" and "goal fever" in Britain, louse-borne typhus had occasionally ravaged the military and civilian populations in most European nations, including Britain itself, for centuries. Yet, it appears British authorities may have been lulled into some sort of false security concerning typhus, as western Europe had been "practically exempt" from large outbreaks after 1850.[231] Still, the disease was re-emerging with alarming vigour in the Balkans and Russia, claiming tens of thousands of lives since the 1890s.[232] In an age where race-based pseudo-science and anthropological quackery enjoyed some popularity, perhaps some of these British military authorities felt they were somehow now immune to this disease that seemed to have evolved into an affliction only affecting non-Anglo peoples.

So, on the eve of the war, the highly destructive and killing nature of typhus was known, if not accepted. It was also known within medical and scientific circles, prior to the first printing of the *Manual of Elementary Military Hygiene* and well before the outbreak of hostilities in 1914, that body lice transmitted *Borrelia recurrentis*, the bacterial agent of louse-borne relapsing Fever and *Rickettsia prowazekii*, the bacterial agent of louse-borne typhus. The bacterial pathogens for these diseases were identified before the war, in 1867 and 1911 respectively.[233] Moreover the louse was scientifically

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[230] Zinsser, *Rats, Lice and History*, p. 286.
[231] Zinsser, *Rats, Lice and History*, p. 286.
[232] Zinsser, *Rats, Lice and History*, pp. 282-96.
[233] Didier Raoult et al, "Evidence for Louse-Transmitted Diseases in Soldiers of Napoleon's Grand Army in Vilnius", *The Journal of Infectious Diseases*, Jan. 2006; Vol. 193: p. 112; Note: the louse-borne diseases of typhus, relapsing fever and, later, trench

confirmed to have been the vector for typhus in 1909.[234]

From a corporate standpoint, if not an altruistic or humanitarian one, the army should have taken better care of its soldiers and its own well-being. Lice were collectively a potential infectious disease time-bomb that could not only threaten the health of individual soldiers, but the battle-readiness and existence of entire armies, nations and empires.

On an organizational level, the British and Canadian armies went to war unprepared to seriously meet the threat of louse infestation in their ranks and, moreover, louse-borne typhus. In retrospect, this situation was inexcusable. For many of the soldiers in the CEF, the body lice situation was nearly intolerable. The net effect was that the CEF and the CAMC, like their British army counterparts, were ill-trained and ill-equipped to deal with the emerging lice infestations faced by No.1 Canadian Sanitation Section and other CEF units. Before a shot was fired on the Canadian-manned trenches, a harmful and potentially deadly pathogenic foe was quietly infiltrating the ranks of the CEF.

Domestically, in the 1910s body lice infestations occurred but were becoming increasingly rare events. During the late nineteenth and early twentieth centuries, the proliferation of sanitation and public health regulations, propelled by advocates of the recently developed principles of modern scientific medical management, were contributing to a slow but steady increase in the general health of the young dominion. Recognizing that lousiness was largely preventable, civilian health authorities adopted

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fever are all also part of a lager group of insect-borne infectious diseases collectively referred to as "Rickettsial diseases", as per Zinsser, *Rats, Lice and History*, p. 219.

[234] Raoult et al, "Evidence for Louse-Transmitted Diseases", p. 112.

the belief that proper hygiene was the key. Then, as today, personal cleanliness of one's body and of one's clothing was the cornerstone of defence against lice. Although lice could "be picked up by anyone" in any city or community, widespread infestations could be stopped very quickly before they began, or at least their negative effects mitigated.[235]

Of course, as we have seen, the wartime environment in and near the Western Front's trenches was very different from that experienced in civilian life, being naturally non-conducive for human hygiene and healthy living. Not so for lice – for them, the war was a boon and their population increased exponentially. By 1915, body lice were omnipresent in the Western Front's trenches and universally despised by soldiers on both sides of the battle lines. The parasitic pests had a way of eroding and draining the human spirit and will more than any other pest encountered in the trenches. One soldier in the CAMC bemoaned the "lousy" situation, observing "but for all varieties of vermin, the louse brought the most misery."[236]

Many a man was driven to distraction by these unwelcome hitch-hikers. Besides the physical discomfort, some soldiers reportedly "passed through all stages of mental disturbance from dislike and disgust to hatred and frenzy."[237] Attesting this, one Canadian soldier with the Canadian 29th Battalion wrote: "To me thus far the chief horror of war has been the sound and sight of comrades in their sleep cursing the lice and the Army and flinging themselves about like madmen while with dirty nails they scratch

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[235] Smart, *Lice*, pp. 17-18; and MacPhail, *The Medical Services*, p. 274
[236] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 258.
[237] MacPhail, *The Medical Services*, p. 274.

chest or legs till the blood streamed down."[238]

Playing host to a multitude of the blood-sucking insects was an inevitable outcome for virtually all of the CEF's soldiers and officers – even for "the most fastidious."[239] No one was safe from becoming infested with body lice, a lesson that at least one Canadian Non-Commissioned Officer (NCO) by the name of Waltonhammer was disappointed to discover. His misfortune, it was recorded, was "the source of real satisfaction on the part of the other Sergeants, a number of whom had, at one time or another, suffered from this source."[240] Stirred by the juices of creativity, and evidently a little more than a modicum of *schadenfreude*, a budding poet in Sergeant Waltonhammer's unit commemorated the event with the following untitled ode:

He always used to laugh at us
When we looked through and through
Our shirts for little things that bite
But now he's lousy too.

While we would sit and scratch all night,
He'd lay abed and snooze;
But now they're marching 'round his back
In fours and threes and twos.

He used to grin as we stripped bare
And found more than a few;
But now we love to hear him swear;
For he is lousy too.

Yes! Waltonhammer has them now;
He's hunting day and night;

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[238] LAC, RG 9, Series III, Vol. 3606, 25-1-0 Vol. 2., Letter written by Mack Eastman, A Company, Canadian 29th Battalion, to Captain Pidgeon, YMCA, London (forwarded to Canadian ADMS – London, March 1918).
[239] MacPhail, *The Medical Services*, p. 274.
[240] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 255.

So now we laugh and jolly him;
It serves hem damn well right.[241]

Clearly, it was with good reason that when the CAMC's official historian, Andrew MacPhail assessed the louse-induced hardship endured by Canadian troops on the Western Front, he concluded that a "war without lice appeared to them a luxurious way of living."[242] Writing home from the trenches, one CEF officer claimed that although his dugout was "swarming with rats and mice … the only thing we are bothered with is the [lice]."[243]

Various methods were employed to control the lice population. The least technical of the systems employed by exasperated soldiers was simply scratching their skin at the site of louse irritation. This may have provided temporary relief, but it did not always kill the louse, being more likely to displace it momentarily. Moreover, clothing, especially multiple layers, acted as a buffer, protecting the louse from injury during a frantic scratching session. It soon became a common practice for Canadian soldiers to pick the insects off their bodies, underwear and uniforms – one by one. Lice were not always readily visible, as they often resided in clothing seams. Accordingly, soldiers found their prey would be flushed out by the application of heat – a hot knife or spoon or strip of metal, a lit candle, a lighter, or a the tip of a burning cigarette often sufficed. As frustrating and time consuming as this must have been it appears that some soldiers gained, among other things, a measure of sweet revenge from the killing the "chats" in

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[241] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 255.
[242] MacPhail, *The Medical Services*, p. 274.
[243] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 18 November 1916.

this manner.

Frequently, trench soldiers found "chatting" became a regular social activity in the evenings, when small groups of men would chat together, whilst sharing their thoughts and swapping a few stories. Interestingly, the term "chat" has since crept into common usage in Canadian and British society, although its origin might surprise most people today.[244] One Canadian trench soldier later related how hunting "seam squirrels" or "reading the shirt" around an open stove with his comrades became one of his favorite events, marked by "fish[ing] out our guests and dropping them on top of the stove. A big greyback exploded with a very satisfactory pop. If the stove was a brazier and had no top we just dropped them in the flames. That was not so good because there was no pop."[245] If immolating the body lice was not possible, most soldiers would kill the insect by pinching and bisecting it between opposing fingernails. A much smaller group of troopers were in the habit of simply cleaving the louse's body with their front teeth. Although necessary, and even cathartic, these manual "hunt and pick" routines were largely inefficient, especially when it came to completely ridding oneself of nits. Individual efforts may have helped to control lice populations on one's body to a degree, but it was impossible to fully eliminate recurrence of infestation.[246]

By mid 1915, the upper echelons of the CEF finally began to react, after accepting that large-scale and systematic procedures were crucial to control, if not eliminate, the growing louse infestation problems in the rank and file. The theory for this had been long established and had worked successfully at averting epidemic infestations in much

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[244] Cook, *At the Sharp End*, pp. 252-3.
[245] Nicholson, *Seventy Years of Service*, p. 89.
[246] Nicholson, *Seventy Years of Service*, p. 89.

of the western world in the immediate pre-war era. It initially appeared simple enough. The lice and nits had to be destroyed. The strategy to accomplish these tasks appeared to be straight forward as well. Soldiers would frequently visit the bath-house and upon exiting, their freshly scoured bodies free of crawling vermin, they would be issued with a freshly laundered pair of underwear and don their newly disinfected louse and nit free clothing. To help make this possible, bathing and laundry facilities were put in place for all Canadian units and a Thresh clothing disinfestor (or "disinfector") was procured from the British. Additional destruction of the lice and nits would be further accomplished through the use of chemical agents.

As is so often the case in life and war, the cogent principle remained that theory is not always easy, nor even always possible, to put into practice. The British and Canadian armies, along with all other belligerents on the Western Front would receive many object lessons in this maxim – not the least of which was related to the management of the lowly louse.

One major stumbling block to having theory and practice dovetail was technical in nature, being equipment related. Shortly after his arrival on the continent in May of 1915, a Major Woodhouse, the Officer Commanding the lone Canadian Sanitation Section attached to the Canadian 1st Division, recorded in his unit's War Diary that they had "a great deal of work ahead of them."[247] One reason for this was, he reported, was that the Thresh disinfector was "inadequate for a division, it not being able to disinfect

[247] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, War Diary/Report Excerpt – CSS 1st Division.

the clothes and accoutrements of a platoon at one time thus prevent reinfection (sic)."[248] Woodhouse's judgment was spot on. The Thresh Disinfector was put into service on the Western Front when it first became apparent to the British that infestations were becoming a problem. Designed on a sound principle, that being that louse and nit destruction was better accomplished through the use of steam, as opposed to the hot water rinses used laundries. British authorities placed great faith in the Thresh disinfector, but unfortunately, it was "too leisurely in action" when it came to treating the massive volumes of clothing required. Additionally, if its operators were too ambitious in placing too large a volume of articles in it, an event made more likely due to the machine's slow functioning time, the steam would not penetrate the clothing properly.[249] In essence, the Thresh was slow, had a small capacity, and was therefore inefficient. These flaws made it prone to be misused. This was established in 1915. Yet, inexplicably Thresh disinfectors appear to have remained in use or at least in partial use, in all allied armies for the remaining three years of the war. Fortunately, this situation would later be mitigated by some home-grown Canadian creative ingenuity.

Further complicating the task of freeing the army from the yoke of lousiness was the fact that epidemic vermin infestation was widespread and although it more frequently occurred in the trenches, it was not unique to these environs. Even for those CEF units still stationed in Britain, well away from the semi-organized chaos of the front lines, vermin infestation was proving to be a problem – not just in terms of occurrence but in terms of responsibility and enforcement.

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[248] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, War Diary/Report Excerpt – CSS 1st Division.
[249] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Administrative Notes: On Lousing and Disinfestation, August 1918, p. 75.

In early August 1915, the CAMC's Assistant Director of Medical Services (ADMS) for the Canadian 2nd Division sent an letter to the Officer Commanding with the Heavy Battery then staging in Otterpool that "I am informed that men of your unit have become infested with vermin. …. This is a matter which lies entirely within your own control and that the men must be given facilities for bathing, water must be brought in ... and tubs used with disinfectants and the clothing treated properly." After the admonishment, the ADMS also strongly encouraged the Officer Commanding to cooperate with the Senior Medical Officer in the Brigade area, as well as the Sanitary Officer and his own medical officer, cautioning him that: "The Medical Service cannot keep your men free of vermin, but can advise you how to do it for them."[250]

As he was a Lieut.-Colonel, the ADMS outranked the Officer Commanding of the Heavy Battery. Yet, in reality, he had very little power to see his will enforced. Upon follow-up just four days later, the ADMS ascertained his "gentle" appeal to the Officer Commanding had fallen on deaf ears. Unwilling to let the matter drop, he made a further petition one step up the army's chain of command, this time to the Officer Commanding of the Brigade Area. He wrote regarding the "extensive outbreak [of lice] among the men of the Heavy Battery", arguing that "this is a matter which the Officer Commanding himself can control if he cares to by ordinary precautions for cleanliness among which bathing stands first."[251] The ADMS also complained that not only had the Battery's commander not cooperated with the medical officers trying to clear up the problem, but he was undermining their efforts by ordering some of his men to attend to other tasks

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[250] LAC, RG 9, Series III, Vol. 4542, Disinfectors and Disinfectants, letter from ADMS, 2nd Canadian Division to OC Heavy Battery, 7 August 1915.
[251] LAC, RG 9, Series III, Vol. 4542, Disinfectors and Disinfectants, letter from ADMS, 2nd Canadian Division to OC Brigade Area – Otterpool, 11 August 1915.

rather than take their turns bathing and having their clothes properly laundered, adding "I respectfully submit that this is quite consistent with his attitude in allowing his men to become lousy at the first and ask your assistance in preventing such carelessness, please in the future."[252] The response of the Brigade Area Officer Commanding to the ADMS is unknown, but, in retrospect, one fundamental question comes to mind. If the commitment to hygiene from combat unit officers required for proper disinfesting could not be relied upon in the calm rear areas in 1915, how could it be expected that effective anti-lousing measures would be accomplished, much less attempted, in the relatively chaotic front lines?

Still, the upper echelons of the CAMC remained optimistic and resolute. In November 1915, wanting to facilitate the destruction of all vermin, especially body lice, in the trenches and billets Canadian troops were inhabiting at or near the front lines in Flanders, the DDMS of the Canadian Corps, who was himself stationed well away from the trenches, wrote to the ADMS of the 1st Division informing him of the suggested procedure that was to be put into use by Canadian battalion-sized units stationed at the front. The plan he endorsed was comprised of three basic steps. First, all dug-outs were to be cleaned of all debris and recently procured atomizers would be used to spray coal oil on the interior walls, floor and ceiling, and contents (benches, cots, tables, etc.). This spraying work was to be done just before a battalion left the lines for their rest period. Next, immediately after leaving the line, each member of the battalion would "have precedence at the baths" where they would present their entire kit, all clothing, including underclothes and socks, blankets and great coats for disinfection. The clothing on the

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[252] LAC, RG 9, Series III, Vol. 4542, Disinfectors and Disinfectants, letter from ADMS, 2nd Canadian Division to OC Brigade Area – Otterpool, 11 August 1915.

men's' backs would be chemically treated and returned to each man upon the completion of his bath, along with a fresh suit of underclothing and socks, with the rest of their items being forwarded to them after being properly laundered and dried. While these men were bathing, those soldiers heading back for the line would clean and spray the billets with the same coal oil solution used in the trench dug-outs. Thus, the DDMS surmised that after this process had been thrice repeated, the whole battalion would have been "thoroughly cleaned and disinfected" and, he optimistically proclaimed, "should free us from lice."[253]

The DDMS's plan seemed simple enough. In 1915, some Canadian soldiers would have been pleased if their commanders made *any* serious effort to help rid the army of lice and not leave them to their own devices. George Bell, a British ex-patriot American fighting in the CEF, complained, not unreasonably most people would contend, that "[f]or more that three months I had been wearing the same underwear and it was well inhabited. We had not heard of delousing stations and each man had to fight his own battle."[254]

In the fight to destroy the "friendly" lice inhabiting them, Bell also noted that he and many of his fellow trench soldiers wrote letters home in which they would plead for a product called Keating's Flea Powder. When their calls were answered by their families and a supply arrived via the mail, they sprinkled the powder "into the seams of our underwear, but the bloody bugs would hibernate a few days and come back stronger than

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[253] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS 1st Cdn Div, letter from DDMS Canadian Corps to ADMS 1st Canadian Division, 14 November 1915.
[254] LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller , n.d, p. 34; Bell served in the First Battalion of the 1st Division in the CEF from the summer of 1914 to Oct 1918.

ever." Evidently, a ringing endorsement for Keating's would not be emanating from the trenches being inhabited by Bell's unit, as he disappointingly explained, "[w]hen we first used Keating's we thought that our troubles were over, and no longer would we need to rub our backs against a post."[255]

In November 1915, recognizing that the rate of body lice infestation was continuing to rise and recognizing the increasing danger vermin posed to health of the army, the CAMC saw to the circulation of a document to all CEF officers. In "Measures for the Prevention of Sickness Canadian Troops" (sic), officers were reminded of the importance of units maintaining a proper regime of bathing and vermin destruction. The notice claimed that bathing and steam disinfection facilities in place were "sufficient to destroy all vermin and their eggs."[256] To augment the steam-based destruction, officers were advised that they were to see that kerosene oil was sprayed in "huts, dug-outs and places where men congregate in the trenches." Given the anti-louse procedures in place, the DDMS concluded "[i]t is hoped that all men will shortly be free from vermin."[257] The DDMS's optimistic "can-do" attitude was commendable, but unfortunately without solid foundation. As 1915 drew to a close, the circumstances and tools necessary to "free" the Canadians from the scourge of body lice were not fully at hand. Time would prove that the tiny yet tenacious blood-sucking louse would not be so easily controlled or defeated.

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[255] LAC, MG 30, E113, Alfred Savage Fonds, *Back to Blighty*, unpublished book manuscript by George V. Bell as told to Lee N. Fuller , n.d, p. 34.
[256] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 1.
[257] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Measures for the Prevention of Sickness Canadian Troops (sic)" – selected excerpts from the War Diary of DDMS, CCS, December 1915. p. 1.

As many Canadians inhabiting the trenches scratched furiously at the parasites inhabiting them, a seemingly unrelated malady surfaced in the rank and file. As this illness emerged, the rancor caused by body lice would become a matter of relatively minor concern in the minds of some medicos and scientists in the CAMC.

Soon after the first Canadians had begun to arrive in the trenches of Flanders in March 1915, some of the young Dominion's soldiers began reporting for daily sick parades presenting some particularly unique and confusing sets of symptoms. The afflicted soldiers typically complained of being suddenly overtaken with mind-numbing anterior headaches, feelings of faintness and/or dizziness, and staggering back pain which quickly seemed to worsen as it migrated to the legs.[258] Others complained of also being nauseated and constipated. Medical officers often reported that their examinations revealed that many had furred tongues and almost always had elevated temperatures – in some of these cases the afflicted soldier would have his temperature elevate to as high as 104 degrees Fahrenheit.[259]

Although lacking scientific confirmation, it soon became clear to some insightful medical officers that they were dealing with an emerging illness of a unique and variable nature that defied standard diagnosis.[260] This conclusion was certainly shared by many of Canada's soldiers, who by mid 1915 began to widely refer to the "new" malady as "trench fever" or "shin fever."[261] Presumably due in large part to a lack of a better more

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[258] MacPhail, *The Medical Services*, pp. 262-3.
[259] MacPhail, *The Medical Services*, p. 263.
[260] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, p. 2.
[261] Some soldiers continued to refer to the disease simply as "shin fever", due to the "violent" lower limb pain that normally accompanied the illness; *The Medical Services*, pp. 262-3

scientific term, many members of the medical and scientific communities adopted the term "trench fever" as well.

Further confounding their understanding of trench fever, many medical officers were frustrated that the symptoms of this hitherto unidentified illness often varied between afflicted individuals.[262] Given the perplexing and intriguing nature of trench fever, the treatment of these cases was generally limited to simply trying to alleviate patients' discomfort and enforced bed-rest at a medical facility located at or near the front. It was observed that in most cases the symptoms would seem to dissipate as quickly and mysteriously as they had appeared. Patients would then report they were feeling absolutely well, would apparently be recovered and completely free of any problems, for anywhere between three and fourteen days but usually five, only to suffer a relapse. In these soldiers the disease became especially nefarious, as these men would invariably be afflicted on many subsequent occasions. Oddly, although the period between these individual's relapses could vary, it remained relatively constant for each particular soldier. It initially generally appeared that the strength and effect of the symptoms lessened with each recurrence.[263] Some men returned to active duty with their assigned units within a week's time, but most of those afflicted with the disease were typically disabled for a period of five to six weeks.[264]

Not surprisingly, as a product of trench fever's extremely unusual and mysterious nature, many Canadian soldiers so afflicted were often diagnosed as having influenza,

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[262] MacPhail, *The Medical Services*, pp. 262-3.
[263] MacPhail, *The Medical Services*, p. 263.
[264] W.G. Macpherson (ed.), *History of the Great War - Medical Services: Diseases of the War, Vol. 1* (London: His Majesty's Stationary Office, 1923), p. 369; and MacPhail, *The Medical Services*, p. 263.

myalgia or even typhus by their medical officers.[265] Thereafter, most of those presenting with these strange symptoms were categorized as pyrexia of unknown or uncertain origin (PUO).[266] PUO was often used as a "catch-all" diagnosis by many military doctors, for any patient that was "simply too ill" to be posted to trench duty. It was easy to use this catchall when the medical facilities and medical personnel were being overwhelmed with battle casualties and or sick.[267] In some cases, the PUO diagnosis was used as "a convenient mask covering a much more controversial illness."[268] For instance, in mid 1917, Beatrice Nasmith, then a Canadian war journalist, privately related in a letter to her father an interesting incident that illustrated this type of fortuitous misdiagnosis and its effect on one Canadian officer: "Captain MacAdams has recently come out of a French Hospital after having been gassed and is still looking rather seedy. He led the hundred men under him to safety – he himself being the only one who got the gas. And as he didn't have on his gas helmet at the time (keeping it off purposefully) in order to detect the gas and do the best for the men under him he is equally liable for a court martial (for self-inflicted wounds) ... ." Fortuitously for the captain, his gas-induced illness was diagnosed as PUO by a French army medical officer who was "either careless or sympathetic." In any case, not only was the Canadian officer not brought up on charges, but his bravery in action was noted when he was mentioned in dispatches by no less than General Douglas Haig![269]

By June 1915, the steady and disquieting increase in cases of suspected trench

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[265] Nicholson, *Seventy Years of Service*, p. 87-8.
[266] Nicholson, *Seventy Years of Service*, p. 87-8.
[267] Debbie Marshall, *Give Your Other Vote to the Sister: A Woman's Journey into the Great War* (Calgary: University of Calgary Press, 2007), pp. 162-3.
[268] Marshall, *A Woman's Journey into the Great War*, p. 163.
[269] Marshall, *A Woman's Journey into the Great War*, pp. 162-3.

fever and PUO spurred British and Canadian military and medical authorities to order researchers to action.[270] Numerous questions related to trench fever required immediate attention. What was the aetiology of this "Unexpected" and unknown illness? Could it be prevented? More importantly, how could trench fever's negative influence upon the Allied wastage rates and, consequently, the war effort be kept under control, if not negated altogether?

At the forefront of the British-led investigation into the aetiology of the mysterious fever was No.5 Canadian Mobile Laboratory. No.5's primary researcher on the endeavor was the talented bacteriologist Major A.C. Rankin, who wasted no time in getting the research started. Copious blood samples were drawn from three soldiers suspected of having what Rankin referred to as "so-called Trench Fever" and were subjected to exhaustive and comprehensive testing conducted by Rankin himself.[271] One week later, Rankin's dissatisfaction was evident, as he was "unable to make out anything in cases of so called trench fever, either from throat or blood cultures."[272] The Canadian medico was experiencing a feature of trench fever that would also confound, and undoubtedly rankle, many of his contemporaries. It was difficult, if not impossible, to normally identify the disease microscopically as "no visible parasite could be found in the blood."[273]

Throughout the rest of the year, Rankin continued to work on "the problem"

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[270] MacPhail, *The Medical Services*, p. 262.
[271] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Report of No.5 Canadian Mobile Laboratory for June 1915", July 1915, p. 2.; and LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 22 June 1915.
[272] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 27 June 1915:
[273] Guy Hartcup, *The War of Invention: Scientific Developments, 1914-18* (London: Brassey's Defence Publishers, 1988), p. 176.

diligently, especially after being ordered to "take up 'Trench Fever' in earnest", obtaining for bacteriological examination a full range of specimens, including throat swabs and blood, urine, and fecal samples, from RCAMC and CAMC field units.[274]

In August of that same summer, the number of trench fever cases being reported continued to grow in the allied ranks and in the local French and Belgian civilian populations. As the cause and or means of transmission had yet to be identified, there was special concern in No.5 when a cook contracted what appeared to be trench fever.[275] Rankin and many of the other personnel in No.5 redoubled their efforts.

In No.5's "Interim Report", an accounting to high command of the mobile laboratory's activities to the end of 1915, it was very apparent that despite the unit's many tasks and responsibilities trench fever remained a continuing investigational priority.[276] Although the exact cause of trench fever remained elusive, some progress had been made. Rankin was "one of the first to recognize trench fever as a specific" and "distinct disease."[277] Subsequently, Rankin, in close cooperation with an RCAMC researcher Captain G.H. Hunt, concluded that "once recognized there is little difficulty in separating this malady from those infections with which it was first confused." Their progress was encouraging. Still, although it now had a name, as 1916 began trench

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[274] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, various entries during July and August 1915; LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of No.5 Canadian Mobile Laboratory for August 1915", p. 2.
[275] LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, 7 August 1915.
[276] LAC, RG 9, Series III, Vol. 3748, LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Interim Report on the Work of No.5 (Canadian) Mobile Laboratory, from the Date of its Opening until December 31st, 1915", p. 6.
[277] MacPhail, *The Medical Services*, pp. 235, 236, 262; and Nicholson, *Seventy Years of Service*, p. 88.

fever's aetiology remained a mystery. Until this was determined, nothing substantive could be done to prevent the disease. All agreed that further research was imperative.[278]

In lieu of a scientific explanation of the cause or causes of the "mysterious" trench fever, Canadian soldiers developed some theories of their own. In 1916, one Canadian officer serving in the trenches wrote to his family explaining that "the most common" sickness experienced by his troops was "something called 'trench fever'." The Canadian captain shared that this illness was "really a very bad chill caused by too much exposure to mud, water and rain", adding, "only men in perfect trim of physical condition can stand these things."[279]

In the spring of 1916, French military and medical authorities organized and hosted a precedent-setting conference, with the aim of exchanging "valuable information, in matters of preventative medicine and general sanitation, between the Allied Nations." Delegates from virtually all active allied nations attended the several week long "First Meeting of the Allied Forces Sanitary Commission." According to the sole Canadian delegate, Lt. Col. Nasmith, because the Canadian and Australian forces were "comparatively small parts of the whole British Army … the British delegates in practically all cases spoke for the whole." Due to the "confidential nature" of the meeting's report, a mere six copies were distributed among the other "British armies", two were sent to the War Office in London, and a single copy was provided to Nasmith,

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[278] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Interim Report on the Work of No.5 (Canadian) Mobile Laboratory, from the Date of its Opening until December 31st, 1915", p. 6..

[279] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 12 December, 1916.

which he then forwarded to the DGMS of the Canadian Contingents in early May 1916.[280]

Nasmith also sent the DGMS an accompanying summary along with the report in which he outlined his own thoughts and reviewed some of the more salient discussions and outcomes of the meetings. Nasmith's chief conclusions were that "[t]hough of great interest nothing very new came to light during the discussions; it is well to know, however, that we have not missed anything of great value, and that the methods used to maintain the health of the British Army are, in all cases, just as good, if not better than those in use in other Allied Armies."[281]

Oddly, although body lice had been scientifically identified as the vector for typhus years earlier and this had been confirmed in more recent tests on monkeys, there was still some discussion surrounding the cause of the deadly disease. Finally, there was a "general consensus of opinion of all the delegates was that typhus and relapsing fevers are conveyed from man to man … solely by lice." It was also concluded that because lice could live for nine days without a human host, it was also possible for "infected lice in trenches of one army to infect troops of another army occupying these several days later."[282] The inference that, with this knowledge, any belligerent could potentially use infected lice, and therefore typhus, as a biological weapon is clear.

Typhus was a paramount matter of concern among many of the delegates, especially those from Serbia and Russia. For their part, the Serbs had experienced

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[280] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission Meeting March-April 1916, cover letter.
[281] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, letter from Lt. Col. Nasmith to DGMS Canadian Contingents, 16 April 1916.
[282] LAC, RG9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 1.

horrible war-induced typhus outbreaks in Serbia in 1914 and 1915, which resulted in death tolls that were later conservatively estimated to be in excess of 100,000 people.[283] Russia had for decades been all too familiar with typhus epidemics wreaking havoc on its inhabitants. Presently, both nations were also trying to cope with "tens of thousands of refugees" who were living under conditions of "appalling misery." Contagions, especially typhus, were easily transmitted in such conditions, and they were extremely concerned about cross-infection between their civilian populations and their armies.[284]

In his summary, Nasmith stressed that "the statement 'No Lice No Typhus' holds good" and accordingly, "the war against Typhus Fever is a war against lice." Admittedly, he continued, this was "is no easy matter even in camps, where baths and disinfecting apparatus are readily obtainable", but for the Russian and Serbian armies, who had lost all their bathing, laundry and disinfesting facilities during their rapid retreat from the German and Austrian forces, "it was practically impossible to control the spread of lice at all."[285] Interestingly, ANZAC forces also found it logistically impossible to practice large-scale louse disinfestations during most of the ill-fated chaotic Gallipoli campaign and therefore "the routine method of hand picking had to be resorted to" exclusively.[286]

Various chemical methods of lice control in the allied armies were also discussed, by the first Sanitary Commission, in particular Naphthalene-based products, some of

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[283] Macpherson, *Diseases of the War Vol. 1*, p. 136.
[284] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 2.
[285] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 1.
[286] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 2.

which were reported to have "a certain value.."[287] Clothing disinfection was shown to be a developing science, with some nations experimenting with steam, hot air, and/or chemical solutions such as sulphurous (sic) acid. It was agreed that all these methods appeared to hold "value."[288]

Nasmith also came to the conclusion that the available lice-borne disease statistics were "of little value", largely because of the simultaneous appearance of a number of "various epidemics" (including typhus fever, typhoid fever, and influenza) occurring on some of the fronts which made proper diagnosis extremely difficult if not impossible.[289] He added that the catch-all diagnosis for *all* pyrexia appeared to be typhoid.[290]

The most significant outcome of the Sanitary Commission meetings was the agreement to form a permanent central committee, based in Paris. This organization was to work as an information collection and clearing house, "such information being of a nature to assist in maintaining or improving the health of the allied armies."[291]

A salient lesson to come out of the Commission meetings was evident. In order to protect themselves from experiencing on the Western Front the debilitating and disastrous effects of typhus befalling eastern Europe, all British armies would have to renew their efforts to declare war on, and destroy, the louse. It may be an old and hackneyed phrase, but the old erudite adage "Know thy enemy" was certainly applicable

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[287] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 1.
[288] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 2.
[289] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 2.
[290] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, pp. 2-3.
[291] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Vol. 1, letter from Lt. Col. GG Nasmith to DGMS Canadian Contingents, 16 April 1916.

in this case. This had not been lost on the British and they had already made steps to gain intelligence and put this strategy to work. It is unclear exactly when someone was assigned to conduct this investigation, but it is very clear that the "right" person was selected.

Before joining the RAMC, Lance-Serjeant A.D. Peacock had amassed impressive *bona fides*, holding a position as Entomologist to the Government of Southern Nigeria and, immediately before the war, had also been a lecturer in Zoology at the University of Durham. Peacock researched, assembled and wrote what is likely the first thorough study of the body louse by any military organization. His comprehensive and well documented report, titled "The Louse Problem at the Western Front", was completed in 1916.[292] It now gives us many fascinating insights into the louse and its relationship with the Canadian and other British armies, and importantly, it also describes the state of anti-lousing procedures being used in early 1916.

Peacock was unambiguously passionate about his subject. His respect, if not outright adoration, is well demonstrated in his prose-like description of the louse, an insect he declared had "beautiful musculature and the strong claws and spines of the legs (which) are admirably adapted."[293] After beginning his report fully outlining the physical characteristics of lice, the entomologist explored the louse's feeding and breeding practices, confirming that in general body lice had an affection for inhabiting areas

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[292] LAC, RG 9, Series III, Vol. 4512, Sanitation Reports, Folder 4, File 15, "The Louse Problem at the Western Front" by Lance-Serjeant AD Peacock (RAMC), His Majesty's Stationary Office, London, 1916. , distributed for distribution by Canadian Corps HQ on 5 December 1916.

[293] "The Louse Problem at the Western Front", p. 10.

"where there is plenty of warmth, plenty of humidity and plenty of shelter."[294] Accordingly, he explained the laying of eggs took place in virtually any piece or part of clothing, although most lice had a distinct preference to lay nits in seams located at or near trouser forks, armpits and shirt-tails. These areas would become veritable verminous nests for the nits on most soldiers, although, as Peacock described, in some particularly acute cases of infestation, body louse eggs had "even been found in the beads of rosaries."[295]

Peacock also quantified the term "lousiness" and determined the average lousiness of British soldiers. To this end he examined hundreds of men, most of whom had not bathed in two to four weeks. This sample was spread over ten infantry units that were located in various front line areas, mostly from the trenches. Painstakingly counting every louse and nit found on the soldiers, their clothing and possessions, an unenviable and distasteful job by any measure, Peacock was able to make some basic conclusions concerning lousiness. First, only five percent of the men examined were *not* infested with body lice. Of the remaining ninety-five percent that were infested, each man had an average of twenty body lice, the "average lousiness" variation being between ten and thirty, although some soldiers had many more.[296]

The British entomologist also identified some "extreme" cases of lousiness. Nearly five percent of the entire sample had lice counts of between 130 and 350 each and nearly another three percent were hosting over 350 adult lice per man.[297] In the latter group were individual men with 376, 400, 552, and 895 body lice. Peacock also mind

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[294] "The Louse Problem at the Western Front", p. 3.
[295] "The Louse Problem at the Western Front", p. 10.
[296] "The Louse Problem at the Western Front", p. 17.
[297] "The Louse Problem at the Western Front", p. 16.

bogglingly found one soldier's shirt alone "held 1,355 lice and 4,260 eggs, while another showed 10,428 lice approximately, and 10,253 eggs approximately"![298]

Lousiness, Peacock expounded, was not confined to the trenches, nor to trench infantrymen, although this group was the most prone to becoming hosts to the six-legged pests. For instance, twenty men of the Royal Field Artillery, living in billets, who had the advantage of bathing and changing once a week, still showed an average of just under four lice each. Peacock also identified what he called a "most interesting case", a group of railway engineers billeting in a single large room. They, like the Royal Field artillerymen, bathed and changed once per week. Despite being located fairly close to the front for three months, "not a single louse was found upon them. It is suggested, by the nature of the work among oil, that this factor attributed the freedom from the pest."[299]

In an attempt to get a handle on individual de-lousing practices in the trenches, Peacock studied the "self-searching" habits and results in a division that had served in two parts of the line, "their average spell in the trenches" having been approximately twelve days. Virtually all those soldiers interviewed reported they had to pay "daily attention" to "seam squirrels", lest he risk having the lice get completely out of control. The "average daily catch" for each of these soldiers was between eight and nine.[300]

Many of the soldiers interviewed in the course of the entomologist's investigation insisted that the trench dug-outs may have provided some level of protection from

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[298] "The Louse Problem at the Western Front", p. 17, 18; At first glance Peacock's findings in these extreme cases may seems preposterous, but it is indeed within the outer realms of possibility. One child in a recently published scientific study was reported to have had 2,657 adult head lice as per Rick Speare, Deon V. Canyon and Wayne Melrose, "Quantification of Blood Intake of the Head Louse: *Pediculus humanus capitis*", *International Journal of Dermatology*, Vol. 45, (May 2006), p. 543.
[299] "The Louse Problem at the Western Front", p. 18.
[300] "The Louse Problem at the Western Front", p. 18.

incoming German shells, but using them was made even more unpleasant as the accommodations were, the men argued, nearly always "swarming with lice." Peacock reported that this perception was so widely held that "the word dug-out was rarely used in regular conversation without the addition of the prefix 'lousy'."[301] Ever the committed scientist, Peacock sought quantifiable evidence supporting the premise in an effort to determine just how "lousy" the dug-outs, with their "unenviable reputations", actually were.[302] His findings were surprising. During his thorough examination of thirteen disreputable dugouts, at one hour for each, Peacock found not one single living louse. Based on his results, he concluded: "it is not denied that lice may be present in dug-outs, but these play a minor part in habouring and disseminating of the parasite."[303] The common belief that billets and bivouacs, the other living places near the trenches, were sources of infestation was also proven to be frequently exaggerated.[304]

Another common conception held by many soldiers and officers was that blankets were especially prone to lousiness. Blankets were very frequently shared, especially in the trenches and, not surprisingly, many were neither particularly clean nor pristine. The careful inspection of a large sample, yielded an average of just one body louse per blanket. "In sporadic cases", Peacock observed some blankets that were "exceedingly verminous", these holding as many as sixty or more lice. The number of lice in the blanket was "always … correlated with the fact that the men using them were very unclean." Still, Peacock concluded that in general blankets were of "minor importance as

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[301] "The Louse Problem at the Western Front", p. 19.
[302] "The Louse Problem at the Western Front", p. 21.
[303] "The Louse Problem at the Western Front", p. 19.
[304] "The Louse Problem at the Western Front", p. 21

harbours and centers of dissemination."[305]

Peacock also correctly deduced that, compared with a nice warm human body, straw held little appeal for body lice. So, although some of the pests may have been found in the makeshift straw and straw-filled paillasses soldiers slept in at and near the front, serious infestation of these beds and bedding material was unlikely. Similar results were found after examination of soldiers' kit. Thus, Peacock was able to establish empirically that although there were many possible sources of lice dissemination, by far the most frequent were infested soldiers and their clothing.[306]

Next, Peacock focused his attention on the subjects of body louse prevention and destruction, two aims that were mutually inclusive. The British and Canadians were already employing three general strategies to accomplish vermin prevention and destruction: insecticide (or "verminicides"), personal hygiene (more specifically, bathing), and disinfection of clothing. Peacock set out to assess the merits of each of these general approaches and the effectiveness of the armies' anti-vermin procedures and practices.

