

**Disease Ridden Outfits:
Contaminated Uniforms and British
Preventative Medicine in the First
World War**

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Abstract

During the First World War, a war of attrition and the dirty and mud-filled environment of trench warfare spurred the onset of various medical conditions. Yet, when soldiers fell ill, it was not immediately recognised that some maladies stemmed from contamination – soiling, infestation and poisons – in their uniforms. With a new focus on preventative medicine, doctors and medical scientists investigated numerous medical conditions that spread through contaminated uniforms. It is well known that these medical professionals developed a body of knowledge on the prevention of uniform contamination. It is far less known, however, that soldiers also developed a set of medical ideas. Two separate ‘systems of medical ideas’ developed simultaneously during the Great War, and this is demonstrated through the study of lice, trench foot, and mustard gas poisoning. While the voices of medical professionals have received ample attention, the voices of the soldiers who also discussed medicine have been neglected. This thesis employs these soldiers’ voices to highlight their reliance on ‘folk medicine’ in the trenches.

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Abbreviations

ADMS	Assistant Director of Medical Services
ADS	Advanced Dressing Station
AMS	Army Medical Services
ASC	Army Service Corps
BEF	British Expeditionary Force
BMJ	<i>British Medical Journal</i>
CCS	Casualty Clearing Station
DADMS	Deputy Assistant Director of Medical Services
DDGMS	Deputy Director General of Medical Services
DDMS	Deputy Director of Medical Services
DGAMS	Director General of the Army Medical Services
DGMS	Director General of Medical Services
FA	Field Ambulance
GHQ	General Headquarters
IWM	Imperial War Museum, London
MO	Medical Officer
NCO	Non Commissioned Officer
RAMC	Royal Army Medical Corps
RAP	Regimental Aid Post
RMO	Regimental Medical Officer
TNA	The National Archives, London
WL	Wellcome Library, London

Introduction

The View is Not Always Better from the Top

*'Lice, mud and gas. Now I consider that was three of the most untemperous [sic] things there was [in the trenches].'*¹

What could soldiers do to rid their bodies or clothes of lice? The *British Medical Journal (BMJ)* reported the authoritative answer in June 1915:

Professor Maxwell-Lefroy, of the Imperial College of Science and Technology, has issued...the most trustworthy methods for avoiding and destroying...lice.²

Maxwell-Lefroy stated that smearing the skin or washing the clothes with crude oil emulsion was the best way to avoid lice infestations in military outfits.³

Medical professionals, like Maxwell-Lefroy, paid close attention to the issues of disease and contamination in the uniforms of British soldiers during the Great War. The stalemate on the Western Front meant soldiers were spending days and weeks in filthy trenches with little opportunity to clean or change their clothing. Soldiers' uniforms became infested with vermin, soiled and poisoned with dangerous substances, resulting in discomfort and infection. Throughout the war professionals in the newly emerging fields of preventative medicine and medical science published studies and opinions in monographs and other journals regarding viable solutions for the contamination of soldiers' uniforms.

¹ Percy Webb, Oral History, Recording 578, Imperial War Museum, London [IWM].

² Anon, "Flies, Lice, and Mosquitoes," *The British Medical Journal* 1, no. 2341 (12 June 1915): p. 1006.

³ *Ibid.*, p. 1006.

On the front line, Private Richard Gwinnell and his pals of the 9th Battalion Gloucestershire Regiment were also debating how to deal with lice. They discussed very different solutions to Maxwell-Lefroy's. Gwinnell noted the learned wisdom of his battalion in a diary. The most effective method, he wrote, was to 'put the shirt into a stream with stones on it, completely covered with water overnight'.⁴ It was a simple remedy that drowned the parasites and, of the many techniques the men employed 'with varying amounts of success', this method produced the finest results.⁵

The difference between Maxwell-Lefroy's and Gwinnell's approaches represents the emergence of two separate systems of knowledge regarding front line health. Medical scientists and doctors published their developing understanding of these problems of contamination so their work is well known and accessible. However, the understanding of soldiers' knowledge is far less advanced. The mud, vermin, and general contamination the men stood in all day and lay in at night presented multiple health problems, especially as their uniforms were directly subjected to the harsh environment. How did soldiers perceive and prevent the forms of contamination that spread through their clothing? Why did they develop their own system of knowledge? These two understandings of contaminated uniforms – the medical scientists' and the soldiers' – sit at the centre of this thesis.

If medicine is understood as a 'system of medical ideas,' then two sets of ideas developed simultaneously during the war — one informed by biomedical preventative medicine and medical science, and the other by the lived experience of soldiers on

⁴ Richard Gwinnell, Diary, p. 107, Private Papers of R. Gwinnell, Documents 11601, IWM.

⁵ *Ibid.*, p. 107.

the front line.⁶ The specific focus of this thesis — the prevention of uniform contamination — is a case study that demonstrates these idea systems produced vastly different approaches. Sometimes these approaches coincided, often they did not. Medical scientists were far removed from the actual environment of front line battle and relied on experimental techniques, or failed to see the need to advise any preventions at all, and advanced theories that lacked practical insight. Soldiers often found that the only way to prevent uniform-spread maladies was to rely on their own forms of ‘folk medicine’ in the trenches.⁷

Historians have not yet considered there may have been *two* different ‘systems of medical ideas’ at play during the Great War. Numerous works in the history of medicine and military medicine explore biomedical prevention in the First World War and the vast array of medical records and publications available to the historian means that much can be known about the overall workings of the British military medical system. The Great War was preceded by a period of rapid change that swept across the Western medical world in the second half of the nineteenth century.

⁶ W.F. Bynum *et al.*, *The Western Medical Tradition 1800 to 2000*, (Cambridge: Cambridge University Press, 2006), p. 2; Nancy G. Siraisi, *Medieval & Early Renaissance Medicine: An Introduction to Knowledge and Practice*, (Chicago: University of Chicago Press, 1990), p. 5. Both argue medical tradition and medicine itself can be understood as a ‘system of medical ideas’. Medical anthropologist Arthur Kleinman, *Patients and Healers in the Context of Culture: An Exploration of the Borderland Between Anthropology, Medicine, and Psychiatry*, (Berkeley: University of California Press, 1980), p. 34, argues that ‘beliefs about illness are always closely linked to specific therapeutic interventions and thus are systems of knowledge and action.’

⁷ Françoise Loux, “Folk Medicine,” in *Companion Encyclopedia of the History of Medicine*, vol. 1, edited by W.F. Bynum and Roy Porter, (London: Routledge, 1993), p. 661, argues that ‘folk medicine’ traditionally implies three things: ‘1 — the notion of transmission and the notion of tradition associated with it; 2 — the intervention of oral culture... and; 3 — finally the marginalised situation of folk culture. Folk culture is in a position dominated by its relation with learned or official cultures: that is, biomedicine in the case of folk medicine.’ She argues that most academic work nuances and opens this narrow categorisation of ‘folk medicine’. Kleinman, *Patients and Healers in the Context of Culture: An Exploration of the Borderland Between Anthropology, Medicine, and Psychiatry*, pp. 179–187, argues that the term ‘folk medicine’ should be solely reserved for concepts of ‘parallel medicine’; medicine practised by those outside of the family setting, which is termed ‘domestic medicine’, and those also outside biomedicine.

The establishment of bacteriology and ‘germ theory’, based heavily on the works of scientists Louis Pasteur and Robert Koch, sparked a new preoccupation with the spread of disease, public health, and sanitation, consequently shifting focus from medical intervention to prevention.⁸ W.F. Bynum states that the reliance on general physicians in the early nineteenth century gave way to an emerging focus on highly specific, scientific sub-disciplines, ranging from bacteriology to immunology, and from epidemiology to pathology. Each specialist developed knowledge on a small area of medical research, and were mostly dependent on new scientific operations and experimentation. Bynum argues that, as ‘medicine in modern times has become so intertwined with science that it is taken for granted,’ it is imperative to study the contexts surrounding this shift.⁹ As Bynum states, the medical ‘ideas and assumptions established before 1914 largely remained intact...and were built on [during the war] rather than being jettisoned or radically modified.’¹⁰ It is not surprising then, that medical historians examine how this transition to preventative medicine and medical science influenced military medicine in the Great War.

Most historical works on British military medicine provide a comprehensive coverage of the medical system. Historians examined the interconnectivity and relationships between various medical scientists and the preventative methods they

⁸ Michael Worboys, *Spreading Germs: Disease Theories and Medical Practice in Britain, 1865-1900*, (Cambridge: Cambridge University Press, 2000); Martin Gorsky, “Local Leadership in Public Health: The Role of the Medical Officer of Health in Britain, 1872-1974,” *Journal of Epidemiology and Community Health* 61, no. 6 (11 June 2007): pp. 468–472; Jeanne L. Brand, *Doctors and the State: The British Medical Profession and Government Action in Public Health, 1870-1912*, (Baltimore: The Johns Hopkins Press, 1965); Gerry Kearns, “Private Property and Public Health Reform in England 1830-1870,” *Social Science and Medicine* 26, no. 1 (1988): pp. 187–199; Dorothy Porter, “Public Health,” in *Companion Encyclopedia of the History of Medicine*, vol. 2, edited by W.F. Bynum and Roy Porter, (London: Routledge, 1993), pp. 1231–1261.

⁹ W.F. Bynum, “The Rise of Science in Medicine, 1850-1913,” in Bynum *et al.*, *The Western Medical Tradition 1800 to 2000*, (Cambridge: Cambridge University Press, 2006), p. 111.

¹⁰ Bynum *et al.*, *The Western Medical Tradition 1800 to 2000*, p. 247.

espoused. Mark Harrison and Harold Ellis are amongst those who have acknowledged the widespread input of medical scientists to the discussion of wartime preventative medicine, often citing the variety of medical fields that contributed to contemporary discussions in medical journals such as the *BMJ* and *The Lancet*.¹¹

Looking further down the chain of medical responsibilities, as Bynum has noted, medical science became valued as ‘something independent from, yet potentially linked to, clinical practice.’¹² During the war, this new relationship influenced the way medical scientists, in laboratories and military hospitals in Britain and general hospitals in France, interacted with medical officers (MOs) working in forward areas.¹³ Older and more established doctors, often past the age of military service, mostly held to ‘configuration’ theories, and argued in the pages of medical journals that the poor environment of the trenches inflicted medical problems on the soldiers. On the other hand, front line doctors, often younger and well-versed in bacteriology and ‘germ theory’, leant towards ‘contagionist’ theories that the spread of bacteria was the primary cause of soldiers’ afflictions.¹⁴ R.L. Atenstaedt argues

¹¹ Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010); Harold Ellis, “The Outbreak of the First World War and the Medical Profession,” *British Journal of Hospital Medicine* 75, no. 8 (2014): p. 476.

¹² Bynum, “The Rise of Science in Medicine,” p. 113.

¹³ Ian R. Whitehead, *Doctors in the Great War*, (London: Leo Cooper, 1999); Ian R. Whitehead, “Not a Doctor’s Work? The Role of British Regimental Medical Officers in the Field,” in *Facing Armageddon: The First World War Experienced*, ed. Hugh Cecil and Peter H. Liddle, (London: Leo Cooper, 1996), pp. 466–474; Jeffery S. Reznick, *Healing the Nation: Soldiers and the Culture of Caregiving in Britain during the Great War*, (Manchester: Manchester University Press, 2004).

¹⁴ Works that outline contingent and/or contagionist theories: R.L. Atenstaedt, “The Response to Trench Diseases in World War I: A Triumph of Public Health Science,” *Public Health* 21 (2007): pp. 634–639; Charles E. Rosenberg, *Explaining Epidemics and Other Studies in the History of Medicine*, (Cambridge: Cambridge University Press, 1992); Peter Vinten-Johansen *et al.*, *Cholera, Chloroform, and the Science of Medicine: A Life of John Snow*, (New York: Oxford University Press, 2003); Roy Porter, ed., *The Cambridge History of Medicine*, (Cambridge: Cambridge University Press, 2006).

that, in fact, most medical personnel across the British military medical system relied on a 'contingent-contagionist' approach, dependent on aspects of both 'configuration' and 'contagion' to a certain extent.¹⁵ This thesis draws on this literature to examine wartime biomedicine.