Most insecticides are designed to perform one or both of the following basic purposes. The first goal is to have an effect on insects and larvae that are present, either to "kill or cause to evacuate." The second aim, is to have a deterrent or repelling effect on subsequently arriving insects. "The Louse Problem at the Western Front", contained the allies' first comprehensive study into the effectual value of various insecticidal compounds available to *some* of the Canadian and British armies in and near the trenches. To this end, Peacock embarked on an ambitious program of testing the various substances

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[305] "The Louse Problem at the Western Front", pp. 19-20.
[306] "The Louse Problem at the Western Front", pp. 19-20.

then in use.[307]

In early 1916, the primary product in use by Canadian and British soldiers was NCI Powder, which was 96 percent Naphthalene and two percent each of creosote and iodoform. Peacock had high praise for this "speedy killing agent" and effective insect deterrent, which he determined was 'undoubtedly … the best all-round insecticide tested" for use on clothing, kit and living areas. Although a valuable tool in the Allies' anti-lousing arsenal, NCI users had to be careful not to become over-exuberant as "a too free use of NCI, particularly at the fork, causes severe smarting."[308] Clearly, louse prevention could sometimes be as onerous as the lice themselves.

Vermijelli (or Vermigelli) Ointment was judged by Peacock to be a good topical deterrent to lice. Unfortunately, its composition is not described. Another effective louse killer and repellent was a preparation called Crude Oil Ointment. Simple, yet effective, it was concocted by adding four ounces of crude oil tar to two pounds of melted soft paraffin wax. The most effective thing, Peacock determined, was using NCI in combination with the ointment applied at the trouser fork and all seams and the powder liberally dusted thorough the trousers and shirt. In trench experiments, the entomologist reported, one application of this combination maintained its efficacy for anywhere from three to seven days.[309]

Some products in use, some in limited use, did not make the grade as far as Peacock was concerned. Mercury Ointment, variously called blue unction, blue ointment, or navy's butter, was mercury mixed with soft paraffin. Its toxic qualities, on

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[307] "The Louse Problem at the Western Front", p. 22.
[308] "The Louse Problem at the Western Front", p. 23.
[309] "The Louse Problem at the Western Front", p. 23.

parasitic vermin anyway, was impressive. The trench environment, however, tended to make it "unusable, and in some cases, noxious." White Mercury Powder, its exact composition unspecified, and sulfur-based products were all found to be ineffective. The latter Peacock dubbed as "complete failures."[310]

Peacock recognized in "The Louse Problem at the Western Front", that bathing and clothing disinfection, the final two facets of large-scale anti-louse destruction and prevention measures were inter-related and mutually dependant – if the louse destruction was going to be effective in the long-term. A "shower-bath" would generally free the troops' body of any body-lice, but what was the use of this if they then dressed in infected clothing? Re-infestation was guaranteed to occur within minutes. Laundering clothes may have killed or washed away some adult body lice and nits, but a proper disinfection of that clothing had to be performed to ensure that virtually all the crawling vermin and, as importantly, the nits were destroyed.[311]

Peacock deemed it should be the role of what he termed "Divisional Baths" to accomplish the entire vermin cleansing process by accordingly having the bathing and disinfecting laundering take place in a controlled, well-organized and timely manner. Three processes were required at these purpose facilities: "bathing, the issue of clean underclothing and the disinfection of the outer garments."[312] Acknowledging that the first two aims were relatively easy, especially when compared to "the latter which is more difficult to accomplish, without which the first two are of little value."[313]

Indeed, it was the disinfection process that created bottlenecks in the entire

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[310] "The Louse Problem at the Western Front", p. 24.
[311] "The Louse Problem at the Western Front", p. 17.
[312] "The Louse Problem at the Western Front", p. 25.
[313] "The Louse Problem at the Western Front", pp. 25-29.

system of "delousing." Peacock was critical of the existing steam and gas disinfectors then in common use, judging them to be too slow – they simply could not work anywhere remotely near the optimal or practical rate of bathing. Experimentation carried out at some divisional baths of non-steam related apparatus included boiling infested clothing. This had provided results that appeared to be promising initially, as boiling shirts in plain water for at least five minutes killed lice and nits were rendered unable to hatch. However, keeping this water at a high enough temperature and circulating effectively throughout the items being washed made large-scale application impractical, especially in the field. Soaking clothing in various water-based solutions, including Cresol and Chloride of Lime for periods of twenty-four hours was "effective", although Alum mixes were reportedly a "total failure."[314]

The essential problem was that crawling lice were relatively easy to destroy with basic laundering, but killing nits was a different matter. After experimenting with various chemical solutions and other methods, Peacock decided that given the available equipment that "Ironing with a hot iron [was] the most practicable scheme", adding, "[t]his is a slow process but one of cardinal importance <u>because it determines the rate of bathing</u>."[315] Applying the principles of scientific management to the problem, which the entomologist tested and measured repeatedly, he determined that if every man in a division was to visit the bath once every fifteen days, then forty ironers would be required at each facility.[316] He anticipated that using local female civilian labour to do the ironing

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[314] "The Louse Problem at the Western Front", p. 24.
[315] "The Louse Problem at the Western Front", p. 25, (emphasis provided in original).
[316] For instance, the establishment strength of an average division in 1916 was 19,200 men. If each soldier was have a fifteen minute bath, once every fifteen days, and the facility was in full operation for an expected eight hours per day, then forty men would

was a feasible idea. Besides being readily available to work, these civilians could be paid just three francs per day, which he deemed was a reasonable and relatively inexpensive remuneration rate by the standards of the day.[317]

Until a more practical method was developed, large-scale disinfection of Allied soldiers would rely on three inter-dependant tactics. Bathing would kill lice and nits on men. Basic laundering, coupled with the thorough ironing of the clothing, would adequately stave off, or at least minimize, the re-infection of the men from the clothing they donned after leaving the bath. Over time, Peacock calculated that as the overall degree of infestation would be slowly eroded, resulting in an increase in the ironing rates, even more soldiers could be processed through each Divisional Bath on a daily basis.[318]

Still, Peacock recognized that having adequate disinfection facilities and processes in place was not a guarantee that the army being louse-free would necessarily follow. As nearly every soldier was a potential carrier of the prolific vermin, all the military and support personnel at the front had to accept the entire scheme and submit to the treatment themselves. Considering the potential personal "pay-off" of living without the inconvenience and discomfort caused by vermin, one might expect that this concept would be an "easy sell" to all the troops. And it was – to a large, but certain, degree.

Encouraging most of the rank and file to embrace anti-louse strategies was like "preaching to the choir." After all, the majority of soldiers openly declared their utter

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pass through every quarter hour, requiring forty ironers. He calculated, as it took ten to twelve minutes to iron "the tunic, trousers and cardigan jacket of each man", the "number of ironers must equal the number of bathers per quarter hour.", "The Louse Problem at the Western Front", p. 25.

[317] It is unclear if Peacock thought females were preferable to males because of a shortage of male labourers, that women could be employed at a lower rate of pay, or if he somehow felt that women were better suited to perform this type of work.

[318] "The Louse Problem at the Western Front", p. 25.

disdain for the lice, some even claiming they were nearly driven insane by the corpulent, seemingly insatiable and tenacious little blood-suckers.[319] The potential of finding relief, especially permanent, from the discomfort of lice was a welcome notion for this group.

Peacock found that many soldiers reported being "lousy" seemed much worse at night, due to fewer distractions, when " … the crawling of the insects, their sharp stabs, the itchiness of each tiny wound and the fierce desire to scratch become intolerable. As one man said, 'you felt as if you could drive yourself to pieces'. Sleep, at best, is broken and uneasy, but is usually impossible. Consequent upon loss of sleep, impaired vitality and mental weariness become very real miseries to the soldier … ."[320]

Many hygiene-minded individuals, including Peacock, seemed stymied and mystified by the readily apparent lack of concern some men – albeit a small minority – had when it came to lice. The reasons for these incidences of indifference and outright apathy varied widely. Some men, of all ranks, simply had strong aversions to practicing basic personal hygiene, shirking bathing or changing whenever and wherever possible.[321] Others, who were more concerned about other obligations than something they deemed as relatively unimportant as hygiene, claimed these other duties precluded their visiting the baths or ensuring that they took the time to ensure that their outer clothing was ironed.[322] One Canadian captain claimed that he and his fellow officers would have liked to "go out" more frequently for bathing, but they "don't like the idea of leaving the

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[319] "The Louse Problem at the Western Front", p. 21
[320] "The Louse Problem at the Western Front", p. 15.
[321] "The Louse Problem at the Western Front", p. 21.
[322] "The Louse Problem at the Western Front", p. 21.

section."[323] Even more inexplicable, a very small minority of men simply felt they were not bothered in any way by lice. Peacock disdainfully observed that even in cases of infestation, some soldiers did not feel any discomfort at all was created by the hitchhikers, adding "such men … always believe themselves to be clean, and generally declare it aggressively."[324]

Winning the hearts and minds of its soldiers to wage war on lice would be a more difficult task than one might suspect. The military, more specifically the army's medical and sanitation proponents, would constantly be combating persistent myths, rumours, general ignorance and even social mores. As in the larger societies which they served, some soldiers were reluctant to show or admit that they were infested. Decades after the war, prevailing thought in some contemporary parts of the general population actually held "the belief that the presence of lice is a sign of health; this takes the form of such tags as 'You're not healthy, you've no nits' ." Another long-term popular misconception was that body lice did not hatch on or near humans, but somehow arose "by spontaneous generation from dirt." One British writer also observed that some groups of people continued to cling to the notion that "certain" individuals were "breeders." It was believed that these "breeders" extruded lice from their skin and that absolutely "nothing [could] ever be done to stop this process."[325]

Erroneous theories were not the monopoly of the uneducated. During the war, one reputed scientist reportedly suggested that he had found some evidence that " the different-coloured races of men have lice coloured to match", with so-called "black lice"

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[323] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 2 January 1917.
[324] "The Louse Problem at the Western Front", p. 20.
[325] Smart, *Lice*, p. 17.

accounting for about five percent of the louse population, the rest being "grey" or "white."[326]

Lice outbreaks and infestations would sometimes be reported by well-meaning, but mistaken soldiers and even medical officers. To the inexperienced or untrained eye, many of the insects inhabiting the trench environment at "first and casual glance may be easily and erroneously identified as lice." One type of crustacean that was more often than not co-inhabiting the trench dugouts was often thus falsely accused, a situation hardly helped by its common name – the wood-louse. Some varieties of mites and "springtails", a type of beetle, could, in the dank and dimly lit dugouts, be easily misclassified as lice, especially since these insects had a distinct predilection for the tiny crumbs of food that would collect on the ground and floors.[327]

Peacock correctly surmised that education was the best weapon to combat mistaken assumptions and myths about lice and their habits. Certainly, the control and maintenance of infestations were not guaranteed with knowledge and the changes of attitude that might follow. Still, such a goal would be rendered virtually impossible without these shifts. Accordingly, the entomologist recommended that lice related "Instructional Work" be immediately implemented throughout the ranks and in every unit deployed in or near the front lines. The aims of these lectures and accompanying leaflets, he proposed, were "the presentation of the true facts with regard to the pest, recommendations for dealing with it, and most importantly, *to foster the idea that it is not*

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[326] Oddly, although he concluded that "black and "grey" body lice were indeed members of the exact same species, Peacock still did not dismiss this theory out-of hand, "The Louse Problem at the Western Front", p. 3.
[327] "The Louse Problem at the Western Front", pp. 9-10.

by any means impossible to bring the parasite under."[sic] [328]

Indeed, the need for education regarding pests in general had been amply demonstrated in the preceding year, by none other than the War Office itself. One Canadian MO had reported to the ADMS that there existed a great deal of confusion over anti-vermin chemicals caused by a leaflet issued by the War Office in June 1915 titled "On the Prevention of Infestation by Lice." The use of the topical Naphthalene Powder (or NCI) and Vermigelli Ointment was promoted. However, the two products were to be used in conjunction in order to be relatively effective – a fact not clarified in the leaflet – leading the MO to advise his HQ that "it seems desirable that this information should be communicated to units to prevent misconception and to ensure the proper application of the remedies."[329]

The issue of controlling the body louse was not simply a concern over the comfort of the troops, Peacock concluded in "The Louse Problem at the Western Front." Combat readiness, he contended, was being negatively and significantly affected by lousiness. Besides the distractions suffered by infested soldiers, striations caused by scratching made a person much more susceptible to contact a plethora of pathogens and parasites, ranging from the relatively benign "louse-rash", to impetigo and scabies and, in severe cases, even sepsis.[330] His greatest fear was that the military must never lose sight of the fact that lice could potentially be army killers, as they could carry "the menace of typhus."[331] His concerns were well-founded as louse-borne typhus was at that very time

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[328] "The Louse Problem at the Western Front", p. 25-6, (emphasis provided in original).
[329] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS 1st Cdn Div, letter from ADMS (Sanitation) to Headquarters France, 2 October 1915.
[330] "The Louse Problem at the Western Front", p. 15.
[331] "The Louse Problem at the Western Front", p. 15, (emphasis provided in original).

rapidly thinning the ranks of Britain's Serbian and Russian allies, reaping more death than German and Austro-Hungarian guns.

Yet, the most important recommendation made by the erudite NCO was informed by his recognition of the military importance of winning the war against the louse and his finding that voluntary, "regular and persistent" compliance with de-lousing and anti-louse procedures could not be relied upon. Accordingly, if the war on the louse was to be won, it was absolutely crucial that supervision and enforcement would also be brought to bear. Peacock's suggestion was not entirely novel or unique, but it was overtly stated and well supported. "Company officers", he argued, "should see that their men take the necessary precautions against the pest" and that these officers, or their medical officer, should conduct a general inspection of their troops "at least once a week." Additionally, more frequent "special attention", he suggested, had to be given to "men of known unclean habits."[332]

Practicality was also a cornerstone of Peacock's scheme. There was little doubt, the entomologist deduced, that anti-lousing work was much more feasible in rear areas than at the front lines. The closer a soldier got to the trenches, the greater the reliance on insecticides, since having effective bathing and laundering regimens was exceptionally problematic when the required facilities and its users were within striking distance of the enemy's guns.[333] This conclusion simply underscored the importance of developing and distributing much more effective and usable anti-lousing agents. To accomplish the former task, Peacock suggested to his ranking superiors that research centers, under the control of a specialist, be established in each army. Each of these centers would be

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[332] "The Louse Problem at the Western Front", p. 28.
[333] "The Louse Problem at the Western Front", pp. 28-9.

charged with studying almost exclusively issues related to lice control, especially insecticide development and testing.[334]

Peacock closed "The Louse Problem at the Western Front" with a succinct conclusion. The two "matters of cardinal importance" were that an explicit "plan of campaign" had to be formulated and that plan had to be "followed up vigourously by the work of proficient men." He had determined that in essence the louse problem was "not so much a problem of pure science as one of common-sense management."[335]

When a limited number of copies of Peacock's comprehensive study were distributed among the upper echelons of the allied armies, including the Canadian, it was determined that its sheer size and scope would have lent itself to not being readily read, much less inclusively reviewed, by more junior officers. Accordingly, the RAMC immediately produced a six page document titled "Campaign Against Lice."[336] Like some similar and subsequent products, "Campaign Against Lice" not only borrowed heavily from, but reproduced verbatim many sections originally produced by Peacock in "The Louse Problem at the Western Front." A single copy of the "new" summary was first received by the ADMS of the Canadian 1st Division in early April 1916.

Interestingly, as its title suggests, the language and tone of "Campaign Against Lice" seems to militarize the problem, making the eradication and/or control of lice a crusade-like quest. Lice were personified, imbued with having human-like traits and habits one might expect to find in the wartime stereotyped "Hun", such as "wandering

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[334] "The Louse Problem at the Western Front", p. 25.
[335] "The Louse Problem at the Western Front", pp. 28-9.
[336] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS Cdn 1st Div, folder 4, file 15, "Campaign Against Lice", undated but received by DDMS on 4 April 1916. p. 1.

about in a characteristically devious fashion."[337] Lice were effectively declared an enemy of civility and forward-thinking modernistic society.

The document illustrates that further field experimentation with, and analysis of, various anti-louse insecticides appears to have taken on new importance in early 1916. The authors reported that "many proved and excellent remedies (to lousiness) such as NCI , vermigelli, mercury ointment, and various essential oils" were "known", but then conceded that the widespread practical use of many of these insecticides had never been achieved. Reversing this problem in the foreseeable future was far from likely due to logistical issues, related to not only availability but also "on the score of expense." The vermicides most commonly available in and near the front lines, Oxford Powder and Oxford Grease, were of "little use", mainly due to their "objectionable character, being extremely black and dirty looking." The authors of "Campaign Against Lice" concluded that in "the present situation … no radical insecticide exists at the front."[338]

Overall, "Campaign Against Lice" echoed, in a summary manner, many of the themes explored in Peacock's seminal work, especially the call to see that Company Officers and/or medical officers "*should*" see that their men complied with proven methods of controlling the problem, including overseeing the distribution and correct use of insecticides.[339] Clearly, although by the spring of 1916 the evidence pointed to the contrary, there remained no clear policy related to enforcement of anti-louse policies, nor

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[337] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS Cdn 1st Div, folder 4, file 15, "Campaign Against Lice", undated but received by DDMS on 4 April 1916. p. 1.
[338] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS Cdn 1st Div, folder 4, file 15, "Campaign Against Lice", undated but received by DDMS on 4 April 1916. p. 4. (circa 1916)
[339] LAC, RG 9, Series III, Vol. 4542, Sanitation (Reports), ADMS Cdn 1st Div, folder 4, file 15, "Campaign Against Lice", undated but received by DDMS on 4 April 1916. p. 6.

was it clearly known or stipulated who was responsible to see that these policies were enforced. No one individual or group was formally charged with taking command responsibility.

Certainly, the louse problem was neither moot nor a matter of minor military significance. Denying that body lice posed a deadly and serious risk to the allied armies on the Western Front was an untenable position to maintain in the face of mountains of scientific evidence. By May 1916, it was the general consensus among the western allies that typhus was "conveyed from man to man … solely by lice."[340] Still, a directive regarding responsibility for maintaining adequate anti-louse measures was to remain wanting throughout the remainder of the year. Not surprisingly, the problem of louse infestation among Canadian troops remained as well. Formerly well rested recent arrivals to the trenches soon found that the entire issue of anti-vermin practices was far from academic, because by 1916 most of the soldiers recently arriving from "ol' Blighty"[341] were lousy within a fortnight of stepping one foot into the front lines.[342] Fortunately, the feared outbreak of typhus never occurred in 1916, but the discomfort caused by the lice continued.

Officer Claude Vivian Williams, known as "Billie" to his family and friends, joined the 86th Infantry Battalion, CEF, in 1915. Soon after the unit's arrival in Britain, it was disbanded and after he was re-trained, he was re-assigned to the 6th Brigade

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[340] LAC, RG9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 1.
[341] In Canadian and British "trench slang", "Blighty" translated as "Britain." According to contemporary sources, the word Blighty was "said to be derived from the Arabic belad-i, meaning My Country or My Home."; LAC, RG 9, Series III, Vol. 5078, Unit Newspapers, Printed Material, *The Dead Horse Corner Gazette* (4th Battalion), No. 2, December 1915. p. 23.
[342] "The Louse Problem at the Western Front", p. 17.

Canadian Machine Gun Company and was deployed to the Western Front trenches. In one of his many descriptive and insightful letters home, Williams explained that finding relief from lice, even in 1916, was a difficult task for himself and his cohorts. Some soldiers would find themselves having to rely on their own devices, as the army was doing little to help them attend to even the simplest of their hygiene needs. Williams' batman, who had been in the trenches well before the Canadian officer's arrival, related that when he had been stationed near the Somme he had "gone as long as three months without a bath."[343] In November of 1916, Williams reported to his family that "… our little creeping friends are becoming rather too numerous to be comfortable now. We haven't had a bath for two weeks but I guess we can hang around for another six days, then back to billets and can have a good one."[344] The situation improved little for Williams and his charges in the ensuing months, with it being "almost impossible to get completely rid of [the lice]", especially when a bath could be expected just once every twenty-four days.[345]

To mitigate the seriousness of the infestations, Williams explained that one of his fellow officers was using some "vermin proof underwear", which he wore under his existing underwear. According to Williams, this "special" underwear was "made of some cheap cloth washed in some chemical, from his mother." Fortunately, Williams happily

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[343] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 18 November 1916.
[344] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 26 November 1916.
[345] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 2 January 1917.

added, "he shares his supply with me"![346]

Williams' letters clearly illustrated he was not only one not to "protect" his friends and family from the truth, but also that he had a strong stoic character, a well-developed sense of pride, and was not prone to hyperbole. For instance, he related that "[i]t is at first an awfully nasty sensation to feel them [body lice] crawling over you", "but like everything you get used to it."[347] Morale, he reported, remained excellent, despite the discomfort caused by infestations. He spoke highly of his men in his unit, relating that unlike those officers in other units that had to "molly coddle them like so many children", in his unit "you never ask for complaints here because you will never get them … they are real soldiers."[348] As testament to the resilience of some Canadian soldiers he later wrote, "[w]e are not grumbling because we are much better off than some in other parts of the line. We have lots to be thankful for … and grin and bear these things." Poignantly, Williams also observed that "[I]t is impressing too how soon one becomes used to conditions that would be shuddered at in civil life."[349]

As Williams and his fellow machine-gunners coped as best they could, No.5 Canadian Mobile Laboratory and A.C. Rankin continued their tireless efforts to understand trench fever, in particular the mysterious disease's aetiology. One of their fellow Canadians, a Major Strathy, medical officer in the CAMC, was wrestling with weighty issues of his own. Given the nature of their work, medical unit personnel were

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[346] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 18 November 1916.
[347] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 18 November 1916.
[348] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 6 November 1916.
[349] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 2 January 1917.

frequently exposed to all varieties of pathogen and a half dozen of Strathy's orderlies had recently been afflicted by influenza – or so it was initially thought. Strathy recorded in his personal diary in June 1916 that these cases of "influenza" victims were in fact "probably cases of so-called 'Trench-Fever' … (seemingly) a very definite disease." The symptoms, he observed, defied standard clinical diagnosis, with "fever, very variable in duration, seldom very severe, but frequently relapsing and prolonged. Pains in the legs and back, and headache, [were] the most marked subjective symptoms" among all those with trench fever and the worst cases had palpable swollen spleens. Microscopic blood sample analysis confirmed uncommonly elevated white cell counts were present in the latter group. The Major added that "convalescence is often very slow, and pains in the legs and weakness marked and prolonged."[350]

Meanwhile, owing to the dogged determination of the CAMC's very own Major L.A. Starkey, then the chief Sanitary Advisor for the DMS of the CEF, arrangements were made in October 1916 to conduct the instruction in sanitation for Canadian Medical officers in the Overseas Forces. With the aid of several of Britain's foremost experts in the field of hygiene, the six day course was designed to deal exclusively with sanitary concerns and conditions found in the field.[351] The classes were conducted in the United Kingdom at existing facilities that had previously only been available to the RAMC, including the Royal Sanitary Institute, the Royal Military College-Millbank, and at the Duke of York's Training School where there existed full size models of Sanitary

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[350] LAC, RG 9, Series III, Vol. 3752, file 3-1-1-14, Trench Fever, personal diary excerpt, 8 June 1916.

[351] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Instruction in Sanitation for CAMC Officers", 11 October 1916.

installations currently in use on the Western Front.[352] The course was made available to the Canadians on the condition that "classes for the Canadians should not interfere with the RAMC work being carried out."[353] It was estimated that allowing for the availability of medical officers twenty per week was likely, whereas the teaching facilities could easily accommodate up to forty to fifty per week.[354]

Effective and practical education and training were cornerstones of medical and hygiene professionals. It was also recognized that the sharing of information, research results and experiences with other allies was an essential asset for the health of the corporate body of an army. The value and efficacy of these practices, so well demonstrated in 1916, motivated further cooperation among the Allies the following year. Evidently, as this chapter has shown, cooperation offered the potential to help the Canadians to eradicate or at least control the problem of lice. Certainly in 1916 infestations were being addressed to a greater degree than they had been in the previous year by the Canadians. Still, until solutions were properly and effectively implemented the lice would remain, as would the known danger posed by typhus. Such was the situation as the third year of the war began.

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[352] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Instruction in Sanitation for CAMC Officers", 5 October 1916.
[353] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Instruction for Canadian Medical Officers in Sanitation", 20 October 1916.
[354] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Instruction in Sanitation for CAMC Officers", 11 October 1916.

CHAPTER FOUR

THE MERGING OF THE CAMPAIGNS AGAINST LICE AND TRENCH FEVER

Early in 1917 the Second Full Session Sanitary Conference of the Allied Powers took place over a three and one half week period. In attendance were delegates from Belgium, France, Italy, Japan, Portugal, Rumania, Russia, Serbia, and Great Britain, including Canada's own representative, Major J.A. Amyot, the Advisor in Sanitation for Canadian Contingents Overseas.

Like the first such meeting the year before, topics of discussion included all matters relating to hygiene and sanitation, especially "front-line" concerns. On the subject of "new or apparently new affections (also exotic affections) observed in the course of the war", the main item of dialogue was trench fever.[355] The French delegation opened the discussion with a brief series of comments, in which they explained that they were split into two opinions regarding the disease. One school of thought professed that trench fever was a modified form of dengue fever imported by "natives from Indo-China or elsewhere in the tropics."[356] Another group of French delegates argued that so-called trench fever was nothing unique, but rather a type of phlebotomous fever (more commonly known in the present day as sand-fly fever), which was endemic in many parts

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[355] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 7.

[356] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 7.

of France.[357] The French medical authorities did not present any evidence to support either claim and, in any case, their explanations did not take into account many of the unique symptoms presented by those afflicted by "trench fever", nor the fact that both dengue and sand-fly fever were known to be transmitted by insects that were generally dormant during the winter months. As the meeting proceedings would later prove, the French positions suggesting that mosquitoes and sand-flies were vectors would become untenable. Although trench fever was present throughout the year, it seemed to flourish in the late fall and early winter, being correlated with the onset of cold weather – the very times that mosquitoes and sand-flies were not even remotely present in or near the trenches of the Western Front.[358]

The British delegation was well prepared to discuss issues related to trench fever. Colonel Sir WB Leishman, an expert in bacteriology and a senior advisor to the RAMC, presented a paper on the disease, emphatically stating that the ailment was a major cause for concern to the British army.[359] In his introduction, Leishman spoke to the high wastage rates caused by trench fever. Though the disease was not fatal, it was

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[357] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 7.

[358] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 8; Although contemporary French sources insisted that mosquitoes carried the disease, British scientists had quickly eliminated these insects from their "suspect list" due to the time of year that trench fever seemed to flourish – late fall and early winter, p. 9.

[359] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, pp. 3, 8.

exceedingly "serious in that it incapacitates many men for a considerable time, four to six weeks, or even more."[360] It was further theorized that this "new disease" had apparently first appeared on and near the western European front and then spread to other theatres of war, such as the Balkans – brought there by soldiers re-deploying from France and Belgium.[361] Still, by early 1917, while trench fever was reported in many different locales, the greatest problems with the affliction appeared to exist on the Western Front.[362]

Importantly, the overall incidence of trench fever, Leishman added, was likely higher than had previously been recognized as the disease was likely being chronically under-diagnosed and misdiagnosed.[363] Contributing to the confusion around diagnosis was the fact that not all trench fever cases presented with a similar set of "striking" symptoms. For instance, while virtually all patients had pyrexia, two distinct fever types had been identified. The first was termed a "short attack", lasting about a week, followed by a brief dormant period and then another febrile period similar to the initial bout. The second fever type, called the "prolonged type", was more common in occurrence than the

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[360] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 8.

[361] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 8.

[362] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9.

[363] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 8.

"short attack." Those individuals afflicted with the "prolonged type" generally saw the first attack lasting for about "three of four days, but followed by three, four, five, or even six relapses at intervals from five to eight days."[364] Both types of trench fever patients suffered from virtually unvarying headaches and other striking pains in various parts of the body, very often in the lower legs. Leishman also reported that gastro-intestinal symptoms were generally not notable, other than constipation, which seemed to be nearly ubiquitous among all patients. Virtually none of the cases had skin rashes or discolouration. While the bacteriologist reported that most of the afflicted had elevated white blood cell counts, he expressly and tacitly stated that enlargement of the spleen was not present.[365] Interestingly, even though not acknowledged in his presentation, this latter observation ran counter to what had been seen by many medical field personnel before 1917.

Moving on to the aetiology of trench fever, Leishman dropped a bombshell. He proposed that although the "actual" causative agent of trench fever remained undiscovered, it was "most likely an infectious disease and probably transmitted through the bites of lice."[366] He continued, "everything seems to demonstrate that there is in the blood an undemonstrated virus, and that the infection from man to man is by the bites of

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[364] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, pp. 8-9.
[365] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9.
[366] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 8.

an insect or parasite." Moreover, he related that based on a great deal of recent experimentation, British scientists and technicians had "established without any doubt" that trench fever stemmed from infected blood and "everything seems to incriminate the louse" as the vector for this infection.[367] It was believed, based on the observations of numerous medical officers, that the incubation period was variable, but generally the onset of the disease was estimated to occur about twelve to fourteen days after exposure. Notably, Leishman shared with the delegates that several un-named officer-investigators in different locations went well above and beyond the call of duty by volunteering to become human guinea-pigs, each allowing themselves to be bitten by a louse that had previously fed on an afflicted patient. All but one of the three was stricken with trench fever within two weeks.[368] Although this particular sample size had some empirical short-comings that would make a responsible statistician wince, it did serve to help strengthen the case that lice were vectors for trench fever.

Next, the conference attendees moved onto discussion regarding the treatment and prevention of trench fever. Relating to the former, Canadian and British doctors found that given the information they had available, they could do little more than continue to treat some of the symptoms, whilst the disease ran its course. Experimentation with various substances that were normally used for other infectious diseases, such as Salvarsan and quinine among others, was attempted, rendering results "without

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[367] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9.

[368] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9.

appreciable effect or value." A French Army delegate remarked that "the production of profuse perspiration had an excellent effect on cases of trench fever", adding that in several instances he had found that "two or three sweats", produced by a combination of chemical means and the application of several layers of blankets, "brought the disease to a rapid termination."[369] The French claim of success in this regard is completely erroneous, as this treatment method was never proven to be reliable nor even replicated nor used by the French subsequently.

Prevention, Leishman proposed, was straight forward: "If the louse is responsible, then it should be attacked."[370] The British and Canadian delegation reported some conclusions regarding lice destruction that had been determined long before this meeting. First, that the chemical suppression of lice with insecticides was effective in theory, but "it had been found that for use on a large scale in the field they are impractical, owing to expense, to the difficulty of ensuring a regular supply and of educating men in their continued use." Secondly, because of these insecticide-related difficulties, it was more practical to rely on "frequent bathing, change of clothing and disinfection."[371]

As the Second Full Session of the Sanitary Conference of the Allied Powers came

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[369] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9.

[370] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 9, (emphasis provided in original).

[371] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, Proceedings of the Second Full Session of the Sanitary Conference of the Allied Powers, Paris, February 21st to March 17th, 1917–Report of the British Delegates and Delegate from the Overseas Dominions, p. 14.

to a close, it was becoming very apparent that trench fever was strongly suspected of either being caused or transmitted by lice. Further experimentation would be required to conclusively prove this theory, but the existing weight of evidence was clear. In any case, the so-called campaign against the louse on the Western Front had been given new impetus.

Fortunately for the Canadians, the anti-lice campaign had already taken on vigour in late 1916 and early 1917, motivated mainly by the desire to mitigate the danger caused by a possible outbreak of typhus. Moreover, some elements in the Canadian high command recognized that theory and policy may differ from, and did not necessary preclude, practice.

In early January 1917, the Department of Militia and Defence requested the CAMC produce a "report describing in practical detail the procedures which, by experience, have been found most serviceable in the matter of Camp and Trench Sanitation", stressing the importance of identifying and exploring the methods then "in actual use."[372] The examination was to focus mainly on issues related to mechanical "destruction of body vermin and disinfection of clothing and bedding, and construction of bath houses and laundries."[373]

Amyot, the CAMC's Consulting Sanitary Officer – Canadian Contingents, was charged with responding to the request for information from Ottawa. Amyot wasted little time delving into the task, providing a thorough reply within a matter of just a few weeks.

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[372] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, letter from Adjutant-General, Canadian Militia (Ottawa) to Canadian HQ – London (HQ 33-1-239), 9 January 1917; (emphasis provided in original).

[373] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, letter from Adjutant-General, Canadian Militia (Ottawa) to Canadian HQ – London (HQ 33-1-239), 9 January 1917.

Speaking to the operation of Canadian army laundries then in service near the front, Amyot concluded that in general these facilities left plenty to be desired, being too sluggish, with only the most seriously louse-infested sets of clothing being done.[374] By comparison, the Belgian armies had in use much larger disinfectors fed by massive stationary boilers, which allowed for much more efficient and effective processing of lousy laundry. Still, as Amyot explained, the comparison was not completely even-keeled, as "our boys are continuously on the move, the Belgian apparatus is too cumbersome and the boilers too heavy to be portable."[375] In general, at this particular time, shirts, under-clothing and socks were subject to disinfection and laundering, whereas great-coats, trousers and jackets were disinfected only.

Each division usually had one bath house and a laundry, located at or near the centre of the area occupied by the formation. When needed, small bath houses were set up for outlaying areas.[376] Sometimes existing buildings were used for these much needed ablution facilities. Breweries, replete with their large holding tanks and massive boilers, were found to be nicely suited and easily modified – undoubtedly much to the horror of many brew-masters and more than a few beer drinkers.[377] Yet, by early 1917, most Canadian Army divisional field laundries functioned in purpose-built buildings which were generally constructed of unfinished and inexpensive lumber, the exterior walls clad

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[374] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, Consulting Sanitary Officer – Canadian Contingents, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, pp. 1-2.
[375] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 2.
[376] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 3.
[377] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 4.

with tar paper, with corrugated iron panels serving as roofs.[378] Under most conditions, incoming clothing was first put through some sort of disinfecting (or delousing) process to some degree, typically in a steam or hot air chamber. Unfortunately, this process created serious bottle-necks in the system and the tools used to accomplish this disinfection were frequently wanting. After disinfecting was done – or not – the clothing was placed in large wash tubs. Locally hired women civilians took over the job of laundering at this point. These women, standing on duckboards for hours on end, washed each piece of clothing individually with washboards and a "soft soap." This soap was usually produced on site by boiling a concoction of bar soap, washing soda and water. The freshly washed clothing was then manually wrung dry by hand or by a roller-wringer and then hung to dry.[379] After it was dried clothes were sorted and folded.

Ironing, when it was attempted, was done not for the sake of aesthetics, but to destroy the integrity of the nits ever-present in the seams of clothing. If disinfection of the clothing had not been attempted or was poor before laundering, this ironing took on great importance. To accomplish the ironing task, local labourers would be hired or work fatigues comprised of the soldiers having their clothing processed would be formed. After ironing, a long and arduous process if it occurred, clothing material in need of minor repair, especially socks, was separated and sent to attached mending rooms.[380]

Located next to the laundries were the "bath houses", more correctly, the showers (or "shower-baths" as they were also known). According to Amyot, the experience

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[378] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, pp. 4-6.
[379] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 5.
[380] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 6.

gained in the first years of war had positively influenced the typical bath house design. In one Divisional bath erected in the Ypres salient in early 1917, water was supplied from a small dammed stream and pumped to a large overhead holding tank. The tank provided water for the bath, an attached laundry and as an emergency reservoir in case of a fire should break out in or near the divisional facilities. From there, water fed into two smaller holding tanks – one heated and one cold and subsequently piped to roof or wall mounted shower heads. Next to a changing room was a large shower room, which measured approximately twenty feet by twenty-six feet – room enough for forty men at a time, Amyot related. Like many other activities in the army, even in their ablutions soldiers enjoyed no privacy, as no cubicles or stalls were incorporated into the design. The bath house had sub-floors and ceilings made of corrugated iron, with duckboards providing the flooring.[381] Grey water from both the bath and laundry was subjected to basic purification process. After being drained by under-floor pipes, the waste water was redirected to holding tanks with a capacity of over 15,000 gallons, where it was treated with hypo-chlorite of lime and skimmed. The skimmed material was mixed with saw-dust and burned, then sand-screened and discharged. The remaining water was piped to a down-stream location and drained.[382]

Soldiers disrobed as a group, their soiled clothing dropped at the laundry, whilst they entered the shower room *en masse*. A single attendant was charged with the unenviable, inarguably thankless and unpopular task of regulating the shower pressure

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[381] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 4.
[382] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 6.

and temperature "to avoid wastage."[383] After showering, the group of soldiers then proceeded into an adjoining dressing room to dry themselves and be issued with a set of clean underclothes, shirt and socks; and then collected their newly sterilized – albeit un-laundered – jackets, trousers and greatcoats. According to Amyot, if the system worked as it should the entire routine took just under thirty minutes and "re-infection with vermin was thus avoided."[384]

Amyot recognized that the proper disinfection of soldiers and their clothing was not always accomplished. The biggest issue the Canadians found they had to overcome was related to the disinfectors. Unfortunately, during the first few years of the war the standard designs of disinfectors in use by British and Canadian formations had been proving themselves to be impractical and beset by numerous technical problems. The result was often predictable. Unless a soldier received a complete set of thoroughly disinfected clothing after leaving the baths, he would be re-infested in a short period of time.[385]

In 1915, lacking any type of disinfector whatsoever, the Canadian contingent was supplied with two main types of disinfectors by the British – the Clayton and the Thresh. Both designs were portable and the only disinfectors being used by the British themselves. The Clayton worked on the principal of gas disinfection, but was determined to be "very slow and impractical for active service", requiring an inordinately lengthy period of seven to eight hours per cycle of clothing. Thresh disinfectors used steam to

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[383] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 4.
[384] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 5.
[385] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 3.

accomplish the task of vermin destruction, but the capacity of the horse-drawn apparatus was relatively small. Most often, the steam produced for each cycle was inadequate, a situation not aided by a frequent lack of pressure. If it was not operated by a well-trained and vigilant crew, Thresh disinfectors were often packed to over-capacity, which hampered what steam was introduced to the closed compartment from circulating properly. Exacerbating all its other difficulties, clothing treated by a Thresh emerged from the apparatus in a wet state and would then have to be hung in a non-infested area and air dried – an extremely time consuming practice. In essence, the sheer volume of disinfection required by a modern army attempting to control wide-spread body lice infestations was far beyond the capacities of existing disinfectors in 1915.[386]

Soon after arriving in England and France, it became obvious to some Canadians that the Clayton and Thresh portable disinfectors were simply not up to the task at hand, being woefully inadequate, quantitatively and in particular qualitatively. Working independently, two of these Canadians acted upon their dissatisfaction and took it upon themselves to develop, design and build better disinfectors.

The first of these Canadian disinfectors, or "disinfestor" as some Canadians preferred they be called, was the brain-child of Captain (later Major) H. Orr, commander of No.3 Canadian Sanitary Section, who fabricated a unit at Shorncliffe Camp in England during the fall of 1915. Orr Huts, as they began to be known, used the principal of hot air as the method of louse and nit destruction. Orr experimented extensively in both Britain and France, tweaking his basic design and continually making improvements throughout the course of the war. He took his job very seriously and approached the construction

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[386] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 3.

and operation of his disinfectors with exacting zeal. By late 1916, he produced a comprehensive construction and operations guide for his 120 square foot floored and eight foot high apparatus. The accompanying materials list was painstakingly detailed, consisting of three legal size pieces of paper. Orr calculated that building a free-standing disinfection hut, required among other things, over one hundred sheets of corrugated iron, nearly 500 feet of wire and eighty-five pounds of various lengths of nails.[387]

The hot air for Orr's disinfestor huts were produced by coke-fed braziers in the foundation of the portable and highly mobile structure. These were covered by the hut's floor, which was made of corrugated iron. Small vent holes in this flooring allowed for circulation of the heat. Walls were thickly insulated, with a small window incorporated to allow an operator to observe the contents and a thermometer. Movable clothing racks, on a narrow gauged track, pushed through the building. Orr's disinfector could be up and running within twenty minutes of setting match to the braziers, when the internal chamber temperature rose to its normal operating zone of between sixty-five and one hundred degrees Celsius. In the latter half of the war, some Orr Huts could run without interruption, with one rack being loaded as another one was baked.[388] From start to finish, the uniforms and underclothing of up to one hundred soldiers could be treated in

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[387] Orr's attention to detail was impressive – certainly he would have been the envy of the most staunch advocates of Taylorism. His calculations were so exacting, as exemplified by his calculation, that "the average time taken to unload and load the chamber … was 58 seconds": LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General correspondence, 25-1-0, "Material Required For Building Disinfestor", H. Orr CAMC, undated, p. 1-3.

[388] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to AG War Office, 25 June 1918.

just thirty minutes.[389] Besides being rapid, Orr's method had the distinct advantage that it could be applied by soldiers that were isolated from disinfection facilities. For instance, a dug-out modified with a blanket sealing the entrance could be used to sterilize clothing when traveling was neither possible nor practicable.[390]

By the last year of the war, one sanitation expert proclaimed that the Orr Hut was such an effective and practical disinfector that "to control lousiness there is very little to beat it."[391] Many others obviously agreed, because Orr Huts also came into use at a wide variety of medical facilities ranging from Casualty Clearing Stations very near the front lines to hospitals located in Britain.[392] Additionally, by mid 1918, the Orr system was being employed in all of the Canadian Corps' four divisions, by many British Armies deployed on the Western Front and throughout the world. It was deemed so successful that it was "adopted by HQ for use throughout the Army."[393]

Another successful Canadian in the field of disinfector design was J.A. Amyot. Amazingly, the Canadian sanitation expert found time away from his myriad of other pursuits to develop a range of effective de-lousing equipment. Amyot was no stranger to disinfectors when he arrived in Britain with the CAMC in 1915. Around the turn of the

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[389] Burpee, "The Canadian Army Medical Corps", p. 110.
[390] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3; and LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to AG War Office, 25 June 1918.
[391] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to AG War Office, 25 June 1918.
[392] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to AG War Office, 25 June 1918.
[393] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Administrative Notes: On Lousing and Disinfestation, August 1918, pp. 75-6.

century Amyot was employed by Ontario's Department of Health and was on the academic faculty at the University of Toronto as a Professor of Hygiene. In the late 1890s, he had constructed a practical steam disinfector during a smallpox epidemic that was ravaging Sudbury, Ontario. Subsequently, he erected similar units in different parts of the province.[394] Soon after his arrival in France, in 1916, Amyot set up the first of his continental disinfectors in the British 2nd Army's area, with "excellent results", and by September of 1917 there were twenty more in operation on the Western Front.[395]

Like the Thresh, Amyot's disinfector relied on steam to kill body vermin. However, the Canadian's apparatus would prove itself to be a marked improvement over the British disinfector design and would undergo a series of minor evolutions during the remainder of the war. Most of the "Amyot Huts" that were active in early 1917, consisted of a portable structure of double-walled construction, housing a room covering approximately seventy-two square feet of floor space and was usually about six and one half feet tall.[396]

In terms of operation, as the boiler was heated to a temperature of eighty-five to ninety degrees Celsius. and a pressure of forty pounds per square inch[397], clothing was hung on carefully placed hooks on the walls and wooden hangers suspended from racks

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[394] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0/C (Vol.1), Third Full Session of the Sanitary Conference of the Allied Powers, Paris, March 1918 – Report of the British Delegates and Delegates from the Overseas Dominions, p. 68

[395] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to Royal Army Medical College – London, 21 September 1917.

[396] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 2.

[397] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 3.

which spaced items apart at pre-planned optimal distances. The chamber was then sealed, pressurized and five rows of heat radiating two inch steam pipes began to preheat the chamber to a temperature of around seventy or eighty degrees Celsius. After this operating temperature was reached, the clothing was then sprayed with compressed steam, emanating from another set of precisely positioned pipes.[398] The steam heat and steam flow continued for approximately fifteen minutes, during which the scalding steam circulated throughout the room and penetrated the clothing entirely. For the next fifteen minutes, the clothing was allowed to stand, rapidly drying in the super-heated chamber. Thereafter, the sealed door was opened, the dry clothes removed and shaken out, ready to be handed directly to the freshly showered men. The entire process, in 1917, if functioning at an optimal rate with trained personnel, took just under thirty minutes from start to finish.[399]

The Amyot disinfector grew in popularity quickly, coming into regular use throughout much of the Canadian 1st Division and then all along the British Western Front divisions.[400] The Australians seized on the design and began to use them throughout their contingents. Some railway boxcars were creatively modified into mobile Amyot Huts, with the locomotive boiler being rigged to provide the steam for the apparatus.[401] British troops deployed as far away as the Mediterranean theatre around Salonika also took advantage of this highly effective rolling disinfector.[402]

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[398] Nicholson, *Seventy Years of Service*, p. 89.
[399] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 2.
[400] Adami, *War Story of the Canadian Army Medical Corps*, p. 229.
[401] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to Royal Army Medical College – London, 21 September 1917; and LAC, RG 9, Series III, Volume 5077,

Under ideal conditions, especially towards the latter parts of the war, so efficient were the Amyot disinfectors that when used in conjunction with efficient baths and laundries, about one hundred men per hour could be processed, with each soldier bathed, provided with a set of fresh underclothing and sterilized outer clothes. About one thousand men per day could be commonly processed in Canadian units.[403]

Of course, regardless of how effective the Orr and Amyot systems proved themselves to be, other methods of clothing disinfection were being attempted, either out of necessity or frustration at not being able to access the required equipment. As late as 1917, Amyot found one Canadian Casualty Clearing Station successfully using a unique technique. At this unit, lice infested clothes were sprayed with gasoline and then tightly rolled. After this the clothing was packed in an enclosed space and left to stand for a full day. Generally, this scheme killed both adult lice and their nits. However, as Amyot submitted, the practice was time consuming, used up "very precious gasoline" and was "not free from fire danger"![404]

Additionally, accessible and efficient disinfectors did not in any way guarantee positive results as the experience of troops from the Canadian 16th Battalion aptly demonstrates. Soldiers from this unit reported that when attending the divisional baths and laundry facilities it would often occur that they would not have all their clothing

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Bulletin of the Canadian Army Medical Corps, Administrative Notes: On Lousing and Disinfestation, August 1918, p. 75.

[402] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 2.

[403] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, letter from DMS Canadian Contingents to Royal Army Medical College – London, 21 September 1917.

[404] LAC, RG 9, Series III, Vol. 3606, file 25-1-0, "Camp and Trench Sanitation: Report upon procedure at the front", 2 February 1917, p. 3.

washed at the same time. Soon after their return, they would be disappointed, but not surprised, to find themselves covered with crawling lice. Moreover, some of these soldiers also found that when clothing was handed over for disinfection and laundering, getting it replaced sometimes caused problems, with some men being shirt-less for want of a new issue.[405]

One soldier in the 1st Canadian Casualty Clearing Station sagely observed that "when baths were readily available", they did little good in affording relief unless a change of clothing was provided. However, he added, "the Quartermasters Department arranged for exchanging and disinfecting clothing, but there was always a suspicion that these clothes were not as pure as they were represented." Of course, demonstrating once again that Canadian soldiers often looked out for themselves wherever possible, many units would wisely hire a washerwoman to ensure that the job was done correctly.[406]

The problems experienced with lice by 16th Battalion and 1st Casualty Clearing Station were not unique. The body vermin continued to be the bane of existence for most Canadian soldiers in mid 1917. Remarkably though, bed bugs were very rarely encountered by the troops.[407] The same applied to head lice, probably due to rigorous preventative hair care. Most men happily complied with anti-head lice measures, by keeping their hair close-cropped. When a small outbreak was detected, it was quickly remedied with Vaseline or coal-oil being applied liberally to the "host's" hair, but

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[405] LAC, RG 9, Series III, Volume 5077, file, *The Brazier*, Newspaper of the Canadian 16th Battalion, 10 February 1917, p. 9.
[406] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 256.
[407] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 7.

carefully "to prevent blistering" on the scalp.[408] Body lice, however, were still a major problem.

Although lice were active throughout the year, the approach of summer normally harkened a decline in infestations. However, in May of 1917, the CAMC's Sanitary Advisor found that body louse infection was "frequent" among Canadians soldiers of all ranks. In his report outlining his most recent investigation of "Sanitation in Canadian Camps", the advisor informed the DMS of Canadian Contingents that many of the standard measures known to destroy the vermin were being applied. Chemical methods, he argued, were "fairly effective." The insecticides, such as crude petroleum-based powders and ointments, the former for use on clothes in general and the latter for the seams of under-wear and trouser seams, were now readily available. Unfortunately, the overall efficacy of this destruction method was suspect as he found that there was "some difficulty in getting the men to intelligently and regularly use it."[409]

The soldiers of the CEF were having shower baths "as frequently as possible, usually every three weeks," after which they were supplied with a clean set of underclothes and a shirt, the CAMC officer reported.[410] However, "re-spreading" was taking place quickly, he explained, since not all the soldiers' clothing was being disinfected or washed while they were in the baths. Crotch seams of trousers, where he

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[408] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 8.
[409] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 8.
[410] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 256.

estimated anywhere from twenty-five to forty percent of the lice on each soldier were present, were being ironed. This he suggested was helpful, but admittedly was not enough. The available disinfectors were too slow, the report continued, leading to a situation where "only the most seriously infected sets are done." Oddly and inexplicably, later in the same report, the CAMC officer then claimed that disinfectors were achieving "almost complete success"![411]

Still, procedural changes had been in the works and, by May 1917, CAMC medical officers were to make daily reports of infectious disease incidences in their respective areas. These reports were forwarded to the DMS and the DADMS Sanitation would then be dispatched to "wherever there [was an] indication of trouble."[412] On a related matter, Inspection of the trenches for hygienic and sanitary purposes, including the review of anti-lice measures, was to have been done by regimental medical officers on a daily basis. Still, it was related by the CAMC's Sanitation Advisor, "the responsibility of keeping the trenches clean and sanitary rests on the Commanding Officer and his staff – the medical officer has advisory capacity only."[413]

Clearly, given the high incidence of "lousiness" in the CEF in May 1917 and the poor state of anti-lice measures, Commanding Officers were generally obviously either unconcerned, unimpressed or uninformed because the present and potential dangers of

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[411] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 8.
[412] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 13.
[413] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 4.

trench fever and typhus were largely being ignored. Accordingly, the "campaign on lice" continued, with the overworked personnel of the CAMC and the Canadian Sanitation Sections shouldering the brunt of the work. The ordinary Canadian soldier continued to shoulder the brunt of the suffering.

Coping with lice and the inevitable infestations was inarguably continuing to be difficult for most of the CEF's soldiers. In one 1917 edition of *The Brazier*, the self-described "trench journal printed and published at the front by the Canadian Scottish for the Brigade", one soldier-contributor bitterly lamented about the unwanted changes lice infestations were forcing upon him and his comrades. The distinctive kilts the Canadian Scottish wore in the trenches may have generated a good deal of *esprit de corps* and pride for their number. However, the numerous pleats on these same kilts provided excellent environments for lice to live and lay their nits – a situation which invariably led to infestations in this unit far exceeding those normally seen in soldiers in other brigades. As a result, the newly trousered Canadian Scottish found their beloved kilts were casualties in the campaign against the lice in 1917.[414]

One other un-named contributor to *The Brazier* had his creative spirit stirred or at least inspired a modicum by the lice, sharing with his military brethren the artistic expression of his desire to get back to Britain, and more importantly, away from the louse-infested environment of the trenches. Intended to be sung to the then popular melody of "Bring Back My Bonnie to Me", "Itchey Cou's" lyrics were both humorous and descriptive:

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[414] LAC, RG 9, Series III, Volume 5077, file, *The Brazier*, Newspaper of the Canadian 16th Battalion, n.d. 1917, p. 6-8.

"How often I've longed for old Blighty,
When unable to get a night's rest,
For the "Itchey Cou" under my 'nighty
A-holding parades on my chest.
Bring back, bring back
Oh bring back ol' Blighty to me to me.
Bring back, bring back
Oh bring back ol' Blighty to me." [415]

Although getting "a Blighty" was usually a "Fox Pass", it was well known among the troops that being wounded could be "jake" or even "jake-a-bon."[416] Serious "Blightys" might mean the soldier would be sent back to "Blighty" for convalescence, and be availed regular baths, clean sheets and freshly-laundered clothing. Less serious Blightys, but grave enough to warrant a trip to a General Hospital in France still meant a higher level of hygiene and comfort was nigh. Early in the war, Sophie Hoerner, a Canadian nursing sister stationed at a CAMC General Hospital "Somewhere in France", reported that all casualties and sick were completely washed and issued a new set of clothes when transferred from a nearby Casualty Clearing Station to her hospital.[417]

Thomas B. Smith, a soldier assigned to 1st Casualty Clearing Station for nearly the entire war observed that "[a]part from the treatment of wounds, no service the unit could render its patients contributed more to their sense of well-being than the delousing

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[415] LAC, RG 9, Series III, Volume 5077, file, *The Brazier*, Newspaper of the Canadian 16th Battalion, 1 April 1917, p. 7.
[416] In Canadian and British "trench slang", a "Blighty" was "a wound serious enough to cause a soldier to be sent to England." A "Fox Pass", was a "bad break" (derived from the French "faux pas"). "Jake" meant good and "Jake-a-bon" was "very good"; LAC, RG 9, Series III, Vol. 5078, Unit Newspapers, Printed Material, *The Dead Horse Corner Gazette* (4th Battalion), No. 2, December 1915, p. 23
[417] LAC, MG 30, E290, Sophie Hoerner Papers, Letter Home, 10 June 1915, p. 2.

and bathing facilities it provided."[418] However, working in medical units constantly exposed one to "patients fresh from long-contaminated billets and trenches." Smith later related that those medical personnel in close contact with "newly arrived patients rarely enjoyed twenty-four hours of complete freedom from that most contagious of all pests, the louse."[419]

Still, for incoming sick and wounded soldiers, admittance to a rear area medical unit usually brought some comforts rarely seen in the trenches – most notably, hygiene and a modicum of life without lice. Canadian machine-gun officer "Billie" Williams, wrote home in late August 1917, informing his relatives that he had been admitted to hospital. True to his stalwart and stoic character, Williams assuredly wrote that "it is nothing serious – a very common complaint called 'trench fever' and a touch of gas." He also related that he did not want to "leave the job and go sick" but was forced to by a medical officer. Of course, Williams was pragmatic, happily pointing out that he was getting plenty of good food and rest. Moreover, he continued, "there is a possibility of my going to Blighty for a while, but that is only a dream as of yet, and I hardly dare hope it will come thru." Williams admitted he had a "rather high temperature" of 104 degrees, but reiterated that "[t]his is a very 'bon' life here tho [sic] nothing to do but read, sleep and eat and nobody bothers you. Oh yes, a good bath every morning as well."[420]

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[418] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 258.
[419] LAC, MG 30, E31, Thomas B. Smith Papers, Manuscript for "Clearing: the Tale of the 1st Canadian Casualty Clearing Station, British Expeditionary Force, 1914-1919, p. 256.
[420] LAC, MG 30, E400, Claude Vivian Williams Papers, "Line Service – France, 31 October 1916 to 14 August 1917", Letter to home, 27 August 1917.

Williams, like any other "trench fevered" Canadians in 1917, could expect medical treatment aimed at alleviating his symptoms only, as the disease itself remained as mysterious as ever to scientists and medical personnel. Typically, Aspirin was dispensed to help take care of the pain and cold compresses proved to provide some relief for aching heads and shins in some cases. During the latter part of the war, most patients were sent to a convalescent facility as soon as possible, "where fresh air, good food and progressive exercise quickly restore him to full capacity; so that he is able to return to duty.[421]

Many "lousy" Canadian trench soldiers may have envied those stationed or sent well away from the front lines, but being in rear areas did not bring a guarantee of being lice-free. On 19 November 1917, the freshly-formed Canadian 236th Battalion, also known as the "MacLean Kilties", arrived in the United Kingdom from Canada. Evidently, these troops did not make the trans-Atlantic voyage alone because the very next day, "the unit was reported lousy, practically throughout."[422] 2,100 pounds of coke were secured to power a steam disinfector and eighty hours later the clothes and kit of the unit's 1,100 men were sterilized. One CAMC officer reported a short time later, the colours on the 236th's tartan kilts happily had not been damaged by the entire process.[423] In another instance, lousiness continued to persistently dog the troops and personnel stationed at a Canadian base camp located in Sunningdale, England. The body vermin

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[421] Arthur Hurst, *Medical Diseases of War* (London: Butler and Tanner, 1943), pp. 227-8.

[422] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General correspondence, 25-1-0, "Disinfection of Clothing" memorandum, 30 November 1917, p. 1.

[423] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General correspondence, 25-1-0, "Disinfection of Clothing" memorandum, 30 November 1917, p. 1.

infestations were so serious in June 1917, that a Sanitary Advisor reported to his superiors that there was an immediate and "very urgent need for a large size" vermin disinfector.[424]

Early the next year, whilst stationed in the trenches, Mack Eastman, a private in the Canadian 29th Battalion, was so troubled and frustrated by the lousiness experienced within his unit at the front that he went outside of regular army channels seeking assistance and begging a senior administrator at Canadian YMCA in London to intercede. Eastman wrote:

> "[a]fter nearly 4 months of life in France and of close observation, it is my considered opinion that the morale of our troops could be raised abruptly 50% if the Army were to undertake and carry through a serious and successful war of extermination against the louse. The improvement in the spirit of our soldiers would be due firstly to a new conviction that the higher command was sincerely interested in the personal comfort and well-being of the men, and not exclusively in their utility as a fighting machine and secondly to the material fact that with the disappearance of vermin could come the possibility of reposeful sleep and a relative immunity from skin diseases.
>
> Only a front line private like myself can adequately realize the waste of energy and happiness caused daily by the prevalence of the lousy pestilence, " the Canadian rifleman continued, adding, "[t]o me thus far the chief horror of war has been the sound and sight of comrades in their sleep cursing the lice and the Army and flinging themselves about like madmen while with dirty nails they scratch chest or legs till the blood streamed down."[425]

Eastman concluded that "it is for medical men and scientists to propose the

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[424] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General correspondence, 25-1-0, "Disinfector for Forestry Camp at Sunningdale" memorandum, 11 June 1917.

[425] LAC, RG 9, Series III, Vol. 3606, 25-1-0 Vol. 2., Letter written by Mack Eastman, A Company, Canadian 29th Battalion, to Captain Pidgeon, YMCA, London (forwarded to Canadian ADMS – London, March 1918).

remedy and for the Army to apply it."[426] The YMCA administrator forwarded the Canadian private's letter to the CAMC's ADMS in London. Any action taken in response to Eastman's plea for assistance is not known.

In March 1918, at roughly the same time as Eastman's letter was making its way to the upper echelons of the CAMC, the Third Full Session of the Sanitary Conference of the Allied Powers met in Paris. Eleven sessions were held with lousiness and trench fever among a wide variety of sanitation and health topics discussed. This would be the largest such conference of the war. The United States, nearing the end of the country's first year in the war, was represented by two delegates. The British delegation of ten included one Canadian – the seemingly ubiquitous and tireless Amyot who was now the DMS Canadian Contingents.

In his report on the proceedings, Amyot related that the American delegates in attendance, United States Army Medical Corp Majors D.P. Card and J.P. Strong, the latter a Professor of Exotic Medicine at Harvard University, had recently collaborated on a series of trench fever related experiments conducted on "human volunteers." Card and Strong presented evidence to the conference that finally conclusively demonstrated that: "a Spirochete found in the blood at the height of the fever *is* the causative agent" of trench fever. Moreover, the American specialists had proven that body lice carried and then transmitted the disease from one human host to another. After a blood meal at the expense of a trench fever afflicted human, a louse, with infective spirochetes reproducing in its lower digestive tract, could transmit the disease to its next human host.

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[426] LAC, RG 9, Series III, Vol. 3606, 25-1-0 Vol. 2., Letter written by Mack Eastman, A Company, Canadian 29th Battalion, to Captain Pidgeon, YMCA, London (forwarded to Canadian ADMS – London, March 1918).

Interestingly, it was not the bite that passed on this infection. Rather, the disease was introduced to humans through the seemingly innocuous act of scratching. This action, besides resulting in the destruction of an irritating louse, could cause striations in the human's skin through which excretal matter from the louse, along with other various louse remains, entered and infected the human bloodstream.[427]

It is interesting to note that both British and Canadian official historians later credited another group, the Trench Fever Committee, which incidentally was dominated by British and Canadian representatives, as being wholly responsible for scientifically proving the aetiology of trench fever sometime in early 1918.[428] The apparent exclusion of this information at the sanitation conference and Amyot's failure to mention anything regarding the committee in his report, coupled with his detailed acknowledgement of the American's efforts, suggests that the Canadian and British official histories may not be entirely accurate in this respect.

In any case, no later than March 1918, the allies confirmed what had long been suspected by many Canadian, British and American experts – body lice were the vector for trench fever.[429] As importantly, as Amyot logically concluded and succinctly summarized to his superiors in his proceedings report: "the campaign against this serious casualty producing disease is [therefore] the campaign against the louse."[430]

Accordingly, the conference discussions moved to the topic of anti-lousing

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[427] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.
[428] Nicholson, *Seventy Years of Service*, p. 88; and MacPhail, *The Medical Services*, pp. 262-3.
[429] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.
[430] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.

measures, more specifically the destruction and prevention of lice. One delegate reported that the available "parasiticides and insecticides were frequently selective in their action on a given species of parasite, and could not be relied upon to be effective against all." This underscored the conclusion that the allies could not rely on insecticides in order to control the lice population to too great a degree.[431]

The consensus among the delegates was that disinfectors offered the best solution. Moreover, they acknowledged that "Amyot's Steam Disinfector" and "Orr's Hot Air" method of louse destruction were the "best methods", then in use in any allied camp, near the front and in rear areas as well.[432] They also agreed that used in conjunction these two disinfector systems were remarkably effective, with Orr's process having the "advantage that it can be applied in isolated units in such an extemporized room as a dug-out, whereas the steam method was the best stationary method, in conjunction with a bath house."[433]

Within a matter of weeks, or even days, after the third Allied Sanitary Conference had closed a British private-sector vermicide manufacturer contacted the DGMS of the CAMC. The purpose of the contact, the company's representative wrote, was that:

> "[s]ince it has now been proved … that body lice communicate [trench fever], we are writing to suggest that you should place your order for Para-Quit as early as possible." The sales pitch continued with the claim that "Trench Fever having been the cause of more sickness on the Western Front than anything else, excepting Scabies, you will agree that adequate

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[431] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0/C (Vol.1), Third Full Session of the Sanitary Conference of the Allied Powers, Paris, March 1918 – Report of the British Delegates and Delegates from the Overseas Dominions, p. 68.
[432] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.
[433] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.

> protection is essential, and there is no more effective and economical safeguard, or remedy, than Para-Quit. As you are doubtless aware, Para-Quit Pomade is the officially approved remedy for body vermin, adopted by the British War Office, who have used upwards of one million issues, and it has a double value since it is a Mosquito deterrent as well as vermicide", adding that " … no time should be lost in furnishing supplies to the affected areas."[434]

The truth of the manufacturer's claims is not known nor does it appear that the Canadians ever did purchase any large supply of "Para-Quit." However, what is clearly apparent is that the Allied investigations and, more specifically, their recent monumental findings regarding trench fever were not a well kept secret at all, despite the "Secret" classification the resulting reports had been given. With little doubt, if this information was available to some British civilians, one must assume that it was not, or would not, long be a secret to the German foe.

Since the beginning of the war, the Canadians and British had interrogated German POWs in order to gain intelligence of the enemy's situations. Hygiene related issues were some of the many topics that were the subject of these interrogations and a good deal of helpful information was gathered. Still, much better avenues of intelligence were exploited by both sides during the war. Inexplicably, the "international communication networks in the medical sciences were sustained" throughout the First World War, aided in large part by the continued uninterrupted "flow of medical information in periodic literature to all sides." Conduits for this information were neutral countries such as Sweden, Spain and the Netherlands; and until 1917 through the United States. Disease prevention, it was deemed by many scientists and researchers, "cut across

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[434] LAC, RG 9, Series III, Vol. 3615, Diseases Misc., file 25-7-1 to 25-7-6, letter from Lawson and Co. (Bristol) Ltd. to the Director General, Medical Department, Canadian RAMC (sic), 25 March 1918.

frontiers and fronts", necessitating the need to openly disseminate and freely share relevant findings. Interestingly, even direct aid was also meted out by the Allies to the Central Powers. The American-based Rockefeller Foundation worked in conjunction with the International Red Cross to organize and operate public health programs in both allied and German controlled territories throughout continental Europe during the entire war.[435]

German scientists, regardless of the level of their patriotism or nationalistic fervor, also aided the Allied war effort on numerous occasions whilst the global conflict raged. For instance, in mid 1918, the *Bulletin of the Canadian Army Medical Corps* republished a German journal article which outlined experiments that had been conducted towards the development of "louse-proof" overalls. At the Berlin Institute for Infectious Diseases, scientists concluded that protective overalls of oilskin were marginally effective but were deemed to be 'too cumbersome' or too 'clownish' by some soldiers. Oilskin vests, the researchers suggested, held the promise of better utility, especially for German medical personnel. So, "to convince the skeptical" of the utility of this material they embarked on a wide-range of experiments measuring the speed and characteristics of lice migration. Their comprehensive results wound up in Allied hands, shortly after being supplied to German military authorities.[436]

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[435] Paul Julian Weindling, *Epidemics and Genocide in Eastern Europe 1890-1945* (London and New York: Oxford University Press, 2000), p. 76.

[436] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Daily Review of the Foreign Press: Pathological Abstracts, May 1918, p. 147. ["Experimentelle Untersuchungen ueber eine lausesichere Schutzkleidung", published in Deutsche med. Wchnscr., 1918, vol.44, p. 231.] The German experiments showed that oilskin was remarkably effective in preventing the migration of lice from an infested area to a non-infested one. They also showed that lice displayed a preference for non-infested material and had a natural inclination to crawl upwards. Remarkably, on a cloth shirt,

At the beginning of the war, the German Imperial government had held a distinct advantage over the Allies in terms of knowledge and experience in dealing with lice infestations and louse-borne disease. As early as the 1890s, the Germans had developed stringent hygienic laws and procedures aimed at preventing migrants, especially those from Eastern Europe, from "importing" infectious disease into Germany.[437] Race-based ideology in Germany helped to fuel scientific investigation of methods designed to "protect" the *Volksdeutshe* from the scourge of typhus and other so-called "Asiatic epidemics."[438]

Having been well-developed in the decades leading up to the Great War, German de-lousing, bathing and laundry facilities and procedures were relatively well organized from the very start of hostilities in 1914.[439] The world-leading German chemical industry utilized its collective expertise to design, test and manufacture a wide-range of pesticides and insecticides that came into more frequent use towards the end of the war. The Germans also originated and used poison gas, including cyanide-based insecticides which were forerunners to the later infamous Zyklon-B, for de-lousing clothing and other

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some lice could travel from the bottom seam of the shirt to the neck collar in less than one minute. Conversely, on slippery oilskin, most lice did not travel further than half an inch in ten minutes.

[437] Weindling, *Epidemics and Genocide*, pp. 56-72; The main target of the German efforts were Jewish émigrés (or what they called "the Jewish Bacilli") from eastern Europe, whom were portrayed by anti-Semitic propagandists and many German bacteriologists as disease carriers and propagators threatening the "spiritual and moral health of the German Volk." As many refugees from eastern Europe were louse-infected, they were easy targets for those German racists wanting to simply blame denounce their lousiness on ethnic backgrounds, rather than the appalling conditions from which they were fleeing, as per Weindling, *Epidemics and Genocide*, pp. 70-1.

[438] Weindling, *Epidemics and Genocide*, p. 73.

[439] Weindling, *Epidemics and Genocide*, pp. 80-4.

personal possessions in fumigation chambers.[440]

Despite their efforts, for the most part, the German army and its soldiers suffered the ill effects of lice infestation and trench fever at levels comparable to that experienced on the Western Front by the Canadians and the British. On their eastern front, there were numerous typhus epidemics between 1915 and 1917, although the Germans were affected to a much lesser degree than their Russian foes.[441]

The control of lice and disease in German operated POW camps was very poor at the beginning of the war, more out of reasons of neglect than a lack of ability. According to Canadian historian Desmond Morton, in December 1914, "the most notorious administrative failure in the first year of the war" occurred in a German camp located near the town of Wittenberg, where approximately twelve to fifteen thousand French, British and Russian POWs were being held in very crowded conditions. A massive louse-borne typhus epidemic among the prisoner population ensued causing the German captors to segregate themselves from the inmates and effectively abandon them. A trickle of medical supplies found their way to the prisoners, who were soon dying like flies. Only after the worst of the epidemic had passed did the Germans resume full supervision of the camp. A short time later, the Germans reacted the same way when typhus broke out at another "dirty and badly managed" camp.[442]

These events garnered a good deal of negative attention from the world press. Wanting to rehabilitate their reputation and avoid similar embarrassments, the German

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[440] Weindling, *Epidemics and Genocide*, pp. 91-2.
[441] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Review of the Foreign Press: Typhus, January 1919, pp. 22-3.
[442] Desmond Morton, *Silent Battle: Canadian Prisoners of War in Germany, 1914-1919* (Toronto: Lester Publishing Ltd., 1992), pp. 17-8.

government made significant improvements to the administration and operation of their POW camps. In late 1915, their Giessen camp was variously rated as an average or above average camp by neutral inspectors. Some of these observers even concluded that "the prisoners usually fared better than their comrades in the field, with a weekly shower and a dry-heat sterilizer to control the ever-present lice."[443] Anti-lice hygiene in the German camps was also improved by the initiation of new regulations by which all newly arriving POWs underwent a rigorous disease prevention procedure at intake, including being "fumigated and deloused."[444]

Trench fever was commonly called "gaiter fever" and "five-day fever" by the Germans. It was recognized as a specific and distinct disease, not a variation on known fever inducing diseases, by German scientists sometime in 1917 — the year after the team of Rankin and Hunt had first made this determination.[445] In terms of treatment, the German medical services were stymied as much as the Canadians and the rest of the Allies. A variety of pharmaceutical regimens were tested in the field, including aspirin, quinine and even arsenic. As the Allies had similarly discovered, the Germans found aspirin had good effect on some of the disease's symptoms, but none of the other products used on their test subjects had a positive influence on preventing or directly treating trench fever.[446] By 1918, the Germans were apparently quite concerned about the manifestation of cardiac problems among some trench fever victims. This trepidation

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[443] Morton, *Silent Battle*, pp. 42-6.
[444] Morton, *Silent Battle*, pp. 43.
[445] Hurst, *Medical Diseases of War*, p. 210; and LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Daily Review of the Foreign Press: Trench Fever, June 1918, p. 176.
[446] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Daily Review of the Foreign Press: Trench Fever, June 1918, p. 176.

was somewhat assuaged or mitigated when a short-term study of more than 1500 ex-patients with this possible product of trench fever did not show a single fatality.[447]

As the latest German research findings related to trench fever were being published in the June 1918 *Bulletin of the Canadian Army Medical Corps*, the "Report on Trench Fever by The Medical Investigation Committee" was produced by the RAMC. Produced just months before the 11 November armistice ended hostilities on the Western Front, the committee's report summarized all the latest knowledge the western Allies had accumulated concerning the medical aspects of trench fever. The committee concluded that there were three types of trench fever, all of which were "merely varieties of the same infection."[448] Declaring that "[h]ere we have our final view of the disease", the committee outlined the symptoms of trench fever. Chief among these manifestations of the infectious disease were: "a sudden onset", with the majority of cases suffering fever relapses; headache, especially in the frontal portions; "pains in back and limbs"; inflammation of the skin, especially on the chest and abdomen; spleen enlargement; a range of eye issues, including tracking difficulties and conjunctivitis. Importantly, the committee also noted that "[w]hile no one symptom can be quoted as characteristic or constant the combination of several or all of the above symptoms renders accurate diagnosis possible … [after] observation for sufficient time."[449]

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[447] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Daily Review of the Foreign Press: Trench Fever, June 1918, pp. 176-7.
[448] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Report on Trench Fever by the Medical Investigation Committee" – selected excerpts from the War Diary of ADMS – 1st Canadian Division, June 1918. The composition of this committee is unclear.
[449] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Report on Trench Fever by the Medical Investigation Committee" – selected excerpts from the War Diary of ADMS – 1st Canadian Division, June 1918.

The committee also confirmed that trench fever was carried in louse faeces and, interestingly, noted that it could also be easily be transmitted from one man to another via transfusions of infected whole blood or plasma. In closing, the committee stressed that "since the disease is transmissible from man to man, is very prevalent and, if neglected, disabling for a long period, it is advisable that … [t]he disease should be borne in the mind of those in charge of cases and this knowledge applied so as to prevent infection … ."[450]

With the aetiology of trench fever scientifically verified, efforts to find effective treatments for those afflicted with the disease were redoubled. Yet, effective treatment – those being wide-spectrum sulfonamide antibiotics – was decades in the future.[451] So, treatment of "the trench fevered" remained the same in late 1918 as it had been in 1915 – managing the debilitating symptoms as best as possible with varying lengths of "rest and nursing care."[452]

Notably, in 1918, the Medical Investigation Committee also observed that trench fever had been associated with the "frequent" development of heart related issues among its victims, predominantly temporarily disabling tachycardia (rapid beating of the

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[450] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Report on Trench Fever by the Medical Investigation Committee" – selected excerpts from the War Diary of ADMS – 1st Canadian Division, June 1918.

[451] The cornerstone of current standard treatment for patients with trench fever is normally centered around the oral administration of antibiotics such as doxycycline or other tetracyclines, which are normally able to eliminate the bacterium and the manifestations of the disease in about a week, as per Leonard N. Slater and David F. Welch, "Clinical Aspects of *Bartonella* Infections", In *Rickettsial Infection and Immunity*, edited by Burt Anderson, Herman Friedman and Mauro Bendinelli (New York and London: Plenum Press, 1997), pp. 188-9.

[452] Slater and Welch, "Clinical Aspects of *Bartonella* Infections", pp. 188-9.

heart).[453] A CAMC medical officer at No.3 Canadian General Hospital concurrently reported that tachycardia was then "quite common" in trench fever cases.[454] As we have seen, similar conclusions had been made by the German military-medical community sometime in 1918 as well, but remarkably this serious consequence of Trench Fever had not been widely recognized at any point since the disease had first "appeared" over three years earlier.

By the fall of 1918, during the closing months of the war, the more severely affected Canadian trench fever cases could expect to spend a minimum of several months at convalescent depots, most of which were located in the United Kingdom.[455] Statistics regarding the average time it took for these Canadians to fully recover or the long term-prognosis of these soldiers were either not collected or have been lost. Still, a good indication of these figures may be derived from statistics accumulated by the RAMC during this period. On average, soldiers in the British army afflicted with trench fever and requiring convalescence, could expect it to be about six months before they would return to full and active service.[456] Twelve percent of these cases were grave enough to require evacuation to general hospitals in the United Kingdom and five percent in total were "permanently disabled by the long term effects of the disease upon the heart or

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[453] LAC, RG 9, Series III, Vol. 3745, Adami Papers, Misc. Papers/ Misc. Extracts, "Report on Trench Fever by the Medical Investigation Committee" – selected excerpts from the War Diary of ADMS – 1st Canadian Division, June 1918.
[454] LAC, RG 9, Series III, Vol. 3752, file 3-1-1-14, Trench Fever "A Report on the Invalidism Caused by Trench Fever", no date, by context and contents: post early 1918. p. 2.
[455] LAC, RG 9, Series III, Vol. 3752, file 3-1-1-14, Trench Fever "A Report on the Invalidism Caused by Trench Fever", no date, by context and contents: post early 1918. p. 2.
[456] Charters, "Lice and Louse-Borne Disease …", p. 41.

nervous system."[457]

Hostilities on the Western Front ceased when the Armistice was declared on 11 November 1918. The Allies' war against the Central Powers – albeit undeniably costly – had ended in victory. Can one conclude the CEF garnered the same result in their war against infectious disease, in particular trench fever, during this same period? Was this "war within a war" possible to win outright or was a qualified victory the best that could reasonably have been achieved? Did the CEF combat trench fever in the most efficient and effective ways possible – moreover, why or why not?