Soldiers' 'folk medicinal' preventions rarely feature in academic literature on British military medicine. The overall focus on the organised hierarchy of medical researchers and practitioners, and their functions, influences the way historians think about contributions to medical knowledge and practice. In particular, it shapes their understanding of which individuals held authority over medical claims. Christopher Lawrence asserts 'doctors, nurses, medical technicians, ambulance drivers, cooks, and cleaners thought of themselves (if they bothered to think about it) as being in some sort of massive hierarchical team.'¹⁶ This construct conveys an association between medical knowledge and membership within an 'institution' of military medicine. Medical personnel felt they had a specific claim over medical knowledge. Medical historians reinforce these claims to medical authority by examining medical knowledge and practice solely within this hierarchy.

A further problem is that most military medical histories concentrate on preventative methods that were seen, then and now, to be effective. Lawrence repeats the overarching historical consensus when he certifies that 'famously, it was the first major war ever, in which more combatants died of wounds than disease.'¹⁷ He attributes this to the fact that 'sanitary measures...conspired to keep...diseases

¹⁵ Atenstaedt, "The Response to Trench Diseases in World War I," p. 636.

¹⁶ Christopher Lawrence, "Continuity in Crisis, Medicine 1914–1945," in Bynum *et al.*, *The Western Medical Tradition 1800 to 2000*, (Cambridge: Cambridge University Press, 2006), p. 251.

¹⁷ *Ibid.*, p. 252.

[away],’ concluding that ‘preventative medicine worked.’¹⁸ This focus on the efficacy of military medics precludes thorough and well-deserved historical attention to soldiers’ prevention methods. Often soldiers’ preventions did not present effective results, but neither were they formally measured for effectiveness. Mark Harrison, who provides one of the most comprehensive studies of British military medicine to date, only briefly mentions the soldiers’ prevention methods, when recounting the battle with vermin in the trenches. All the attention he gives to soldiers’ practises is one short paragraph, in an entire chapter dedicated to preventative medicine. He argues that the men’s methods only kept trench fever at manageable levels, concluding that ‘early admission to hospital and careful nursing worked in the vast majority of cases.’¹⁹

Harrison (and most medical historians) only seem to perceive efficacy, and therefore historical interest, in the realms of professional intervention. As such, academic discourse on the formulation of British preventative military medicine generally only examines the opinions and actions of individuals working in traditional, formal settings of biomedicine. This creates an exclusivity about which individuals were entitled to discuss preventative medicine, and what can be constituted as a preventative method. This thesis challenges this singular focus on the biomedical perspective, by examining the lived experience and understanding of soldiers.

¹⁸ *Ibid.*, p. 252.

¹⁹ Harrison, *The Medical War*, p. 135.

This is not to say that historians have neglected soldiers' lives and thoughts. The soldier's perspective has been one of the focal points of 'new military history'.²⁰ This sub-discipline has, over the years, produced a wide range of 'history from below'.²¹ These works are the launching pad for this study of soldiers' preventative medicine in the trenches. They weave human experience, emotion and feeling into the picture. Working between the social history of medicine and military history, Denis Gerard Dubord uses the soldiers' lived experience as a lens to examine the 'unseen enemy' of disease in the trenches.²² His interest in the impact of disease that is not fatal but which causes disability and discomfort, and his reliance on accounts of personal experiences, is useful for examining the suffering caused to soldiers by their contaminated uniforms and their preventative responses to lice in the trenches.

Historians of military uniforms have used soldier's experiences in their histories. Laura Ugolini has investigated the 'dirty uniform' as a central factor in the establishment of a battle-ready 'combatant identity'.²³ While she deftly examines soldiers' perceptions of their soiled uniforms, she only touches briefly, and somewhat dismissively, on the role of clothing in the spread of disease and contamination:

²⁰ Jim Sharpe, "History From Below," in *New Perspectives on Historical Writing*, edited by Peter Burke, (Pennsylvania: The Pennsylvania State University Press, 2001), pp. 25–42; Edgar Jones, "The Psychology of Killing: The Combat Experience of British Soldiers during the First World War," *Journal of Contemporary History* 41, no. 2 (April 2006): pp. 229–246; Vanda Wilcox, "'Weeping Tears of Blood': Exploring Italian Soldiers' Emotions in the First World War," *Modern Italy* 17, no. 2 (2012): pp. 171–184.

²¹ 'History from below' means using the viewpoint of the working class or the 'ordinary person' to examine history. Tim Hitchcock, "A New History from Below," *History Workshop Journal* 57 (Spring 2004), p. 296, describes the decrease in popularity of 'history from below' in the 1990s, especially in the sub discipline of medical history, referring to the work of Thomas Lacqueur. Although now rising in popularity once more, in British military medicine it is most often neglected.

²² Denis Gerard Dubord, "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," (Ph.D., Thesis, University of Victoria, 2009).

²³ Laura Ugolini, "War-stained: British Combatants and Uniforms, 1914–18," *War and Society* 33, no. 3 (August 2014): pp. 155–171.

'combatants' personal accounts...stressed the dangers to their physical health far less often than those to their sense of self'.²⁴ Ugolini, preoccupied with identity construction, at times presumes soldiers lacked interest in or understanding of the contamination present in their uniforms, and overlooks the importance of health in the trenches, a topic frequently addressed by soldiers in their diaries and letters.

Ugolini avoids the study of soldiers' 'folk medicinal' prevention methods, while Dubord only briefly touches on 'chatting' in the trenches, stating such methods were more of a 'measure of sweet revenge' on the pests than a true method of prevention.²⁵ This was clearly not the case. In this thesis, I employ a preventative medical lens to bring new focus to the history of soldiers' experiences, and to reformulate historical conceptions about which individuals were capable of influencing and proffering medical ideas and practises. The study of soldiers' 'folk medicine,' alongside more traditional investigations into biomedical prevention, helps to both historically investigate and outline the practice of two separate 'systems of medical knowledge' at the front line.

This thesis highlights the unique history of British preventative medicine through a qualitative, comparative examination of both biomedical and soldiers' perspectives. The diaries, letters and publications of medical researchers and practitioners show the impact of biomedicine and science, while articles in the *BMJ* and *The Lancet* reveal the dominant medical discourse. The *BMJ*, the official publication of the British Medical Association, and *The Lancet*, one of the most widely disseminated medical journals of the time, encapsulate the consensus on medical theory. They present the most influential theories of the period, and published scholarship mirrored by other medical publications. In addition, the personal

²⁴ *Ibid.*, p. 167.

²⁵ Dubord, "Unseen Enemies," pp. 87-88.

accounts of medical practitioners, especially those on the front line, reveal whether they believed in the preventions they practised, while also conveying their general thoughts about preventative medicine in war.

These biomedical sources convey the strength of an ‘overarching discourse’. Medical researchers and practitioners contributed to this discourse from varying branches of medical work. Although they may not have practised together, their discussion, across all medical disciplines, forms a cohesive body of professional medical knowledge. This thesis discusses contributors to the dominant discourse as ‘medical scientists’ or ‘researchers,’ whether they were entomologists, pathologists, or chemists. Often this dominant discourse included the opinions of medical officers (MOs), especially Regimental Medical Officers (RMOs) on the front line, other times it did not. On the occasions where MOs working at the front upheld methods that medical scientists incorrectly recommended, the power of the dominant discourse across all areas of medical practice can be clearly seen.

To explore the knowledge developed by soldiers, this study relies on the diaries, letters, and oral histories of British soldiers. These records lay out the lived experience and practicality of the learned treatments in the trenches. Like most primary sources, these documents are not objective. Diaries and letters can be written in the moment, or in hindsight, and raise the issue of memory, particularly when significant time has passed. This is even more important when interpreting this thesis’ other primary source for lived experience – oral history.²⁶ While the scope of

²⁶ For detailed studies of oral history and memory see: Paul Thompson, *Voices of the Past: Oral History*, 3rd ed., (Oxford: Oxford University Press, 2000), pp. 89-96; Joan Tumblety ed., *Memory and History: Understanding Memory as Source and Subject*, (London: Routledge, 2013); Alistair Thompson, “Memory and Remembering in Oral History,” in *The Oxford Handbook of Oral History*, edited by Donald A. Ritchie, (New York: Oxford University Press, 2011), pp. 77-95.

this project is not large enough for a lengthy discussion of memory, oral histories can be used profitably in a dialogue with diaries and letters.²⁷

The strengths of the sources far outweigh their shortcomings. Diaries and letters describe the conditions the men experienced and present anecdotes about the variety of prevention methods soldiers employed in the trenches. These happy, sad, comedic, and often fearful accounts highlight the collaboration between soldiers and the widespread discussions of their prevention methods throughout the trenches. This demonstrates that their ideas formed a larger body of medical knowledge. Further, many of the oral histories examined in this thesis reveal sensory experiences more so than other personal accounts. They capture the feeling of sitting in mud-filled trenches, and the emotions connected to this existence.²⁸ Megan Hutching rightly argues:

oral history interviews illuminate the often ignored experiences of ordinary people caught up in war and the range of reactions that different aspects of war evoked from them.²⁹

These sources provide an invaluable key to an untapped form of medical understanding and practice, where medicine is not distanced from human experience. These sources allow this thesis to avoid the solely 'clinical' gaze of some medical histories.

Placing biomedical and soldiers' perspectives side by side, in a 'top down/bottom up' configuration, allows for nuance, where historical discussion expands

²⁷ This is argued to be the strongest way to employ oral histories, or in fact all types of primary sources, by Norma Smith, "Oral History and Grounded Theory Procedures as Research Methodology for Studies in Race, Gender and Class," *Race, Gender and Class* 9, no. 3 (2000): pp. 121-138; Tim Kenyon, "Oral History and the Epistemology of Testimony," *Social Epistemology* 30, Issue 1 (2016): pp. 45-66.

²⁸ Megan Hutching, "After Action: Oral History and War," in *The Oxford Handbook of Oral History*, edited by Donald A. Ritchie, (New York: Oxford University Press, 2011), p. 234.

²⁹ *Ibid.*, p. 234.

beyond the ideal construction of medical practice to examine the practicalities and actions that eventuated in the trenches. By considering both viewpoints together, it is possible to consider not only the distinct ideas of each group but also the tensions and similarities between them.

Each chapter of this thesis discusses a different form of contamination, disease, or infection – the role uniforms played is the link between them. Corporal Percy Webb of the Dorsetshire Regiment was asked what the worst horrors of trench life were and replied ‘lice, mud and gas.’ These are the three ‘most untemperous [sic]’ medical problems this thesis explores. Most of the information comes from the Western Front, with minor reference to the theatres in Egypt and Turkey.³⁰

This thesis is divided into three chapters, each of which considers a different issue where the viewpoints and actions of biomedical scientists and the men at the front diverged. Chapter One examines lice infestation and the resulting spread of trench fever, relapsing fever, and typhus. Medical scientists working on biomedical preventions had a limited understanding of the nature of trench life. The methods they proposed should be implemented presented multitudinous problems for the soldiers fighting at the front, and adversely affected their physical and mental wellbeing.

Chapter Two explores how poorly-made boots, in the wet and muddy environment, contributed to the debilitating condition of trench foot. In this instance, the poor relationship between RMOs and the men led to breakdowns in trust, and this resulted in problems with proper prevention.

³⁰ Webb, Oral History, Recording 578. The limits on geographical theatres of war is purely based on the word constraints of this thesis. Some examples from both Egypt and Gallipoli are examined at times to provide a comparison for the ‘folk medicine’ practised on the western front.

Chapter Three examines the mustard gas that settled in men's uniforms, and poisoned their wearers. In this case, medical scientists failed to develop a comprehensive coverage of contamination in public medical discourse. However, alternative modes of treatment and prevention were developed on the front.

Mark Harrison writes that, as the First World War becomes more distant, the collective memory of the medical practices that flowed from the conflict has largely faded from view. 'Little is remembered of the many thousands who worked on the Western Front or in other theatres as doctors, orderlies, and nurses; still less of their patients.'³¹ This thesis recovers both the medical science of the war and the practical experience of the men who endured the diseases that flourished in the trenches.

³¹ Harrison, *The Medical War*, p. 1.