The trench environment on the Western Front during the First World War was inherently unhealthy for Canada's soldiers. This was true, of course, just because of the ever-present dangers of being maimed or killed by German bullets, artillery shells or poisonous gases. The diseases in the trenches were serious threats to our soldiers' health and well-being, as well. Certainly, the subterranean world in which the trenches were dug provided soldiers with a measure of safety from enemy weapon fire. However, as the war dragged on and the battlefield remained relatively static, the soil in and around the trenches became a toxic stew and living underground became hazardous to soldiers as well. Vermin and omnipresent pathogens flourished.

The Canadians found that the trench environment influenced the incidence and strength of many infectious diseases. It fostered the rapid development, spread and intensity of many known infectious diseases, such as anaerobic infections. Additionally, and in many ways even more disturbing, the trenches appeared to create an infectious disease of unprecedented virulent and mysterious nature—this disease would become

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[457] Charters, "Lice and Louse-Borne Disease …", p. 41.

commonly known as trench fever. Exacerbating the situation, many Canadian soldiers were predisposed to illness even before they arrived on the battlefield and as their time on the Western Front passed, the physical and mental resistance of all soldiers was slowly eroded.

Some elements in the CEF were instrumental in reducing the number of Canadian soldiers afflicted with certain infectious diseases. Many of the medical officers of the CAMC, including Battalion medical officers, contributed immensely with the formulation, implementation, and enforcement of anti-infectious disease strategies. The testing, research and practical innovations stemming from the personnel with No.5 Mobile Laboratory aided Canada and its allies in their attempts to minimize infectious disease. Additionally, the five Canadian Sanitary Sections provided valuable hygiene assistance and helped to ensure that health precautions could be followed.

Once the aetiology of a disease and its vectors were scientifically identified, or at least strongly suspected, the subsequent pivotal component required to combat infectious disease in the ranks of the CEF was corporate will. Without it, many of our soldiers perceived that there existed a distinct lack of material support from the upper echelons of the organization – this situation, if it were allowed to develop, could seriously erode or destroy an individual's will, if not ability, to fight. Corporate will to combat disease and its causes could only be fostered if it was embraced and promoted by the upper echelons of command. Without this commitment, hygiene and health discipline could not be enforced. With the commitment from the CEF's senior ranks, precautions could be strictly enforced and preventative infectious diseases could be effectively controlled, as was the case with water-borne diseases and trench foot.

In terms of controlling body lice, and in the process help to prevent the spread of trench fever, this same corporate commitment was not immediately forthcoming from the upper echelons of the CEF, nor even from some elements of the CAMC. Clearly, body lice had a profoundly negative impact on the already compromised quality of life in the trenches, as nearly all of Canada's trench troops were often infested with these parasitic vermin. Sleep deprivation, discomfort, preoccupation with itching and scratching, were matters considered far from the picayune to most of those crawling with the blood-suckers. Thus assailed and afflicted, many soldiers understandably were induced to ponder more than a modicum of averse against a system that allowed and, in some cases appeared to even encourage, the louse to have its way with him. A lack of confidence in his superiors and the army for not providing him with the tools to defeat or at least control the pest could encourage the spread and festering of this emotional contagion. The earliest casualty in the case of widespread louse infestations can be morale.

When it came to pre-war preparation – vis-à-vis delousing – the British effort was poor. Canadian planning for combating these vermin was virtually non-existent, bordering on the negligent. Essentially lice were not recognized as a dire threat to the existence of the CEF. Rather they were just another nuisance and indignity of soldiering life, to be endured, when or if infestations occurred. When widespread louse infestations became evident in the CEF in 1915, some disease-conscious Canadians in the CEF and the CAMC recognized that these insects, as irritating as they were upon the psyches of individual soldiers, collectively posed an even greater threat to the effectiveness and existence of entire Allied armies. Although the exact mechanism by which lice transmitted typhus to humans was not yet scientifically proven at the beginning of the

war, the direct causal connection between lice and the deadly disease typhus was well recognized.

Still, during the first few years of the war, regardless of the potential catastrophic threat of a typhus outbreak and the very present negative effect lice infestations were inflicting upon the morale and battle-readiness of the Canadian army and its trench soldiers, corporate efforts to control the vermin continued to be largely ineffectual. Initially, large-scale disinfection was attempted through the use of scalding hot water washes and the application of hot irons to the seams of uniform and underwear seams. Unfortunately, the results garnered with these methods were marginal and largely ineffective--especially in killing the lice larvae in egg-ridden seams.[458] The British army had "great hopes" that the Thresh Disinfector would be up to the task, but as one Canadian commentator later observed, it was found to be "too leisurely in action."[459] That the Thresh was too slow, too small and inefficient was established in 1915. Yet, inexplicably it appears to have remained in use or at least in partial use, in all allied armies until the end of the war.

Fortunately, individual efforts by some Canadians would produce a much better alternative to the Thresh and, in the process, provide a good deal of benefit and comfort not only to some of their compatriots but for some other allied soldiers as well. Canadian civilian-soldiers Amyot and Orr each developed delousing apparatus that would be adopted into use by most allied armies and were by the end of the war being praised by

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[458] Nicholson, *Seventy Years of Service*, p. 89.
[459] LAC, RG 9, Series III, Volume 5077, Bulletin of the Canadian Army Medical Corps, Administrative Notes: On Lousing and Disinfestation, August 1918, p. 75.

Canada's allies as "the best methods" available.[460] Canadian Sanitary Sections should take much credit as well for preventing discomfort and disease, being "very effective" in building and operating these and complementary de-lousing facilities.[461]

The relief provided by Canadian shower-bath, laundry and disinfection centers was welcome but usually brief, for many men so treated would rejoin the trenches which were occupied by still infested soldiers, each with a batch of lice many of which were eagerly awaiting migrating to a newly cleaned home. Still, the problem could be slowly eroded and, although the lice population could not be completely eliminated, a measure of control was established in the latter part of the war. It is remarkable that despite eventually developing the tools to properly control the lice problem, louse infestations would continue to be a major problem. Unfortunately, a significant number of the CEF's Officers Commanding, and for that matter Canadian High Command, consistently refused to seriously embrace the "War on Lice", even after it was "declared."

This lax corporate commitment in the "War on Lice", although mitigated to a degree given the myriad of omnipresent dangers facing their troops and the weighty responsibilities of command, was regrettable, but retrospectively not as deadly as it could have been. Conversely, in and near eastern Europe's Great War front lines typhus flourished, especially among the louse-ridden Russian armies.[462] Although contemporary records were spotty at best, some estimates suggest that during the first year of the war, over 100,000 Russian soldiers and civilians likely contracted typhus.[463]

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[460] LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., p. 3.
[461] Burpee, "The Canadian Army Medical Corps", p. 109.
[462] Zinsser, *Rats, Lice and History*, pp. 298-9.
[463] Zinsser, *Rats, Lice and History*, p. 299.

As the war progressed and living conditions in Russia regressed, especially with the onset of revolution and civil war, local authorities reckoned that between 1917 and 1921 there "probably more than twenty-five million cases of typhus" among the civilian and military in the Soviet Union, ten percent of which resulted in fatality.[464] Typhus also exacted a staggering toll on the Serbian Front during 1914 and 1915, the lice-enabled outbreak causing at least 100,000 deaths.[465]

Conversely, according to official British medical services historian W.G. Macpherson, between 1916 and 1918, just five confirmed cases of typhus were contracted by soldiers affiliated with the British army on the Western Front, none of which resulted in fatality.[466] Hans Zinsser would later suggest the virtual absence of typhus from the western trenches was "among the most remarkable phenomena of the war" for which there was "no completely satisfactory explanation."[467] Indeed, Canadian and British official historians failed to explain typhus' non-occurrence conclusively or convincingly, other than to point to the effectiveness of disinfection techniques and other "preventative measures."[468] But these measures, we have seen, were not completely successful at ridding the Canadian and British armies of lice – universal de-lousing and the end of lice infestations in the Canadian army were in no way fully achieved even at the war's end.

British researcher John Charters recently put forth what appears to be a reasonable and rational explanation for typhus' "non-appearance" in and on the Western Front.

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[464] Zinsser, *Rats, Lice and History*, p. 299.
[465] Macpherson, *Diseases of the War Vol. 1*, p. 136.
[466] Macpherson, *Diseases of the War Vol. 1*, p. 140.
[467] Zinsser, *Rats, Lice and History*, p. 298.
[468] Macpherson, *Diseases of the War Vol. 1*, p. 139.

According to Charters, recent research has shown that historically "typhus epidemics … have needed a background of social dislocation, hunger, malnutrition, overcrowding, poor hygiene and large population movements." Concurrently, he adds, "malnutrition and extreme squalor are particularly important in the genesis of typhus epidemics."[469] If this theory is correct, then the mere presence of limited typhus pathogen, even with a plethora of vectors – that being body lice – did not guarantee that typhus would take root, as although living conditions were horrid for the Canadians living in the trenches, they were never bad enough to allow for the outbreak of typhus. Thus, victory over typhus was achieved by all the combatants on the Western Front – against an opponent that was, fortuitously, a no-show.

The Canadians were not so fortunate when it came to dealing with the scourge of trench fever. Admittedly, this "new and mysterious" disease was not as horrific in its virulence and consequence as typhus. Nevertheless, neither was trench fever a disease to be ignored or under-estimated. Still, thanks in no small part to the tireless efforts of Rankin and his fellow medical researchers at No.5 Canadian Mobile Laboratory, "so-called Trench Fever" was confirmed to be a "definite disease", with the causative link between lice and the affliction finally established in 1917. Regrettably, even after this connection was made, trench fever continued to be nearly as frequently misdiagnosed by CAMC and RAMC Medical Officers as it had previously. Misdiagnosis of the disease had long been exacerbated by the fact that the name "trench fever" was not officially sanctioned by British medical and military authorities until 1917. Moreover, the reporting of outbreaks to senior medical service commanders was not made obligatory

[469] Charters, "Lice and Louse-Borne Disease …", p.51.

until 1918.[470]

Recognizing the inherent problems with the statistical record, Macpherson, in his official history, estimated that during the last two years of the war approximately 200,000 of the British-led forces on the Western Front were infected with trench fever, which constituted a "very heavy drain on the army."[471]

What of the specific Canadian numbers regarding trench fever? In the immediate post-war era, the CAMC's official historian, Andrew MacPhail, estimated that during the Great War there were over 15,000 cases of unidentified fever and nearly 5,000 cases of confirmed trench fever in the Canadian ranks, with "almost none fatal."[472] In a much more recent examination of the statistical and historical evidence, Canadian historian Bill Rawling concluded that trench fever likely accounted for 20,000 cases of illness in total during the conflict.[473] Still, given the well documented and consistent likelihood of misdiagnosis, especially as influenza, and chronic confusion with trench fever nearly throughout the entire war, and the incredibly high degree and incidence of continued lice infestations in the Canadian ranks, it is this author's considered opinion that all these previous estimates may fall remarkably short of the actual.[474] Admittedly, exactly how much is difficult to determine, but the actual incidence of trench fever was certainly significantly higher than all these previous assessments. Moreover, it cannot continue to be assumed that trench fever did not claim Canadian lives. During the post-war period medical tracking of those ex-soldiers that had contracted trench fever during the war and

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[470] Hurst, *Medical Diseases of War*, pp. 212, 224-5.
[471] Macpherson, *Diseases of the War Vol. 1*, p. 360.
[472] MacPhail, *The Medical Services*, p. 263.
[473] Rawling, *Death Their Enemy*, p. 71.
[474] Influenza, dengue fever and malaria were often erroneously diagnosed instead of trench fever; Hurst, *Medical Diseases of War*, pp. 224-5.

then developed heart issues was virtually non-existent, leaving one to wonder if this louse-borne disease may have exacerbated those Canadian soldiers' health problems and even hastened their deaths. Sadly, much of this suffering need not have happened.

When it came to the challenges posed by lice and trench fever, the CAMC's personnel – many of whom were not only dedicated and determined, but also highly skilled – were initially overwhelmed by unprecedented circumstances and events beyond their control. They were unprepared for what they encountered on the Western Front, a situation perfectly understandable given the relatively unprecedented and unexpected nature of modern trench warfare. Still, by the latter part of the war, this initial shock was overcome and trench fever and its causes were correctly identified. With these the CAMC and the CEF developed or were availed the knowledge, technology and means necessary to effectively control, if not eradicate, body lice infestations in its ranks and effectively prevent the spread of trench fever.

With the tools needed in the Canadian arsenal to achieve qualified victory over lice, and therefore over trench fever, why did the problems persist, as did the threat of louse-borne disease? Quite simply, the CEF was badly hobbled by organizational inertia in its upper ranks. Unlike many of their subordinates, the army's senior commanders did not fully adapt to modern war when they collectively failed to fully embrace the notion that health and hygiene were crucial matters that demanded serious attention in modern armies. Moreover, they failed to accept that they were ultimately responsible for seeing that effective health measures were properly and adequately adopted. Obsolete and poor leadership in this regard led to systemic dysfunction. The corporate will required to effectually "pull the trigger" on lice and louse-borne disease was neither effectively

fostered nor enforced by the senior commanders of the CEF. Apathy, incompetence and even negligence – not purely ignorance – were trench fever's greatest allies in its battle with the Canadians on the Western Front. It must be concluded that these institutionalized problems not only plagued the army's uppermost ranks, but were perpetuated by the CEF's senior commanders as well.

CHAPTER FIVE

PEACE, THE ATROPHY OF MEMORY AND A NEW WAR

Over 21,000 men and women served in the CAMC during the Great War.[475] One year after the cessation of hostilities, in recognition of their stellar service and contribution to the war effort, King George V conferred the title of Royal upon the permanent force of the CAMC, in November 1919.[476] Unfortunately, attaching the Royal prefix may have been a fine honour, but it added no money to the coffers; and the Canadian army's medical service underwent a rapid, and relatively haphazard, de-mobilization process that began within weeks of the Armistice, eventually reverting to a permanent establishment comparable to its pre-war size. By 1924, the Royal Canadian Army Medical Corps (RCAMC) consisted of 144 officers, including nursing sisters, and ORs.[477] The organization's non-permanent militia numbered just over 1,100 in 1924.[478] As a general trend, this paucity of both permanent and non-permanent personnel in the medical services steadily worsened over the next decade and a half.[479]

This numeric diminution of the Royal Canadian Army Medical Corps was accompanied by a marked policy of fiscal reductions at the hands of a federal government

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[475] Nicholson, *Seventy Years of Service*, p. 112.
[476] An additional two decades would pass before the non-permanent army medical corps would also be conferred the honour of the "Royal" prefix. Bill Rawling, *Death Their Enemy: Canadian Medical Practitioners and War* (Quebec: AGMV Marquis, 2001), p. 71; Nicholson, *Seventy Years of Service*, p. 114.
[477] Nicholson, *Seventy Years of Service*, p. 114.
[478] Nicholson, *Seventy Years of Service*, p. 116.
[479] *Report of the Department of National Defence Canada for the Fiscal Year Ending March 31, 1932* (Ottawa: King's Printer, 1932), pp. 8-16, 33, 55; and *Report of the Department of National Defence Canada for the Fiscal Year Ending March 31 1939* (Ottawa: King's Printer, 1939), p. 9-16.

more concerned with domestic issues than the possibility of another massive "war to end all wars." Consequently, "very little money" was allocated by the federal government to train members of both the permanent and non-permanent groups in the aftermath of the Great War – a chronic problem in the relatively peaceful decades that followed.[480]

Salaries of senior medical staff were also cut, with the RCAMC's total complement of administrative *and* medical officers "barely exceeding thirty for most of [the 1920s and 30s]."[481] Capital expenses were cut to the bone, especially during the economic downturn of the 1930s.[482] Under-funding became the rule of the day. Conspicuous austerity and depletion continued to be a constant and over-riding theme in the medical services. Education of medicos and the training of all service personnel in terms of health and hygiene was conducted inadequately. Within the Canadian military, infectious disease prevention was on the human equivalent of palliative life support. Corporate amnesia, within the entire Canadian military, was acute.

The army, on which the RCAMC and CAMC served, was consistently short of money, as the nation's defence budgets "remained pitifully small for most of the twenty years between the two world wars."[483] In particular, during Prime Minister RB Bennett's tenure in the 1930s, cash-strapped politicians and bureaucrats were continually seeking funds to somehow financially mitigate the ravages of the Depression on Canada. As a consequence, they "ransacked" an "obvious target" – the Department of Defence

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[480] Nicholson, *Seventy Years of Service*, p. 116.
[481] Nicholson, *Seventy Years of Service*, p. 122.
[482] *Report of the Department of National Defence Canada for the Fiscal Year Ending March 31 1939* , p. 8.
[483] Stephen J. Harris, *Canadian Brass: The Making of a Professional Army, 1860-1939* (Toronto: University of Toronto Press, 1988), p. 192.

budgets.[484] Bennett's successor, Mackenzie King, had a remarkable aversion to defence spending, as well. Under King, the permanent army and militia faced even more cuts, although the navy and air force both experienced some marginal increases in funding in the late 1930s.[485]

Still, as Canadian military historian Stephen Harris has concluded, the interwar funding crunch "is no excuse for failing to produce an officer corps well versed in the art and science of war and be able to lead effectively."[486] Perhaps the same could be said of the RCAMC.

When General Arthur Currie resigned in 1920, he was "convinced that the regular army had been sentenced to years of mediocrity" due, in part, to the consideration that there existed "few opportunities and little motivation to keep the best minds of the experienced veterans on board."[487] By extension, Currie's comments could have been applied to the talented and experienced personnel of the CAMC, many of whom came to the fore during the Great War. Certainly, for medical scientists and clinicians alike, a return to civilian life – replete with civilian salaries, not to mention funded research and career opportunities – looked like the only sane option, especially when compared to staying actively involved with a cash-strapped and apparently uninterested military establishment.

It is beyond doubt that the chronic and long-term under-funding of the RCAMC and CAMC was damaging. Moreover, the decisions made by medical service officers on

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[484] Desmond Morton, *A Military History of Canada: From Champlain to the Gulf War* (Toronto: McClelland and Stewart, 1992), p. 174.
[485] Morton, *A Military History of Canada*, p. 174-77.
[486] Harris, *Canadian Brass*, p. 193.
[487] Harris, *Canadian Brass*, p. 193.

how to make sparse expenditures were also suspect to a degree. In support of this conclusion, one official historian of the medical service, Col. G.W.L. Nicholson, reported that "the only significant purchase of medical equipment made during the years of peace" was twelve ambulances. Not surprisingly, by the eve of Nazi Germany's invasion of Poland and the start of the Second World War in 1939, much of the RCAMC's equipment was deemed "either obsolescent or obsolete", a situation that was apparently the rule throughout the Canadian army as a whole.[488] So serious was the state of affairs that virtually all the field equipment for the entire Canadian 1st Division overseas would have to be supplied by Britain.

In addition, the appalling lack of attention to training, brought about in large part but not exclusively to a paucity of funds, was apparent. One future ADMS in the Canadian Army, when reflecting on his experiences at the beginning of the war, would later relate that "none of us had more than a faint knowledge of our tasks." Oddly, after his inclusion of this statement in *Seventy Years of Service*, the official historian, G.W.L. Nicholson, then made the apparently contradictory conclusion that "the qualifications possessed by these professionals made it possible for them to respond with alacrity when the call came, and thereafter to maintain a standard such that their Corps would never be found wanting during the whole of the war."[489] Clearly, Nicholson's optimism and positivism in regard to Canadian medicos' preparedness at the onset of the conflict was unwarranted.

A high level of *esprit de corps* existed in the RCAMC at the beginning of the Second World War. However, the issue and consequence of Canadian unpreparedness,

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[488] Nicholson, *Seventy Years of Service*, p. 135.
[489] Nicholson, *Seventy Years of Service*, p. 135.

especially in terms of health related matters, would prove itself to be an issue not entirely related to well-meaningfulness or drive within the RCAMC. Rather, the key and central issue for the RCAMC and the rest of the Canadian Army was how quickly, if ever, it would take so that they may regain the corporate skill, knowledge and memory related to their collective experiences with disease prevention which was so difficultly amassed during the Great War – and apparently so easily tossed away during the interwar era.

With the exception of the ill-fated raid on Dieppe in August 1942, Canadian army units deployed to Britain and the European theatre would not see combat until the summer of 1943. So, fortunately, there was time available to correct the deficits that had been allowed to develop during the previous decades of neglect. Surely, the luxury of time – a valuable commodity not often available in wartime – would not be squandered by the Canadian authorities and the interwar shortfalls would be overcome before the Canadians would see large-scale combat in their first major campaign of the Second World War. In 1943, that battleground would be Sicily. The foes, the Axis nations of Germany and Italy, and another unseen enemy which would challenge the Canadian's health and survival: the infectious disease of malaria.

In 1943, senior military personnel, scientists and medical practitioners were aware of the causes of malaria and measures that could limit, if not eliminate, its effect upon the fighting strength or health of soldiers. Malaria, whose name was derived from the Latin "malus" meaning bad and "aer" meaning air, is a disease caused by the introduction of sporozoan parasites into the bloodstream. Transmission of these parasites, from one human host to another, is facilitated by the bite of a vector — a female anopheline mosquito. Soon after introduction to a human's circulatory system,

the parasite begins to attack and destroy its host's red blood cells. Overt physical symptoms are normally seen after a ten to twelve day incubation period. These incapacitating symptoms include chills, fever (often accompanied by hallucination), high temperature and then profuse perspiration. Two types of malaria were present in Sicily in 1943. The first, and by far the most prevalent strain, was benign tertian (BT), which was rarely fatal. The much less common malignant tertian (MT) malaria, which could prove to often be fatal, especially if left untreated, probably accounted for just a few Canadian deaths, although statistical evidence is lacking. At best, soldiers afflicted with either type of malaria could expect to be bed-ridden for over a week and then face at least another ten to fourteen days of convalescence, before rejoining their respective units. Drug treatment for those infected with malaria in the early 1940's was the same as it had been for over a hundred years – the oral administration of quinine.[490] Caution had to be exercised in determining dosage as individual sensitivity to quinine's toxicity could vary. Frequent relapse of the disease was very likely in the event the infected person was not completely cured.

Nearly three decades previously, during the First World War, a significant number of CAMC personnel had become very familiar with malaria, especially with regards to treatment of those afflicted with the infectious disease. Between 1915 and 1917, over one thousand Canadian medical workers, most of whom were stationed at the three CAMC General Hospitals temporarily located in the Mediterranean and Middle-eastern theatres, in support of British Army operations[491], saw thousands of cases of

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[490] Hill, *Silent Enemies*, pp. 19-21.
[491] Most of these Canadian medical personnel were stationed at or near Salonica, in current-day Greece.

malaria. Some of these Canadians contracted the disease during their deployment, although the specific number is not known.[492] Some of the more serious cases of malaria among those Britons and Canadians infected with the disease in these other theatres of war were transferred to England for additional treatment and convalescence, many of them at CAMC General Hospitals.[493] Additionally, Canadians, specifically the senior ranks of the CAMC, were made very well aware of modern and effective anti-malaria measures, treatments and moreover, the great problems the disease was causing to some of its co-belligerents, Allied Forces Sanitary Commission meetings.[494] The DMS in charge of Canadian Medical Units saw to the wide internal circulation of "An Interim Report on the Treatment of Malaria: Abstract of 2,460 Cases – War Office Investigations" compiled by a British War Office Malaria consultant. This report, which was published in several versions during late 1917 and early 1918, clearly and comprehensively presented information concerning the treatment of malaria.[495] Some CAMC Sanitary Sections, under the direction of senior medical officers, working on and near Canadian occupied sections of the Western Front during the First World War took

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[492] LAC, RG 9, III, B2, Vol. 3602, DMS – London, Medical War Diaries, file 24-3-3 (Vol. 1), "Malaria in Canadian Troops", memorandum from No. 3 Canadian General Hospital, n.d. (circa late 1917) p. 1.
[493] LAC, RG 9, III, B2, Vol. 3615, DMS – London, Diseases Misc., Mediterranean Fever, file 25-4-3, various completed "Infectious Diseases Notification Forms" dated circa 1918.
[494] LAC, RG9, Series III, Vol. 3606, file 25-1-0, Vol. 1, Summary of Allied Forces Sanitary Commission meeting March-April 1916, p. 6.
[495] LAC, RG 9, III, B2, Vol. 3615, DMS – London, Diseases Misc., Mediterranean Fever, file 25-4-3, "An Interim Report on the Treatment of Malaria: Abstract of 2,460 Cases – War Office Investigations", 17 April 1918, p. 1; It's interesting to note that this CAMC file was located under the heading "Mediterranean Fever", and moreover, no specific Malaria file seems to have been created by anyone in the DMS office during or directly after the Great War.

measures to environmentally alter known mosquito breeding areas in 1917.[496] These moves were wise, given that it was known in some circles that "malaria was rife" in Flanders' recent history.[497]

Not surprisingly, at the forefront of Canadian anti-malarial work during the First World War was the hard-working Captain (later Major) A.C. Rankin of No.5 Canadian Mobile Laboratory. Throughout the Great War, the tireless Canadian scientist gathered, examined and analyzed mosquitoes and larvae; tested hundreds, if not thousands, of blood samples and smears he personally collected from British, British colonial and Canadian troops.[498] Fortunately, although mosquitoes were endemic to the Western Front, not a single new case of malaria was ever identified in this theatre of operations by 1916 and the highly contagious disease never became a problem in the Canadian ranks during the campaign.[499]

Still, concern about malaria breaking out in Canada as a direct consequence of the Great War was evident in a September 1917 letter sent from the Director-General of Medical Services (DGMS), Canadian Militia (based in Ottawa) to the DMS of Overseas Military Forces of Canada, based in London. The DGMS was wary that of "a certain number of old malaria cases being returned to Canada", coupled with the "fairly

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[496] LAC, RG 9, Series III, Vol. 3606, DMS – London, Sanitation – General Correspondence, 25-1-0, "Sanitation in Canadian Camps" Report from CAMC Sanitary Advisor to DMS Canadian Contingents, 16 May 1917, p. 6; and LAC, RG 9, Series III, Vol. 3606, Sanitation, file 25-1-0, "Report on Sanitation – Paris Meeting March 1918" by DMS Canadian Contingent, n.d., pp. 4, 6-7.
[497] Adami, *War Story of the Canadian Army Medical*, p. 281.
[498] LAC, RG 9, Series III, Vol. 3748, Adami Papers – No.5 Canadian Mobile Laboratory, "Interim Report of No.5 Canadian Mobile Laboratory … until December 31st, 1915", p.7; and LAC, RG 9-III-D-3, Vol. 5038, No.5 Canadian Mobile Laboratory, War Diary, various 1915 to 1918.
[499] LAC, RG 9, III, B2, Vol. 3748, Adami Papers, "No.5 Canadian Mobile Laboratory", "Report of Work Done in No.5 (Canadian) Mobile Laboratory during August 1916", p. 1.

universally" present mosquitoes in Canada. Accordingly, he requested that one hundred copies of the British War Office publication "Provisional Instructions for the Treatment of Malaria Cases, August 1917" be forwarded to Canada for distribution.[500] The DGMS's unease may have been fuelled as well by growing domestic first-hand knowledge and experience with malaria afflicted soldiers at CAMC operated medical facilities in the dominion's west coast region.[501] In any case, it appears that malaria was not introduced – or at least identified as a public health risk – in Canadian territory immediately after the Great War.

Nevertheless, two and a half decades later, it would become crystal clear that on the eve of Operation HUSKY, the Allied invasion of the Italian island of Sicily, that the existing military, scientific and medical knowledge of malaria was not effectively applied. Certainly, direct Canadian experience with malaria among those in active service was virtually non-existent in all branches of the armed forces, including the RCAMC, but more importantly, Canada's corporate knowledge of the disease which it had gained in the Great War had been long forgotten. Adding to this dire dearth of malaria-related intelligence, virtually no Canadian soldiers involved in the planning or execution of HUSKY had served in tropical or malarious locales prior to 1943.

So what of Canada's combat troops? Understandably, malaria was not well known, if at all, and of little concern to a machinist from Quebec City turned tank driver

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[500] LAC, RG 9, III, B2, Vol. 3615, DMS – London, Diseases Misc., Mediterranean Fever, file 25-4-3, Letter from the Director-General of Medical Services, Canadian Militia (Ottawa) to the DMS of Overseas Military Forces of Canada (London), 15 September 1917.

[501] LAC, RG 9, Series III-B2, Vol. 3746, Adami Papers – Misc. Extracts; Reports etc., "No.5 Canadian General Hospital – British Columbia: Registrar's Department, Report on Admissions, Discharges, Diseases etc. For the Year 1916", pp.1-2.

or a farmer from Abbotsford, British Columbia, turned rifleman. For these men, and for many of their comrades-at-arms, mosquitoes were perceived to be not much more than a trifling nuisance at home. It understandably would have been difficult to believe that a "pesky little skeeter" could constitute a threat to their life or their long-term health, especially on the field of battle. But what of those individuals who were responsible for these soldier's well-being and ability to combat? In the first half of 1943, the prevalent culture in the Canadian military appears to have been not particularly receptive to hygiene in general and, in particular, to something as intangible and unseen as malaria. Regardless of their various backgrounds and professions, the troops, officers and medical officers of the Division and the RCAMC shared a common future when they landed on the shores of southern Sicily – a steep learning curve.

It is clear that, given the advanced state of available contemporary knowledge regarding military hygiene and anti-malaria measures, the Canadian army that landed in Sicily should not have experienced a serious problem, much less an epidemic, with malaria. Yet, it did. The causes of malaria, as well as anti-malarial measures, were known in medical and senior military circles at the onset of the Second World War. British experience with malaria outbreaks during the North and East African campaigns of 1940 to 1943 had not only served to underscore the danger of this disease but had allowed opportunity to further develop and organize effective anti-malarial strategies and the necessary infrastructure to support them.

For their part, the Canadian force that landed in Sicily in 1943 would not effectively apply a cohesive or well-coordinated and cogent anti-malarial strategy. As the following chapters will demonstrate, a lack corporate memory would contribute

significantly to this negative result. Unfortunately, it will also become clear that the dominant and prevalent attitudes held towards disease during the First World War by many of our senior commanders remained alive and well in the hearts and minds of their successors in this subsequent war – once again needlessly placing the nation's army in peril.

CHAPTER SIX

"ENEMY NO. 1": ANTI-MALARIA MEASURES ON THE EVE OF THE INVASION OF SICILY

As in the First World War, the organization of all medical related units in the Canadian Army, including hygiene and sanitation, were based on the British model. The RCAMC, although technically a separate entity from Britain's Royal Army Medical Corps (RAMC), worked in close cooperation with the British and was largely dependant on the British for direction and equipment since the beginning of the war. Thus, the anti-malaria policies, procedures and measures that were to be practiced by the Canadian Army and RCAMC, in theory, mirrored those of the British.

In early 1943, Britain's War Office, with the aid of military and civilian medical authorities and scientists, published the "Handbook of Military Hygiene 1943." The officers' guide stipulated that "there are no subjects of greater importance than the preservation of the health of the soldier and the prevention of disease in the Army." The rationale for this conclusion was also provided. The authors recognized that large resources were required to fully train and equip soldiers. Disease not only limited or rendered ineffective the fighting ability of individual soldiers, sick casualties created a drain of the Army's materials and resources since they consumed the efforts of other military personnel and the expenditure of scarce resources needed to conduct military operations.[502] In essence, if left unchecked, disease could both hinder the ability of armies to conduct operations in the field and endanger entire campaigns.

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[502] DHH, FN 62, "Handbook of Military Hygiene 1943", p. 4.

Of course, the "Handbook of Military Hygiene" was meant to promote correct hygiene and sanitation practices wherever the British armies were garrisoned or deployed. However, the main thrust of the War Office was to promote the belief that the pursuit of proper hygiene was of particular importance for wartime field armies, since the incidence of disease was more likely in such cases than in any other. The reasons for this are compelling. First, field soldiers might experience lowered resistance to disease due to a lack of and/or poor quality of sleep, food, and protection from the elements. Second, cross infection between soldiers was facilitated by frequently crowded conditions. Third, sanitation facilities which were normally taken for granted by civilians and soldiers during peacetime had to be rudimentarily recreated in the field. Last, it was often militarily expedient to traverse or inhabit areas in which some diseases naturally flourished and would, therefore, normally be avoided.[503]

Since the aetiology and vectors of most diseases were known, they were deemed as being largely preventable. It was simply a matter of following scientifically based principles. To facilitate this, the War Office publication declared it "essential" that individual soldiers be trained in the techniques of proper hygiene "just as the soldier is taught during training the use of weapons he will employ in battle."[504] According to the "Handbook of Military Hygiene", although every soldier, regardless of rank, was obliged to practice these measures, the ultimate responsibility belonged to Commanding Officers, who were to constantly and consistently ensure that "the measures laid down for the preservation of health and fighting efficiency of the troops are carried out by all ranks

[503] "Handbook of Military Hygiene 1943", p. 7.
[504] "Handbook of Military Hygiene 1943", p. 5.

under their command."[505] This accountability had been originally codified in the 1930 Field Service Regulations and the Kings Regulations in 1940.[506]

Although holding ultimate responsibility within their unit boundaries, the burden was not solely placed upon the Commanding Officer's shoulders. As in any other of a commander's duties, assigning to subservient staff and personnel hygiene related tasks was a desirable, if not necessary, strategy. The same official War Establishments that allowed for Commanding Officers or Officers Commanding to delegate specialized manpower to accomplish tasks in kitchens or offices, required them to supply adequate personnel to act in all areas of hygiene ranging from water quality assurance and procurement, to the placement and digging of latrines, to anti-malaria squads.[507] Advice, training, literature and equipment--virtually any type of assistance--regarding any aspect of hygiene, was available to the commander through their regimental medical officer or the RAMC.

In addition to the "Handbook of Military Hygiene", army commanders and other officers slated to take part in HUSKY could also consult another War Office publication called "Malaria 1943: A Pamphlet for Officers." As its title suggests, "Malaria 1943" was directed at officers with two expressed purposes: first, to instruct the officers themselves with regards to malaria and anti-malaria measures; and second, to provide officers with a guidebook to facilitate the education of the men under their command. There was also a short section in the guide aimed exclusively at medical officers.[508]

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[505] "Handbook of Military Hygiene 1943", pp. 4-5.
[506] "Handbook of Military Hygiene 1943", p. 4.
[507] "Handbook of Military Hygiene 1943", p. 5.
[508] The Directorate of History and Heritage, National Defence Headquarters, Ottawa (hereafter DHH), FN 61, "Malaria 1943: A Pamphlet for Officers", foreword.

The writing style and tone of "Malaria 1943" was simple, basic and direct. Officers and ORs were encouraged to demonstrate their adherence to anti-malaria precautions and to compel others more junior to do so, as well. Various motivational appeals were supplied in "Malaria 1943." These ranged from appeals to the universal desire of most soldiers to return home unscathed, such as "Malaria can ruin your health permanently", to collective desires to be victorious: "A battle, even a campaign, can be lost without a bullet being fired." Strict discipline was the key to defeating the enemy on the field of battle, claimed "Malaria 1943", adding "there must be no shirkers."[509]

The central message regarding responsibility in "Malaria 1943" was the same as that stressed in the "Handbook of Military Hygiene." It appears that the War Office, at least officially, was consistent in its view that commanders must consider it their personal duty to ensure that correct anti-malaria procedures were being followed by all those falling under their command. This weighty responsibility, the pamphlet continued, was not to be delegated to their unit's medical officer, whom the commander was to consider as "only the expert advisor."[510]

"Malaria 1943" and the "Handbook of Military Hygiene" provide an informative window into the specifics of recommended anti-malaria precautions for the British Eighth Army on the eve of the HUSKY invasion. The pamphlets made it clear that, singularly, anti-malaria measures were not deemed to be especially effective. Rather, success was considered to be achievable when a combination of four basic precautionary categories were satisfied. Recognizing that mosquitoes were the "porters" of malaria, the destruction and/or control of these disease vectors was paramount. The recommended

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[509] "Malaria 1943", p. 1.
[510] "Malaria 1943", p. 1.

counter measures to be followed in malarious areas were: i) avoidance of the vector; ii) elimination and control of the vector; iii) protection of men from being bitten by potentially infected mosquitoes; iv) prevention of cross-infection; and v) chemical prophylaxis.[511]

The first anti-malaria precaution was the avoidance or limitation of contact with existing mosquito populations. The responsibility of satisfying this precaution when on active operations was normally that of a unit's commander, since he usually had some measure of choice in selecting encampments, avenues of advance and transportation routes. Of course, the outright avoidance of mosquito infested locales was not always possible due to overriding tactical or strategic military concerns, which were often determined by senior officers at Army, Divisional or Corps headquarters. Yet, siting permanent or temporary camps in order to minimize contact with mosquitoes was a primary concern of senior medical officers in the War Office. Thus, their standing recommendation was that, wherever and whenever possible, British commander's choice of camp and bivouac sites be made with hygiene and malaria in mind. Two main criteria governed site selection. First, encampments in or around civilian dwellings and villages were determined to be potentially dangerous, since as stated in "Malaria 1943", "the most common source of malaria is the local inhabitant. He generally goes about only half-clad and therefore mosquitoes have glorious opportunities to feed on him; nor does he use a mosquito net at night."[512] The notion that local populations in tropical areas were semi-civilized and veritable cornucopias of disease was encouraged by the War Office. This perception included the erroneous and persistent belief that malarious areas were only

[511] "Handbook of Military Hygiene 1943", p. 76.
[512] "Malaria 1943", p. 3.

located in the tropics and confusion as to the identity of the actual vectors of malaria. In both "Malaria 1943" and the "Handbook of Military Hygiene", there was apparently little, if any, official concern expressed for the danger large numbers of foreign troops posed to the health of local civilian populations. Yet, this ethnocentrism did have some justification, for if needless contact between civilians and military personnel could be limited, the propagation of disease could also be limited, a benefit for both groups. The second component of camp and bivouac site selection, for malaria conscious officers, was to stay away from, and up-wind of, suspected or confirmed mosquito breeding areas.

The second major anti-malaria measure was the destruction and/or limitation of mosquito populations at either the larval or adult stages. Mosquitoes lay their eggs on or just below any water surface. Although most species of mosquito prefer to do this in free-standing or relatively stagnant water, many varieties of the insect are generally not adverse to choosing breeding grounds in agitated or flowing water. Consequently, the British Army cautioned its men that eggs and larvae could be found in a multitude of locations ranging from "ponds and streams, marshes, shallow collections in large leaves or hollows at the forks of branches of trees, or in domestic collections in water tubs, broken guttering, tins thrown in the rubbish heap, ... abandoned water troughs", and even in the muddy water that often collected in hoof prints and wheel ruts.[513] Although most species of mosquitoes favour laying their eggs in standing shaded water, some readily bred in sunlit water.[514] Ideally, if the indigenous species of malaria-carrying mosquitoes could be determined, then so too could their breeding habits and adaptability. Yet, in practical terms, owing to the difficulty of entomological analysis in field and combat

[513] "Handbook of Military Hygiene 1943", pp. 84-5.
[514] "Handbook of Military Hygiene 1943", p. 86.

conditions, a wide-encompassing attempt to eliminate breeding was recognized to be the wisest form of prevention.

Environmental control and management was a cornerstone of hygiene. Accordingly, all ranks were expected to deny mosquitoes the opportunity to breed in and around army encampments, simply by ensuring that rain water was not allowed to accumulate and by either screening or netting drinking water tanks and reservoirs. As the larvae stage for most mosquitoes was seven to ten days in length, livestock water troughs—impractical to keep constantly sealed—were to be drained and allowed to dry on a weekly basis.[515]

These local efforts were helpful but large scale work was recognized to be necessary to control mass mosquito breeding. Large collections of water, such as swamps, marshes and pools, required draining on a weekly basis. When this was impractical, these areas were to receive the same treatment as lakes and ponds, which was oiling, spraying and dusting of the water's surfaces with various inhibitors and insecticides.[516] This work, the War Office had determined, demanded designated personnel, not only due to the scope of the work but because of the high degree of specialization required.[517]

The destruction of adult mosquitoes was a somewhat more understandable task for the average soldier. It was known that adult Anopheline mosquitoes, which were the dominant variety and the most likely malaria vectors around the Mediterranean, typically avoided exposure to the sun and, generally, were most active in the period from dusk to

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[515] "Handbook of Military Hygiene 1943", p. 86.
[516] "Handbook of Military Hygiene 1943", p. 85.
[517] "Handbook of Military Hygiene 1943", p. 86.

dawn. Thus, while resting during the day, if they were not seeking the protection offered by outside overgrowth, they could be found "hiding" in shady and sheltered areas indoors, such as in hanging clothing, inside cabinets and cupboards and in corners. Accordingly, British troops in malarious areas were encouraged to engage in indoors hunting expeditions at every opportunity during daylight.[518] The War Office suggested that the use of a fly-swatter was preferable to the less desirable but effective, method of slapping or crushing mosquitoes with one's hands. A hand-held, pump activated, insecticide sprayer which could also be used in dark indoor recesses was widely issued in malarious zones. To aid finding and spraying one's quarry, it was suggested that walls in barracks or buildings be painted in light colours to contrast with the mosquitoes.[519]

Since the beginning of the war, the British utilized an insecticide for indoor use which was comprised of one part pyrethrum to sixty-four parts kerosene. Pyrethrum, an extract derived from a type of chrysanthemum flower, was often in short supply owing to high demand and limited production. The industrial rendering of pyrethrum was done in the United States but this was dependant on the harvesting of flowers only available in quantity from Kenya. Manufacturers required one ton of flowers to yield one hundred pounds of extract.[520] Due to the difficulties in guaranteeing stocks, pyrethrum spray (also known as "flysol" or more commonly as "flit") was mainly for indoor situations and normally applied by hand held pump sprayers (flit sprayers). However, in early 1943, a new weapon in the anti-mosquito arsenal was touted, in "Malaria 1943." This was the first generation of aerosol "bomb", which released a fine mist of enveloping pyrethrum

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[518] "Handbook of Military Hygiene 1943", p. 85.
[519] "Handbook of Military Hygiene 1943", p. 86.
[520] F.A.E. Crew, *History of the Second World War: The Army Medical Services, Administration Vol. II* (London: Her Majesty's Stationary Office, 1955), pp. 196-7.

insecticide in enclosed areas. These bombs had a more immediate, effective and persistent effect than other contemporary applicators.[521]

Of course, the complete and total destruction of adult mosquito populations in malarious areas was virtually impossible to guarantee, especially in and near combat zones. Consequently, the third line of defence against malaria was to create a barrier between potentially infected mosquitoes and individual soldiers. Various strategies and methods of "personal protection" were promoted by the War Office. The first was to wear proper clothing when in malarious locales. Tropical and desert combat wear in the British Army, for both officers and ORs, typically included short sleeved shirts and shorts. Puttees, which were not consistently worn, provided the calf some protection from elements and insects. During daylight hours, exposed skin did not constitute a problem, insofar as malaria was concerned, since there was virtually no danger of mosquito bites. However, at sundown officers and ORs were required to minimize the amount of exposed skin.[522] "Malaria 1943" stated that all ranks "should" don full-legged pants and long-sleeved buttoned down shirts (buttoned at sleeve and collar) or jackets before sundown.[523] The use of boots or puttees in the evening and the wearing of "two pairs of socks" when not wearing footwear was also recommended.[524] During active operations, it was suggested that veils and gauntlets be supplied to soldiers on non-daylight sentry duty or patrols.[525]

Clothing alone, for all practical purposes, could not provide a barrier between

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[521] "Malaria 1943", p. 6.
[522] "Malaria 1943", p. 6.
[523] "Malaria 1943", p. 7.
[524] "Malaria 1943", p. 7.
[525] "Handbook of Military Hygiene 1943", p. 88.

man and mosquito. When not "turned in" for the night, all ranks in malarious areas were required to use an anti-mosquito repellent. This was available in the form of a cream or ointment that was to be "liberally" applied on all exposed skin; such as hands, neck and face.[526]

After dark, the best way to avoid mosquitoes altogether was by staying in an enclosed area. In rear areas, soldiers assembling and/or socializing in the evening were advised to do so indoors, where mosquitoes could be easily denied easy access to a blood meal. In barracks or billets, mosquito-proofing included the use of window screens and a further measure of protection could be found through the use of mosquito nets.[527] When in the field or on active operations, bush nets or bivouac mosquito nets were to be used. The contemporary British bush net was designed to provide a portable and protective sleeping coverage for one soldier. It consisted of four wooden corner posts and guy ropes supporting a canvas and mosquito netting rectangular box. Its transportable gross weight was just over three pounds. An alternative, the two-man bivouac mosquito net, had a design that was similar to that of a standard "pup" tent, with canvas sides and mosquito or sand-fly proof netting on each end. The next anti-malarial precaution was to prevent cross-infection. That is, stopping mosquitoes from transporting the malaria parasite from an infected and sick soldier to a healthy soldier. This measure was often easy to accomplish since those afflicted with malaria were usually exhausted and bed-ridden.[528]

The last stage in defence, and the most important component, in guarding against malaria was chemical (or "drug") prophylaxis. For decades, the standard drug used

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[526] "Malaria 1943", p. 7.
[527] "Malaria 1943", p. 6.
[528] "Handbook of Military Hygiene 1943", p. 86.

successfully world-wide for this suppressive purpose was quinine. Of course, in low suppressive doses, quinine did not protect individuals from being bitten and having the malaria parasite introduced into their blood but it did serve to keep the malaria parasites in check and prevented the spread of the disease. Large doses of quinine were reserved for treatment of full-blown cases of malaria, since the drug could be toxic and, if not administered carefully, could cause permanent liver damage.

Essentially, the island of Java was home to the world's only supply of raw quinine, which is a derivative of the bark of cinchona trees. Presumably spurred by the awareness that the drug could be denied them by the Dutch, German chemists in the early 1930's succeeded in their attempts to produce a substitute for quinine. The synthesized drug, called atebrine, would be of great use for military operations in the tropics, a fact not lost on the German *Wehrmacht*. Inexplicably, before the war broke out a nearly intact formula for atebrine was sold to American interests by German chemists.[529] With the aid of this information, British and American scientists were able to develop an equivalent by the end of the 1930's. It was called mepacrine.

The Japanese occupation of Java, in early March 1942, created a grave crisis for the Allies, as the island was their principal source of quinine. The British responded to the crisis by immediately restricting use of their existing stocks of quinine and accelerating the production and purchase of mepacrine. Testing of mepacrine and atebrine had indicated that although they had good suppressive qualities, the drugs fell short of equaling quinine's therapeutic efficacy. As a result, it was decided that

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[529] Mark Harrison, "Medicine and the Culture of Command: the Case of Malaria Control in the British Army During the Two World Wars", *Medical History*, Vol. 40 (1996), p. 445.

mepacrine would be used solely for malaria suppression and quinine for treatment. Quinine was to be used as a malaria suppressant only if mepacrine was unavailable.[530]

For the remainder of 1942 and into early 1943, British medical experts experienced difficulty in determining what dosage of mepacrine would protect against the most resistant strains of malaria and yet not be toxic. The prophylaxis doses initially settled upon for military personnel stationed in hyper-endemic areas were ten grains per day, everyday except Sunday, for a total of sixty grains (0.6 grams) per week.[531]

Soon after these mepacrine dosage recommendations were put into effect, it was suspected that the dosage levels were too high. It was reported by some units, then in North Africa, that the recommended mepacrine doses were producing some particularly nasty side-effects which included "severe vomiting, diarrhoea and cramps", even leading in some cases to "extreme collapse."[532]

The British Army's Director of Hygiene later recorded that although there "was some doubt as to the safety" of administering soldiers a full sixty grains of mepacrine per week, it was decided by a panel of experts that the dose was "not unduly dangerous" for soldiers in areas determined to be hyper-endemic malarious. Army personnel deployed in areas where malaria was considered to be endemic were administered forty grains of mepacrine per week. Suppressive treatment was to be begun one week before soldiers arrived in the malarious zone to allow for habituation and hopefully avoidance of negative physical side-effects.[533]

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[530] Crew, *Administration Vol. II*, p. 198.
[531] Crew, *Administration Vol. II*, p. 198.
[532] Crew, *Administration Vol. II*, p. 199.
[533] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.

In December 1942, British Field-Marshall A. P. Wavell informed the General Officers Commanding-in-Chief, that future military success was predicated upon strident hygiene practices. He surmised that "disease, and especially malaria" might be "a more dangerous factor than enemy resistance in future operations."[534] Spurred in part by Wavell's ominous warnings and by the knowledge that troop commitments and deployments in malarious areas were bound to increase drastically in the very near future, the RAMC assembled a group to examine and evaluate the existing state of malaria prevention and treatment in the British and Commonwealth armies. This group was then to report and make recommendations to the British Army. Consequently, on 15 March 1943, Lt. General A. Hood, the Director-General of the Army Medical Service (DGAMS), convened a meeting in London. The meeting's roster was composed of an impressive, and unprecedented, collection of distinguished scientists, researchers, scholars, and senior medical officers, but there were no Canadian representatives in attendance. The meeting's minutes were forwarded to the RCAMC a month later.[535]

Serving as the group's chairman, the DGAMS professed in his opening remarks that "malaria must be regarded as 'Enemy No. 1' in campaigns in many parts of the world." Discussion appears to have been candid and forthright. One senior RAMC officer relayed that he had heard reports that some troops that had recently been deployed in North Africa had not begun anti-malaria measures of any kind until two or three days after arrival. He added that he was also aware that many medical officers "had not been

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[534] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, untitled memorandum from Field-Marshall A. P. Wavell to the General Officers Commanding-in-Chief, 9 December 1942.
[535] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.

properly instructed, and were said to be slack and not interested" in anti-malaria measures. This contention was strenuously denied by the attending representative from the London School of Tropical Medicine and Hygiene, who countered that his institute had trained 1200 to 1400 "extraordinarily keen" medical officers. The DGAMS supported his colleague, adding that "every" medical officer had received a comprehensive ten to fourteen day education course dealing with tropical disease and was issued the recently published "Malaria 1943." Following this, the main topics of discussion fell into the categories of i) suppressive drug treatment; ii) mosquito repellents (sprays and creams); iii) clothing; and iv) mosquito destruction.[536]

The policies and procedures surrounding suppressive mepacrine had continued to be controversial. The DGAMS's assembly noted and discussed the nagging concerns regarding the potential toxicity of mepacrine. Scientifically sound evidence in this area remained incomplete. Yet, the dosage levels that had recently been approved by the Director of Hygiene were agreed to for the time being. The committee also concurred with the Director's contention that it was prudent to ensure that troops, in order to avoid risking cross-infection, maintain taking mepacrine for a period of one month after leaving malarial areas.[537]

One meeting member insisted that the crucial matter regarding mepacrine was not limited to determining safe dosage levels but ensuring that all ranks in malarious areas were consistently complying with the regulations to take the drug on a regular basis. "Skipping" or irregularly administrating mepacrine severely limited the drug's

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[536] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[537] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.

suppressive value. The chief consulting physician for the Colonial Office suggested that verification of mepacrine in a soldier's system could and should be confirmed through mandatory urine testing.[538]

After much discussion the meeting's participants determined that the only practical course of action to ensure that the self-administration of mepacrine was regularly taking place was through supervision by officers in the field. The responsibility for supervising troops in this regard, they concluded, did not and should not fall upon medical officers, thereby reiterating the stipulation in "Malaria 1943" that the role of MOs was to advise combat officers regarding malaria matters, not to direct ORs.[539]

The next topic for consideration was anti-mosquito cream. Although it had previously been declared a vital component of personal prophylaxis, convincing soldiers to use anti-mosquito cream had proven to be a difficult task. This was hardly surprising, given that it was described in the very same literature advocating it to be a "sticky substance" and "not too pleasant when smeared on your face." Yet, for all its repulsive qualities, "Malaria 1943" instructed officers to advise their men that they had to "put up with it" until a less obnoxious formula was developed.[540]

At the time of the DGAMS's meeting, the most commonly used anti-mosquito cream consisted of oil of citronella and a combination of paraffin waxes. Unfortunately, this product had, in addition to its unpleasant qualities, many drawbacks. Its repellency reportedly lasted for just ninety to 120 minutes, and it tended to rub off easily. The

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[538] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[539] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[540] "Malaria 1943", p. 7.

assembly also learned that its users found that it was prohibitively greasy to the touch, stained clothing, and was "very hot in hot weather." Other formulas in limited use in some theatres held good promise, some providing nearly complete protection from mosquitoes for up to eight hours. However, these creams were plagued by difficulties that ranged from being unstable in heat to chemically eroding all available containers.[541]

It was also confirmed that pyrethrum-based repellent was in very short supply and the prospects for meeting future demands were virtually non-existent. It was agreed that a relatively new product, di-methyl phthalate (DMP or DEET), although not fully field tested, held great promise of replacing pyrethrum products by surpassing their efficacy. DMP also had the added advantage of providing repellent protection from insects other than mosquitoes and appeared to be suitable for clothing impregnation. In light of this, the group recommended that production of DMP be increased drastically in the United Kingdom and representations be made to the United States to do the same.[542]

The shortage of pyrethrum was also problematic with regards to the manufacture of the flit insecticide used to kill adult mosquitoes in enclosed areas. Although flit spray consisted of less than two percent pyrethrum, "it was agreed to reduce the use of pyrethrum sprays to the absolute minimum." Several alternate sprays were considered and it was decided to temporarily adopt an "economy formula" consisting of two percent carbon tetrachloride and ninety-eight percent kerosene until other products could be

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[541] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[542] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.

developed and tested.[543]

Protective clothing, then in use in the British Army, was found to be adequate. However, it was recommended that a modified arctic-use head net should be adopted as a replacement for the model then in use in the tropics.[544]

The DGAMS's blue ribbon assembly ended its meeting with the unanimous conclusion that "the first and most important factor in the prevention of malaria in the field is personal prophylaxis, the executive responsibility for which rests solely on Officer's Commanding." Further, they surmised that for front-line troops the administration of suppressive drugs "on a regular and unfailing" basis was the cornerstone of personal anti-malarial measures and that the importance of anti-malaria measure training was crucial. [545]

In the months following the DGAMS's conference, debate and discussion in senior medical and military circles regarding drug prophylaxis continued. On 6 May 1943, the RCAMC's Assistant Medical Director received correspondence from P.G. Shute, the Assistant Malaria Officer for the Ministry of Health. Shute revealed that "based on our researches, mepacrine is a true casual prophylaxis ..... the ineffective organism, the spirochaete, is destroyed at the time it is injected by the mosquito and therefore before the red cells are invaded."[546] Thus, he deemed mepacrine to be a true prophylactic and not merely a suppressive agent. The malaria officer suggested that other

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[543] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[544] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[545] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of Meeting to Discuss the Prevention and Treatment of Malaria in the Army", 15 March 1943.
[546] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, letter from P. G. Shute to Lt.Col M.H. Brown, 6 May 1943.

anti-malaria precautions be taken. Although the efficacy of mepacrine was now a matter of record, he declared that "What we do not know, is whether people can continue without harm to take mepacrine indefinitely, say a year or more."[547] This was contrary to his statement at the DGAMS's conference less than two months earlier. Notified of these conclusions, the Division's Assistant Director of Medical Services (ADMS), Colonel C. H. Playfair, promptly dismissed complaints that mepacrine caused the yellowing of skin to not being indicative of its short or long-term toxicity. These concerns were considered, by Playfair, to be purely cosmetic and of "no significance."[548]

The upper echelons of British medical and military circles may have deemed the question of long term toxicity less important than keeping malaria at bay for the short-term. This opinion was evidently not universally shared by British troops. Not surprisingly, many of the soldiers and officers then engaged in the North African theatre continued to be opposed to taking mepacrine, given the unpleasant experiences some of them had recently had with it. The Army Hygiene Service, troubled by this non-compliance and the potential of a malaria outbreak, petitioned the aid of the army's high command. In response, on 23 May 1943, Allied Force Headquarters, officially adopted the British DGAMS's recommendations and announced that the use of mepacrine was mandatory and "executive responsibility for carrying out and maintaining effective anti-malaria precautions rests with the unit commanders."[549] Medical officers were also admonished. Then the author of the communiqué attempted to reassure personnel of

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[547] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, letter from P. G. Shute to Lt.Col M.H. Brown, 6 May 1943, (emphasis provided in original).
[548] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Directive to Unit Medical Officers", 10 May 1943.
[549] Crew, *Administration Vol. II*, p. 200.

mepacrine's safety by adding that mepacrine was "not known to produce permanent or late ill effects in the human subjects."[550] After this ringing endorsement, he must have felt few doubters would remain. Besides, he declared, "the Supreme Commander takes his tablets."[551] This official declaration would have done little to quell the distrust of many soldiers and junior officers, for rumours were also circulating that quinine and the bitter tasting mepacrine tablets could also cause impotence and even death.[552]

These chronic problems with mepacrine administration compliance came to the fore just as the Allies were driving German and Italian forces from Tunisia in May 1943. After depriving the Axis of this toe-hold on the African continent, the Allies set their sights on Sicily. Operation HUSKY called for an assault on the Italian island's southern tip by a combined Anglo-American force, in July 1943. The Canadian 1st Division was attached to the British Eighth Army and slated to be part of the first wave of the amphibious attack. These Canadians had not yet seen combat, as they had been stationed in Britain for nearly three and one half years. HUSKY would represent the first action by any Canadian ground forces since the disastrous raid on Dieppe.

Planning for HUSKY quickly gained impetus, as the Allies were interested in pressing home their advantage in the Mediterranean theatre before the Germans and Italians could strengthen and better organize their coastal defences. A quickly planned attack increased the element of surprise but it threatened the possibility of thorough medical preparation. This difficulty was particularly acute for the RCAMC, given that intelligence sources confirmed that the climate and geographical conditions of Sicily and

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[550] Crew, *Administration Vol. II*, p. 200.
[551] Crew, *Administration Vol. II*, p. 199.
[552] Harrison, "Medicine and the Culture of Command", p. 445.

Italy were exceptionally conducive to the malaria vector Anopheline mosquito, which had a distinct preference for inhabiting the areas in or around human dwellings and structures.[553] To make matters worse, the ADMS revealed to his medical units at the end of May 1943, that HUSKY would be taking place during the height of the malaria season, which occurred from June to November. BT malaria was the most prevalent throughout these months, although the number of MT infections could be expected to increase after September.[554] The ADMS sagely surmised that the introduction of large numbers of Allied troops onto the island and the disruptions caused by combat would greatly increase the incidence of both strains of the disease in this already malarious region, prompting him to conclude that malaria was "undoubtedly the disease which is most to be guarded against in Sicily."[555]

Other factors must have weighed heavily on Playfair's mind. Combat casualties were projected to be greater than had been experienced during any other campaign of the war and, in addition to malaria, the battlefields of Sicily were considered to be prime environments for a host of other diseases including typhoid, typhus, diphtheria, dysentery, dengue fever, and hepatitis.

Yet, for all the preparations HUSKY required, the length of time in which the RCAMC and the Division had to properly plan medical arrangements for the invasion was measured in weeks. The problem was exacerbated by the fact that Montgomery's Eighth Army was headquartered in Cairo, while the vast majority of Canadian medical

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[553] LAC, RG 24, Vol. 12615, "Cdn Mil. HQ - Medical Intelligence", "Medical and Sanitary Data on Italy, Sicily, Sardinia and Albania", 15 April 1942.
[554] Crew, *Campaigns Vol. III*, p. 4.
[555] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Section 'C' Orders for 4 CCS, 2 Cdn FDS, 2 Cdn Fd Hyg Sec", 29 May 1943.

personnel slated for HUSKY and the Division were stationed in Britain. Medical information from the Deputy Director of Medical Services (DDMS) for the Eighth Army's and Middle East General Headquarters that dealt with a wide range of medical subjects "trickled in slowly and seemed incomplete" and "arrived in Canadian hands too late for effective action to be taken."[556] As a result of these communications obstacles, the RCAMC was unable to efficiently plan for HUSKY, and were hampered in their attempts to organize anti-malaria strategies. Undoubtedly, the complexity of attempting to co-ordinate all the components of the Eighth Army, which were staging in numerous and far-flung departure points, was a difficult task for the senior British planners. The multifarious nature of the task, coupled with tight time constraints, created numerous delays in finalizing operational plans and severely hobbled the co-ordination of medical arrangements.[557]

Within days of Canadian participation in HUSKY being confirmed, Playfair initiated efforts to facilitate the training of anti-malaria measures in Canadian units. He quickly recommended to the Division's Assistant Adjutant and Quartermaster General (AA&QMG) that every unit nominate a regular officer to study the pamphlet "Malaria 1943."[558] He also assured the AA&QMG that correct anti-malaria measures and

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[556] W.R. Feasby (ed.), *Official History of the Canadian Medical Services 1939-1945, Vol. I: Organization and Campaigns* (Ottawa: Queen's Printer, 1956), p. 125.
[557] DHH, D 11, W. R. Feasby, "Official Medical History of The Second World War: Medical Services in War - A Critical Analysis of the Principal Medical Lessons of the Second World War, Based on the Official Histories of Australia, Canada, India, New Zealand, and the United Kingdom", n.d. , p. 25.
[558] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Draft Medical Precis for Preliminary Admn Instruction", 26 April 1943.

practices among Canadian units were "vigorously pursued"[559] and reminded all Canadian medical unit commanders of the importance of training and discipline.[560] The reason was clear: malaria could "cause more wastage than the enemy."[561]

Concurrent to the ADMS's warnings, on 30 May 1943, the War Office's Director of Military Training (DMT) sent a memorandum to British General Headquarters - Home Forces and copied to British Commanders-in-chief world-wide. The DMT stressed that in light of massive troop deployments in areas outside of Britain, it be remembered that malaria was "by no means confined to tropical countries." He continued to suggest that combat units could be reduced to as little as thirty to forty percent of their normal fighting effectiveness in these malarious areas unless anti-malaria training and precautionary measures were properly addressed by commanders and their staffs.[562]

Anti-malaria training arrangements were laid down by the DMT. Staff officers and senior medical officers had access to instructions through the Hygiene Directorate. Regular officers, Non-Commissioned Officers (NCOs) and medical officers could receive training and assistance from Field Hygiene Sections. The regular officers and NCOs were in turn to deliver malaria prevention lectures and drill to ORs. The DMT expressed his belief that after hygiene education had been delivered and the importance of it impressed, that "unit discipline alone" would maintain personal prophylaxis. Yet, he

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[559] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "1 Cdn Div Medical Appreciation No. 1", 28 April 1943.
[560] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "General ADM Instruction No. 4", 23 May 1943.
[561] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "1 Cdn Div Medical Maintenance Plan", 31 May 1943.
[562] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, untitled memorandum from Director of Military Training (DMT) to General HQ - Home Forces, 30 May 1943.

concluded that "In all instruction and training the responsibility of the regimental officer must be stressed."[563]

Although the time for training in anti-malarial routines was limited, with the aid of instruction hastily organized through the British Army School of Hygiene, it appears that each Canadian combat unit trained an officer or an NCO to serve as his group's anti-malarial officer.[564] Additionally, eight Canadian medical officers who had previously received instruction at the British School of Tropical Medicine received a couple of days of additional training exclusively in matters pertaining to malaria.[565]

To help facilitate the steep learning curve faced by all Canadians, the ADMS requested the services of a medical liaison officer who was also a malaria specialist with practical experience gained with the Eighth Army in the Middle-East. His request was granted very early in the HUSKY planning process, allowing him to repeatedly promise Canadian unit commanders that an experienced malariologist would soon be available to them for consultation, training and co-ordination of anti-malaria measures.[566] Unfortunately, the malariologist did not arrive in Britain until just three days before the Canadians embarked. To make matters worse, he was unable to make contact with many of the medical officers assigned to Canadian units.[567]

In addition to facilitating anti-malaria measures training for Canadian soldiers,

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[563] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, untitled memorandum from Director of Military Training (DMT) to General HQ - Home Forces, 30 May 1943.
[564] Feasby, "A Critical Analysis", p. 25.
[565] Feasby, *Vol. I: Organization and Campaigns*, p. 125.
[566] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "General ADM Instruction No. 4", 23 May 1943.
[567] Feasby, *Vol. I: Organization and Campaigns*, p. 125; and Feasby, "A Critical Analysis", p. 26.

officers and medical officers, the Division also began to plan for the field organization of medium and large scale mosquito destruction. Based on the British model, each combat or medical unit formed a small anti-malaria squad under the direction of the group's anti-malaria officer.[568] The squad's role was to carry out anti-mosquito measures in areas immediately adjacent to its encampments. Related tasks could range from overturning discarded tin cans to draining small marshes. Although squads were responsible for the destruction of adult mosquitoes outdoors, the spraying of insecticides for this purpose was rarely practiced. Rather, outdoor application of insecticides was aimed at killing mosquitoes in the larvae stage. This highly specialized task was assumed by Anti-Malaria Control Units (AMCUs), whose responsibilities were the large-scale elimination or treatment of mosquito breeding areas, and the eradication of larvae and adults. Like the existing British formations, Canadian AMCUs were to be established as army units, composed of regular army personnel but attached to RCAMC Field Hygiene Units. Plans for the formation of three Canadian AMCUs were initiated in the United Kingdom. Some limited training for a handful of AMCU personnel was done prior to departure and the equipment for these army units was to be supplied by the British and arrive on Sicily's shores soon after D-Day.

A vast amount of anti-malaria supplies was required by the rest of the Division. The scale of distribution and supply for these HUSKY indents were dictated by the RAMC. The minimum allocations required for 1,000 men over a thirty day period in Sicily included: 165 gallons of Malariol (an arsenic-based larvacide); 112 pounds of Paris Green (also a larvicide); 375 pounds of anti-mosquito cream; and 25,700 tablets of

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[568] "Malaria 1943", p. 6.

mepacrine.[569] All these consumables, including suppressive mepacrine, were to be indented for, and collected with rations for the voyage, from the Royal Army Service Corps (RASC) or the Royal Canadian Army Service Corps (RCASC).

Just days prior to the scheduled embarkation of the Division for Sicily, an astute medical services liaison officer made a startling discovery. He confirmed that, in accord with War Office directions, arrangements had been made to have all of the Division's troops begin malaria prophylaxis one week before landing on Sicilian soil. However, no one had seen fit to ensure or organize for an uninterrupted supply of mepacrine tablets after HUSKY's D-Day. He also discovered that the supply ship carrying the Canadian's mepacrine allotment was not due to arrive in Sicily until three days after the landings were to take place. The logistical problems of trying to ensure that this mepacrine was identified, off-loaded and distributed quickly would have been insurmountable. The official historian of the RCAMC later reported that this situation was corrected and Canadian troops were issued with larger personnel supplies of mepacrine prior to the HUSKY landings.[570] However, it now appears that this larger issue was neither ordered nor distributed.

Other difficulties in other anti-malaria supply were either not detected or were impossible to correct prior to departure from the United Kingdom. At the end of May, the War Office ordered that anti-malarial training kits be issued to all units stationed in Britain, including, of course, Canadian units. These kits included, for demo and training purposes: mosquito and bush nets, flit sprayers, mosquito veils and gauntlets, and anti-

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[569] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Amendment No. 1 to Medical Administrative Order - Section A", 25 May 1943.
[570] Feasby, *Vol. I: Organization and Campaigns*, p. 125.

mosquito cream.[571] Canadian Military Headquarters (CMHQ) was not informed of the War Office order until 5 July.[572] In any event, the anti-malaria demonstration kits, along with other medical equipment, were either delivered late or not received at all, allowing Canadian medical personnel no "time to see it, let alone become familiar with it."[573] This logistical problem was serious but paled in comparison with the difficulties in supply, co-ordination and communication caused by numerous changes to the Eighth Army's medical plan and the late addition of five Canadian RCAMC units to the order of battle.[574]

In late June and early July, several troop and supply ship convoys carrying the Division left the Clyde; their next stop, the beaches of Sicily. Their destination had been kept secret to all except the most senior ranks, although some junior officers had correctly reasoned that they were headed for tropical climes, tipped off by the issue of khaki uniforms and anti-malaria instruction some had received while still in Britain.[575] Briefings for all ranks were begun when their respective convoys were well out to sea. Many of the scheduled lectures concentrated on anti-malarial precautions. Medical officers, charged with the task of ensuring that the troops and officers were "malaria minded", stressed the vital importance of mepacrine use for malaria prophylaxis.[576] The commander of the Eighth Army, General Bernard "Monty" Montgomery, communicated to all his unit commanders that every soldier, regardless of rank, was obligated to do his

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[571] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Anti-Malarial Training", 5 July 1943.
[572] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Anti-Malarial Training", 5 July 1943.
[573] Feasby, *Vol. I: Organization and Campaigns*, p. 125.
[574] Feasby, "A Critical Analysis", p. 26.
[575] Nicholson, *Seventy Years of Service*, p. 160.
[576] Nicholson, *Seventy Years of Service,* p. 161.

personal utmost to control the spread of disease.[577]

While aboard ship, Canadian troops and officers stayed active in their cramped quarters. Sunbathing, socializing, playing cards, cleaning equipment and weapons, and the writing of letters to loved ones were popular and typical pastimes for most soldiers. A few others engaged in bartering, begging and cajoling to add their cohort's daily "tots", a 2 ounce rum ration, to their own, creating a mix of reactions among their ship mates and a few minor disciplinary problems.

When not engaged in leisure activities, some units received thorough drill in a variety of tactical and medical topics, including malaria. Others did not.[578] The inconsistency in drill was indicative of the many irregularities related to mepacrine and its administration. The day before leaving port, No.1 Canadian Field Dressing Station "finally" received a visit from the Division's Deputy Assistant Director of Medical Services (DADMS) after "two weeks of fruitless efforts on the part of the Officer Commanding to contact him."[579] The DADMS was reportedly "very definite and very emphatic" about the administration schedule for mepacrine, stating that it was to be taken for four days in a row and every second day thereafter. His "verbal but very final" orders appear to have confirmed the opinion of the Field Dressing Station's Officer Commanding, who had been at loggerheads with the ship's medical officer, over the issue.[580]

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[577] Feasby, *Vol. I: Organization and Campaigns*, p. 134.
[578] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.
[579] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 27 June 1943.
[580] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 27 June 1943.

Unfortunately, it appears the DADMS's mepacrine administration directions and, therefore, the drug practices of No.1 Field Dressing Station, were contrary to those that had most recently been circulated to all the Division's units by the ADMS. Playfair's recommendations regarding mepacrine administration and dosage, which had been based on the considered advice of his British medical colleagues, were reliant upon the level of malaria risk expected. Accordingly, in malaria endemic (or "malarious") locales, mepacrine was to be administered two days per week (Mondays and Thursdays). On each of these days each man was to take one tablet (0.1 gram or ten grains) of mepacrine after breakfast and another tablet after dinner. In hyper-endemic (or "hypermalarious") areas, one tablet was to be taken every day of the week except for Sunday. To ensure that all ranks complied, the ADMS ordered that the administration be done during parade under the watchful eye of an officer. Mepacrine was to be commenced one week prior to entering a malarial area and not discontinued until one month after leaving.[581]

No.1 Field Dressing Station, albeit well intentioned, was not the only unit to be non-compliant with the ADMS directive regarding the taking of mepacrine. On 1 July, the Carleton and York Regiment's war diarist observed that "all ranks taking malaria pills every three days."[582] It also appears that No.1 Field Dressing Station's personnel may have received mepacrine tablets just twice during their twelve days at sea.[583] Another RCAMC field medical unit had their mepacrine distributed by their ship's medical officer, a Royal Navy officer, with the instructions to take a single pill every second

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[581] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Directive to Medical Officers", 10 May 1943.
[582] LAC, RG 24, Vol. 15050, Carleton and York Regiment, War Diary, 1 July 1943.
[583] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 1, 5, 8 and 13 July 1943.

day.[584] Additionally, some units reported to have had mepacrine parades on board ship and others did not.

Many men, of all ranks, were confused and/or suspicious of the tablets they were ordered to ingest. Some of the confusion may be attributable to the nearly concurrent initiation of the daily administration of ascorbic acid to the Canadian soldiers. One infantry battalion war diarist reported the men of his unit had each been instructed to take a pill which was "rumoured" to be "an anti-malarial precaution."[585] Other rumours were also circulating among the ranks of other units, even grossly erroneous ones. "One prevalent one is that it (the tablet) is an aphrodisiac which is of course utterly stupid", wrote one suffering war diarist.[586] The examples set by some officers would have done little to motivate their charges to readily comply with the orders to take the malaria suppressive, as one War Diary reflects: "Last night we took our first mepacrine--with no ill effects, except that Capt Ryan had some difficulty swallowing his and experienced a bit of a rotten taste. Remarked he 'CENSORED'."[587]

Yet, for all the muttered profanities, rumours, and inconsistencies in mepacrine instruction, some officers followed to the letter the dosage schedule that had been dictated by the ADMS and properly supplied each of their troops with an adequate supply to last on shore for one week—four ten grain tablets of mepacrine.[588]

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[584] LAC, RG 24, Vol. 15846, No.2 Light Field Ambulance, War Diary, 4 July 1943.
[585] LAC, RG 24, Vol. 15072, Hastings and Prince Edward Regiment, War Diary, 24 June 1943.
[586] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 23 June 1943.
[587] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 29 June 1943, (emphasis provided in original).
[588] LAC, RG 24, Vol. 15901, No.1 Canadian Field Dressing Station, War Diary, 6 July 1943.

As this chapter has shown, the prevention of a wide-spread outbreak of malaria among the Canadian ranks invading Sicily and Italy was certainly very possible. Still, theory by no means guarantees practice. An uninterrupted supply of mepacrine coupled with compliance with anti-malaria precautions by all ranks was necessary if the disease was to be controlled. As the next chapters will show, unfortunately, neither of these conditions would be attained anytime soon. Despite the plethora of warning signs, the Canadians were nowhere near as ready to meet the threat of malaria as they were the German and Italian armies.

CHAPTER SEVEN

INFECTIOUS DISEASE BREECHES THE CANADIAN DEFENCES

On 10 July 1943, an Allied army consisting of Canadian, British and American troops landed on Sicily's southern shores. Code-named Operation HUSKY, it was the largest amphibious operation of the war up to that point and in terms of troops being landed on the first day, the largest of the entire war. The Allies' landings were largely uncontested by the Italian defenders who put up only light resistance, allowing for the rapid establishment of beach-heads. The ultimate goal of occupation was the seizure of Messina. The Allied force's battle plan called for the United States' Seventh Army to secure the western half of the island, in the process capturing Marsala and Palermo. The Americans were then to swing to the east and meet the British at Sicily's north eastern tip, at the city of Messina. While the Americans were busy in the western part of the island, the bulk of the British Eighth Army was to advance up Sicily's east coast, seizing the port cities of Syracuse, Augusta, Catania, and lastly Messina. The remainder of the British Eighth, the Canadians, were to advance from their landing zones on Sicily's southern most tip (the Pachino peninsula) in a north-westerly direction, and secure the area between their two allies by pressing towards the centre of the island. The route they would follow would take them through the mountainous centre of Sicily, from Ragusa to Caltagirone, then to the east of Enna, and then north-east in the direction of Messina.

For the troops of the Division and the personnel of the RCAMC, the Sicilian campaign was separated into two distinct phases, each with its unique challenges. The first phase encompassed a period of just over four weeks, during which Canadian combat

units were actively involved in offensive operations against their Axis foes. The second phase, or period of rest, began when Canadian combat units were pulled from active front-line service on 7 August 1943, just ten days before the occupation of Sicily was completed. This period of non-combat lasted about three weeks, ending when the Allies crossed the Messina Strait and invaded the Italian mainland.

Soon after solidifying and consolidating their landing areas on the Pachino peninsula, Canadian combat units began their northern advance into the mountainous Sicilian interior. The initial euphoria that had accompanied their unexpectedly easy victory over Italian troops, soon gave way to trepidation when reconnaissance units discovered the main line of the untested Canadian troops was blocked by Germany's battle-hardened Hermann Goering Panzer Division.