Chapter One

The Lousy Business of War

*The biggest, greatest discomfort, all the time from the time I first went into the trenches was body lice...the itch was almost maddening!*¹

Lance Corporal Ernest Sheard of the West Yorkshire Regiment documented the day his battalion realised they were 'getting more company.'² The new recruits were not fresh troops but body lice, which increased by the minute. 'How the louse came was surprising,' Sheard wrote in his diary, 'they must have spent all their time breeding.'³ He attributed their formidable numbers to the 'clamminess' of soldiers' bodies and the 'stuffy' and confined trenches.⁴

The vermin seemed unshakeable and consistently irritating. The sheer scale of warfare during the First World War, as well as its static and dirty nature, particularly on the Western Front, exacerbated the problems of personal cleanliness for soldiers like Sheard. Trenches were cramped spaces where soldiers lived in close proximity to each other and there were few opportunities to remove and clean uniforms. This was the ideal habitat for lice, and the perfect environment for infestations. As Sheard concluded, 'they appeared to have found a good spot.'⁵

Body lice (*Pediculus humanus humanus* or *P. humanus corporis*) were a logistical and medical nightmare for armies long before the First World War. During previous conflicts, including both the Napoleonic and Crimean Wars, their presence

¹ William Davies, Oral History, Recording 564, Imperial War Museum collections, London (IWM).

² Ernest Sheard, Diary, p. 361, Private Papers of E. Sheard, Documents 12021, IWM.

³ *Ibid.*, p. 361.

⁴ *Ibid.*, p. 361.

⁵ *Ibid.*, p. 361.

helped drive discussion on the connection between vermin infestations and disease.⁶ Lice were the ‘constant accompaniment of all armies,’ and hence, so were the diseases that travelled with them.⁷ Even before the outbreak of the Great War medical researchers and practitioners knew that lice spread rickettsial bacteria such as typhus and *Rickettsia prowazekii*, as well as *Borrelia recurrentis*, or ‘relapsing fever.’⁸ During the war, medical scientists postulated that scratching lice bites infected the wounds with lice faeces, thus spreading the highly contagious rickettsial disease ‘trench fever’, which is now known to be *Bartonella quintana*.⁹ The link was officially confirmed in 1918.¹⁰

This chapter elucidates the introduction of preventative biomedicine for lice infestations in the First World War. Medical researchers, from a variety of roles both in and out of the front line, shaped the dominant medical discourse in scholarly journals and other publications. There was general consensus, across various branches of medical work, that the prevention methods promoted by these researchers yielded positive results. Numerous medical historians have observed that during the Great War, the first ‘modern’ conflict, was accompanied by a high level of bureaucratic standardisation and routinisation. This relied on ‘experts’, who defined

⁶ Didier Raoult *et al.*, “Evidence for Louse-Transmitted Diseases in Soldiers of Napoleon’s Grand Army in Vilnius,” *The Journal of Infectious Diseases* 193, no. 1 (1 January 2006): pp. 112-120.

⁷ A. E. Shipley, “Insects and War,” *The British Medical Journal (BMJ)* 2, No. 2803 (19 September 1914): p. 498.

⁸ Raoult *et al.*, “Evidence for Louse-Transmitted Diseases in Soldiers of Napoleon’s Grand Army in Vilnius,” p. 112.

⁹ Cedric Foucault, Philippe Brouqui, and Didier Raoult, “Bartonella Quintana Characteristics and Clinical Management,” *Emerging Infectious Diseases* 12, no. 2 (February 2006): p. 217. Trench fever was also known as ‘pyrexia of unknown origin,’ or P.U.O.

¹⁰ P. S. Lelean, *Sanitation in War*, (London: J. & A. Churchill, 1915), p. 103; J. Parlane Kinloch, “An Investigation of the Best Methods of Destroying Lice and Other Body Vermin,” *BMJ* 1, no. 2842, (19 June 1915): p. 1039; R. L. Atenstaedt, “The Response to Trench Diseases in World War I: A Triumph of Public Health Science,” *Public Health* 121 (2007): pp. 634-639; Ian R. Whitehead, *Doctors in the Great War*, (London: Leo Cooper, 1999), p. 232.

and ordered systems of knowledge.¹¹ This was certainly the case for military preventative medicine, where the views of medical professionals held sway. However, this privileging of dominant medical discourse hindered medical researchers and practitioners from perceiving the inadequacy and impracticability of the methods they promoted and implemented.

Mark Harrison has written that military sanitation and preventative medicine was:

the art of the possible: a practical discipline born of a compromise between scientific ideals and the often unfavourable conditions in which military medics were forced to work.¹²

Yet, when soldiers experienced the multiple failures of preventative biomedicine, they did not think it was ‘the art of the possible’. Soldiers outlined the shortcomings of biomedical methods (and their overall dissatisfaction) in diaries, letters and oral testimonies. Their overwhelming need to rid themselves of lice led them to develop their own form of ‘folk medicine’ in the trenches - their own system of medical knowledge.

¹¹ Roger Cooter, Mark Harrison, and Steve Sturdy, eds. 1998, *War, Medicine and Modernity*, (Stroud: Sutton Publishing), p. 1; Christopher Lawrence, “Continuity in Crisis, Medicine 1914–1945,” in Bynum et al., *The Western Medical Tradition, 1800-2000*, (Cambridge: Cambridge University Press, 2006), p. 251.

¹² Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010), p. 125.

Medical Scientists

In 1912, two years before the outbreak of the Great War, the Royal Army Medical Corps (RAMC) publication *Manual of Elementary Military Hygiene*, the guide to military sanitation and preventative medicine, made no mention of lice, or their link to the spread of disease.¹³ British medical professionals knew of the scientific evidence that linked lice with typhus and relapsing fever. However, owing to the success of late nineteenth century public health and sanitation campaigns, body lice infestations were less common in formerly verminous urban areas.¹⁴ Lice and associated diseases were not, therefore, at the forefront of the minds of British medical scientists and practitioners. The vermin problems of past conflicts seemed a vague memory in the early twentieth century. However, it did not take long for these insects to raise their ugly, disease-ridden heads.

As the war progressed, the vermin problem escalated, and medical researchers realised they needed to address the havoc wreaked by these six-legged pests. Scholarly journals such as the *British Medical Journal (BMJ)* and the *Lancet* played an important role in educating medical scientists who were serving on and behind the front line.¹⁵ As early as September 1914, even before most battlefronts had become bogged down in trench warfare, medical scientists used the *BMJ* to remind their colleagues:

¹³ Denis Gerard Dubord, "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," (Ph.D., Thesis, University of Victoria, 2009), p. 82.

¹⁴ *Ibid.*, p. 84.

¹⁵ This is not to say that medical practitioners only used these two scholarly journals to spread their ideas, but both the *BMJ* and the *Lancet* held the most sway across the various branches of medical practice.

wherever human beings are gathered together in large numbers, with infrequent opportunities of changing their clothes, *P. vestimenti* is sure to spread.¹⁶

By 1916 the *BMJ* declared the entire Western Front was riddled with lice and that '95% of men examined were infested.'¹⁷ This was far from acceptable considering the understanding that military advancement relied on the health of the men in the trenches.

For the first time, lice infestation was no longer viewed as an inevitable byproduct of battlefield environments.¹⁸ Medical scientists, especially those in advisory roles to the RAMC in hygiene, knew they must lead the charge with a new focus on preventative medicine, and in the *BMJ* they stated that 'in view of the present known relationship between vermin and the transmission of disease, and in consideration of the prevalence of typhus in...the present war,' it was desirable to issue preliminary results about prevention measures.¹⁹

From then on, in the pages of scholarly journals, medical researchers documented their preventative medical ideas. Lieutenant Colonel P.S. Lelean, the Assistant Professor of Hygiene at the Royal Army Medical College, was one who placed high value on the role of medical knowledge in conquering disease: 'it is upon the knowledge of sanitation possessed by medical officers that this essential condition primarily depends.' All 'newly joined' medical officers (MOs) attended

¹⁶ Shipley, "Insects and War," p. 497, *P. Vestimenti* is an alternative latin name, in stead of *pediculus humanis corporis*, for body lice.

¹⁷ A.D. Peacock, "The Louse Problem at the Western Front," *BMJ* 1, no. 2892 (3 June 1916): p.784.

¹⁸ Shipley, "Insects and War," p. 498.

¹⁹ J. Parlane Kinloch, "An Investigation of the Best Methods of Destroying Lice and Other Body Vermin," *BMJ* 1, no. 2842, (19 June 1915): p. 1038; role of specialist medical and scientific advisors described by Whitehead, *Doctors in the Great War*, 140.

lectures by medical scientists, ‘purporting to give an insight into the mysteries of sanitation on active service.’²⁰ The MOs were expected to implement these ‘expert’ preventions on the front line.

For the first time, these researchers examined an aspect of combat life that had rarely received a medical-scientific focus — uniforms. As Lt. Col. Lelean observed: ‘clothes play so great a part in maintaining [soldiers’] health and comfort as to demand more attention than is usually given to them.’²¹ The three main approaches that emerged from this discourse: bathing facilities, chemical powders, and the use of ointments, were all in some way, linked to the role uniforms played in vermin contamination.²²

The provision of divisional bath houses, usually run by Field Ambulance (FA) MOs, were the largest operation undertaken to keep soldiers vermin-free.²³ Constructing and running these facilities, often in unused breweries and barns behind the front line, required detailed planning and logistics, and a phenomenal amount of labour.²⁴ In the trenches, both line officers and non-commissioned officers (NCOs) were entrusted with the responsibility for maintaining cleanliness among the

²⁰ Lelean, *Sanitation in War*, pp. iii–vi.

²¹ *Ibid.*, p.18.

²² De-lousing pits which enabled the men to de-louse themselves while in the trenches were only advised and implemented by professionals in 1918, as discussed by Whitehead, *Doctors in the Great War*, pp. 232–233. If they had been implemented earlier it may have rapidly decreased the rate of lice infestation, and may also have positively influenced soldiers’ attitudes towards professional prevention methods.

²³ Whitehead, *Doctors in the Great War*, p.232; Harrison, *The Medical War*, p. 133, also notes that bath workers on occasion were medical convalescents or men temporarily unfit for other duties.

²⁴ Later in the course of the war, medical and sanitary personnel introduced more mobile solutions on specially fitted medical trucks including Thresh disinfectors and Clayton disinfectors, as described by Harrison, *The Medical War*, p. 133, but overall issues with professional lice prevention remained.

troops. Soldiers were bathed in units to avoid re-infestation, but this was only possible when fighting at the front allowed.²⁵

Researchers published on these medicated baths. MOs Captain Henry Norman Goode and Captain Basil Hughes of the FA, outlined the recommended procedure. They stated that men removed their clothes and ‘passed through the sprays.’²⁶ While they bathed, their trousers were ‘put through the Thresh disinfector,’ and their breeches were ‘ironed...to kill the lice and nits.’²⁷ After exiting the sprays, men were issued with a clean shirt, pants, and socks, while their old boots, tunics, and belongings were returned to them.²⁸

This method effectively avoided the cross-contamination of soiled and clean items, and 2000 men could be bathed *per diem*.²⁹ Medical and army officials both revelled in this rapid and effective turnover.³⁰ They also noted the effect of baths on the men's emotions. One *BMJ* article included a description by Major Charles E. Goddard of the Royal Army Medical Corps (Territorials) of the joy men felt when bathing:

²⁵ Anon, “Military Hygiene and the Efficiency of the Soldier,” *BMJ* 1, no. 2828 (13 March 1915): p. 474; also discussed by Harrison, *The Medical War*, pp. 132–133.

²⁶ H. Norman Goode, “A Brief Account of a Method of Providing Baths for the Soldier in the Field,” *The Lancet* 187, no. 4825 (19 February 1916): pp. 422–424.

²⁷ *Ibid.*, pp.422–424.

²⁸ *Ibid.*, pp. 422–424.

²⁹ *Ibid.*, p. 422.