Exacerbating the difficulties of adapting to combat and life in the battlefield, the Canadian troops also had to contend with Sicily's oppressively hot and dry summer climate. Additionally, many Canadians reported being incessantly bitten by some unidentified insects. The Division's ADMS, Playfair, who had arrived in Sicily on D-Day +1, concluded the offending insects were probably fleas or ants. However, the risk of hygienic problems remained high due to the widespread prevalence of flies.[589] Within four days of his arrival, the ADMS appears to have quickly surmised that the threat of malaria was not great, recording that although the incidence of malaria was high in some isolated local areas, "the fascists seem to have done a good deal in Malaria control."[590] Additionally, Playfair observed in his War Diary that the local mosquito population was

[589] LAC, RG 24, Volume 15656, ADMS War Diary, 11 July 1943.
[590] LAC, RG 24, Volume 15656, ADMS War Diary, 15 July 1943.

less than had been anticipated.[591]

As the Canadian advance took up steam and swallowed up enemy territory, the first of Sicily's four million civilians came under Allied control. Fortunately, it soon became apparent that the majority of these civilians did not pose a threat to the occupying Canadians and were "very hospitable." This high level of acceptance and cooperation with their Canadian occupiers may not have been due exclusively to their abhorrence of Mussolini and his fascist bureaucrats but, rather, due to the difficult and impoverished conditions in which they lived. The living conditions of the poor Sicilian peasants were drastically different from any the typical Canadian soldier had ever seen before. Most of these families shared their Spartan single-roomed dwellings with meager collections of livestock and poultry.[592]

Close on the heels of the Canadian fighting units were the medical field units of their compatriots in the RCAMC, setting up the required infrastructure to properly care for the sick and wounded. From the onset, the problems and challenges faced by these RCAMC medical units were overwhelming and prevented them from quickly becoming fully operational and/or effective. These difficulties included severe equipment shortages and misappropriations, bad roads, and a paucity of practical experience.

Initially RCAMC equipment shortages were due to the loss of medical cargo shipped with the invasion fleet. The various Canadian laden convoys had rounded Gibraltar virtually unmolested. On entering the Mediterranean, shipping casualties attributable to German and Italian submarines and aircraft began to mount. The resulting experience of No.9 Canadian Field Ambulance, albeit an extreme example, reflects the

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[591] LAC, RG 24, Volume 15656, ADMS War Diary, 11 July 1943.
[592] LAC, RG 24, Volume 15656, ADMS War Diary, 11 July 1943.

crippling effect these losses had on RCAMC efforts to become even marginally operational. The medical unit's 200 officers and ORs arrived unscathed on Sicilian shores on D-Day +2. Yet, they soon discovered that they had lost all the unit's equipment and vehicles at sea, with the exception of five motorcycles and four of its allotted trucks which somehow turned up in the landing area.[593]

In addition to having to cope with these losses, many RCAMC units found themselves struggling to maintain possession of supplies that had not been sent to the bottom of the sea. Seeking to make up for their own shortages, many regular army combat units immediately appropriated vehicles and equipment that had been slated for use by medical units, often at the exact moment their tires rolled onto Sicilian sand. Even senior ranking RCAMC officers were directly susceptible to regular unit "poaching" activities. Worse still, the ADMS reported that he could not readily secure replacement supplies or adequate transport from the tight-fisted quartermasters of the RASC, prompting him to complain that "it is still difficult to operate an ADMS office without any office equipment and working in the back of a truck."[594] Those medical units and personnel fortunate enough to secure vehicles to transport themselves, medical equipment and casualties found that their transport problems were far from solved, as the Division's sector had an over-abundance of hilly terrain that could only be traversed via a few narrow gravel and dirt roads. Of course, the Germans added to their transportation woes, by demolishing bridges in the wake of their withdrawal.

Throughout July and into August the confused and disorganized states of the

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[593] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, 11 July 1943; and LAC, RG 24, Vol. 15849, No. 4 Field Ambulance War Diary, 11 July 1943.
[594] LAC, RG 24, Volume 15656, ADMS War Diary, 18 July 1943.

landing areas and recently captured ports continued to result in the loss of Canadian equipment and stores. One RCAMC war diarist complained that there was "considerable looting of unclaimed kit being done by naval ratings and British troops." When notified, British embarkation staff in this area were reported to have been apathetic and apparently oblivious to Canadian pleas to have these thefts stopped.[595]

Yet, necessity often does breed creative solutions. To alleviate the chronic equipment deficiencies in Sicily, RCAMC personnel were often able to press into service medical equipment and stores that had been "liberated" from the German and Italian armies. This practice proved so successful, and perhaps so necessary, that "scrounging" of this type was endorsed and encouraged by some pragmatic senior RCAMC officers.[596]

The third major problem facing Canadian medical units was related to the inherent challenges delivery of field medicine held. Incredibly and unconscionably, the majority of Canadian medical officers and medical personnel were unfamiliar with much of the medical equipment that did get through and those working in Field Ambulance units had done little field training and had no practice working in canvas tent environments.[597] Canadian medical units also were unable to find adequate existing structures to occupy in Sicily. Improvised medical facilities were often filthy and bug infested with no utilities or sanitation facilities.

In the latter half of July, as smaller RCAMC units were attempting to adapt to the difficulties posed by man and nature, the supply convoy carrying the equipment and

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[595] LAC, RG 24, Vol. 15675, No.5 General Hospital War Diary, 21 July 1943.
[596] LAC, RG 24, Volume 15656, ADMS War Diary, 20 July 1943.
[597] Sir Arthur Salusbury MacNaulty and W. Franklin Melnor (eds.), *Medical Services in War: The Principal Medical Lessons of the Second World War* (London: Her Majesty's Stationary Office, 1968), p. 486.

stores for No.5 Canadian General Hospital, managed to arrive in Sicily relatively intact. As these ships awaited unloading, they fell victim to the German air raids that were plaguing the harbour on a nightly basis. German aircraft sunk and damaged many of the Allied ships docked in Augusta and in the process destroyed No.5's entire allotment of equipment.[598] Undaunted, the hospital staff continued on to Catania where they found the facility they had planned to set up in, which had been previously operating as a German military hospital, in terrible condition. Like other facilities, it had been sabotaged by the retreating Germans. They had also successfully encouraged local Italian civilians to loot and otherwise strip the building of anything of value they had not managed to take with them.[599]

Still, after just a few weeks of what must have been inspired and creative efforts, No.5 General Hospital's 600 doctors, nurses and support personnel managed to set up a nearly fully functioning facility. Their coping skills were exemplified by their ability to function over an extended period with just a single microscope that had been transported to Sicily in an officer's personal kit. Fortunately, the problems of hospital supply and organization were effectively overcome before British and Canadian battle casualties began to arrive in numbers.

No.5's deficiencies were not only limited to medical supplies and equipment but extended to items as basic as cigarettes and personal kit. Contingency plans had called for all replacement materials to be provided by British sources. However, No.5's war diarist reported that "no cooperation" was immediately forthcoming from the British,

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[598] LAC, RG 24, Volume 15656, ADMS War Diary, 28 July 43.
[599] LAC, RG 24, Vol. 15675, No.5 General Hospital War Diary, 11 August 1943.

"who state their stores are for British troops only."[600] Unfortunately, these claims were not unusual and tales were rife among Canadian troops that British personnel were being, both qualitatively and quantitatively, better supplied. Perhaps spurred by the recognition of the potential destructiveness of these reports, a senior RCAMC officer immediately dismissed these "rumours" as "irresponsible" and "pure slander", lacking any objective basis.[601] Despite the medical officer's protestations to the contrary, for many Canadian soldiers, the general feeling of being differentially treated continued to grow.

While RCAMC personnel in field units and hospitals were attempting to become fully functional, the Division's malariologist was hard at work. Since his scheduled arrival on Sicily on D-Day +2, Capt. F.W. Boon, the malariologist seconded from the RAMC, discovered that his role as the Division's advisor on malaria related matters was quickly evolving. Reporting directly to Playfair, Boon was soon performing malaria surveys (also referred to as area surveys) on newly captured territory. Additionally, he became actively involved in the diagnosis and treatment of malaria patients, and conducted malaria instruction for other medical officers.[602]

Boon's area surveys were performed with the goal of determining the malaria risk (or "malaria index") in a particular locale. There were two main components to be considered when making this determination: the area's mosquito population (both larval and adult) and the level of malaria infection among the locale's inhabitants. Boon found that Italian civil health authorities were very willing to render assistance. However, he

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[600] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, 4 August 1943.
[601] LAC, RG 24, Vol. 10494, file 21201.8009 (D 28) "Operation HUSKY", memorandum from Lt-Col D. Farquharson to CMHQ, 6 August 1943.
[602] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.

soon began to question the credibility of some of these sources after he found some of the information they provided was untrustworthy.[603] Accordingly, Boon placed most of his reliance upon data which he could personally observe or directly collect.

Armed with a captured microscope and low power hand lens, the malariologist set off into the field, focusing most of his attention in the Dittaino and Salso valleys, areas in which the bulk of the Division had been involved in combat since D-Day +6. Boon soon verified that, as had been expected, the most common mosquitoes throughout Sicily were anopheline (*A.Maculipennis* and *A.Superpictus*), the prime vectors for malaria. Again, as expected, geographical and climatic conditions combined to create many ideal environments for mosquito propagation. There were a few surprises related to mosquito breeding in store for the British malariologist. First, potential breeding locations were more extensive than had been expected, as there were innumerable pools of water, especially in the numerous dried up tributary beds, which were often fed by underground streams. Second, mosquito larvae were found to be thriving in locations previously thought immune, such as rapidly flowing mountain creeks and brackish pools.[604] Additionally, the national and local fascist governments had made no appreciable efforts towards stemming larval growth in the region.

The adult mosquito population in the Dittaino and Salso valleys was massive. Accordingly, most inhabited or inhabitable structures were infested with adult mosquitoes, although the dwellings of civilian government officials and bureaucrats were equipped with screened windows. Unfortunately, almost all of the rest of the Sicilian

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[603] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.
[604] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.

population had been infected with the malaria parasite, as evidenced by the high rate of splenomegaly (swollen spleens) in local children. Malaria had caused such great suffering that Boon often found himself surrounded by civilians pleading and begging for quinine.[605] As well, Boon was dismayed to discover that in Sicily the incidence of malaria did not decrease in altitudes above 3,000 feet, as was previously thought.[606]

On 4 August, Boon made a regular visit to No. 9 Field Ambulance in order to collect blood smears from patients who were decidedly febrile but NYD. Using his captured microscope, he confirmed the presence of malaria parasites in some of these blood samples.[607] Upon questioning these newly diagnosed malaria patients, it was discovered that prior to their falling ill, the vast majority of them had been taking mepacrine on an irregular basis. Some, No.9's war diarist claimed, took "their tablets only two or three times a week in place of the four which have been laid down."[608] Three days later, on 7 August, Boon passed on his findings to Playfair, confirming that seventy-seven percent of his small sample group of NYDs were actually malarial and further claimed that all of these had only taken two to three tablets per week, prior to falling ill. He also made the determination that the remaining twenty-three percent of the febrile patients in his sample had properly and regularly received the standard dose of mepacrine and were, therefore, "simple fevers."[609] Thus, Boon confirmed mepacrine had to be taken on a regular basis in order to be effective.

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[605] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Report on Malaria in 1 Cdn Div From D TO D31", 10 August 1943.
[606] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[607] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, 4 August 1943.
[608] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, 4 August 1943.
[609] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Precautions", 7 August 1943.

In light of his findings, Boon cautioned Playfair that there existed a "grave danger that a serious and widespread epidemic of malaria may entirely disable the division" unless the Division's anti-malaria discipline was immediately improved.[610] The prospects for vigorously implementing Boon's prescription should have appeared to be excellent, since the Division, successful in its occupation of the Dittano and Salso Valleys, was in the process of being withdrawn from the front-line. This rest phase, which was initiated on 7 August, was certainly more conducive to maintaining all proper anti-malaria measures that had proven difficult to practice and enforce in the line of combat. By 10 August, nearly the entire Division set up encampments in the area around Lake Lentini. This locale had been selected by senior Canadian commanders. It is unclear as to whether or not any medical officers had been consulted regarding this choice. However, it became obvious that the site selection was a poor one. The Division would spend approximately three weeks in this area, one that the Division's malariologist had, that very day, confirmed to be "almost entirely hyper-endemic."[611]

Boon's forewarning could have only served to strengthen Playfair's concern about a potential malaria outbreak. The ADMS had already been aware that since the onset of the campaign there had been widespread irregularities in mepacrine administration. On D-Day +3, he had noted that the RSAC had yet to issue mepacrine to Canadian units.[612] Two days later, this deficiency had still not been rectified, much to Playfair's chagrin.[613] Additionally, the majority of Canadian combat troops that landed in Sicily on D-Day had

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[610] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Precautions", 7 August 1943.
[611] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Report on Malaria in 1 Cdn Div From D TO D31", 10 August 1943.
[612] LAC, RG 24, Volume 15656, ADMS War Diary, 13 July 43.
[613] LAC, RG 24, Volume 15656, ADMS War Diary, 15 July 43.

been issued a one week supply of mepacrine, just prior to landfall. In the absence of solid or waterproof containers, the majority of these troops simply carried the tablets in their shirt pockets, an unfortunate planning oversight, especially when one considers that most of the Canadians were part of an amphibious force. Consequently, their first week's supply of mepacrine was accidentally dissolved, crushed or otherwise rendered useless.[614]

In addition to these problems with mepacrine administration, it would have been readily apparent to any concerned observers that there were also plenty of other malaria related difficulties and complications. Playfair's concerns were not widely shared outside the ranks of the RCAMC, as the vast majority of Canadian senior officers continued not to take the threat of malaria seriously. This lax attitude not only allowed but promoted the continuance of poor anti-malaria practices throughout the Division. Indeed, anti-malarial personal precautions were in a sad state throughout virtually all the Division. Clothing problems were particularly worrying. Canadian soldiers had demonstrated a strong affinity for the short pants that they had been issued just prior to HUSKY. This clothing may have been practical for the avoidance of heat prostration and in promoting comfort, but shorts did nothing to protect against or discourage mosquito bites. The first component of "sundown precautions" was complying with dress regulations, which called for changing from short pants into long trousers and the rolling down of sleeves on shirts and/or battle tunics. Unfortunately, this anti-malaria practice was frequently ignored by Canadian troops and their commanding officers. Those personnel whose duties took them away from their encampments, such as truck drivers, would often find

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[614] W.R. Feasby (ed.), *Official History of the Canadian Medical Services 1939-1945, Vol. II: Clinical Subjects* (Ottawa: Queen's Printer, 1953), p. 140.

themselves without a change of clothes.[615] Additionally, a distribution of protective clothing for troops on night-time guard or sentry duty had been made. However, mosquito-proof headgear and gauntlets were seldom worn by these assigned troops, as they trapped heat and impeded vision.[616] Not surprisingly, enforcement of all these clothing measures was infrequent and inconsistent.

The second and final component of sundown precautions was the application of anti-mosquito cream. This cream, which was sometimes referred to as ointment, was to be used on all exposed skin when the use of mosquito nets or protective clothing was impractical or impossible. However, as had been anticipated by the British Army before HUSKY was launched, Mk. 1 Anti-Mosquito Cream was only effective for up to two hours under ideal conditions, since it could be easily rubbed off, especially under battlefield conditions.[617] In recognition of this, the instructions in "Malaria 1943" advised all ranks to apply the cream "more frequently and lavishly" when on active operations.[618] Canadian troops seldom used the topical mosquito cream, either due to a lack of supply, or more often than not because of its sticky, greasy and smelly qualities. The oppressively hot Sicilian summer heat melted the cream, causing it to flow out of leaky containers, staining many soldier's uniforms and personal kit.[619] Further reinforcing any aversion the soldiers may have had for using, much less carrying, the

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[615] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[616] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[617] "Handbook of Military Hygiene 1943", p. 88.
[618] "Malaria 1943", p. 7.
[619] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.

cream, much of the available supply had become marginally rancid.[620] Some British troops, who like the Canadians, received their indents from the RASC, later insisted that the cream "actually attracted mosquitoes"![621]

Another cornerstone of Canadian anti-malaria strategy was the use of mosquito nets. Due to a combination of logistical errors in Britain and shipping losses enroute to Sicily, nearly half the planned netting did not arrive on schedule. In fact, many nets slated for arrival on D-Day and D-Day +1 would end up coming nearly six weeks later.[622] For those Canadian soldiers that were issued nets, their use depended on several factors. Combat troops were loath to use them for several practical reasons. First, the netting systems were difficult to pack, prohibitively heavy to transport, cumbersome to erect and easily damaged.[623] As a result, the closer a soldier was to the front lines the greater the likelihood was that his mosquito net would be disposed of in short order. The only time troops in forward areas were likely to use their nets was when their brigade was at rest. Most nets in use were properly set up, although daily net inspections by officers and/or NCOs were generally inconsistent.[624]

Perhaps the greatest aversion Canadian soldiers and RCAMC personnel had towards using their mosquito netting was due to the practical desire for survival. Much to the delight of German snipers, the netting material was highly visible on cloudless or moonlit nights. Wanting to get bush nets back into popular use, the AA&QMG ordered

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[620] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[621] Harrison, "Medicine and the Culture of Command", p. 446.
[622] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[623] Feasby, *Vol. II: Clinical Subjects*, p. 140.
[624] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

that they be dyed with a solution of potassium permanganate that was to be supplied by unit medical officers. The DADMS stated that this was not possible, presumably due to a lack of supply and instead proposed that the nets be stained with tea leaves.[625] This alternative must have been impractical because Canadian soldiers demonstrated their creativity by endeavouring to use a multitude of different materials to camouflage their nets. Various units were purported to have tried shoe-polish, mud, walnut stain, captured dyes and a host of chemical concoctions.[626] One witness of the results suggested that the wide variety of hues and tints being used had given his camp "the appearance of a Persian bazaar."[627] The effectiveness of these and similar net camouflaging attempts was later ascertained by Boon to be largely unsuccessful.[628]. Either due to laxity on the part of commanders to enforce the AA&QMG's order or an inability to find adequate dyes, many units did not comply with the dye order.

Spurred in part, perhaps, by personal knowledge of existing shortfalls in anti-malaria measures and his malariologist's memo, Playfair sent two memorandums to the Division's AA&QMG. Playfair suggested that "sterner measures" be taken in order to reduce the incidence of disease since it appeared that basic hygiene practices were not being followed by many Canadians. Unhygienic cooking practices in conjunction with prevalent use of unsterilized and unpotable water had created diarrhoea of nearly

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[625] LAC, RG 24, Volume 15656, ADMS War Diary, 22 July 1943.
[626] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[627] LAC, RG 24, Vol. 15902, No.2 Field Dressing Station War Diary, 5 August 1943.
[628] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

epidemic proportions among Canadian troops.[629] Playfair also suggested that these lax attitudes were likely indicative of those taken towards anti-malaria precautions. Certainly, Playfair's case was strengthened by his claim that forty-two percent of all Canadian casualties to that date were due to a "lack of observance of hygiene and anti-malarial measures."[630] Insofar as supervision was concerned, Playfair remained resolute in the philosophy that "while the Medical Corps can instruct (and) to some extent supervise, the final responsibility (for maintaining proper anti-malaria precautions) is a personal one."[631] The ADMS also recommended that all Commanding Officers, some of whom were claiming to have never even heard of "Malaria 1943", be reminded of this and stressed that medical officers could not go it alone.[632] He emphatically stated that "ALL officers and NCOs MUST become hygiene conscious."[633]

As his superior was pleading for better health related practices, Boon was finalizing his "Report on Malaria in 1 Cdn Div from D to D31" and submitted this summary to the ADMS on 10 August. Based upon the area surveys he had just completed and his informal tours of medical facilities, Boon concluded that all the men of the Division "must have been bitten" by the mosquitoes of the Dittaino and Salso valleys. Yet, as of that date, he cited there were just 150 cases of malaria in the Division, a rate of

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[629] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report on Divisional Hygiene and Incidence of Disease", 8 August 1943.
[630]LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, untitled memorandum from ADMS to AA&QMG, 9 August 1943.
[631] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report on Divisional Hygiene and Incidence of Disease", 8 August 1943.
[632] LAC, RG 24, Vol. 12581, file 207/22, "Conferences - DMS Branch - CMHQ", "Deputy Director of Hygiene Conference Meeting Minutes, 6 August 1943", 6 August 1943; and LAC, RG 24, Volume 15656, ADMS War Diary, "Casualty Breakdown and Control of Disease", 9 August 1943.
[633] LAC, RG 24, Volume 15656, ADMS War Diary, "Casualty Breakdown and Control of Disease", 9 August 1943, (emphasis provided in original).

less than one percent. At the time, he attributed this low rate of incidence to regular mepacrine administration and other anti-malaria measures and suggested that it was important to ensure that these precautions be improved. He identified many weaknesses that were particularly evident in many combat units, such as "patchy" pre-invasion malaria instruction, but reasoned these training shortfalls were perfectly understandable, given the need for secrecy and the unfamiliarity most Canadians had with malaria.[634] Additionally, Boon found that there were no mitigating circumstances that excused the relative inaction of the Division's anti-malaria squads and Anti-Malaria Control Units (AMCUs).

The malariologist had high praise for RCAMC units, stating that its personnel had "given an excellent example of malaria discipline ... i.e. only one case of malaria to date."[635] His conclusion can certainly be supported in the case of No.9 Field Ambulance. The unit's Officer Commanding appears to have been relentless in ensuring that anti-malaria discipline was a top priority. As early as 22 July 1943, No.9's Daily Orders regularly reminded personnel of a variety of anti-malaria related activities, ranging from non-compliance with sundown precautions to mepacrine administration reminders.[636] Those soldiers failing to follow laid out procedures soon found their names published in Daily Orders, albeit a list bereft of officers, and warned that disciplinary action would

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[634] LAC, RG 24, Volume 15656, ADMS War Diary, "Casualty Breakdown and Control of Disease", 9 August 1943.
[635] LAC, RG 24, Volume 15656, ADMS War Diary, "Casualty Breakdown and Control of Disease", 9 August 1943.
[636] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, "Daily Orders to 9 Cdn Fd Amb for 22 July 1943" and 26 July 1943.

follow future breaches.[637] The penalties for non-compliance, as prescribed by the Officer Commanding, must have been viewed by his troops as substantial. "Rank and file" offenders could expect to lose ten days of pay; sergeants, a "severe reprimand"; and officers were liable to be "reported to ADMS."[638]

The pro-active anti-malaria stance taken in No.9 Field Ambulance was commendable. It also appears to have been exceptional when compared with other medical units and certainly with combat units. Evidence supporting this, and more importantly suggesting that Boon may have been premature in expressing an overly optimistic view, were two reports that were compiled by the newly appointed Division Special Malaria Officer, Major J. D. McIntosh of the RCAMC. McIntosh, who had been serving as a medical officer with No.4 Canadian Field Ambulance, assumed the duties of this previously vacant position on 9 August. McIntosh wasted little time, immediately embarking on an inspection tour of many of the Division's brigades and battalion HQs, in order to investigate the state of anti-malaria affairs. In the three days that followed, he spoke with and observed innumerable regular officers, medical officers and ORs. Subsequently, he submitted two related reports to his direct superior, Playfair. McIntosh told a slightly different story than Boon that should have removed any doubt that anyone may have had regarding the sad state of anti-malaria precautions being practiced in the Division.

McIntosh began his initial tour of the Division at the Canadian First Infantry Brigade HQ. Upon inquiry, the brigade's Commanding Officer, Brigadier General

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[637] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, "Daily Orders to 9 Cdn Fd Amb for 4 August 1943."
[638] LAC, RG 24, Vol. 15863, No.9 Field Ambulance War Diary, "Daily Orders to 9 Cdn Fd Amb for 8 August 1943."

Howard Graham, and his staff informed McIntosh that their supply of mepacrine had "been adequate and regular." Graham also claimed that he had made the administration of mepacrine a responsibility of junior officers and NCOs, adding he was watching their returns. It is unclear as to whether or not he was referring exclusively to his own HQ, but it does appear that no such order had been received by the brigade as a whole.[639]

McIntosh also discovered that many aspects of anti-malaria measures were either being ignored or neglected at the brigade's HQ. Evening precautions were being "overlooked to a large extent", with many men of all ranks wearing shorts, not rolling down their shirt sleeves nor applying anti-mosquito cream. The supply of anti-mosquito cream was not a concern since a large supply of it remained untouched. Many soldiers had either lost or damaged their containers, a difficulty since the repellent was issued to the entire division in bulk. The HQ's staff reported that anti-mosquito nets had been employed shortly after D-Day +6. Yet, McIntosh discovered that a good portion of them had gone missing and not been replaced, a shortage worsened by the brigade's reinforcements arriving at the front without nets.[640]

A cursory visit to the Royal Canadian Regiment (more commonly known as the RCRs) revealed that sundown precautions were not being adhered to by the majority of its men. Some of the unit's members, many not wearing shirts at all, claimed to be unaware of sundown precautions in general and stated that they thought anti-mosquito cream was only to be applied when turning in for the night. Even so, McIntosh

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[639] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.
[640] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.

concluded that anti-mosquito cream use in the RCRs was virtually nil.[641]

Problems with mepacrine supply and use were rife in the RCRs. Several personnel had not received any preliminary mepacrine prior to landing and many more had ruined their one week supply during the amphibious landing and then not replaced it. Supply and/or administration issues were still not resolved as of early August. McIntosh spoke with one soldier who declared that he had taken only four mepacrine tablets since D-Day. As of 10 August, mepacrine was issued on parade that was overseen by individual company's second-in-command and was considered a platoon level responsibility.[642]

After his inspection of the 12th Canadian Tank Regiment, McIntosh was also dismayed to find that here too sundown precautions were not being complied with. Many soldiers were observed wearing nothing but shorts, hours after darkness had set in. The incidence of anti-mosquito net use was good, but there were several cases of irregular mepacrine use.[643] On a follow-up visit, McIntosh reported that he met with both the 12th's Officer Commanding and medical officer to discuss anti-malaria policies and procedures. These officers explained that the need for proper sundown precautions was comprehended by the rank and file, but had not been enforced. Many men in the unit explained to McIntosh that they had no choice but to wear shorts in the evening since their kit had long been destroyed due to enemy action and not been replaced, leaving them with literally nothing more than the clothes on their backs. The supply of anti-

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[641] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.
[642] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.
[643] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.

mosquito cream was very good, which is hardly surprising given the "objectionable" repellent was rarely used.[644] According to these officers, the 12th was using captured stocks of Italian mepacrine (*Italchina*). It appears that the *Italchina* supply that had been supplied to them from the rear echelon was adequate. Yet, for an unexplained reason, the unit's medical officer had the impression that there may have been some hoarding in these rear echelon areas. Two tablets of mepacrine were issued on both Tuesdays and Thursdays, and one every other day, although the medical officer stated that "he has received med orders to give it every day except Sunday." Both the tank regiment's medical officer and the Officer Commanding expressed their concern to McIntosh regarding the rising numbers of troops that had to be evacuated to medical units due to NYD fevers. Twelve men, some with temperatures as high as 105 degrees had been evacuated in the previous two days. Although he admitted to not ensuring anti-malaria measures were universally complied with in his unit, the commander inquired of McIntosh: "why don't they oil (Lake Lentini)?"[645]

During McIntosh's visit to the "Hasty Peas" (the Hastings and Prince Edward Regiment), he observed sentries who were using neither helmet-netting nor anti-mosquito cream. Several of the other troops in the unit claimed ignorance of sundown precautions. When challenged by McIntosh, they claimed that they thought that they only had to wear long pants or roll down their sleeves when they were on guard duty. Reportedly, the

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[644] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.
[645] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.

Hasty Peas were issued one tablet of mepacrine per day, seven days a week.[646]

The personnel of the Fourth Canadian Field Company of the Royal Canadian Engineers, also did not demonstrate compliance with sundown precautions. Anti-malaria clothing infractions were typical and anti-mosquito cream, described as "sticky" and "smelly", was only effective for a half hour after application and, in any event, was not issued universally due to a lack of proper tin containers. McIntosh found that the administration of mepacrine was not done on schedule. Instead the men received mepacrine "every other day because they don't know Monday from Friday."[647] McIntosh approved of this practical strategy and the unit's officer's apparently strict supervision of its administration. Use of mosquito nets was good but many men were reportedly very "anxious" to have dyed nets.[648]

The level of candidness and cooperation MacIntosh had found at the 1st Infantry Brigade HQ was lacking when, on 12 August, he visited the 3rd Infantry Brigade HQ. After explaining the nature of his inspection, the Division's Special Malaria Officer found Brigadier Howard Penhale to be just "moderately receptive." The Commanding Officer insisted that he had sent anti-malaria orders to his battalions, concluding that there was "nothing more he could do." Compliance with anti-malaria sundown precaution guidelines by personnel assigned to the brigade HQ was lacking. Additionally, although mepacrine was generally being taken by most personnel, its

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[646] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943.
[647] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943..
[648] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-malarial Investigations", 10 August 1943..

administration was not strictly supervised.[649]

The situation at the 22nd Regiment was similar to that of its brigade HQ. Orders dictating sundown precaution had been received but were not robustly enforced. However, by this point in the campaign, the administration of mepacrine was done by parade and overseen by the "Vandoo's" platoon commanders.[650]

Regardless of their attitudes towards anti-mosquito nets, the officers and troops of the Carleton and York Regiment had not used any since the invasion of Sicily had begun because the battalion's entire allotment of netting had been lost at sea. The loss might have been moot, for anti-malaria precaution control, compliance and enforcement were quite poor. When questioned by McIntosh regarding their proclivity to wander about bare-chested after dark, many "C and Y's" invoked a defence that McIntosh was hearing more and more frequently. Offenders persistently claimed to be uninformed and unaware of correct sundown procedures.[651]

The West Nova's Regiment appeared to be exercising good anti-malaria precautions, no doubt thanks to the inspired efforts of an Officer Commanding who had himself contracted and suffered through malaria in the past. The battalion's officers explained that non-battle conditions had allowed for higher levels of all anti-malaria discipline and compliance, in spite of an unnamed senior officer's nausea and vomiting

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[649] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.
[650] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.
[651] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.

being blamed on mepacrine's supposed toxicity.[652]

McIntosh's findings during his first week as the Division's Special Malaria Officer should have been cause for concern. However, he only confirmed what other RCAMC personnel had already begun to suspect, that the Division was in for a rough ride with malaria. A war diarist from No.1 Canadian Field Dressing Station complained that it was difficult to impress many Canadian soldiers with the "seriousness of the situation" and encourage them to be malaria-minded.[653] No.5 General Hospital had reported, as early as 7 August, that there was an "alarming rise" in British malaria cases, which should have suggested that an even larger influx of Canadian malaria cases was likely, given the relatively higher malariousness of the regions that had been occupied by the Division.[654]

As mid-August approached, many Field Ambulances were beginning to be overloaded with Canadian casualties presenting with high fevers and general malaise. The experience of No.2 Canadian Light Field Ambulance was typical. Although Canadians were not involved in combat, No.2 was as busy as it had ever been and was finding it increasingly difficult to find beds and process the ever-increasing numbers of ill Canadians who were arriving on a daily basis. Pressed for space and constantly filled to capacity, No.2 hastily erected outbuildings to accommodate patients and quickly found these shelters were filled as soon as they were built. The vast majority of the Canadian patients were termed NYD fevers, although they were strongly suspected to be malarial. A more detailed diagnosis was impossible due to lost equipment that had yet to be

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[652] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Investigation Section Notice", 12 August 1943.
[653] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 8 August 1943.
[654] LAC, RG 24, Vol. 15675, No.5 General Hospital War Diary, 7 August 1943.

replaced, especially microscopes, prompting one frustrated and dismayed medical officer to complain that this diagnostic inability was making it nearly impossible to "know which ones we can safely keep and those that should be evacuated for malaria treatment."[655] The unit was soon inundated, forcing the evacuation of most of the incoming NYDs.[656] On 12 August, of the seventy-eight seriously ill patients who had been sent to the rear for further treatment, fifty-seven were diagnosed as NYD.[657] By 14 August, No.2 was notified that nearly eighty percent of the NYD patients sent to the rear were confirmed as having malaria.[658]

The lack of diagnostic tools at the Field Ambulance level certainly may have delayed categorization of patients. Moreover, the transportation to appropriate medical facilities and treatment for many of these NYDs was further delayed by the ADMS. Playfair insisted that an NYD patient displaying all the outward signs of malaria not be officially diagnosed as malaria until a examination of a blood smear confirmed the diagnosis. As well, until this was done, quinine treatment was not to be initiated. One Casualty Clearing Station that had managed to procure a microscope and was experiencing difficulty in correctly analyzing his smears, began to place all "these NYD fevers on anti-malaria treatment as soon as they arrive in the unit."[659] This unilateral action by the unidentified CCS may have been in contradiction to the ADMS's wishes, but it was a reasonable reaction consistent with a RAMC recommendation that had originally been published in Britain the previous year and distributed to Canadian

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[655] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 13 August 1943.
[656] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 15 August 1943.
[657] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 12 August 1943.
[658] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 14 August 1943.
[659] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 14 August 1943.

medical officers in June 1943. This Army Medical Department Bulletin stated that "Medical officers in the tropics soon come to think of malaria whenever they see a fever."[660] Though Sicily could not be considered tropical, there was little doubt that the island was as highly malarial as any tropical region in the world.

Perhaps in response to the overcrowding crisis, Playfair decided to rationalize and standardize the treatment of malaria cases and ordered that all the Division's diagnosed cases were to be directed to No.2 Field Dressing Station. He advised the AA&QMG that the minimum period of treatment would be seven days at the Field Dressing Station, followed by approximately ten days in a convalescent camp. Playfair was obviously pleased to note that "we have, in fact, been complimented by DDMS of 13 Corps both in connection with the low malaria rate, and the low incidence of disease in general", as proven by a "quite good" 0.23 percent 'sick rate' (0.3 percent considered normal), for the 15,000 personnel in the Division.[661] This figure amounted to a total of thirty-seven patients. Playfair's remarkable claim was extraordinary. The number of Canadian sick passing through any single Field Ambulance unit on a daily basis easily exceeded his figure. Playfair was seriously misinformed, sadly mistaken or errant in his judgment due to his own firm insistence that NYDs not be classified as malaria, even if presenting all the physical symptoms associated with the disease, unless diagnosis was confirmed with a microscopic smear. In any case, the statistical information he relayed to the AA&QMG

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[660] DHH, FN 46, "Army Medical Department Bulletin No. 14", January 1942/June 1943, p. 2.

[661] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Malaria Control and Incidence of Disease", 15 August 1943.

was erroneous.[662]

Yet, the ADMS's efforts to streamline treatment for those diagnosed and confirmed as malarial appear to have been well received by most RCAMC personnel. Unfortunately, the processing of NYD and diagnosed malaria patients continued to be hampered by what was described as a persistent "lack of co-operative spirit" practiced by some senior Canadian Field Ambulance officers.[663] This was exemplified during the redeployment of many Canadian units after the Division was pulled from the line. On 15 August No.1 Field Dressing Station arrived in their newly designated encampment area only to discover that No.5 Field Dressing Station was occupying the locale and unwilling to give up or share what was considered prime real estate. This sparked an argument between the respective Officers Commanding. No compromise was reached. Exacerbating the problem, reported No.1's war diarist, was that existing RCAMC redeployment plans were changed by someone but "no one, (not) even the ADMS knew where we were to go."[664]

As the evening of 15 August 1943 waned, most of the men in the Division must have been feeling a large measure of relief. In the previous six weeks they had participated in a campaign that appeared to have been a brilliant success. Canadian troops had shown to their western allies, to the Germans and, more importantly, to themselves that they were a capable fighting force. Now at rest, many of these Canadians may have looked into the clear Sicilian night sky to observe a nearly total eclipse of the moon. The event was inspiring to one Canadian diarist who ended his daily entry by

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[662] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Malaria Control and Incidence of Disease", 15 August 1943.
[663] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 15 August 1943.
[664] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 15 August 1943.

rhetorically pondering; was the eclipse a "good omen?." [665] If it was an omen at all, it would certainly prove not to be a fortuitous one for the Canadians in Sicily.

As this chapter has shown, for the most part anti-malaria measures were not properly adhered to in the Canadian rank and file during the first month of their presence in Sicily. Sundown precautions and correct mepacrine use fell short for a wide variety of reasons, including a lack of training, inconsistent supply and sloppy execution. Proper anti-malaria measures were further hampered by qualitative and quantitative equipment problems, some of which were exacerbated by German offensive action. Yet, as it was recognized by many of the more insightful RCAMC and other army personnel, the chief problem was an overwhelming laxness of attitudes towards the threat posed by malaria, resulting in poor anti-malaria practices. Some of the worst offenders in this regard came from the upper ranks of the Canadian army. Their lack of leadership had created and was sustaining these slack attitudes and practices despite the many warnings regarding the dire danger of mosquitoes and the disease they carried. As the next chapter will show, the product of this corporate laxness would prove to be an epidemic of malaria.

[665] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 15 August 1943.

CHAPTER EIGHT

EPIDEMIC

On 17 August 1943, the Allied occupation of Sicily was completed and planning for Operation BAYTOWN, the crossing of the Messina Strait to invade the Italian mainland, continued in earnest. Flush with victory, the battle-weary Canadian, British and American troops settled in their temporary encampments. Although most were not aware of exactly where they would once again be deployed in combat, most realized that after a short respite on Sicily, their war would be continuing elsewhere. Just over 2,200 Canadians had been killed or wounded in combat during HUSKY.[666] However, the total number of casualties in the campaign was already escalating, for with every passing day another battle was raging and growing in magnitude— the battle against malaria. The prospects for winning the campaign against malaria continued to be marred by a lack of consistent and coherent leadership from the senior ranks of the Canadian army.

There was to be no respite for the Division's medical personnel during this period of non-combat. At all levels of care, from mid-August, wards were inundated by a steadily increasing influx of NYDs and malarial patients. The experience of No.2 Light Field Ambulance was typical. The unit's medical personnel quickly became alarmed by the rising incidence of suspected malaria, coupled with a severe shortage of drugs to combat the diarrhoea most of these patients were experiencing. Exacerbating the situation was the apparent lack of direction and support the unit should have received from the Division's ADMS, who maintained a policy of refusing to allow the evacuation

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[666]G.W.L. Nicholson, *Official History of the Canadian Army in the Second World War, Vol. II: The Canadians in Italy 1943-1945*, (Ottawa: Queen's Printer, 1957), pp. 174-75.

of suspected and confirmed malaria cases. No.2 became so badly congested that it was unable to accommodate new arrivals and was forced to send them back to their units.[667] This practice lasted for just a few days until the frustrated No.2 staff decided to ignore the ADMS' direction and began to evacuate their NYDs and malaria cases to No.5 Canadian General Hospital in Catania.[668] The newly vacated beds at the Field Ambulance hardly cooled off, as they were occupied within hours by a new batch of feverish sick.