³⁰ Robert J. Blackham, *Military Sanitation: A Handbook for Soldiers*, (London: John Bale, Sons & Danielson, 1920), pp. 87–90.

none of those who were there...will soon forget the delight of the men at the sight of the hot baths...or hearing the witty comments, and seeing them in such high spirits.³¹

Chemical powders were often employed in the bathing process, but also used separately in the trenches, and medical scientists proposed dusting soldiers' uniforms to combat lice.³² The most discussed powder in medical journals combined the organic compound naphthalene (96 per cent), carbonaceous chemicals distilled from tar, creosote (2 per cent), and the organiodine compound Iodoform (2 percent), and was commonly known as N.C.I. powder.³³ Articles also discussed benzene powder, comprised of an organic chemical compound of the same name. Biomedical literature sang the praises of these powders stating that N.C.I. was clearly a 'speedy killing agent,' and 'a complete deterrent.'³⁴

While these 'tried and tested' chemical powders effectively exterminated lice, they were potent and sometimes toxic chemicals that irritated soldiers' skin. Professionals were aware of this side effect.³⁵ The same *BMJ* article warned: 'CAUTION - It is most important to remember that a too free use of N.C.I., particularly at the fork, causes severe smarting.'³⁶ Yet, Dr. Parlane Kinloch, lecturer in Public Health at the University of Aberdeen, stated in the *BMJ*, that 'to secure immunity from

³¹ Anon, "The Duties of a Sanitary Section in the Field," *BMJ* 1, no. 2875 (5 February 1916): p. 215.

³² Harrison, *The Medical War*, p. 134.

³³ Peacock, "The Louse Problem at the Western Front," p. 786.

³⁴ *Ibid.*, p. 786.

³⁵ It would only be much later in the twentieth century that medical scientists would make the connection between benzene and cancer, as described by The World Health Organisation (WHO), 'Exposure to Benzene: A Major Public Health Concern', available from <http://www.who.int/ipcs/features/benzene.pdf>

³⁶ Peacock, "The Louse Problem at the Western Front," p. 786.

lice infection [sic], means are required for keeping the clothes and body constantly obnoxious to lice,' concluding that 'powder' was 'the most destructive.'³⁷ Even Lance Sergeant Alexander Peacock who served as a front line entomological researcher with the RAMC argued that the evidence of the utility of chemical powder was clear; 'the men since using have not been troubled [by lice].'³⁸

Medical scientists discussed employing emulsions and ointments on the seams of uniforms to suffocate lice eggs before they hatched. This method, too, was overseen by medical or combat officers in the front line.³⁹ Researchers such as Professor Maxwell-Lefroy of the Royal College of Science and Technology who devised an emulsion of crude mineral oil, soft soap and water, also suggested smearing these ointments across the skin.⁴⁰ Maxwell-Lefroy expressly stated that his preparation was successful because it could be 'retained on the skin indefinitely,' as it was 'non-poisonous.'⁴¹ From Maxwell-Lefroy's findings, Messrs Bowley & Sons produced a proprietary product at the Wellington Works at Battersea, marketed as 'Vermijelli'.⁴² A similar product was 'Vermin Westropol'.⁴³ Medical researchers believed ointments were effective as they were readily available to soldiers, were highly successful, and when the men rubbed 'Vermijelli' or crude oil emulsion on their

³⁷ Parlane Kinloch, "An Investigation of the Best Methods of Destroying Lice and Other Body Vermin," pp. 790–792.

³⁸ Peacock, "The Louse Problem at the Western Front," p. 786.

³⁹ Harrison, *The Medical War*, p. 133.

⁴⁰ Anon, "Flies, Lice and Mosquitos," *BMJ* 1, no. 2841 (June 12 1915): p. 1006.

⁴¹ *Ibid.*, p. 1006.

⁴² Bruce F. Cummings, *The Louse and Its Relation to Disease*, (London: British Museum (Natural History), 1915), p. 1.

⁴³ A.E. Shipley, *The Minor Horrors of War*, (London: Smith Elder & Co., 1915), p. 22.

skin, they received relief from constant itching.⁴⁴ This meant they were less likely to scratch their lice bites, which diminished the potential of contracting diseases.

These professional preventions – baths, chemical powders, and ointments – only achieved full efficacy through cumulative use.⁴⁵ Medical scientists wanted men to enter the baths, wash, apply cresol soap solution and N.C.I. powder to their uniforms and skin, and rub ointment into the seams of their garments. When soldiers implemented these preventions all together, as directed, medical scientists' prescriptions mostly worked.

Despite their confidence, medical scientists and researchers worked from the comfort of laboratories in Britain or general hospitals in France, away from all aspects of battle. They wrote into journals, procuring results from reports on lice entomology, while conducting scientific experiments in sterile laboratories. This was a major problem for prevention on the front line. Researchers tested their various disinfection methods in conditions that could not be replicated on the battlefield. They did not take into account the need to send soldiers back into the trenches afterwards, where they again came into contact with other lousy soldiers, terrible conditions, and unwashed blankets. Medical scientists simply did not have to deal with the environmental factors the men faced in the trenches.

Some MOs, particularly Regimental Medical Officers (RMOs) who worked in the trenches with combat soldiers, did have to deal with the front line environment. Yet, even though some implemented more practical prevention methods over the course of the war, the power that the dominant discourse in scholarly journals possessed over medical ideas influenced both MOs' reception of inaccurate, false, or

⁴⁴ Peacock, "The Louse Problem at the Western Front," p. 786.

⁴⁵ Parlane Kinloch, "An Investigation of the Best Methods of Destroying Lice and Other Body Vermin," p. 1041.

inefficient preventative claims as well as their ability to critique ‘expert’ prevention methods.⁴⁶ The number of MOs that openly supported these faulty findings thus far outnumbered the few front line doctors who professed the need for more practical methods. MO Lieutenant Norman King-Wilson of the 88th Field Ambulance RAMC stated, he and his men willingly constructed bathing facilities, sometimes even in the short space of ten days due to their urgent necessity.⁴⁷ Further, MOs, like Captain Norman Goode and Captain Hughes, wrote articles in medical journals stating that their experiences of prevention methods yielded the same results as medical scientists’.⁴⁸ This reveals that the overwhelming majority of front line doctors, who most likely had some practical insight into the failings of biomedical prevention methods, still supported the claims researchers made to efficacy, much to the dissatisfaction of the men in the trenches.

Soldiers’ Responses

While most medical researchers and practitioners, both in and out of the front line, were singing the praises of preventative biomedicine, it was left to the soldiers in the trenches to review ‘expert’ methods. Their personal records show these reviews were not positive. While researchers claimed that their preventions were most powerful when employed cumulatively, Private Fred Potter of the King’s Liverpool Regiment observed: ‘the powers that be didn’t seem to be able to arrange for an

⁴⁶ Small-scale disinfectors like the ‘Serbian barrel disinfectant’ were readily implemented by some front line MOs. These were wheeled in and out of the trenches to provide ‘on the go’ solutions that were easy to use. Operation required no technical proficiency and they enabled disinfecting to be taken to the men, rather than the men struggling to get to the disinfectors, as described by Harrison, *The Medical War*, p. 134. Such methods were only of secondary interest and importance to most medical scientists and MOs.

⁴⁷ Norman King-Wilson, Diary, p. 32, Private Papers of Lieutenant N. King-Wilson, Documents 12259, IWM.

⁴⁸ Norman Goode, H., “A Brief Account of the Method of Providing Baths for the British Soldier in the Field,” pp. 422–424.

infantryman to have a bath, a clean shirt, and a clean blanket all at the one time.⁴⁹ When soldiers only had access to one, or perhaps two, biomedical preventions it was likely to be a guaranteed failure. This response from Private Potter was only one of many that related the overwhelming shortcomings of professional preventative medicine.

The first problem with bathing facilities was access. Most soldiers were unable reach the divisional baths for weeks on end.⁵⁰ The logistics of the bathing process meant it was susceptible to problems. Army officials pushed for a high turnover of men so bath workers cut many corners, whether knowingly or inadvertently. They shoved too many uniforms into Thresh disinfectors, and left uniforms half dried. Private Herbert Empson of the London Field Ambulance RAMC grudgingly wrote he 'returned with a wet shirt and pants, caused by the process of fumigation to which all of our clothes have to be submitted.'⁵¹ Even when bath workers did not rush, numerous uniform items were neglected in the disinfection process, especially outside layers such as trench coats.

Generally, the disinfection processes did not work. Despite the praises army medical officials bestowed on bath workers, they failed to avoid cross-contamination. The 'new' set of underwear given to the men was actually garments collected from other soldiers, improperly washed and treated, the day before. Private F. E. Harris of the Yorkshire Light Infantry caustically reflected in his diary: 'change of pants and shirt supposed to have been washed. Don't delude yourself kid.'⁵² Passing an iron

⁴⁹ Fred Potter, Oral History, Recording 379, IWM.

⁵⁰ The divisional baths were generally located far behind the front line, and often soldiers did not reach the baths for weeks, as described by Harris, Diary, pp. 107–108: 'all we have had to date has been an odd bath.'

⁵¹ Herbert Empson, Diary, entry dated 8 February 1916, RAMC/1217: Box 266, Wellcome Library collections, London (WL).

⁵² F. E. Harris, Diary, p. 202, Private Papers of F. E. Harris, Documents 14979, IWM.

quickly across these 'new' uniforms would not have destroyed all the extant lice and eggs. The men knew this. Corporal Percy Spong of the Royal Fusiliers reminisced, 'put that shirt on your body, and within half an hour...you could feel them.'⁵³ Private Harris corroborated, 'wear 'em a day...these new lice you've acquired have got warmed up, come out on patrol and it is the old scratch! scratch!'⁵⁴

Worse, although professionals could overlook the irritant nature of chemical powders, soldiers could not. Private R.H. Lawson of the Royal Field Artillery wrote:

I put some...on the seams of my trousers [and] all that stuff started burning my privates...by George!...I never used [it] again, no!⁵⁵

In any case, the 'tried and tested' powders were not that easy to acquire. Professional powders could only 'be obtained from ASC [Army Service Corps] on indent authorised by ADMS [Assistant Director Medical Services]' which had to be signed and dated by a MO, with a battalion address attached.⁵⁶ Many civilian businesses cashed in on this shortage by creating imitation lice-exterminating powders.⁵⁷ These were sadly lacking. One *BMJ* article discussed the impotence of these fraudulent lice powders, stating that 'the great majority' of the 'one hundred and eighty one substances...tested for their capacity to protect against infection [sic] with lice...were quite useless.'⁵⁸ It accused the 'vendors of these valueless preparations,

⁵³ Percy Spong, Oral History, Recording 24525, IWM.

⁵⁴ Harris, Diary, p. 202.

⁵⁵ R.H. Lawson, Oral History, Recording 24882, IWM.

⁵⁶ S. Monckton Copeman, "Note on a Successful Method for the Extermination of Vermin Infesting Troops," *BMJ* 1, no. 2823 (6 February 1915): p. 247.

⁵⁷ For reference to imitation powders see: Christopher Moore, *Roger, Sausage & Whippet: A Miscellany of Trench Lingo from the Great War*, (London: Headline Publishing Group, 2012).

⁵⁸ Anon, "Lice," *BMJ* 1, no. 2890 (20 May 1916): p. 734.

sold under high-sounding names, at exorbitant prices' of committing fraud.⁵⁹ Men who had, in desperation, acquired them, achieved no solution or cure. As Private Richard Gwinnell of the Gloucestershire Regiment recorded in his diary:

At last someone told me of some stuff which he declared was THE stuff. It was called trench powder. I...sent home for some...[and was] determined to test it out at once. Off came my shirt, and I picked out a good specimen. I put it very gently into a small tin, being careful not to injure it in any way. I then covered it over with plenty of my precious powder, leaving it on a ledge of the trench for 24 hours. We then gathered round, about 20 of us, to see the result...All my mates craned their heads forward to see the experiment. The lid came off, and never have I ever seen a more healthy or happy louse. Believe me, it was as lively as a cricket, in perfect condition, and fat as a pig.⁶⁰

Gwinnell's experiment indicates that soldiers were dubious about counterfeit powders.

When soldiers were stuck in the trenches, without access to baths, they applied ointment to their clothes and skin but found it did not kill the lice already crawling across their bodies, and only suffocated the eggs along the seams of their uniforms. They were unable to remove their uniforms to do so 'in the front line, where it was not permissible to strip.'⁶¹ Men were not even allowed to take their boots off because they 'never knew what was going to happen next.'⁶² Soldiers were only able to

⁵⁹ Anon, "Lice," *BMJ* 1, no. 2890 (20 May 1916): p. 734.