The evacuees arrived at No.5 General Hospital to find its wards already filled to capacity. The cause, the hospital's war diarist surmised, was Playfair's, the Division's ADMS, non-evacuation directive. To cope with the onslaught, a plan was set in motion to set up a recovery centre to which malaria patients, after they became afebrile, would be transferred.[669]

Already pressed, the Division's medical units found the spread of illness was overwhelming. Over a two day period, No.5 Field Ambulance alone had over 400 new cases of suspected malaria report for sick parade. The medical formation's Commanding Officer lamented that, due to the sheer numbers of sick, it was impossible to meet the ADMS's demand that clinical malaria patients not receive quinine treatment until the diagnosis was confirmed by microscopic examination. Laboratory facilities, equipment and time were simply not available. Consequently, although he declared himself "loathe" to do so, the unit's commander ordered that malaria treatment be commenced immediately for the most ailing patients.[670]

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[667] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 13, 16, and 17 August 1943.
[668] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 19 August 1943.
[669] LAC, RG 24, Vol. 15675, No.5 General Hospital War Diary, 20 August 1943.
[670] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, 20 and 21 August 1943.

Motivated by the high number of confirmed and suspected malaria cases in the Division and in some other units of the Eighth Army, the British initiated a series of meetings to evaluate the state of anti-malaria strategies and practices. On 20 August, the Division's Special Malaria Officer, McIntosh, reported to the ADMS on the proceedings of one such malaria conference held at 13 Corps HQ. Mepacrine was the main topic of discussion and it was readily apparent that there was still disagreement regarding the prophylaxis' administration. Some units in the Eighth Army were adhering to the recommended standards, by seeing that their personnel were receiving one tablet four times per week. Others were administering two tablets twice a week.[671]

Also discussed at the Corps meeting was a recommendation made by some scientific advisors at the War Office that Canadian soldiers in Sicily begin an experimental trial of mepacrine. The proposed study would see all Canadians in the Division increasing their intake of mepacrine to six tablets per week; one tablet per day, six days per week. This constituted a total dosage increase of fifty percent per week. According to McIntosh, the War Office proposal was seriously deliberated and then rejected for no other reason than that there simply was not enough mepacrine available to facilitate the supplement. In fact, the mepacrine supply in the entire Mediterranean theatre was already strained. This was a surprising situation, McIntosh concurred, considering that both the 13 and 30 Corps had already drawn from stocks three times the amount of mepacrine to which they were entitled. Of even greater concern was that these ample supplies were unaccounted for. The Division's malaria officer was also perplexed that additional mepacrine was not available from its American manufacturer, especially

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[671] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report of Anti-Malaria Investigation Section - 20 August 1943."

since they had had years to produce a product that would have been anticipated to be in high demand.[672]

The responsibility for ensuring that mepacrine was administered to all Canadian and British soldiers was also discussed. The RAMC and RCAMC medical officers agreed that the existing policy regarding this was sound, reiterating that "the health of the troops is a Commanding Officer's responsibility and that this responsibility is allocated to Battalion Officers." Ideally, mepacrine was to be taken by the troops during an Officer's parade. If this was not possible, a parade overseen by a senior NCO would be acceptable.[673]

Four days after the Corps level meeting, Playfair issued "Malarial Directive for RMOs", which was copied to all the Division's medical units. The ADMS reaffirmed the Corps' mepacrine administration policies and reminded his personnel that the responsibility for regimental medical officers in this regard was limited to their "occasional attendance of the mepacrine parade and reporting to the [Officer Commanding] any laxity or deficiency in administration."[674] Playfair also stressed the importance of medical officers conducting brief and basic lectures to reinforce the practice of anti-malarial measures. Medical Officers were also reminded that Divisional orders had stipulated that Commanding Officers were obliged to consult with them when selecting encampment areas. These sites were to be situated at least three kilometers from bodies of water, swamps and civilian populations in order to minimize the risk of

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[672] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report of Anti-Malaria Investigation Section - 20 August 1943."
[673] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report of Anti-Malaria Investigation Section - 20 August 1943."
[674] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, "Malarial Directive for RMO's", 23 August 1943.

malaria.[675]

Playfair's direction with regards to siting was particularly sage, albeit tardy. In early August, medical personnel had been consulted in the re-location of the Division's Rear HQ, after the old locale had been "condemned as unhealthy."[676] Although it is unclear if the ADMS was aware of it at the time, the encampments inhabited by Canadians during their campaign in the Salso valley were also, from the perspective of malaria prevention, particularly poor.[677]

Following his directive, Playfair congratulated the Division's regimental medical officers, citing statistics that suggested that the ratio of Canadian sick to battle casualties was lower than that of their British cohorts. Unfortunately, Playfair either did not know, or did not divulge, several important mitigating factors. First, the incidence of malaria in British units had been high, but it had peaked in the first half of August and had been waning ever since. Second, his insistence on not classifying NYDs suspected to be malaria as malaria, may have skewed the statistics. Additionally, in the days previous to the ADMS's complimentary pronouncement, he was aware that Canadian medical units were being flooded with hundreds of new cases of suspected and confirmed malaria; and he noted that the Officer Commanding No.5 Field Ambulance reported 120 such cases had arrived that same day.[678]

Concluding their emergency malaria meetings and convinced that a malaria epidemic could envelop parts of the Eighth Army, the British Assistant Director of

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[675] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report of Anti-Malaria Investigation Section - 20 August 1943."
[676] LAC, RG 24, Volume 15656, ADMS War Diary, 7 August 1943.
[677] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[678] LAC, RG 24, Volume 15656, ADMS War Diary, 22 August 1943.

Hygiene of the 13th Corps and the OC of his No.8 Malaria Field Laboratory, jointly concluded that a radical approach had to be taken. Their recommendations, which were immediately initiated in all British units, called for the universal administration of large doses of quinine, at a rate of ten grains per day, per man, for three consecutive days. The assistant director reasoned that this level of suppressive treatment would effectively "blanket" the disease and thus conserve manpower for the upcoming assault on the Italian mainland.[679] The second stage of the British anti-malaria campaign called for all soldiers to begin and regularly follow the newly recommended prophylaxis schedule for hyper-endemic areas, which was one mepacrine tablet per day, six days per week.[680] The entire scheme was immediately approved by British military authorities and the RAMC.

Accordingly, on 24 August, the British requested the ADMS immediately carry out the British blanketing plan for all Canadian personnel. Playfair was neither willing nor interested in implementing their recommendations, rejecting the possibility of Canadian compliance on several grounds. Playfair deemed the proposal "unscientific" and did "not consider the incidence of malaria in (the Division) as excessive", nor did he "agree with their assumption that NYD fevers were malaria." Besides, he argued that the Canadian wastage rate to malaria was not a concern. He suggested the proposed strategy threatened to "upset anti-malaria discipline in the Division and would lead to an epidemic of malaria at a future time producing chaos."[681]

Playfair's conclusions were unusual considering a report he had received just two days previously from Col. Noble, the Officer Commanding No.5 Field Ambulance.

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[679] LAC, RG 24, Volume 15656, ADMS War Diary, 22 August 1943.
[680] LAC, RG 24, Volume 15656, ADMS War Diary, 24 August 1943.
[681] LAC, RG 24, Volume 15656, ADMS War Diary, 24 August 1943.

Noble's formation was inundated with NYDs presenting at a rate of 120 per day, provoking him to state that "he could not continue to cope with the situation" as he had too few microscopes and a shortage of general medical supplies. As a consequence, Noble asked Playfair for permission to begin "treatment on some of the clinical malaria upon admission rather that await result of the smear." Playfair was apparently unmoved, responding that he continued to be against initiating treatment until microscopic confirmation was made. Perhaps in an attempt to placate his subordinate, the ADMS added that "he would personally see that one or two more microscopes" would be delivered to No.5 the next day and Boon, the Division's malariologist, would be sent to render additional assistance.[682]

Over the following two day period, No.5 Field Ambulance continued to be strained, running at nearly three times its normal capacity. New NYD admissions were in excess of 130 per day, as were the number of patients evacuated to No.5 General Hospital in Catania.[683] In turn, the hospital's wards were packed with feverish patients, its harried staff having received no instructions from RCAMC senior command regarding the handling or evacuation of malaria patients.[684]

Undoubtedly, pressure on Playfair to approve the blanket treatment of the Division was increasing at a rate comparable to the increase in Canadian sick. Beginning to bend but not break, on 26 August Playfair visited British Army medical stores in Catania, in order to collect the entire amount of quinine that would be required to blanket the entire Division. Yet, he had no intention of distributing the 192,000 tablets in the

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[682] LAC, RG 24, Volume 15656, ADMS War Diary, 22 August 1943.
[683] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, 26 August 1943.
[684] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 25 August 1943.

foreseeable future, remaining resolute in his beliefs that the British "shotgun" method was over-kill.[685] After picking up the quinine stocks, he informed some of the medical staff at No. 1 Field Dressing Station that he intended to visit with the Division's General Officer Commanding (GOC), General Guy Simonds, the next morning to explain that he felt the RAMC scheme was "not necessary or wise."[686]

It appears that Simonds may not have been won over by the ADMS's arguments, or that Playfair, who had concurrently visited many Canadian medical units that day, finally became sufficiently impressed by the malaria problem to soften his stance. In any event, the ADMS's opinion regarding the blanket treatment abruptly changed on 27 August, when he suggested that in light of the worsening situation with malaria and considering that an Allied invasion of the Italian mainland was rapidly approaching, he "cast the die and decided that all troops would take 10 grains quinine daily for 3 days." Once Playfair's decision was made he became a stalwart promoter and champion for immediate implementation of the British plan. When the Division's AA&QMG informed the ADMS that he wanted his own office to issue the blanket order, Playfair responded that this would cause an "unnecessary delay ... not warranted in this extreme emergency."[687]

The ADMS released the blanket order on 28 August and all personnel in the Division, regardless of their state of health, began the three day quinine regimen. This news was well received at No.5 Field Ambulance, which had "now reached absolute

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[685] LAC, RG 24, Volume 15656, ADMS War Diary, 26 August 1943.
[686] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 26 August 1943.
[687] LAC, RG 24, Volume 15656, ADMS War Diary, 27 August 1943.

saturation point."[688] So many new NYD patients had been arriving at No.1 Field Dressing Station every day that securing the food rations required to feed them all created some difficulties.[689] All Canadian medical units were operating at, or in excess of, their capacities, with the exception of No.9 Field Ambulance.

While the numbers of febrile Canadian troops had been escalating, during the latter half of August, Boon and McIntosh continued their "campaign rounds", visiting the Division's combat units when time allowed. In addition to informally observing a unit's anti-malaria practices and offering their evaluations and advice to Officers Commanding, they also offered support to regimental medical officers. As regimental medical officers were responsible for maintaining anti-malaria training for their respective units, Boon and McIntosh found them to be receptive to their aid. As well, a plan had been conceived that Boon and McIntosh would hold battalion sized anti-malaria lectures during the Division's rest phase. As the loud speakers required to facilitate this could not be secured, the concept had to be discarded, leaving the instruction to be done on a piecemeal basis by regimental medical officers, which was a task that often was impossible to achieve, much less pursue, by most of these beleaguered regimental doctors.[690]

During their campaign rounds, Boon and McIntosh also attempted to evaluate the performance of the Division's individual unit anti-malaria squads. Each unit had been advised to form squads prior to departure from the United Kingdom. These squads, which initially consisted of one NCO and three ORs per battalion, were to have received

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[688] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, 27 August 1943.
[689] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 27 August 1943.
[690] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

training from their unit's regimental medical officer. Unfortunately, the effectiveness of these squads, throughout most of the Division, was for several reasons extremely limited. They were often very poorly trained and organized. Many of the personnel assigned to this type of duty lacked motivation, thinking it was futile work and of low priority, especially in combat zones. Many of those who had received proper training had been reassigned to other duties and not replaced. Consequently, these squads generally accomplished very little, if any, mosquito control within their local boundaries, up to the fourth week of August 1943.[691]

The large scale destruction and/or modification of mosquito breeding areas was a task that had been assigned to AMCUs. Based on the British model, Canadian AMCUs were considered as regular army units and, as such, received advice from regimental medical officers but direction from regular army command. The AMCUs consisted of one junior ranking officer (typically a lieutenant), an NCO and five to seven soldiers of lower rank.

AMCUs would concurrently follow two basic strategies to control or limit mosquito breeding within Division boundaries. To deny adult mosquitoes adequate egg-laying environments, AMCUs would drain, and/or flood with fresh water, any large bodies of water; such as ponds, swamps and marshes. Additionally, streams would be canalized and smaller pools of water backfilled with rocks or dirt. Where physical modification was not practical or feasible, as was the case with lakes, water surfaces would be sprayed with the insecticide Malariol, dusted with Paris Green, or oiled with a cresol-based solution. These chemical treatments would kill larvae or retard the

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[691] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

development of eggs for periods of one week or longer.[692]

During preparation for HUSKY, three Canadian AMCUs had been formed in the United Kingdom. The formation process effectively amounted to each of the Officers Commanding receiving a few days of anti-malaria and anti-mosquito instruction. The units arrived on Sicilian shores close on the heels of HUSKY's assault forces, but the Canadian AMCUs found their efforts to start mosquito control were stymied at every turn. Virtually all of their equipment and supplies never arrived or were never accounted for, having been inexplicably lost in transit or soon after arrival in Sicily.[693] To add to their woes, all three of the units had left British ports without any of the motorized transport they would require after landing. Not surprisingly, upon disembarkation they had been unable to appropriate any vehicles whatsoever.

Getting the Canadian AMCUs re-supplied and active proved to be nearly impossible. For nearly a month, the ADMS made repeated appeals to senior army staff, including the AA&QMG, to equip and activate all three units.[694] Playfair noted that, ironically, when vehicles were finally allocated to the units on 6 August, the transports were promptly reallocated to move salvage.[695] During this period of inactivity, many AMCU personnel were reassigned to other non-related tasks, some permanently.

In mid-August, after the end of active combat in Sicily, all three of the Division's AMCUs were reformed and commenced one to two weeks of practical training with experienced British Army AMCUs. The nature of the AMCU's tasks were physically

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[692] "Malaria 1943", pp. 3-5.
[693] LAC, RG 24, Vol. 15947, No.3 AMCU War Diary, 14 August 1943.
[694] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report on Divisional Hygiene and Incidence of Disease", 8 August 1943.
[695] LAC, RG 24, Volume 15656, ADMS War Diary, 6 August 1943.

demanding and required a great deal of manpower. To help deal with the massive projects all Canadian AMCU personnel began to direct and supervise the activities of large groups of civilian labourers who had been hired by the British. In late August, No.2 Canadian AMCU was overseeing the activities of no less than 185 Sicilian workers.[696] Yet, even with this civilian aid, No.2's lieutenant was still experiencing a great deal of trouble in trying to accomplish his unit's mandate due to continuing problems in securing transport and equipment. So serious were these shortages that the soldiers of No.2 were forced to scrounge for materials in order to fabricate even the most basic tools, including shovels, rakes and picks.[697] No.3 AMCU faced similar equipment shortages but managed to obtain a large transport truck. This single truck was the unit's sole vehicle transport for all of its personnel and their kit, a smattering of supplies and over one hundred Sicilian labourers.[698] For all the AMCUs, supply and equipment shortages remained the norm. Officers Commanding these Canadian units consistently found themselves wasting precious time and resources trying, most often in vain, to "get supplies from any source."[699]

As the end of August approached and the malaria epidemic gained impetus, positive changes in the attitudes held by some of the Division's non-medical officers and troops towards malaria began to develop, albeit slowly. Troops saw more and more of their friends and comrades felled by the disease, which made the practice of malaria

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[696] LAC, RG 24, Vol. 15947, Appendix to No.2 AMCU War Diary, "Anti-Malarial Control", 24 August 1943.
[697] LAC, RG 24, Vol. 15947, Appendix to No.2 AMCU War Diary, "Anti-Malarial Control", 24 August 1943.
[698] LAC, RG 24, Vol. 15947, No.3 AMCU War Diary, 16 August 1943.
[699] LAC, RG 24, Vol. 15927, Appendix to No.2 Field Hygiene Section War Diary, "Appreciation - No. 2 Cdn Fd Hygiene Section, RCAMC", November 1943.

precautions more palatable. The specific motivations may have varied for officers, but many must have been impressed by the steady decrease of troops reporting for daily parade. The cause of the vast majority of this wastage was beginning to be recognized as malaria. Of course, senior regular army officer's reasons for wanting to reverse this dangerous trend were not altogether altruistic. The manpower crisis in the Division may have been of issue but more importantly, a continuation or worsening of the malaria epidemic would have seriously jeopardized Allied combat performance in Operation BAYTOWN, which was slated to begin on 3 September 1943. German resistance was expected to be stiff, which would make the upcoming Italian campaign a very long and arduous one. Malaria had to be dealt with — and quickly. Quite simply, military expediency demanded that malaria be controlled. However, it soon became clear that the full cooperation of all ranks was far from guaranteed.

Although both Boon and McIntosh had continued in their attempts to tour the Division and dispense anti-malaria advice to officers and their units, they found that other demands were pressing. As No.2 Canadian Field Hygiene Section was already conducting inspections of hygiene related matters in the Division, such as water quality and ablution and kitchen facilities, it was decided, presumably by Playfair, to have them also evaluate anti-malaria measures in order to free up some time for his malariologist and the Division's Special Malaria Officer. The inspectors from No.2, most of whom were ORs, began this process during the last few days of August.[700]

On 27 August, Major P.A. Scott, No.2 Field Hygiene Section's OC, submitted the first of his inspection reports to Playfair. His findings suggested that in the Canadian

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[700] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

Second Infantry Brigade, discipline in many aspects of hygiene, including anti-malaria precautions, was leaving much to be desired. In spite of numerous reminders to select encampment areas wisely, the Seaforths of Canada were situated in a particularly highly malarious area. Even worse, it had been discovered that the administration of mepacrine at the brigade's HQ was being "left to the individual to take--which is being neglected."[701] It appears that this attitude towards mepacrine administration was indicative of the way in which many soldiers, of all ranks, were continuing to ignore basic medical directives. Scott made his frustration clear in a letter to the CMHQ in London, noting that hygiene discipline was exceptionally lax in the Division. Scott surmised that the situation was so poor in some cases, that "It is too bad that more disciplinary action could not be taken." He continued, "all the ammunition is available, in standing orders, routine orders and directives but no one seems to want to fire the gun, and make examples of the culprits. Officers are as culpable as the men." In order to improve the situation, the RCAMC major made several recommendations. Chief among these was that all the Division's Commanding Officers be obligated to receive formal instruction in hygiene and sanitation.[702]

Scott's tireless efforts to improve his formation's effectiveness were seriously hampered by transportation difficulties. Although the Division was not involved in combat at this stage, No.2 Field Hygiene Section had just two trucks and these transports were not large enough to effectively carry all of the unit's equipment and personnel. Consequently, the crammed and cramped vehicles had to be unloaded at virtually every

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[701] LAC, RG 24, Vol. 15927, Appendix to No. 2 Field Hygiene Section War Diary, "Sanitary Report - 2 C.I.B.", 27 August 1943.
[702] LAC, RG 24, Vol. 15927, Appendix to No. 2 Field Hygiene Section War Diary, letter from OC No. 2 Field Hygiene Section to AMD5 - CMHQ, 31 August 1943.

stop in order to get access to required material, an "awful absurdity" which prompted Scott to declare that it was making "this unit the laughing stock of the army and I mean the Army." The major's inability to secure transportation for himself, even in the form of a motorcycle, inspired him to artfully lament in his war diary how he "sits on a compo box under the shade of a fig or olive tree, trying to imagine conditions up front, and correct them, but finally comes under the spell of the excessive heat and falls into a somnambulant state and no work is done."[703]

Playfair would have undoubtedly related to his subordinate's transportation plight because the ADMS had experienced chronic vehicle woes of his own. Playfair's sole transportation on the poorly maintained and narrow gravel roads of Sicily was a three ton truck. He had also had continual difficulty in finding drivers.[704] Finally, at the end of August, the ADMS received a jeep, but still did not have enough room in his truck for all his medical and office equipment.[705]

For all the frustrations RCAMC officers and their formations experienced, their efforts began to have a positive effect upon some aspects of anti-malaria practices in the Division. One area in which this effect was evident was seen in late August, when battalion level anti-malaria squads generally became more active, implementing the recommendations for killing adult mosquitoes in inhabited buildings and shelters, as outlined in "Malaria 1943" and the "Handbook of Military Hygiene." Of course, this increase in activity was not solely attributable to the RCAMC, but there can be little doubt that they provided much of the motivation to regular army officers and NCOs to

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[703] LAC, RG 24, Vol. 15927, Appendix to No. 2 Field Hygiene Section War Diary, letter from OC No. 2 Field Hygiene Section to AMD5 - CMHQ, 31 August 1943.
[704] LAC, RG 24, Volume 15656, ADMS War Diary, 27 August 1943.
[705] LAC, RG 24, Volume 15656, ADMS War Diary, 31 August 1943.

see that the squads' responsibilities were discharged. Deficiencies in the number of flit guns, one of the squad's main tools, were beginning to be reversed. However, flit remained in short supply and was only released from reluctant RASC personnel in small amounts. Additionally, recognizing the labour demands efficient mosquito destruction required, anti-malaria squads began to expand in size to three per company, which was typically one NCO and two privates.[706]

For anti-malaria squad members, the work was not as physically demanding as it was time consuming and very often mind-numbingly boring. As mosquitoes would propagate in any collection of water, no matter how small, every square foot of an encampment area would have to be examined for potential problems. Old tires, open buckets and even discarded tin cans in garbage heaps were overturned and/or drained of free-standing water. Tire and track ruts had to be filled.

The methods for controlling or eliminating mosquito breeding in or near camps which had recently proven so successful in Canadian units stationed in North Africa were endorsed for implementation.[707] One such innovation arose out of the need to kill mosquito larvae in drinking water, and yet keep the water potable. In such cases, a small amount of gasoline was added to the unit's water barrels. A guard was then posted to ensure that this now tainted water was not consumed for a twenty-four hour period, during which the gas would evaporate and the water would be rendered again drinkable. This process would be repeated on a weekly basis.[708]

Besides motivating behavioral changes in anti-malaria squads, the epidemic also

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[706] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[707] Feasby, *Vol. II: Clinical Subjects*, p. 142.
[708] Feasby, *Vol. II: Clinical Subjects*, p. 139.

provided impetus for a new program of anti-malaria education and training for Canadian medical officers, that had been initiated in the latter half of August. Most of these medical officers had received this instruction at newly formed British malaria diagnostic and treatment centers.[709] Additionally, Sicilian civilians, their well-being also threatened by the severity of the epidemic, were given clear and concise anti-malaria education; and issued with mepacrine and mosquito repellents from RCAMC and AMCU personnel.[710]

The malaria epidemic also had a distinct effect on the final plans for Operation BAYTOWN. From an organizational perspective, the order of battle for the Division's BAYTOWN invasion force was slightly modified. Although No.1 AMCU remained an army unit, it was attached to the RCAMC's No.2 Field Hygiene Section. The situation stayed the same for No.2 and No.3 AMCUs, which remained under direct Divisional control.[711]

In terms of anti-malaria equipment and supply, several changes were enacted in the BAYTOWN plan. Mosquito netting was to be issued to all soldiers and carried in their haversacks. Additionally, tents and bivouacs were allocated to be placed on unit transport. Each unit was issued a two week supply of mepacrine, which was twelve tablets per man. In turn, each soldier in the unit would receive a week's supply which was to be carried in newly issued waterproof containers, which had been designed to prevent the deterioration or destruction of the mepacrine tablets, thus avoiding the difficulties experienced after the HUSKY amphibious landings. The remainder of the unit's reserve supply was to be divided between at least three transports in order to

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[709] LAC, RG 24, Volume 15656, ADMS War Diary, 17 August 1943.
[710] Feasby, *Vol. II: Clinical Subjects*, p. 139.
[711] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

minimize the risk of combat loss.[712]

Quartermasters were also expected to ensure complete distribution of a newly formulated anti-mosquito cream that had become available for indent in mid-August. Although its effectiveness was on par with existing stocks, this new cream had a lesser tendency to become rancid. As well, an added improvement was the availability of non-leaking cream containers that had recently arrived from British manufacturing plants in Egypt.[713]

The other component of sundown precautions, which was clothing, appears to have been largely ignored by BAYTOWN planners, just as it was being ignored by many Canadian soldiers. The habit and practice of wearing shorts after sunset was well engrained. A prime example of this was later reported by Boon. It seems that directly following the presentation of an anti-malaria lecture, an unidentified Commanding Officer in the Division took an evening stroll inside his formation's perimeter. In spite of the instruction and standing orders to the contrary, he found many of his men to be dressed improperly. Subsequently, the officer "gave up the checking of names" because he deemed the act hopeless.[714]

The high incidence of breeches in sundown precautions, particularly clothing, was brought to the attention of the Director of Medical Services (DMS) at CMHQ, by an Assistant Medical Director, Lt.-Col. Brown. Brown suggested that continuing to issue both shorts and slacks to Canadian troops was problematic and impractical, since soldiers

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[712] LAC, RG 24, Vol. 15856, Appendix to No.5 Field Ambulance War Diary, "Exercise 'Baytown' - Section 'A' Orders - Administration", 28 August 1943.
[713] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report of Anti-Malaria Investigation Section - 20 August 1943."
[714] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

engaged in combat "would find it difficult, if not impossible, to carry the pair of slacks and secondly, to change into them when required." Accordingly, Brown recommended that as the additional physical effort required to wear trousers was negligible, no shorts should be issued to Canadian troops in malarious areas.[715] If Brown's plan was adopted, in future, Canadian troops would not wear shorts in malarious areas, not out of choice but out of necessity.

It was recognized by many of the Canadian officers based in Sicily, that any decision to cease issuing shorts would create a good deal of consternation amongst the rank and file. Comfort issues were paramount. Since their withdrawal from combat, most troops had occupied their time taking part in numerous leisure activities including plays, orchestral presentations and stunt flying exhibitions by the RCAF's 417 squadron. More importantly, the most popular activities for the troops were sports related. Inter-unit baseball tournaments and track and field competitions, up to and including some organized at the brigade level, were not only popular activities, but a strong source of unit pride and cohesiveness.[716] Canadian officers, up to and including brigade level, encouraged and organized these sporting events. The wearing of long trousers while participating in these events, coupled with the hot and arid climate of Sicily and southern Italy, was not and would not be readily complied with.

As August closed, so did the Division's reprieve from the hardships of combat. In preparation for BAYTOWN, regular units moved towards their staging areas near the Messina Strait. RCAMC mobile units hurriedly evacuated their sick, the majority of

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[715] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Tropical Kit", August 25 1943.
[716] LAC, RG 24, Vol. 15845, No.2 Light Field Ambulance War Diary, 23 August 1943.

whom were malarial, to existing convalescent facilities in Sicily, Malta and North Africa. The medical units also loaded their transports and made ready to follow the rest of the Division to the Italian mainland. According to some medical formation personnel, the BAYTOWN medical plans left much to be desired. Contradictory orders and/or a lack of orders had created a great deal of difficulty in some RCAMC units.[717] A war diarist with No.1 Field Dressing Station spoke of this abysmal state of affairs, musing "With all this utter confusion [over orders], we wonder how the [Division] ever does as well as it does. And this is not all one would like to say. Some day it will all come out."[718]

As this chapter has shown, the concerns voiced by many anti-malaria measures advocates were not purely academic, as an epidemic took hold and ran amok over the Canadian force in Sicily. This malaria epidemic was no small affair. No part of the Division was left untouched by the outbreak of the disease, despite the best efforts of many talented and dedicated "malaria-minded" Canadian medical and hygiene-related personnel to improve procedures and increase compliance. Still, for the most part, resistance to anti-malaria precautions continued to be a major problem, especially in command, even after the importance of these measures was so clearly demonstrated by the spread of the epidemic.

As the next chapter will demonstrate, some components of the BAYTOWN plan may have been problematic, but the timing of the Italian mainland invasion turned out to be fortuitous. Just prior to the massive exodus of Canadians out of Sicily, the daily influx of Canadian malaria cases had begun to steeply decline. Although many new cases would continue to report to medical units over the course of the next six to eight weeks,

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[717] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 31 August 1943.
[718] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 31 August 1943.

the worst of the Division's malaria epidemic had past.

CHAPTER NINE

INFECTIOUS DISEASE ON THE ITALIAN MAINLAND AND BEYOND

On 3 September 1943, the bulk of the Division's combat formations crossed the Messina strait, initiating Operation BAYTOWN, the invasion of the Italian mainland. The Division was slightly under-strength, since its losses due to malaria and battle casualties in Sicily were greater than the number of reinforcements it had received. The RCAMC's medical units, with the exception of No.5 General Hospital, made the crossing in the weeks that followed. As had been the case in HUSKY, the Canadian force was at the centre of the Allied assault, with the British making flanking attacks on the right and the Americans on the left. The advance initially gained ground rapidly, hastened to a small degree by the Italian surrender on 8 September. By month's end the Division was engaged in the Foggia area, facing an ever-stiffening German defence. Yet, the Canadians drove forward slowly in a north-westerly direction through Campobasso and, in November, towards the Sangaro River.

The route the Division had followed during these initial phases of the Italian Campaign, had taken it through the most highly malarious regions of southern Italy.[719] Soon after it was occupied, the city of Foggia and the surrounding Foggia Plain was found to be so rife with malaria and mosquito breeding that the Eighth Army's Advising Malariologist recommended that "the whole plain be placed out of bounds between the

[719] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

hours of sunset and sunrise."[720] In addition to malaria, epidemics of typhoid, paratyphoid and trachoma were widespread in Foggia, possibly perpetrated and certainly exacerbated by the crossing of the city's fresh water and sewer lines, presumably done intentionally by vacating German troops.[721] Conditions in the Division's various encampments and bivouacs were difficult, as most suitable siting areas had been badly fouled by the retreating Germans, which contributed to a difficult situation in which one diarist claimed his unit was "plagued by thousands of flies by day and thousands of mosquitoes by night."[722] Like Sicily, the environment in southern Italy posed a serious threat to the health and well-being of the Division.

Canadian experiences in Sicily fuelled some improvements in anti-malaria discipline between September and the end of the malaria season in early November.[723] One such change was the subtle shift in the attitudes held by some regimental officers towards the Division's hygiene inspectors from No.2 Field Hygiene Section. Initially, No.2's war diarist explained, they had been treated as "just another headache, bothersome and snooping." As time passed and it was accepted that the inspectors "were not Gestapo", the advice and assistance they rendered appeared to be more readily accepted by many of the Division's units.[724] A second change prompted by the epidemic was the creation and distribution of "Malaria Maps" to help commanders and medical officers

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[720] LAC, RG 24, Vol. 15947, Appendix to No.1 AMCU War Diary, "AMCU Responsibilities", 2 October 1943.
[721] LAC, RG 24, Vol. 15947, Appendix to No.1 AMCU War Diary, untitled memorandum from OC No. 1 AMCU to ADMS, 3 October 1943.
[722] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 18 September 1943.
[723] LAC, RG 24, Vol. 15927, Appendices to No.2 Field Hygiene Section War Diary, various October 1943 inspection reports.
[724] LAC, RG 24, Vol. 15927, "Appreciation - No.2 Cdn Fd Hygiene Section, RCAMC", November 1943.

select encampment sites.[725]

Some changes sprouted from the Division's lower ranks. Home-made signs and placards festooned some camps with anti-malaria propaganda.[726] The creative talent of one unknown Canadian soldier was aptly demonstrated in one such poster, where above the slogan "Hit Back with Mepacrine", was a hand-drawn depiction of anti-aircraft guns shooting mepacrine tablets at a group of sinister looking dive-bombing mosquitoes.[727] Information regarding malaria and personal precautions was also disseminated in battalion newspapers, such as the Hastings and Prince Edward Regiment's *Horse and Plough Piquet*, whose first issue was published in September 1943.[728] Whatever the cause, Canadian soldiers became much more malaria conscious in late 1943 and 1944, and the percentage of men taking mepacrine on a regular basis increased significantly towards the end of the campaign.[729]

As beneficial as these changes may have been, many of the problems that had helped precipitate and perpetuate the Division's epidemic in Sicily continued to haunt it in Italy. Supply deficiencies in anti-malaria training kits and mepacrine were experienced in some formations.[730] Flit was, more often than not, nearly impossible for many units to obtain. Making its supply even more scarce, the insecticide was popular on the black market, with many Italian civilians very eager to trade fresh eggs with Canadian

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[725] Feasby, "A Critical Analysis", pp. 29-30.
[726] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[727] LAC, RG 24, Volume 15656, ADMS War Diary, September 1943.
[728] LAC, RG 24, Vol. 15072, Hastings and Prince Edward Regiment War Diary, 21 September 1943.
[729] DHH, 147.009 (D29), "The Campaign in Italy: 1943-44-45", n.a., n.d., p. 13.
[730] LAC, RG 24, Volume 15656, ADMS War Diary, 15 September 1943; and LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Anti-Malarial Training", 16 September 1943.

soldiers for flit.[731] In addition to the flit shortage, AMCUs found their attempts to eradicate mosquitoes in southern Sicily were severely curtailed by a variety of other chronic supply problems.[732] The lack of adequate or appropriate transportation that had been experienced by the Division's three AMCU's and No.2 Field Hygiene Section during HUSKY, also continued. Exacerbating this, the few tools that had been issued for mechanical service on the formations' motorcycles and trucks were of inferior quality, prone to break and difficult to replace.[733]

In addition to experiencing supply and equipment problems, the Division's medical units were also revisited by many of the organizational problems that had plagued them in Sicily. During the first few weeks of BAYTOWN, several Canadian medical units had serious problems trying to determine what the approved procedures were for the transfer and evacuation of malaria patients.[734] Additional confusion, and evidently frustration, were generated by several instances of conflicting orders being issued by the ADMS and DADMS, prompting one Canadian medical unit commander to record "We thought, perhaps wrongly, that HQ was supposed to solve problems, not to create them."[735]

Other weaknesses in the Division's anti-malaria strategy also persisted in Italy. It

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[731] LAC, RG 24, Vol. 15947, No.3 AMCU War Diary, 12 September 1943; LAC, RG 24, Vol. 15947, No.1 AMCU War Diary, 22-27 September 1943; and appendix to No.1 AMCU War Diary, "AMCU Responsibilities", 2 October 1943.
[732] LAC, RG 24, Vol. 15947, No.1 AMCU War Diary, 20-22 September and 6-13 October 1943.
[733] LAC, RG 24, Vol. 15927, "Appreciation - No.2 Cdn Fd Hygiene Section, RCAMC", November 1943.
[734] LAC, RG 24, Vol. 15856, No.5 Field Ambulance War Diary, 18 September 1943; and LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 15 September 1943.
[735] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, 16 September 1943.

was clearly evident that, although some improvements had been made, the malaria threat continued to not be taken seriously in many quarters. While the Division was located near the Foggia Plain, the Officer Commanding No.1 AMCU reported two occurrences to the ADMS that suggested that a majority of unit's anti-malaria squads were either unwilling or unable to fulfill their responsibilities. On a single day, the officer visited no less than six of the Division's combat and support units to conduct training of unit squads, only to discover that in every case "there were no unit squads available."[736] Less than two weeks later, while visiting six other units the Officer Commanding found that not one of these formations had a functioning anti-malaria squad. He inquired as to why this was the case at two of these units and was informed that there was no need for squads as there were no mosquitoes in the camp. Minutes later, in each case, several of the insects were caught in the orderly rooms of these units.[737]

With many soldiers of all ranks maintaining a casual attitude towards malaria, it is hardly surprising that personal anti-malaria precautions continued to be problematic. A significant number of Canadian troops not only persisted in wearing shorts and short-sleeved shirts in the evening, but the donning of local traditional Italian headwear gained popularity, in spite of standing orders to the contrary.[738] Even as late as November and the approach of cooler winter weather, some foolhardy, yet undeniably hardy, Canadians in the Division continued to wear short pants though many of their cohorts donned full

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[736] LAC, RG 24, Vol. 15947, Appendix to No.1 AMCU War Diary, untitled memorandum from No.1 AMCU to ADMS, 28 September 1943.
[737] LAC, RG 24, Vol. 15947, Appendix to No.1 AMCU War Diary, untitled memorandum from No.1 AMCU to ADMS, 7 October 1943.
[738] LAC, RG 24, Vol. 15901, No.1 Field Dressing Station War Diary, "Daily Orders for 24 September 1943."

battledress to protect them, if not from mosquitoes, then against the evening chill.[739] There were also several isolated instances of non-compliance with mosquito netting precautions but the worst case appears to have taken place at No.1 Canadian Infantry Brigade Support Group's encampment area, where the entire unit discarded their nets and placed their complete reliance upon mepacrine to keep them free of malaria.[740]

An indication of how seriously the commanders at the Rear Division HQ took the importance of supervised administration was illustrated during a hygiene inspection, in late September. In spite of countless recommendations and orders to the contrary, the HQ's commanders did not place a junior officer in charge of overseeing the taking of mepacrine, instead choosing to have a corporal in charge of the kitchen "check off names."[741] This unreliable method of mepacrine administration must have pleased those soldiers in the unit that continued to be suspicious of the anti-malaria drug. Whatever the reasons, a small but significant number of Canadian personnel continued to believe it caused nausea and diarrhoea. The ADMS, Playfair, had earlier dismissed these complainants as unreliable and "irresponsible", and Boon, the malariologist, determined these symptoms to be unproved and "undoubtedly psychological" in nature.[742] Yet, persistent rumours that long-term mepacrine use could cause sexual impotence or liver disease, found fertile ground in the minds of some Canadian troops, especially since no

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[739] LAC, RG 24, Vol. 15927, Appendix to No. 2 Field Hygiene Section War Diary, "Monthly Hygiene Report", 2 November 1943.
[740] LAC, RG 24, Vol. 15947, Appendix to No.1 AMCU War Diary, untitled memorandum from No.1 AMCU to ADMS, 15 October 1943.
[741] LAC, RG 24, Vol. 15927, Appendix to No.2 Field Hygiene Section War Diary, "Sanitary Inspection of Rear Div HQ", 25 September.
[742] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Report on Employment of medical units in Sicilian Campaign", 25 August 1943; and LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

one could deny the drug made skin take on a yellowish hue.