⁶⁰ Richard Gwinnell, Diary, p. 107, Private Papers of R. Gwinnell, Documents 11601, IWM.

⁶¹ H. J. Youngman, Diary, p. 40, Private Papers of H.J. Youngman, Documents 16008, IWM.

⁶² James H. Butlin, letter to family, n.d., Private Papers of Lieutenant J.H. Butlin, Documents 7915, IWM.

properly apply ointment when they were out of the trenches. As soon as they went back into the trenches, lice re-infested their uniforms. Captain Samuel Smith of the Cheshire Regiment replied in his letter to his sister, 'thanks very much for [the parcel] ...though I have not the faintest intention of using the ointment.'⁶³

The medical researchers and practitioners promoting these interventions forgot (or ignored) the counter-effects of soldiers' lives under a war of attrition. The day-in-day-out routine of trench life undermined their methods. The numerous MOs working on the front line, trusted the information in the dominant medical journals about the efficacy of biomedical prevention methods, even when their first hand experience in the trenches may have demonstrated otherwise. Most often, medical scientists judged the effectiveness of their prevention methods from official reports and statistical evidence. They did not ask soldiers about their experiences of biomedical methods, or whether they remained effective once they left the bathing facility or MO's quarters. Yet clearly, for the men living in the trenches, these methods were not the best solutions. The methods soldiers relied on most in the trenches were, in fact, their own.

Soldiers' 'Folk Medicine'

When asked what the worst part of trench life was, Corporal William Davies of the Machine Gun Corps replied 'the biggest, greatest discomfort, all the time from the time I first went into the trenches was body lice.'⁶⁴ Davies said being infested with lice was comparable to mental torture – 'the itch was almost maddening!'⁶⁵ As a *BMJ* article observed:

⁶³ Samuel H. Smith, letter to sister, January 17 1916, Private Papers of Captain S.H. Smith, Documents 15947, IWM.

⁶⁴ William Davies, Oral History, Recording 564, IWM.

⁶⁵ *Ibid.*

the irritation due to the body louse weakens the host and prevents sleep, besides which there is psychic disgust which causes many...to fear lice more than they fear bullets.⁶⁶

Soldiers described this 'psychic disgust' in detail. Corporal George Singleton of the King's Liverpool Regiment thought the 'worst thing was the lice...it was awful, no respite at all.'⁶⁷ Most, like Corporals Davies and Singleton, described lice as a daily nuisance rather than vectors of disease. The men sitting in the trenches, were preoccupied with addressing the immediate and constant discomfort caused by lice, whereas medical researchers and practitioners were more concerned to avert the loss of manpower from lice-borne disease.

However, disease was an issue for soldiers too. They knew trench fever, relapsing fever and typhus were spread by lice. Yet even when they were sick, they focussed on the ways lice attacked their wellbeing and comfort and downplayed the diseases they caught. Captain Smith wrote to his sister 'sorry to say I have got a slight attack of trench fever. Sounds bad but really it is only influenza...fear I am rather irritable.'⁶⁸ Lance Corporal Sheard, examining men with lice-borne diseases as a medical orderly, argued that 'as long as the men were free from *certain* diseases they were alright.' He furthered that 'we were all more or less lousy and nobody could help it, you could not sleep in blankets that were itchy, or keep a shirt on for five to six weeks and be goodness knows how long without a bath and still remain clean.'⁶⁹

Battalions in some sections of the line sat in trenches for up to six weeks without changing their clothes. Lance Corporal Sheard lamented, 'we have now been

⁶⁶ Shipley, "Insects and War," p. 498.

⁶⁷ George Singleton, Oral History, Recording 24553, IWM.

⁶⁸ Smith, Letter to Sister, 21 August 1915.

⁶⁹ Sheard, Diary, pp. 415–416.

without a bath for over six weeks and five weeks out of the six we had not been able to take our stockings off...so now we were proper lousy.⁷⁰ Once in the trenches most soldiers only had the clothing on their backs.⁷¹ They were not even able to take their uniforms off. At night soldiers lay in dugouts, tightly packed together, where lice crawled from one person to the next. Men arriving at dressing stations with various complaints writhed with lice, and Sheard witnessed lice breeding in the bandages of sick and wounded soldiers: 'you could see them creeping about the wool dressings, and often when I was undoing the dressings I just felt as if I could scratch myself to pieces.'⁷² These infestations meant already sick men not only lived with constant 'psychic disgust', they also ran the risk of suffering further diseases.

Clearly, the poor trench environment spurred soldiers to develop their own prevention methods. Yet, there is a lack of accord between historians regarding the causes of soldiers doing this. Mark Harrison argues that soldiers turned to their own methods on the recommendation of medical professionals.⁷³ Denis Gerard Dubord claims that the general inefficiency of soldiers' methods sparked the creation of biomedical preventions at the start of the conflict.⁷⁴ Soldiers' diaries and personal records provide evidence that neither Harrison nor Dubord is correct. Soldiers were disgruntled and helpless when provided with the ineffective solutions of medical researchers and practitioners. It is not hard to believe, in fact, this was the most likely cause for soldiers' establishment of 'folk medicinal' preventions. They relied not on

⁷⁰ *Ibid.*, p. 192.

⁷¹ Officers' letters show they had more opportunities to write home to procure new underclothes or uniforms than both non-commissioned officers (NCOs) and regular men — still, they mostly received these items when they were out of line.

⁷² Sheard, *Diary*, pp. 415–416.

⁷³ Harrison, *The Medical War*, p. 134.

⁷⁴ Dubord, "Unseen Enemies," pp. 87–88.

the recommendations of medical professionals, but on their own 'system of medical ideas'.

Soldiers took the opportunity of 'down time' in the trenches to discuss preventions for their verminous condition. As Private Gwinnell recorded, a 'bitter subject of conversation was lice...and we spent lots of time discussing ways and means of destroying the pest.'⁷⁵ Gwinnell 'tried out all the suggestions, all with varying amounts of success', and recorded the results;

Leave the shirt and pants out in the frost at night – inside out. Result. Shirt and lice gone in morning. Or if shirt still there, at first appearance of the sun – life returns to the apparently dead lice.

1. Dig hole and bury shirt. Result. Fairly good. Disadvantage of this – "two legged moles" – again loss of shirt.
2. My own. Put shirt in stream with stones on it, completely covered with water. Stand sentry over it all night. Result. Excellent.
3. Daily operation of thumb nail. The only known definite result, and practised by thousands.'⁷⁶

Gwinnell's wryly amusing list demonstrates that soldiers took strides to carefully and thoughtfully investigate, then catalogue, the ways they improvised preventive medicine in the trenches. The list was also the product of collaboration and represents the musings of an entire battalion of men, who were sharing ideas about a subject of intense interest. Across the various theatres of war, soldiers began to practise a form of 'folk medicine' based on the ideas they shared in the trenches.

⁷⁵ Gwinnell, Diary, p. 107.

⁷⁶ *Ibid.*, p. 107.

As medical researchers and practitioners developed one 'system of ideas' about preventative medicine, soldiers formed another.

In the trenches along the Western Front, soldiers used available materials and their surrounding conditions to create prevention methods. Some men, like Lance Corporal Sheard, improved on the methods researchers and practitioners promoted. Sheard, after his official bath, always took his 'own shirts for the change and brought our dirty ones back then had a washing day,' where he and the other men would set up their own bathing facilities. He then 'had a real good [sic] bath in two old petrol tins', boiling his uniform in another.⁷⁷ Even so, materials to assist in bathing were limited in the trenches. Soldiers such as Corporal Walter Hopes of the Royal Field Artillery 'used to boil 'em [lice]', but bemoaned 'you'd never kill 'em.'⁷⁸

As the soldiers collaborated and discussed the lice problem further, the number of 'folk medicinal' interventions grew. Methods spread from soldier to soldier by word of mouth, and recorded in their letters, diaries and oral histories. The most popular method mentioned by soldiers was 'chatting' for lice – using a fingernail and thumbnail to pop vermin. It was the most immediate solution for dealing with lice and did not rely on any added equipment. Often soldiers, such as Private Bert Sprason of the Royal Warwickshire Regiment, 'used to have some fun...with the "chatting".'⁷⁹ Others found it dull. Private Harris documented that 'killing each louse one by one' was a 'slow and tedious task' that made the 'finger and thumb nail very messy too!'⁸⁰ Trying to systematically kill each individual louse when there were thousands crawling in their shirts was quite ineffective.

⁷⁷ Sheard, Diary, p. 388.

⁷⁸ Walter Hopes, Oral History, Recording 29169, IWM.

⁷⁹ Bert Sprason, Oral History, Recording 32815, IWM.

⁸⁰ Harris, Diary, p. 107.

Another common and widespread tactic was to take candles that were rationed to soldiers in the trenches, and 'burn 'em out.'⁸¹ Harris noted they resorted 'to candle ends,'⁸² which Corporal George Armitage Nichols of the York and Lancaster Regiment recalled 'you used to...[light] up the seams of your shirt.'⁸³ Private Ernest Bell of the York and Lancaster Regiment used to enjoy 'hear[ing] them popping, cracking...cracking like fireworks.'⁸⁴

Other soldiers recounted treatment attempts that were more about amusing themselves than combatting lice. One was turning their shirts inside out – 'uniform tricks' said to confuse the lice. Private Christopher Cockburn of the Northumberland Fusiliers remembered he would 'take [his] shirt off and turn it inside out and put it on again. All so that you could have a rest before [the lice] could walk around to the other side!'⁸⁵ At other times soldiers used objects from their surrounding physical environment. Corporal Alfred West of the Monmouthshire Regiment recalled his pal used to:

send out for some pebbles and some...powder that made you sneeze...and he used to have them [lice and pebbles] in little bags, he said every time they sneezed they bashed their brains out!⁸⁶

In the Middle East, the men developed specific techniques tailored to the geographical location and hotter climate. In Egypt, some men used a divisional monkey. Corporal West recollected they 'had a monkey on the transport lines,' who

⁸¹ Albert Day, Oral History, Recording 24854, IWM.

⁸² Harris, Diary, p. 107.

⁸³ George A. Nichols, Oral History, Recording 26874, IWM.

⁸⁴ Ernest Bell, Oral History, Recording 26870, IWM.

⁸⁵ Christopher Cockburn, Oral History, Recording 9148, IWM.

⁸⁶ Alfred West, Oral History, Recording 12236, IWM.

would 'open the seams up and he'd eat the lot...and crack the eggs.'⁸⁷ West also steeped his uniform in the Suez Canal, arguing that the salt water did not agree with lice:

You'd take your shirt off and get the cord that you clean your rifle out with, put that in your shirt hole, shove your shirt in the canal into the salt, and peg it into the bank. In about a few minutes you could watch it, and you could see the lice crawling up this cord!⁸⁸

These methods depended on elements in the soldier's environment and the equipment they already had in their kits. It shows soldiers experimented with absolutely everything they had available to rid themselves of lice.

These intervention methods reveal a collaboration between men presented with no other viable options. Biomedical prevention methods lacked practical insight. As they worked in sterile laboratories in Britain, the methods they recommended did not stand in the poor environment of the trenches. Divisional baths were located miles from the front line, and it took weeks for some soldiers to have a wash. The chemical powders promoted by medical scientists burnt soldiers' skin, and the imitation powders more easily accessible in the trenches did not work. Ointments were also of little use when soldiers could not remove their uniforms in the front line. Further, the power medical scientists' preventions held over most medical personnel working in forward areas meant that these method were not reviewed with a critical eye.

Soldiers' drive to exterminate their vermin often outweighed both their reliance on faulty 'expert' methods and the constant danger that surrounded them on a daily

⁸⁷ *Ibid.*

⁸⁸ *Ibid.*

basis. Lice infestations not only caused 'psychic disgust', but also produced numerous health problems, and the men in the trenches began to practise a form of 'folk medicine'. The intervention methods soldiers practised were so far removed from those purported by medical professionals, that they clearly form a new 'system of ideas', which relied on the conditions that surrounded soldiers, and the materials they had access to in the trenches.