For their part, the War Office and the upper echelons of the RAMC were not completely satisfied that mepacrine was benign, as questions regarding mepacrine's adverse effects remained a matter of investigation and debate in senior scientific, medical and military circles.[743] Certainly, evidence suggested that the drug had some legitimate contraindications. Earlier in 1943, RAMC dermatologists had determined that mepacrine was sometimes directly related with "a most bizarre and yet disturbing dermatitis."[744] In 1943 the British Medical Research Council's Malaria Committee concluded, after an exhaustive review of all available scientific literature, that the drug was likely not toxic in the long-term, yet its short-term effects required "investigation and elimination."[745] In early November, as the Allies temporarily ceased the administration of mepacrine due to the close of Italy's 1943 malaria season, these inquiries gained steam.[746] Time was short, as the onset of the 1944 malaria season was expected to occur late the following spring.[747] Based on these inquiries, the War Office would conclude in 1944 that mepacrine was "harmless" and could be taken for periods of one year or more, "without any detectable ill effects."[748] Subsequently, Canadian and British medical officers were reminded to discount any adverse rumours regarding mepacrine and make no mention of

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[743] LAC, RG 24, Vol. 15645, Appendix to Director of Medical Services War Diary, "DDMS circular", 1 October 1943; and LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Report on Malaria given by Major General Biggam at the Inter-Services Consultants' Committee Meeting on 11th September 1943."
[744] Feasby. ed., *Vol. II: Clinical Subjects*, p. 128.
[745] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Drug Suppression or Prophylaxis of Malaria", September 1943.
[746] Crew, *Campaigns Vol. III*, p. 525.
[747] Crew, *Campaigns Vol. III*, p. 525.
[748] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Suppression of Malaria By Mepacrine", 7 April 1944.

any "possible toxic effects."[749] Undoubtedly, their efforts to placate concerned or suspicious soldiers were made all the more important due to the approved increase in the administration schedule for mepacrine, for troops deployed in malarious areas, from six to seven times per week. The daily dosage of one 0.1 gram tablet remained unchanged.[750]

With the end of the 1943 malaria season, the Division's Anti-Malaria Investigative Section, comprised of Boon, the malariologist, and McIntosh, the Special Malaria Officer, produced a comprehensive summary of the Division's experiences with malaria since the start of HUSKY. The investigators deemed that Canadian anti-malaria practices were marginally better in Italy than they had been in Sicily.[751] This was certainly the case with regards to mepacrine consumption. It was estimated that well under one-half of Canadian soldiers consumed mepacrine during the first week of HUSKY. According to Boon and McIntosh, between mid July and the end of October, administration rates increased to levels of up to ninety-five percent in some units, with the vast majority of Canadian soldiers "almost demanding it, as they would their rations."[752] The malaria officers may have been overly optimistic in their estimate, but there was a fifty percent decrease in malaria cases between August and September. Most

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[749] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Minutes of the First Meeting of the Eighth Army Anti-Malaria Committee", 29 February 1944.
[750] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, untitled memorandum from DGAMS RAMC to AMD5 - CMHQ; 17 February 1944; and LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Anti-Malarial Training - Individual Protective Measures", 15 April 1944.
[751] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[752] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.

of these 530 patients would have contracted the disease while still deployed in Sicily.[753] The downward trend reversed itself in October, as malaria increased substantially in the Division's ranks, to 954 cases.[754] Mitigating the strong resurgence of malaria cases in October were a large number of relapses suffered by Canadian soldiers who had received, due to operational considerations, an abbreviated six day treatment regime when the Division was based in Sicily in August.[755]

Most other aspects of the Division's anti-malaria procedures and practices in Sicily, according to Boon and McIntosh, had been sub-standard. They also suggested the prospects for improving the Division's anti-malaria performance could be readily achieved if these problems were addressed properly. Accordingly, the Investigative Section made a series of recommendations. First, sufficient quantities of all relevant types of equipment and supplies, including transportation, had to be made available to all those involved in anti-malaria work. Next, comprehensive and coherent instruction in individual precaution measures should be delivered to all personnel, regardless of rank--all reinforced with propaganda. AMCUs and anti-malaria squads would benefit from more specialized training and medical officers would increase their effectiveness with diagnostic, laboratory and entomology courses. Lastly, Boon and McIntosh suggested that designing better netting, clothing and anti-malaria equipment, as well as

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[753] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Survey of Malaria - Based on Discharge Diagnosis", 10 November 1943.
[754] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Survey of Malaria - Based on Discharge Diagnosis", 10 November 1943.
[755] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.

investigating treatment options, would be prudent.[756]

Similar malaria investigations were also conducted by the British during the fall of 1943. Like their Canadian cohorts, many of the British units in the Eighth Army experienced comparable difficulties in proper anti-malaria precautions, training and supply.[757] The greatest difference exhibited in the Canadian and British post-HUSKY reports relates to the issue of responsibility – specifically, identifying who was responsible for ensuring that anti-malaria measures and discipline were properly carried out.

In his report regarding malaria in Sicily, British RAMC Major General Biggam proclaimed that Field Marshal Montgomery, the Eighth Army's commander, and his senior staff were "definitely malaria conscious." Biggam contended that responsibility for ensuring anti-malaria discipline lay at the feet of individual unit Commanding Officers, but blamed "junior officers and NCOs (whom) often set a bad example in the matter of malaria protection." Certainly, there were many instances of British officers cutting the sleeves off their shirts; and this practice was not limited to junior ranking officers. Although conceding that many RAMC personnel had "done their utmost", Biggam contended that many regimental medical officers had not lent the necessary aid to their unit commanders.[758]

In contrast to Biggam, Boon and McIntosh suggested that the majority of the

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[756] LAC, RG 24, Volume 12617, "Malarial Summary - First Canadian Division", 10 November 1943.
[757] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Report on Malaria given by Major General Biggam at the Inter-Services Consultants' Committee Meeting on 11th September 1943."
[758] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Report on Malaria given by Major General Biggam at the Inter-Services Consultants' Committee Meeting on 11th September 1943."

Division's regimental non-medical officers were responsible for failing to place enough importance upon encampment siting, to adequately enforce compliance with anti-malaria measures, to motivate unit squads to conduct mosquito destruction and, most importantly, to set a good example.[759] Certainly, the manpower crisis, sparked by the malaria epidemic at the end of August, had initiated a transformation in the attitudes held by some of the Division's senior commanders towards the disease. Yet, organizational indifference and denial of responsibility was well rooted in the senior ranks. Playfair, who later claimed that "malaria control depended on over 90% discipline", implored his Commanding Officers to "constantly advise, supervise, coux (sic) and curse in order to do everything possible to implant a hygiene and sanitary conscience in every individual" in the Division including officers.[760]

The efforts of the RCAMC to get all the Division's senior commanders and regimental officers "malaria minded" did not have immediate or universal success. In late September, in response to a poor malaria inspection report, the AA&QMG vehemently denied there was any laxity in anti-malaria precautions at his Division HQ. The same day Boon was ordered to submit subsequent malaria inspection reports directly to the AA&QMG.[761] The poor anti-malaria performance exhibited at this HQ, albeit remarkable, was hardly unique, as the various Canadian HQ's were consistently among the Division's worst offenders.

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[759] LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Malarial Summary - First Canadian Division", 10 November 1943.
[760] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Medical Responsibilities", 5 September 1943; LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, LAC, RG 24, Vol. 15657, "Meeting minutes of 1 Cdn Div Med Society", 10 February 1944.
[761] LAC, RG 24, Volume 15656, Appendix to ADMS - Canadian First Division War Diary, "Anti-Malaria Precautions - 1 Cdn Div.", 26 September 1943.

Like the Allies, the German army was mauled by malaria during the Sicilian Campaign, albeit to a lesser degree. After observing German prisoners-of-war, the RAMC's DMS reported that the captives appeared to be "particularly well disciplined in Hygiene" and were suffering "very little malaria."[762] However, German documents recovered after the war suggest that some *Wehrmacht* formations had experienced relatively high illness rates during the fighting in Sicily.[763]

The chemical cornerstone of the *Wehrmacht*'s anti-malaria strategy was atebrin, which was administered daily. The suppressive drug had caused some adverse reactions among German troops in North Africa, but an adjustment of the dosage levels to .06 g daily was thought to have alleviated reoccurrence of this problem in Sicily.[764] Mosquito control was accomplished through the use of Paris Green and, beginning in 1943, Gesserol, a Dichloro-diphenyl-trichloroethane (DDT) equivalent. The German Army later began to impregnate mosquito netting with Gesserol, as well.[765]

Although the German methods were unclear, post-war British intelligence sources determined that German commanders had adjusted their tactics during the battle for the intensely malarious Lake Lentini and Catania Plain, in order to place the Eighth Army in an unhealthy field environment.[766] Later, during the campaign on the Italian mainland, retreating German soldiers purposefully damaged drainage systems in marshes and

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[762] LAC, RG 24, Vol. 15645, Appendix to Director of Medical Services War Diary, "DDMS circular", 1 October 1943.
[763] DHH, D 136, "Report on the Sicilian Campaign - Information From German Sources" by Historical Section (GS) Army HQ Report No. 14, 15 April 1947.
[764] LAC, RG 24, Vol. 15645, Appendix to Director of Medical Services War Diary, "DDMS circular", 1 October 1943
[765] LAC, RG 24, Vol. 12577, file 206/5, "Captured Enemy Documents (Medical)", Appendix A of "Combined Intel. Operations Sub-committee Report", n.d.
[766] Crew, *Campaigns Vol. III*, p. 52.

flooded low lying areas to provide mosquitoes extensive breeding areas in enemy occupied lands.[767]

Through the winter of 1943/44, many of the anti-malaria recommendations made by Boon, McIntosh and their Allied colleagues were implemented in anticipation of the upcoming malaria season, which was expected to begin in the March or April of 1944. It was recognized that to lessen the incidence of malaria, the first priority was to improve the Division's technical abilities. Additional training in mosquito control was given to AMCU personnel and the Division's medical officers received comprehensive malaria instruction at the RAMC's No.8 Malaria Field Laboratory in Bari, Italy.[768] All combat unit officers also received classes of instruction in hygiene, malaria and malaria control in Bari, as well.[769]

Another vital component of that winter's preparation period for the next malaria season, was motivating the troops to willingly comply with anti-malaria personal precautions. To help bring this about, malaria education efforts were redoubled during the winter. Canadian soldiers were presented with anti-malaria films (such as *You Too Can Get Malaria* and *The Mosquito and Malaria*), film strips (such as *6 Little Soldier Boys*), cartoons and professionally finished posters.[770] This propaganda augmented a program of anti-malaria lectures and hands-on familiarization training with equipment and supplies.

A long-term positive consequence of the post-HUSKY malaria investigations was

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[767] Harrison, "Medicine and the Culture of Command", p. 449.
[768]Crew, *Campaigns Vol. III*, pp. 524-5.
[769] DHH, 147.009 (D29), "The Campaign in Italy: 1943-44-45", n.a., n.d., p. 14.
[770] Crew, *Administration Vol. II*, pp. 194-5; and LAC, RG 24, Vol. 12617, Prevention and Treatment of Malaria, "Training Film - You Too Can Get Malaria", 19 April 1944.

the cultivation of scientific and technological cooperation between the British and the Americans. Need and ability meshed. As a result, research and development of anti-malaria systems and strategies boomed as Allied biologists, chemists and engineers received additional funding. DDT, invented by a German scientist in the 1870s, was first used as an insecticide by the British in 1942 but it did not see widespread use in Italy until early 1944. DDT based formulas were used liberally by the Allies during the remainder of the Italian campaign, mainly in indoor applications. Adult mosquitoes could be repelled or killed in these environments for periods of up to two months with just a single DDT aerosol bomb.[771]

DDT was found to be very effective when used outdoors but difficulties with delivery systems limited its use. After 1944, the chemical was mixed with an oil solution to form a larvicide that was floated on stagnant water surfaces. Open ground spraying often employed the "area and barrier" technique, where a "chemical wall" was created to keep the area free of adult mosquitoes.[772] Aerial spraying of large tracts of land with DDT was tested in the latter stages of the war, but it was not perfected by the British and, therefore, not widely used.[773] The adverse effects DDT had on mosquitoes were immediately obvious and any negative effects it may have had upon human health appears to have been of little concern, although late in the war the use of DDT near food stores and food preparation areas was avoided.[774] A decade later, the official history of the British Army Hygiene Service deemed the insecticide as "practically non-toxic to

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[771] Crew, *Administration Vol. II*, pp. 121-22.
[772] Crew, *Administration Vol. II*, p. 123.
[773] Crew, *Administration Vol. II*, p. 197.
[774] Crew, *Administration Vol. II*, pp. 121-2.

man", a conclusion that is now recognized to be questionable at best.[775]

An effective solution to minimizing the incidence of soldiers being bitten by mosquitoes was the manufacture of uniform material impregnated with di-methyl phthalate (DMP or DEET) repellent.[776] This monumental insect repellent replaced all existing formulations, which were shown by Canadian researchers to be unable to protect soldiers against mosquitoes for no more than thirty minutes per application.[777] Testing centers in Saskatchewan, Ontario and Quebec quickly began to develop DMP-based products, enjoying a high level of cooperation with the Canadian and US Departments of Agriculture. In 1944, two such formulations resulted in Canadian and all other Allied troops being issued with DMP-laced anti-mosquito ointments and creams which provided up to six hours of protection per application. The cream was initially found to cause skin irritation, but subsequent formulas minimized these disturbing and off-putting effects.[778]

Pointing to the claim that malaria had been endemic in parts of Canada "years ago", concerns were raised by the CAMC and the Department of Pensions and National Health that "some attention should be paid to the possible reintroduction of malaria into Canada" by troops returning home from overseas postings. The trepidation voiced by domestic authorities did not appear unreasonable, considering that some indigenous species of Anopheline mosquitoes were suspected of being susceptible to becoming vectors. In 1944 and 1945 mosquito traps were set up in up to forty five specially

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[775] Crew, *Administration Vol. II*, pp. 121-2.
[776] MacNaulty and Melnor, *Medical Services in War*, p. 83
[777] DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., p. 74.
[778]MacNaulty and Melnor, *Medical Services in War*, p. 83; and DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., p. 74.

selected military service establishments from Sydney, Nova Scotia to Patricia Bay, British Columbia. The results of these surveys and related investigations quelled some of the domestic malaria concern, when it was proven that the mosquitoes most likely to be capable of carrying malaria were a relative minority throughout the country. Thus, the National Research Council was able to deem "the threat of malaria [was and would be] of no great concern for Canada" in the immediate and post-war era.[779]

Related to malaria, the RCAMC and other federal government sponsored bodies considered and tested what some contemporary researchers and analysts involved in these examinations readily admitted were some "patently 'screw-ball' ideas" during the last few years of the war.[780] "Adopting the attitude" that war-time needs and shortages required that some of these novel notions should be field tested to a prudent degree before being dismissed out of hand, they went to work late in the last few years of the war.[781] For instance, a civilian engineer, then living in Winnipeg, claimed that when he was working at some unidentified location "in the Orient", he observed that grapefruit seeds were a high source of Quinine. Owing to the scarcity and importance of quinine in 1944, it was considered necessary to test the claim by RCAMC researchers. A resulting government report related that "[a]rrangements were therefore made with the Chateau

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[779] DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., pp. 75-6.
[780] DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., p. 77.
[781] One of the more notable – albeit slightly bizarre – civilian "inventions" that was deemed by screeners as "not … necessary to submit to a field trail" was an apparatus called "the Human Jack-Rabbit." This device "was claimed to enable a soldier to march at a rate of eighteen miles per hour." It "consisted of a series of springs in the soles of army boots. These acted like a pogo stick and were supposed to bounce the man through the air in great leaps."; DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., pp. 77-8.

Laurier Hotel in Ottawa to collect all grapefruit seed over a period of two weeks. This provided several buckets which were then taken [to a government analyst] … [where] … the seeds were found to contain no quinine."[782]

One of the most important organizational changes made in Italy during the winter of 1943-44 was the creation of the Eighth Army Anti-Malaria Committee, which held its first meeting on 29 February 1944. The powerful group, composed of several high-ranking senior Eighth Army and RAMC officers and commanders, received from Army Command the mandate to "do everything possible to reduce the incidence of malaria ... (and) ... its consequent wastage of manpower." Virtually every aspect of the Army's anti-malaria strategy fell under the committee's control. Evidently, Canadian input was neither sought nor desired to any great degree by any interested parties, as the highest ranking Canadian in attendance was a captain.[783]

The Anti-Malaria Committee reiterated the vital importance of having soldiers comply with existing personal anti-malaria precautions. However, their authority was partially undermined in early April 1944, when Eighth Army Command ruled that every soldier was to receive two pairs of shorts when summer clothing was issued. In response, the committee concluded that the issue of whether or not these shorts would be worn would be at the discretion of formation commanders, with the advice of the DDMSs concerned.[784]

The committee also ordered that the position of Malaria Staff Officer be created at

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[782] DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., p. 77.
[783] LAC, RG 24, VOL. 12617, Prevention and Treatment of Malaria, "Minutes of the First Meeting of the Eighth Army Anti-Malaria Committee", 29 February 1944.
[784] LAC, RG 24, VOL. 12617, Prevention and Treatment of Malaria, "Minutes of the First Meeting of the Eighth Army Anti-Malaria Committee", 29 February 1944.

the Corps and Divisional levels. Working closely with the ADMS, the Division's Malaria Staff Officer would be responsible for ensuring that anti-malaria precautions were carried out and anti-malaria supplies were maintained. Divisional commanders were to be responsible for ensuring encampments were sited properly and for defining "the general scope of anti-malaria measures to be taken." As well, he was to ensure that an adequate number of trained personnel, both medical and non-medical, were available to discharge anti-malaria related duties.[785]

These changes in the administration and organization of the Division's anti-malaria strategy had a definite positive effect on the Canadians' performance. As the areas occupied by the Division during 1944 were either malarious or hypermalarious, the potential for a serious malaria outbreak, similar to or worse than the one experienced in Sicily, remained. However, in 1944 the Division and the rest of the Eighth Army had marked decreases in the incidence of malaria. According to some sources, the reduction was nearly as great as seventy-five percent.[786]

Still, it remains clear that the 1943 malaria epidemic among Canadian troops stationed in Sicily need not have happened. Operation HUSKY's planners were well aware that the island was highly malarious and that a severe malaria outbreak could not only compromise the health of individual soldiers but the success of the campaign. The solutions for avoiding or minimizing this danger were also known to the planners. Sound anti-malaria strategy had two basic aims. First, individual anti-malaria precautions had to be practiced. This consisted of wearing proper clothing, applying repellent, sleeping

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[785] LAC, RG 24, VOL. 12617, Prevention and Treatment of Malaria, "Minutes of the First Meeting of the Eighth Army Anti-Malaria Committee", 29 February 1944.
[786] Crew, *Campaigns Vol. III*, p. 590.

under mosquito netting and following recommended mepacrine schedules. Secondly, the mosquito population had to be controlled, through the destruction of adult mosquitoes and larvae and the chemical treatment or alteration of environments conducive to propagation.

It is clear that if the anti-malaria measures that were in place before HUSKY had been properly followed, the incidence of malaria could have been minimized to relatively insignificant levels. A prime example of this was the anti-malaria victory garnered by No.15 Canadian General Hospital, which opened on 24 July 1943, just two weeks after the onset of HUSKY. Located near El Arrouch, Algeria, No.15 handled many of the Allied casualties that were shipped or flown from Sicily. The area in which the hospital was situated was considered hypermalarious. However, thanks to the foresight and diligent efforts of the unit's Commanding Officer, a malaria outbreak was avoided by strictly adhering to existing anti-malaria precautions. This success was later termed in the official British Army history as a "remarkable achievement."[787] Equally remarkable was the superlative anti-malaria performance demonstrated by the New Zealand Second Division, which after joining the Eighth Army for BAYTOWN, experienced exceptionally few cases of the disease.[788] These formations showed unequivocally that if proper and disciplined anti-malaria measures were taken, in the field or in static conditions, the incidence of malaria could be restricted and effectively negated.

The danger of malaria was known, as were effective counter-measures. So, why did such a severe epidemic occur in the Division? The British official history stated that "there can be no avoidance of the conclusion that there was a general neglect on the part

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[787] MacNaulty and Melnor, *Medical Services in War*, p. 487.
[788] Crew, *Campaigns Vol. III*, p. 524.

of the division as a whole and of the individuals comprising it to make the fullest use of the measures of protection as were even then available."[789] Feasby, the official historian of the RCAMC, found that "[f]rom all aspects it would appear that the root cause of the Canadian malarial epidemic in Sicily was general neglect on the part of units and individuals to implement the measures laid down, a neglect induced by inadequacy of training."[790] Certainly, the claim that both histories make, that "general neglect" by the Division or units within the Division, brought about the Canadian epidemic is not incorrect. These explanations, besides being ambiguous, are incomplete. Neither identifies the cause or causes of the "general neglect" present in the Division.

The main contributing factor to the Division's malaria epidemic was the complacent and/or apathetic attitude held towards anti-malaria measures by the upper echelons of the War Office, CMHQ, and the Eighth Army HQ. The threat of malaria was clear and the means to combat it were known. However, in order to ensure that precautions were effective, consistent and coherent anti-malaria discipline had to be followed, if for no other reason, than to ensure battle-readiness. It is clear that if the senior commanders of the Canadian and British forces wholeheartedly believed and supported the successful implementation of anti-malaria measures, the required discipline would have been followed. They did not lead and the Division did not follow.

The lack of proper leadership led to serious problems before and during HUSKY. These included a lack of communication regarding malaria and medical planning between the Canadians and the British War Office, Eighth Army HQ and, to a lesser degree, the RAMC. Canadians failed to attend or were under-represented at many high

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[789] Crew, *Campaigns Vol. III*, p. 524.Ibid., p. 49.
[790] DHH, D 11, W. R. Feasby, "A Critical Analysis", p. 27.

level hygiene and planning meetings, either because they were not invited by the British or because the Canadians were apathetic. Virtually all aspects of the pre-invasion anti-malaria preparations were inept or incomplete. The training of all ranks in personal precautions was woefully inadequate, as was the specialized instruction of AMCUs, unit anti-malaria squads, medical units and some medical officers. AMCUs were chronically ill-equipped, ill-supplied, poorly organized and supported so that, in spite of tremendous efforts by some of their personnel, they accomplished very little mosquito destruction.[791] Persistent transport shortages repeatedly stymied the efforts of the many different units involved in anti-malaria efforts, including those of as senior an officer as the ADMS, who did not even have enough authority to secure adequate transport for himself. Most Canadian medical units, strained and drained of resources by the huge numbers of malarial patients, had difficulties obtaining diagnostic equipment. Soldiers experienced numerous, and often onerous, qualitative and quantitative difficulties with some of the anti-malaria equipment and supplies they were furnished with.

Most Canadian medical personnel attempted to fulfill their responsibilities to the best of their practical abilities. The RCAMC's most senior ranking officer in Sicily, ADMS Playfair, had since D-Day +1 actively advocated that anti-malaria measures and personal precautions had to be followed or the Division would be in trouble. His warnings, aimed at the Division's commanders and officers, fell on deaf ears.

As the number of malaria and suspected malaria patients began to clog the wards of his medical units, Playfair made several crucial errors. He underestimated the severity of the outbreak and resolutely refused to alter his policies regarding diagnosis and

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[791] LAC, RG 24, Vol. 15927, Appendix to No.2 Field Hygiene Section War Diary, "Appreciation - No. 2 Cdn Fd Hygiene Section, RCAMC", November 1943.

treatment of suspected malaria cases. In retrospect, his actions can be seen as folly, as they increased the likelihood of cross infection and delayed proper therapy for some Canadian ill. However, Playfair did not create the culture that allowed anti-malaria precautions to be ignored and allow the epidemic to take hold. His authority over non-RCAMC units was minimal, so poor that he could not even secure his own jeep or have a driver assigned. The responsibility of all medical officers in the RCAMC, including Playfair, was to provide advice to the Division's commanding officers and to care for sick and wounded soldiers. The medical officer's role was not to provide leadership to the Division's soldiers or to enforce anti-malaria precautions.

Like their superiors, most senior officers in the Division and some in the RCAMC were slow to react to the malaria outbreak. The majority of the Division's officers appear to have been resistant to change and many, rather than make an example of themselves, demonstrated a continual lack of regard for anti-malaria precautions. Given the example set by many of their officers and the state of their instruction, it is hardly surprising that individual Canadian soldiers were generally not inclined to comply with anti-malaria precautions.

During the Sicilian campaign, the Division's officers, NCOs and ORs proved that without proper motivation, anti-malaria discipline was no discipline at all. Historian Mark Harrison contends that the key component in controlling and then negating the scourge of malaria, in every theatre of Allied operations, was a drastic shift in the command paradigm, to one in which medicine and health issues were recognized as being crucial components in the conduct of war.[792] The Division's experience in Sicily

[792]Harrison, "Medicine and the Culture of Command", p. 438.

supports his assertion. It must be concluded that the Division's abysmal anti-malaria performance during the Sicilian campaign, and through much of the Italian campaign, was due to lax management and poor leadership. Without capable command, direction and support, the Division's malaria epidemic was not only facilitated but virtually guaranteed. The reason, perhaps, was that there was little glory to be won in the war against malaria, for unlike human opponents, disease cannot be defeated but merely controlled.

The malaria epidemics experienced by the Allies on Sicily eventually served as a catalyst to change the prevalent culture in the War Office, the CMHQ and the Eighth Army HQ. When these organizations recognized and accepted the vital importance of consistent and coherent anti-malaria measures, meaningful changes began in subordinate formations, including the Division. These attitudinal changes forced behavioral changes, in all ranks of the Division, if not through education or encouragement, then through consistent enforcement. In this manner, effective anti-malaria discipline was eventually realized in 1944, just before the Canadians were removed from Italy for service in North-west Europe. However, eventual control of the threat which was precipitated by the Canadian 1st Division's malaria epidemic can hardly be considered a triumph – for it was a battle that needlessly left hundreds of casualties in its wake.

In late 1944 and early 1945, the Canadian 1st Division continued its slow but steady northerly drive up the Italian peninsula. In the meantime, their Canadian army brethren were making significant contributions in the Allied liberation of Northwest Europe, followed by the invasion and eventual defeat of Nazi Germany. From D-Day in Normandy to VE-Day, as a measure of the scope and ferocity of the fighting, the main

concern of the RCAMC was treating the thousands of Canadian battle casualties. Although there were some concerns raised within the ranks of the RCAMC that contact with civilian populations and POWs in these recently liberated areas could constitute a disease threat to the army, fortunately there was never any widespread problem with any infectious disease for the Canadians during the Normandy and Victory campaigns, with the possible exception of venereal disease.[793]

Why this relative lack of infectious disease in the eleven months the Canadians fought in Northwest-Europe at the end of the Second World War? Certainly, some credit can be taken by the Sanitary Sections and the RCAMC. However, it is also clear that some good fortune was involved in this seemingly salubrious campaign. Situations and circumstances were such that large-scale outbreaks of most infectious disease among the Canadian ranks were rendered less likely. For instance, modern vaccines, relatively rapid advances and a dynamic front line all lessened the likelihood of disease taking hold, especially water-borne disease. Liberal use of DDT, as it had done late in the Italian campaign, drastically reduced the threat of insect vectors. Moreover, the lack of endemic disease in these areas during this era was an additional asset. Still, it also appears that little, if any, anti-disease direction came from senior Canadian commanders during the Northwest-Europe campaigns. This suggests that collectively, these leaders did not change the lax attitudes vis-à-vis disease that had been so potentially dangerous in Sicily and Italy. Many of the lessons apparently learned and eventually acted upon in the Mediterranean theatre were promptly forgotten or ignored. In terms of disease, perhaps the Canadians were more lucky than well led in those eleven months, as corporate will

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[793] Nicholson, *Seventy Years of Service*, pp. 239-41.

was apparently still not being seriously directed from the top.

CONCLUSION

In retrospect, it appears that the illness that repeatedly threatened the battle-readiness and survival of the Canadian army was corporate amnesia in its upper ranks. It is clear that non-willful negligence in allowing for the loss of expertise and knowledge took place in the interwar period. This conclusion may appear to be harsh, but it is not an unqualified indictment of the senior ranks of the Canadian military and the medical service. The dire dearth of peacetime funding and general inattention from the federal government was certainly both a causal influence and mitigating factor.

Despite the obvious lack of adequate planning and preparation to meet the potential threat of infectious disease at the beginning of each of these campaigns, it is truly remarkable that the army was collectively able to eventually overcome, or at least compensate for, their corporate and attitudinal deficits before disease had dealt it a blow from which it could not recover. In neither the First World War, nor the Second, did infectious disease completely compromise the combat integrity of the Canadian army. Yet, that threat was often looming.

As recently as during the Great War, it was demonstrated that armies that did not look after themselves could be and sometimes were destroyed by disease. The experiences of the Serbian and Russian Imperial armies had amply proven this. During the Second World War, Imperial Japanese forces in the Pacific had abysmal tropical disease prevention practices. Months before the first Canadian soldier slapped at a mosquito on the southern shores of Sicily in July 1943, it was well recognized by the U.S. Army that infectious disease, and in particular malaria, was annihilating their

Japanese foes at a faster pace than American gunfire. As the official US. Army history later reported, even though "malaria decimated the American ranks, it caused havoc among the enemy. Among the Japanese probably every man was a victim. They had no systematic malaria control, few mosquito nets, ..."[794] Ironically, the Japanese had a virtual monopoly on the world's natural quinine supply at the time.

Early in the Americans' south-west Pacific war against the Japanese, it was recognized that malaria was the "most serious medical problem of the campaign", causing "five times as many casualties as enemy action in the South Pacific."[795]

On Guadalcanal in January 1943, experienced and talented American army commanders had to be replaced due to falling "too ill from malaria to continue in command."[796] Still, although rocked back on its heels by the rude surprises produced by malaria, the "lessons of the first months of Guadalcanal had been well learned (and) were applied in the final stages of the campaign." After it was determined that anti-malaria discipline had been lacking in all units, the Americans recognized that "it was essential … that malaria discipline … be strictly enforced."[797] Following that rough start, the Americans formulated and executed workable methods to combat malaria in the Pacific.

This qualified American victory over infectious disease was in many ways comparable to that won by the Canadians decades earlier. During the First World War, the Canadians faced immense disease challenges and, in the end, did relatively well. The main reason is clear. By 1918, the Canadian's had collectively learned that they had to

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[794] John Miller, *United States Army in World War II: the War in the Pacific: Guadalcanal: the First Offensive* (Washington, D.C.: Historical Division, Department of the Army, 1949), p. 229.
[795] Miller, *Guadalcanal: the First Offensive*, pp. 141, 225-27.
[796] Miller, *Guadalcanal: the First Offensive*, p. 346.
[797] Miller, *Guadalcanal: the First Offensive*, pp. 225-27, 317-18.

rigorously follow procedures in order to minimize the impact of disease.

So why, during the Second World War, did not the Canadians apply the lessons they had so expensively learned in the past? One chief reason was that despite having nearly four years to prepare the Canadian armies for deployment in the fields of battle, Canada's military commanders collectively failed to see that stringent anti-disease measures would be rigorously followed.

Why did virtually all Canadian senior commanders in the Second World War not see that anti-infectious disease training, preparation and enforcement were strictly adhered to? How could Generals Andrew McNaughton, Guy Simonds, B.M. Hoffmeister and Chris Vokes not recognize the threat infectious disease posed to the Canadian army and its soldiers? If they did, it does not appear that this recognition was acted upon. This failure of command is made even more remarkable when one considers the individual backgrounds of these professional career soldiers. McNaughton, the Commanding Officer of the Canadian 1st Division between 1939 and the end of 1943, had experienced life in the trenches during his tenure as an artillery officer during the First World War.[798] His successor, Simonds, and most of his fellow senior Canadian commanders in Sicily and Italy, including the much revered Hoffmeister and Vokes, may have been too young to have served in the trenches, but all had been in Canada's interwar army and had distinguished themselves at Royal Military College as students and instructors.[799] Incredibly, despite their extensive military backgrounds and the luxury of a lengthy training period, each of these commanders failed to properly prepare their troops by

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[798] J. L. Granatstein, *The Generals: The Canadian Army's Senior Commanders in the Second World War* (Toronto: Stoddart Publishing, 1993) , p. 56.
[799] Granatstein, *The Generals*, pp. 56, 145, 158, 179.

providing abysmally inadequate anti-disease instruction. Training for battle and training for life in the battlefield are unique, if not mutually exclusive, tasks.

If Canadian high command truly made disease prevention and hygiene a priority, surely it would have become a priority in the rank and file. It seems clear that organizational inertia was present in the army. Senior commanders continued to resist changing their practices despite ample evidence that new conditions warranted the reassessment of their lack of attention to disease and hygiene-related issues. The result of their tacit inattention was unnecessary casualties, unnecessary risk to the collective entity and unnecessary risk and suffering for the individual soldiers under their command. Luckily, as entities, the Canadian army and nation did not end up paying the price that Serbia, Russia and the Japanese did for similar laxness in planning, practices and command.

It was individuals that paid the price for the Canadian army's corporate amnesia, organizational inertia and apathy regarding infectious disease. It was also individuals that helped the Canadian Army recover from its corporate problems before these created widespread fatal results. Virtually all of these people were amateur, not professional, soldiers – civilians thrust into serving their nation at time of war. These men and women are unsung war heroes. Rankin, Nasmith, Amyot, Orr, Boon, McIntosh and Scott immediately come to mind. So do the multitude of others who combated infectious disease and its vectors in lesser known yet still meaningful ways: the nursing sister attending to a febrile patient, the Sanitation Section private digging a drainage ditch, the medical officer collecting water samples, and the tank regiment commander ensuring that his men were taking their mepacrine. It was individual effort and drive that, insofar as

infectious disease was concerned, saved the collective – the Canadian army – from itself. Canada's full-time professional army has repeatedly relied on talented civilians turned temporary soldiers to answer the need for effective infectious disease measures.

It is inarguable that pathogens and vermin have had not only a profound effect on war, but on human history in general. Infectious disease, like other health and medical issues, has always played a central role in the lives of soldiers and the armies in which they serve. The CEF's experience in the trenches of Western Europe during the First World War illustrated this, as did the Canadian 1st Division's run-in with malaria on Sicily and in Italy. Some infectious diseases could be effectively managed and others could not. It is also evident that if left unchecked, the pathogens inherent to the trenches would have ravaged or even destroyed the Canadians. It is because of this dangerous potential that these omnipresent enemies of soldiers must be understood. Considering these facts, one must also conclude that the vast majority of Canadian campaign histories related to this era are badly flawed because they have not taken disease into full account and placed it into its proper military context. Clearly, to ignore the import of infectious disease is folly—for military commanders and historians alike.

Within a year of the Second World War's conclusion, Canada's National Research Council issued a paper titled, in part, "Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946." The report's authors recognized the interwar atrophy which had stricken Canada's medical services, arguing that "[s]ome agency should be kept alive to stimulate research in Military Medicine. Until the time when battle is unknown and armies unnecessary, we must keep army doctors alert and vigilant. … let us hope that the RCAMC never again

descends to a purely administrative level … ."[800]

However, just like it had been in the immediate aftermath of the Great War, the RCAMC was severely shrunk once again. Nearly 35,000 Canadian men and women had served in the medical service in widespread locales on more than three continents during the Second World War. Reduction, of course, was necessary, but the reductions were ridiculously harsh in this, the beginning of the Cold War era, with the RCAMC being quickly "reduced to a single field ambulance unit and a school, in Bordon, with a staff of about a hundred."[801]

The drastic loss of corporate experience and memory early during the interwar period, fueled in no small part by similarly dire cuts in personnel and funding, had played havoc with Canada's ability to plan and react to the threat of malaria during the Sicilian and Italian campaigns. Yet, once again, in 1946, even to contemporary observers, a recurrence of corporate amnesia seemed certain. Clearly, problems related to disease in the Canadian military persisted and the opportunity to improve the future based on past experience was once again missed.

Just five years later, Canadian soldiers were deployed for battle during the Korean War. In this far East Cold War conflict, the Canadian army and its soldiers had to pay the price for its faulty corporate memory and its inability to learn the hard-won lessons related to infectious disease in previous campaigns. The unpreparedness and planning incompetence among the Canadian army's high command has been well detailed and

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[800] DHH, 147.013 (D6), "National Research Council Report on Medical Research and Development in the Canadian Army During World War II: 1942-1946", n.d., p. 88.
[801] Bill Rawling, *The Myriad Challenges of Peace: Canadian Forces Medical Practitioners Since the Second World War* (Ottawa: Ministry of Public Works and Government Services, 2004), prologue.

documented by Brent Watson, who concluded that "the Canadians were clearly not prepared to deal with the epidemiological dimension of service in the far East."[802] Moreover, Watson found that "the 25th Brigade suffered a disturbingly high number of non-battle casualties, which placed an enormous strain on its already overtaxed manpower resources."[803] Insofar as malaria was concerned, Watson further concluded that "the Canadian army had not fully digested the lessons learned in Sicily", and therefore suffered remarkably; however, mitigating this unnecessary and sad state of affairs in Korea, Canadian medical officers acted quickly and made timely improvements in prevention and treatment of malaria.[804] Watson's findings dovetail nicely with this study of the Canadian army's campaigns in the Western Front trenches during the Great War and the Sicilian and Italian campaigns of the Second World War. Once again, the well-established pattern of the Canadian's repeated failure to learn from the past was seen.

Since the Korean War, the Canadian army has been engaged in a wide variety of United Nations peacekeeping missions and NATO sponsored actions. These international commitments have necessitated the deployment of Canadian units throughout the world in a wide variety of hazardous situations and threatening environments in areas including the Congo, Cyprus, Somalia, Haiti, Bosnia-Herzegovina and Afghanistan. Unfortunately, in many of these actions, Canadian soldiers have continued to experience a myriad of unusual disease and health-related issues. While these operations have not yet been thoroughly and properly examined, one must wonder

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[802] Brent Byron Watson, *Far Eastern Tour: The Canadian Infantry in Korea, 1950-1953* (London and Montreal: McGill-Queen's University Press, 2002) , p. 141.
[803] Watson, *Far Eastern Tour*, p. 125.
[804] Watson, *Far Eastern Tour*, pp. 128-30.

if a lack of corporate memory and organizational inertia has continued to hamper the operational deployments of the Canadian army and needlessly risked the well-being of its soldiers.

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