Chapter Two

Getting Cold Feet

The nearer to the trenches, the worse the sights grew...their poor feet were swollen to double their normal size, blue and stone cold. The pain must have been frightful...¹

‘The next happening was nearly disastrous for me...as this place was no health resort,’ Private Morsley of the Royal Garrison Artillery wrote in his diary. ‘I became afflicted by continually working in the rain and slush.’² Like most soldiers he spent long days standing still, and winter brought severe problems for Morsley; ‘the continual strain began to toll on me...I could hardly move my arms and turn my head owing to the exposure...’³ The mud pooling on the trench floor had the consistency of ‘glutinous soup’,⁴ and the constant rain caused trench walls to cave in. The water and mud often rose above the soldiers’ knees, and sometimes as much as six to eight feet.⁵ There was no shelter from the weather – the single waterproof ground sheet issued to soldiers was hardly useful in such surroundings.⁶

Alterations to the trenches did little to ease soldiers’ plight.⁷ Alfred West said digging trenches ‘was like digging a grave.’⁸ Men laid wooden boards — duckboards

¹ Norman King-Wilson, Diary, p. 30, Private Papers of Lieutenant N. King-Wilson, Documents 12259, Imperial War Museum collections, London (IWM).

² Private Morsley, Diary, pp. 43-44, Private Papers of Private Morsley, Documents 15334, IWM.

³ *Ibid.*, p. 44.

⁴ Donald A. Hodge, Oral History, Recording 11341, IWM.

⁵ King-Wilson, Diary, p. 30.

⁶ Richard Gwinnell, Diary, p. 106, Private Papers of R. Gwinnell, Documents 11601, IWM.

⁷ H.J. Youngman, Diary, p. 44, Private Papers of H.J. Youngman, Documents 16008, IWM.

⁸ Alfred West, Oral History, Recording 12236, IWM.

– to ease their passage through poorly constructed trenches. In some places the mud was too thick for duckboards to provide assistance.⁹ Other times the boards broke or iced over; men slipped into the deep mud and drowned, the weight of their kits sucking them down.¹⁰

Private Morsley ‘felt afraid’ of the mud.¹¹ It meant disease, drowning, and death. It covered soldiers’s boots and seeped into them, leaving their feet constantly wet. Unsurprisingly, men’s feet became riddled with medical problems. Private Reg Coldridge of the Devonshire Regiment knew ‘they always sent men to hospital’ while an unlucky few lost their feet.¹² Medical Officer (MO) Lieutenant Norman King-Wilson of the 88th Field Ambulance (FA) dejectedly surmised: ‘we could fight the Turk and his German masters, but the first rainstorm of the winter had defeated us.’¹³ The problem was what would become known as trench foot.

As with lice infestations, combat troops throughout history have experienced the problems of cold feet. Napoleon's invasion of Russia left many suffering horrific foot conditions. Soldiers in the Great War were aware of the afflictions suffered by their predecessors, referring to such cases as ‘frostbite’.¹⁴ At the start of 1915, men were complaining of frostbitten feet, even though there had not been any frost for weeks. By the end of the first week of January, 90 per cent of men presenting to hospital suffered from ‘bad feet.’ Medical personnel then began to label such cases

⁹ Albert Hurst, Oral History, Recording 11582, IWM.

¹⁰ Ulick B. Burke, Oral History, Recording 569, IWM; and King-Wilson, Diary, p. 30.

¹¹ Morsley, Diary, p. 47.

¹² Reg Coldridge, Oral History, Recording 24864, IWM.

¹³ King-Wilson, Diary, p. 30.

¹⁴ J. Lorrain Smith, J. Ritchie, and J. Dawson, “On the Pathology of Trench Frost-Bite,” *The Lancet* 186, no. 4802 (11 September 1915): pp. 595–598; P.S. Lelean, *Sanitation in War*, (London: J. & A. Churchill, 1915), p. 25.

as ‘trench foot’; an umbrella term for foot conditions spurred by the cold and damp of the water-logged trenches.¹⁵ Together, medical scientists and medical officers (MOs) working in the field promoted a variety of preventive methods based on what they understood to be sound medical theory. To counter the extreme trench environment, they advised men be provided with alternate footwear, like gumboots and multiple pairs of socks. MOs and RAMC officials performed regular foot inspections and rubbed whale oil into the men’s feet. They thought implementing these methods would lower the alarming prevalence of foot conditions. Such attempts, however were futile. The men in the trenches were left with cold feet. Again, as professional methods failed, soldiers adopted their own ‘folk medicine’.

Medical Scientists

In *The Lancet* in 1917, Major Philip Turner of the RAMC, working at a base hospital in France, defined ‘the essential difference between trench foot and true frostbite’:

in the latter the direct action of severe cold leads to the complete destruction of the vitality of more or less extensive masses of tissue, while in the former the effect of cold and wet, combined with certain factors which impede the circulation in the extremities, is to produce [an] inflammatory reaction.¹⁶

Turner claimed, a ‘histological examination’ of trench foot ‘showed that the chief changes took place in the blood vessels,’¹⁷ and medical scientists understood that

¹⁵ Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010), p. 128.

¹⁶ P. Turner, “The Treatment of Trench Feet and Allied Conditions by Bier’s Method of Passive Hyperaemia,” *The Lancet* 190 no. 4913 (27 October 1917): p. 639.

¹⁷ Turner, “The Treatment of Trench Feet and Allied Conditions by Bier’s Method of Passive Hyperaemia,” p. 639; supported by C.C. Ungley; Channell, G.D.; Richards, R.L., “The Immersion Foot Syndrome,” *Wilderness and Environmental Medicine* 14, Issue 2 (June 2003): p. 135.

the 'alien trench environment' and, in severe cases, a lack of circulation that precipitated dermal ischaemia, caused the condition.¹⁸ According to this 'exposure/circulatory' theory, soldiers contracted trench foot from constantly standing still in water and mud that was at a temperature of between 15 degrees Celsius and freezing point.¹⁹ Trench foot was classified as an 'immersion foot' condition and it caused phenomenal casualties during the wet winter months. Affected feet would expand and swell, as pain gradually increased.²⁰ Men's feet became gangrenous and rotten, and pieces fell off, often a symptom of secondary bacterial infection.²¹ By the end of January 1915, Colonel Arthur Lee, who was reporting on Army Medical Services to Secretary of State for War Lord Horatio Herbert Kitchener, reported that the 27th Division alone suffered 2000 cases of trench foot after a single week on the Western Front in France.²²

These staggering figures revealed the aggressive rate at which trench foot developed and motivated medical scientists to investigate the precipitating factors for the condition. It was well known that the risk of 'cold injuries' drastically increased

¹⁸ R.L. Atenstaedt, "The Response to Trench Diseases in World War I: A Triumph of Public Health Science," *Public Health* 121 (2007): p. 638; Dermal ischaemia is a condition causing skin death (necrosis): R.L. Hutchison, "Frostbite of the Hand," *Journal of Hand Surgery* 39, Issue 9 (2014): pp. 1863–1868; C.C. Ungley *et al.*, "The Immersion Foot Syndrome," p. 135.

¹⁹ 'Exposure/circulatory' theory posited that vasomotor constriction maintained for a prolonged period of time caused trench foot. Medical researchers through this was from both the exposure to the terrible trench environment and a lack of mobility, as described by: Robert L. Atenstaedt, "Trench Foot: The Medical Response in the First World War," *Wilderness and Environmental Medicine* 17, Issue 4 (2006): p. 284; P.S. Lelean, "Military Hygiene and the Efficiency of the Soldier," *The British Medical Journal (BMJ)* 1, no. 2826 (27 February 1915): p. 380.

²⁰ 'Immersion Foot' now also known as 'Nonfreezing Cold Injury' (NFCI) as described by: Atenstaedt, "Trench Foot," p. 282.

²¹ The most frequent results were both gas and liquefaction gangrene. History of trench foot aetiology described by: Atenstaedt, "Trench Foot," pp. 282–287.

²² Lord Kitchener was the Field Marshal and Secretary of State for War, as described by Harrison, *The Medical War*, p. 128.

when proper preparation for cold and damp climates was impaired.²³ During the Great War, both medical services and soldiers were severely under-prepared for the weather and environment. While numerous historical works address the role of footwear as a form of prevention, they do not give sufficient weight to the ways inadequate footwear caused the condition.²⁴ Footwear was the only potential barrier between the men's feet and the outside environment and hence it is valuable to examine the central role of inadequate footwear in the development of trench foot.²⁵

Overwhelmingly, medical scientists' reviews of existing footwear aligned with the dominant and popular 'exposure/circulatory' theory. When Lieutenant Colonel P.S. Lelean, Assistant Professor of Hygiene at the Royal Army Medical College, reflected on the inadequacy of service boots he attested that 'the desiderata for a suitable service boot' should, above all, include both 'waterproofing and pliability.'²⁶ Yet, service boots were neither waterproof or pliable. Medical scientists focussed on the 'pressure and constriction' caused by standing in water for long periods of time, and the fact many soldiers laced their boots too tightly, and failed to ensure proper waterproofing with oils.²⁷

Puttees – strips of cloth wrapped tightly around the lower legs of soldiers – added to both the constriction of service boots and the worries of medical scientists.

²³ Mohr, William J., Kamrun Jenabzadeh, and David H. Ahrenholz, "Cold Injury," *Hand Clinics* 25, Issue 4 (2009): pp. 481.

²⁴ Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010); Ian R. Whitehead, *Doctors in the Great War*, (London: Leo Cooper, 1999); R.L. Atenstaedt, "The Response to Trench Diseases in World War I: A Triumph of Public Health Science," *Public Health* 121 (2007): pp. 634–639; R.L. Atenstaedt, "Trench Foot: The Medical Response in the First World War," *Wilderness and Environmental Medicine* 17, Issue 4 (2006): pp. 282–289.

²⁵ Robert E. Burr, "Trench Foot," *Journal of Wilderness Medicine* 3, no. 4 (1993): p. 348.

²⁶ Lelean, *Sanitation in War*, p. 22.

²⁷ Anon, "Trench Frost-Bite," *BMJ* 2, no. 2869 (25 December 1915): p. 934.

The tight wrappings exacerbated the pressure on soldiers' feet. Most medical researchers spent a great deal of time debating the danger of puttees, and Lelean, in particular, knew that they were 'more smart than satisfactory.'²⁸ He wrote that, 'when saturated [puttees] contract by three per cent of their total length,' and hence they were 'potent factors in the production of "frost-bite".'²⁹ Pathologists working at the University of Edinburgh, Professors J. Lorrain Smith and James Ritchie, alongside neurological histologist Dr. James Dawson from the Laboratory of the Royal College of Physicians of Edinburgh, conducted an investigation into trench foot at the request of the official Medical Research Committee.³⁰ They recommended discarding puttees all together as they 'may not only constrict the leg and so obstruct the circulation, but when wet may cause a continuous loss of heat from the limb.'³¹

In October 1915, The Director General of Medical Services (DGMS) Sir Arthur Sloggett issued an Army Routine Order, reprinted in *The Lancet* in 1916, which defined the cause of the conditions known as trench foot:

²⁸ Lelean, *Sanitation in War*, p. 22.

²⁹ Lelean, *Sanitation in War*, p. 22, many medical texts still discussed trench foot as 'frost bite,' although they knew it was a separate medical condition.

³⁰ The Medical Research Committee (later Council) was a government established research board that investigated the many health and disease problems that arose across the course of the war, as described by Christopher Lawrence, "Continuity in Crisis, Medicine 1914–1945" in W.F., Bynum *et al.*, *The Western Medical Tradition 1800 to 2000*, (Cambridge: Cambridge University Press, 2006), p. 259.

³¹ J. Lorrain Smith, J. Ritchie, J. Dawson, "On the Pathology of Trench Frost-Bite," *The Lancet* 187, no. 4802 (11 September 1915): pp. 595–598; findings also referenced in Anon, "Trench Frost-Bite," p. 934.

Caused by prolonged standing in cold water or liquid mud in the trenches, and their onset hastened by tight boots, tight puttees, and everything calculated to interfere with the blood circulation.³²

Sloggett's order demonstrates that the 'exposure/circulatory' theory held by the majority of medical scientists had become part of official military medical understanding.

RAMC central authorities did not approve any particular medical system for trench foot and the investigation of prevention methods was left to medical researchers.³³ As the topic of prevention of foot conditions was fairly new to most medical scientists, they advanced highly experimental ideas and theories. Nevertheless, they promoted them with full vigour, and as medical historian Ian R. Whitehead argues, their process of experimentation enabled the emergence of a recommended preventative program.³⁴

The first focus of medical scientists, the replacement of puttees with socks, was accepted without dispute. The best recommendation was for soldiers to wear one pair of socks while keeping another dry in their kit.³⁵ Researchers further recommended that soldiers replace their service boots with sufficiently waterproof alternatives.³⁶ The Director of the Public Health Laboratory at the University of Manchester, Sheridan Delépine, promoted 'India-rubber stockings, waders, and

³² Arthur Sloggett, 1st Army: Diary of Director General of Medical Services, 11 November 1915, WO 95/44, The National Archives, London (TNA); Anon, "Measures Taken in France for the Prevention of Chilled Feet and Frost-Bite," *The Lancet* 187, no. 4819 (8 January 1916): p. 109; Atenstaedt, "Trench Foot," p. 285.

³³ Ian R. Whitehead, *Doctors in the Great War*, (London: Leo Cooper, 1999), pp. 166–167.

³⁴ *Ibid.*, p. 167.

³⁵ C. Nepean Longridge, "A Note on the Cause and Prevention of Trench Foot," *The Lancet* 189, no. 4872 (13 January 1917): p. 62.

³⁶ Whitehead, *Doctors in the Great War*, p. 231.

boots' as the most effective options.³⁷ The reasoning was that such footwear would stop the outside environment affecting soldiers' feet.

Once again, RAMC officials adopted medical researchers' recommendations, regardless of the fact that they could not provide any evidence of their methods' efficacy. Sir Arthur Bowlby, consultant surgeon to the 2nd Army, recommended special wading boots be provided for all troops, and by November 1915, provisions started to arrive at the front.³⁸ The *BMJ* recorded a 'considerable delay' in the development of foot conditions after the issue of 'rubber thigh boots,' and Bowlby recorded in April 1917 that these measures constrained cases in the 2nd Army to 600, compared to the 6000 the previous winter.³⁹

The Deputy Director of Medical Services (DDMS) of the 9th Army, Colonel Robert J. Blackham, wrote in his monograph *Military Sanitation* that:

these [different preventions] all had their share in saving to the divisional commander [sic] hundreds of trained men who might otherwise have found their way to the base with trench foot.⁴⁰

Medical scientists and military medical officials seemed entirely convinced of the efficacy of such prevention methods and so are many medical historians. Mark Harrison, Ian R. Whitehead, and Christopher Lawrence all argue that these measures both decreased the severity and overall incidence of foot conditions,

³⁷ S. Delépine, "Some of the Effects of Exposure to Wet Cold and Their Prevention," *BMJ* 2, no. 2868 (18 December 1915): p. 889.

³⁸ Harrison, *The Medical War*, p. 129.

³⁹ Anon, "Trench Frost-Bite," p. 933; Harrison, *The Medical War*, p. 129.

⁴⁰ Robert J. Blackham, *Military Sanitation: A Handbook for Soldiers*, (London: John Bale, Sons & Danielson, 1920), p. 7.

positing their success.⁴¹ When looking at statistical representations of the incidence of trench foot across the entire war this may be the case, as numbers of cases did gradually decline each year. However, not all divisions and armies recorded the same results.⁴² Harrison attributes these inconsistencies in the numbers of foot conditions in other armies to the 'many men' that were 'forced to occupy shell holes rather than proper trenches.'⁴³

Harrison's point highlights the often injurious nature of the environments many soldiers found themselves in. Even when the men did not have to occupy shell holes, allocation to a trench was not synonymous with safety from trench foot and some trenches were worse than others. The only way medical scientists could test their theories of prevention was in the trenches, and unfortunately these theories met with disaster in the most appalling parts of the front line.

If medical historians gave more credence to the voices of the soldiers who had firsthand experience of the prevention methods espoused by medical scientists, they may have drawn different conclusions about the success of these experiments. Soldiers tried to employ researchers' techniques but found themselves constantly battling the trench environment, to no avail. The alternative footwear promoted by medical scientists, such as gumboots, were of little use to most soldiers. Private R. Read of the London Regiment wrote that his gumboots regularly flooded.⁴⁴ Certain trenches were so muddy that the thick slush sucked soldiers' boots completely

⁴¹ Harrison, *The Medical War*, p. 129; Whitehead, *Doctors in the Great War*, p. 230; Lawrence, "Continuity in Crisis," p. 258.

⁴² Harrison follows the statistics Bowlby presented of the decrease from 6000 to 600 in the 2nd Army with the fact that there were still a record 23,000 cases in the 4th and 5th Armies, in Harrison, *The Medical War*, p. 129.

⁴³ Harrison, *The Medical War*, p. 129.

⁴⁴ Read, *Diary*.

under.⁴⁵ Lieutenant James Butlin of the Dorsetshire Regiment remembered 'when the Bedfords came to relieve us many of them literally stuck in the mud and had to be pulled out.'⁴⁶ Lance Corporal Ernest Sheard of the West Yorkshire Regiment recalled one particularly bad case during his time working as an orderly:

The man...had unfortunately got stuck in the mud, to get himself clear he was obliged to pull both his legs out of his rubber boots and had proceeded bare foot. It must have been torture to him every time he put a foot down, he was obliged to cry as he sat on the dug out steps...his feet were absolutely raw... when he left, the MO said he would not be surprised if the man did not lose both feet.⁴⁷

Gumboots caused more problems than they solved. Even when they did not flood, men's socks and feet were perpetually wet as the gumboots' rubber exteriors prevented sweat from evaporating.⁴⁸ As a result, men in gumboots often contracted trench foot faster than when they wore their service boots.

The men were glad to do away with puttees, which Private H.J. Youngman of the London Rifle Brigade viewed as 'a stupid piece of clothing.'⁴⁹ The recommendation that soldiers wear multiple pairs of socks on rotation was only useful when the weather was friendly. In constant rain, there was no way either the soldier or either pair of socks were going to stay dry. Lieutenant Butlin wrote 'the

⁴⁵ F.E. Harris, Diary, p.81, Private Papers of F.E. Harris, Documents 14979, IWM.

⁴⁶ James H. Butlin, letter to sister, 4 December 1915, Private Papers of Lieutenant J.H. Butlin, Documents 7915, IWM.

⁴⁷ Ernest Sheard, Diary, p. 363, Private Papers of E. Sheard, Documents 12021, IWM.

⁴⁸ B. Hughes, "The Causes and Prevention of Trench Foot," *BMJ* 1, no. 2890 (20 May 1916): p. 712.

⁴⁹ Youngman, Diary, p. 50.

weather was rather bad...in fact I never got dry again the whole time.'⁵⁰ The socks stored in soldiers' kits got as wet as those on their feet. Even when soldiers found reasonably dry dugouts and could take their shoes off to sleep, they often woke up to frozen boots, which they had no choice but to don. The natural warmth radiating from their feet turned the frost to water, soaking their socks.⁵¹ Their feet were wet, once again.

Many soldiers kept their boots, and their socks, on for weeks or months at a time. Corporal Percy Spong of the Royal Fusiliers recalled 'anytime, if you were in water, you didn't bother changing them [socks] you'd just leave them as they were.'⁵² By the time boots could be removed, the socks had disintegrated. Corporal George Singleton of the King's Liverpool Regiment had not taken off his boots 'from the time we left Aldershot...when we took our boots off...our socks come away [sic] in powder...just powder.'⁵³ Others found the inside of their boots as muddy as the outside. Private Frank Austin of the London Regiment (Queen Victoria's Rifles) remembered 'peeling my socks off and my legs were shining black with dirt.'⁵⁴ In these conditions, trench foot remained rife.

RAMC officials focused a great deal of attention on the practice of MOs working in the field. They hoped that their immediate presence in the trenches would guarantee soldiers implemented professionally prescribed preventions.

⁵⁰ Butlin, Letter to sister, 4 December 1915.

⁵¹ Sheard, Diary, p. 310.

⁵² Percy Spong, Oral History, Recording 24525, IWM.

⁵³ George Singleton, Oral History, Recording 24553, IWM.

⁵⁴ Frank Austin, Oral History, Recording 33293, IWM.

Medical Officers

To understand how medical officers (MOs) influenced prevention methods at the front, it is necessary to explain their intertwining roles as both doctors and army officers. MOs were meant to 'loom large as such in the eyes of the combatant officer and man,' and their purpose was to maintain the efficiency of the army by promoting the health and strength of the fighting men.⁵⁵ Historians G.D. Sheffield and Clare Rhoden both argue that British officers and soldiers worked through what they term a 'deferential bargain', in which officers, including MOs, held authority over the men.⁵⁶ This authority, or 'looming large', shaped the creation and reception of their medical preventions.

MOs, especially regimental medical officers (RMOs), positioned in the trenches, worked in forward areas practically implementing preventions. The RAMC deployed them to ensure recommendations, such as rubbing whale oil into soldiers' feet, became a reality.⁵⁷ On 16 January 1915, RAMC administration issued Army Routine Order 554, that stated whale oil should be rubbed on soldiers' feet and boots, and that all soldiers should attend foot inspections.⁵⁸ As front line doctors, MOs viewed their role, in this Order, as one of authoritative facilitators. They also trained combatant officers and non-commissioned officers (NCOs), often through

⁵⁵ DMS 1st Army Diary, April 1918, Appendix 10, WO 95/198, TNA.

⁵⁶ G.D. Sheffield, *Leadership in the Trenches: Officer-Man Relations, Morale and Discipline in the British Army in the Era of the First World War*, (London: Palgrave Macmillan Ltd., 2000), pp. 61–76; Clare Rhoden, "Another Perspective on Australian Discipline in the Great War: The Egalitarian Bargain," *War in History* 19, no. 4 (2012): pp. 445–446.

⁵⁷ Medical research that discussed foot inspections and the use of whale oil include C. Nepean Longridge, "A Note on the Cause and Prevention of Trench Foot," *The Lancet* 189, no. 4872 (13 January 1917): pp. 62–63; S. Delépine, "Some of the Effects of Exposure to Wet Cold and Their Prevention," *BMJ* 2, no. 2868 (18 December 1915): pp. 888–892; Anon, "The Etiology of 'Trench Frost-Bite,'" *BMJ* 1, no. 2825 (20 February 1915): pp. 352–353.

⁵⁸ DGMS Diary 1915, 19 January 1915, WO 95/44, TNA.

lectures, on the prevention of trench foot.⁵⁹ To MOs, their immediate presence ensured the largest number of men received proper care. Medical historian Robert L. Atenstaedt argues that this 'close surveillance' ensured the success of biomedical preventions.⁶⁰ Starting in the trenches, overseeing the majority of the men, RMOs dealt with immediate prevention of trench foot. Initial cases approached the RMO in the Regimental Aid Post (RAP), where they either received medical attention or, in more severe cases, were sent out of the line to the Field Ambulance (FA). Only on rare occasions did trench foot cases end up leaving the FA for the Casualty Clearing Station (CCS) or base hospital.⁶¹ All MOs, however, across all the various medical units in the field, worked as overseers, fulfilling their role in the 'deferential bargain'.

MOs, or most usually their medical orderlies under direction, performed the preventions for soldiers' feet. Many MOs thought that fatigue led to cases of trench foot, and so fed soldiers hot meals and drinks. RMO Captain Basil Hughes wrote to the *BMJ* from the front that he, and his other medical staff, gave soldiers 'stimulating hot drinks at night with a rum issue at stand-to in the morning,' arguing that by his adept supervision 'we might hope to get rid of the condition entirely.'⁶² This idea spread to numerous FAs across multiple fronts. MO Lieutenant Norman King-Wilson working at a FA in Gallipoli also stated that 'the rum and soup did wonders.'⁶³

As ordered, MOs supervised soldiers rubbing whale oil on their feet at RAPs, and severe cases were sent for more intensive medical care at the FA.⁶⁴ Officially,

⁵⁹ Whitehead, *Doctors in the Great War*, p. 230.

⁶⁰ Atenstaedt, "Trench Foot," p. 288.

⁶¹ Lawrence, "Continuity in Crisis," p. 255; Whitehead, *Doctors in the Great War*, pp. 181-217.

⁶² Hughes, "The Causes and Prevention of Trench Foot," p. 713.

⁶³ King-Wilson, Documents 12259, p. 30.

⁶⁴ Whitehead, *Doctors in the Great War*, p. 230.

they were supposed to conduct foot inspections daily, to ensure the oil provided a viscous barrier between the men's feet and their soggy socks, and the circulation of blood through the men's feet was increased by rubbing. RAMC General Headquarters (GHQ) shipped provisions of whale oil to MOs across the front, to maintain a constant supply. MO Captain Hughes stated that, when MOs treated cases of trench foot at an early stage, all visible symptoms subsided within 48 hours. However, if soldiers left their swollen feet for too long, moderate to severe cases resulted and the outcome was not as pleasant.⁶⁵

Despite this practice, men were still arriving at RAPs and FAs with feet far past general swelling.⁶⁶ When both medical scientists and army officials directed that all men with foot problems should see the medical officer at once, a large proportion of them did not. Soldiers themselves were aware that untreated trench foot often resulted in demobilisation or even amputation. Yet, some men clearly did not approach MOs when they presented with symptoms of cold feet.

As doctors, most MOs believed their most important duty was the compassionate treatment of suffering. MO Lieutenant King-Wilson was horrified by the state of men's feet, documenting that:

Ninety-five per cent of those evacuated were genuine cases...the nearer to the trenches, the worse the sights grew...[soldiers'] poor feet were swollen to double their normal size, blue and stone cold. The pain must have been frightful.⁶⁷

However, not all MOs presented with a compassionate attitude. Young RMOs had treated soldiers too leniently at the start of the war, sending an overwhelming number

⁶⁵ Hughes, "The Causes and Prevention of Trench Foot," p. 712.

⁶⁶ Anon, "The Treatment of Wounds in War," *BMJ* 1, no. 2992 (4 May 1918): p. 516.

⁶⁷ King-Wilson, *Diary*, pp. 30–32.

of men back through FAs to the CCS, and depleting manpower at the front. This detrimental 'Hippocratic' compassion led to changes in the RAMC that impressed upon RMOs the importance of strictness.⁶⁸ Lieutenant Charles Huxtable, RMO to the 2nd Battalion of the Lancaster Fusiliers, bemoaned that he could not show compassion towards the soldiers in his regiment because 'if you relax and give favours to one man you may get a flood of others.'⁶⁹ What stood in the way of many men being successfully treated for both trench foot and frostbite was the duty that the MO owed the army.

This duty was the role they fulfilled as officers. As stated above, there was both a real and perceived divide between them and the men. Further, as they worked through the RAMC, unlike doctors who had volunteered for services like the British Red Cross Society, they followed military orders from RAMC GHQ, which believed the MO's purpose was to send every man, fighting fit, back to front line duty.⁷⁰

Unfortunately, the unspecific symptoms of trench foot provided 'malingering' men with a perfect means to escape the trenches.⁷¹ Private Bert Sprason of the Royal Warwickshire Regiment recalled one man 'dipped his feet in water... his feet swelled up. Trench foot. Just to get a "Blighty" you see.'⁷² Foot conditions were not usually life-threatening so some feigned illness to avoid battle, or to be sent home. As GHQ were highly aware of this, they impressed the need for strictness during the

⁶⁸ Whitehead, *Doctors in the Great War*, p. 223.

⁶⁹ Charles Huxtable, Oral History, Liddle Collection, University of Leeds, in Whitehead, *Doctors in the Great War*, p. 223.

⁷⁰ Whitehead, *Doctors in the Great War*, p. 223.

⁷¹ The definition of malingering is 'symptoms invented or exaggerated for external gain', as described by Mark Turner, "Malingering," *The British Journal of Psychiatry* 171, no. 5 (November 1997): p. 409.

⁷² Bert Sprason, Oral History, Recording 32815, IWM.

assessment of various illnesses and conditions.⁷³ Even MOs themselves witnessed numerous cases of men either feigning or actually contracting foot conditions to avoid service.

This affected the way many MOs in forward areas treated foot conditions. Some no longer had time for 'trivial' medical problems, such as cold feet, because they lacked patience for treating malingerers.⁷⁴ Others knew it was their duty to send men back to the fray if they only presented with mild symptoms. MO Major E.S.B. Hamilton of the RAMC 7th Field Ambulance cursorily recorded his duties in his diary: 'feet inspection - more blisters pricked today.'⁷⁵ He then abruptly moved on to discuss other matters. Many personal diaries of MOs discussed foot inspections as an unnecessary chore.⁷⁶ MOs often presented a brusque or blunt façade (if in fact it was a façade). Undoubtedly, suffering soldiers did not appreciate this.

As the men were not privy to their doctors' orders, they did not understand why they were being treated in a curt and callous manner. When soldiers suffered painful ailments like foot conditions, they mostly thought of the discomfort they felt.⁷⁷ Soldiers associated the MO with care and relief from pain, so when they approached an officer who was pushing past strictness to cruelty, they quickly became disenchanted. Men often expressed disdain for the MOs. Private Harris sneeringly described rubbing his feet with whale oil 'under the eagle eye of Scotch Bob, the

⁷³ Whitehead, *Doctors in the Great War*, p. 223.

⁷⁴ Yet, in fact, trench foot was not a 'trivial' problem, with a total of 74,711 casualties and 41 deaths across the entire war, as described by Atenstaedt, "Trench Foot," p. 287.

⁷⁵ E.S.B. Hamilton, Diary, entry dated 23 October 1915, Private Papers of Major E.S.B. Hamilton MC RAMC, Documents 150, IWM.

⁷⁶ Examples of MOs describing foot inspections as a chore include: Bruce A. West, Diary, Private Papers of Captain B. A. West, Documents 537, IWM; Gerald E. Spicer, Diary, Private Papers of Captain G.E. Spicer MC, Documents 6904, IWM.

⁷⁷ In the cases where numbness was not present, as described by: John E. Davis, Oral History, Recording 18835, IWM.

battalion MO.⁷⁸ Medical orderly Lance Corporal Sheard only called for the RMO on special occasions:

The men preferred to accept our word rather than see him, and I was not surprised as he was in his way a bit of a rotter to the chaps, when their feet were in this state who wanted them prodding with a walking stick, it seemed a callous way of telling whether they were bad or not.⁷⁹

As most MOs treated men with foot conditions as 'time-wasters', some men thought doctors would categorise them amongst the malingerers if they sought assistance for a problem as 'insignificant' as cold feet.

Men complained about consistently being turned away for 'medicine and duty', discussing this phrase with a bitter undertone. Private Richard Gwinnell of the Gloucestershire Regiment recorded the death of his pal, bitterly writing in his diary 'his highness [RMO] condescended to examine the man,' and the diagnosis: 'the doctor gave him medicine and duty.' When, after a day had passed and the man was so unwell he was unable to walk, the RMO begrudgingly sent him to hospital where 'it was too late to do anything for him.'⁸⁰ Unsurprisingly, 'medicine and duty' became synonymous with doctors dismissing soldiers's complaints. When doctors sent men back to the front, it exacerbated the problem, leaving men far worse off than when they had first sought help. Bitter anecdotes, like Gwinnell's, spread among the men, breeding animosity.⁸¹ Ultimately, soldiers thought MOs did not listen and they did not care. The men Lance Corporal Sheard encountered thought these doctors 'really had too much of the Red Tape Business.' Consequently, he noted these men 'would not

⁷⁸ Harris, Diary, p. 81.

⁷⁹ Sheard, Diary, p. 353.

⁸⁰ Gwinnell, Diary, pp. 101–102.

⁸¹ Whitehead, *Doctors in the Great War*, pp. 224–225.

come [to the RMO] until they were forced, then it meant hospital, whereas a few days sooner in reporting sick would have saved a great deal of trouble.’⁸² Private Alfred Day of the Gloucestershire Regiment even referred to his RMO as ‘the old quack’.⁸³ Soldiers thought that doctors did not have the same lived experience as them, and evidently thought they did not understand the burdens men shouldered.⁸⁴

This lack of trust between the two parties affected the success of medical treatments and the severity of countless trench foot cases. Unquestionably, as the men discussed stories among themselves of extremely unsupportive MOs and subsequent amputations, they lost trust in front line doctors. Hence, soldiers found the most immediate way to treat their cold feet was to rely on their own initiative.

Soldiers’ ‘Folk Medicine’

Foot conditions were a painful affair. When Lieutenant Butlin received a teasing letter about his feet from his friend Basil he replied ‘stand for a week in mud and slush up to your knees nearly and see if your feet aren’t a bit funny in that time!’⁸⁵ Over one month later, his feet were still ‘horribly swollen and sore.’⁸⁶ When soldiers’ foot conditions grew worse, the excruciating pain drove men to tears. Private Morsley professed that ‘just after lights out is the worst time in a Hospital Ward,’ as ‘the boys

⁸² Sheard, Diary, p. 252.

⁸³ Albert Day, Oral History, Recording 24854, IWM.

⁸⁴ This was most definitely not the case. Most RMOs endured the same environment, and therefore the same medical conditions, as the men. Both Whitehead, *Doctors in the Great War*, p. 184, and Christopher Lawrence, “Continuity in Crisis,” p. 255, assert that approximately forty RMOs died per month.

⁸⁵ James H. Butlin, Letter to friend Basil Burnett Hall, 1 November 1915, Private Papers of Lieutenant J.H. Butlin, Documents 7915, IWM.

⁸⁶ James H. Butlin, Letter to friend Basil Burnett Hall, 4 December 1915, Private Papers of Lieutenant J.H. Butlin, Documents 7915, IWM.

with the frozen feet begin to cry and shout with pain.⁸⁷ Lance Corporal Sheard witnessed the men's pain first hand, before their feet were even bad enough to warrant being sent out of the line. He recalled at one sick parade:

The mens' feet were now turning a bluey colour and were very tender even to the lightest touch, toes were swollen and covered with a layer of greyish coloured skin...all the dirt and wool from the socks...was sticking to the sores... the aroma in the Aid Post was far from pleasant.⁸⁸

Soldiers did not approach trench foot lightly. They understood the repercussions of not seeking rapid and effective treatment, and they were aware of the intense pain such conditions caused, on the occasions they did not result in numbness. When medical researchers and MOs presented unachievable solutions, soldiers deadlocked in the trenches perceived the most effective response was relying on their own methods.

Unfortunately, unlike their preventative methods for lice, soldiers' preventions for foot conditions were resoundingly unsuccessful. When soldiers put off seeking medical treatment from trained personnel, they got cold feet. Yet, although they did not work , their methods show the collaboration and ingenuity that soldiers possessed in adverse conditions.

The lucky few, who thought to adapt MOs' methods to suit their immediate environment, mostly avoided serious foot conditions. Some men put their provisions of whale oil to good use. Corporal Alfred West rubbed oil onto his feet in a unique way. He placed a large portion into the toe end of his socks, sinking his feet into the

⁸⁷ Morsley, Diary, p. 44.

⁸⁸ Sheard, Diary, p. 349.

viscous liquid before replacing his boots.⁸⁹ Other soldiers capitalised on oils in general. When stuck in the trenches Private Leonard Davies of the Royal Fusiliers 'wore two or three pairs of socks and soaked them in oil or fat or grease, anything you can get hold of first.'⁹⁰ Private Austin also thought these techniques were unfailingly effective, proudly stating he never got trench foot or frostbite, as 'the water never got through that thick coating of vaseline.'⁹¹

The majority of men, however, were not so lucky with the outcome of their 'folk medicinal' preventions. The most immediate problem the men faced was their inadequate footwear. The men's service boots were often in shocking condition; falling apart from overuse or ill fitting from the start. They only received one pair of service boots when they enlisted, and because the boots were constantly in use they quickly fell into disrepair; the leather soles and uppers rotting in the damp conditions. Private Oliver Coleman of the RAMC 88th Field Ambulance returned to his billet most days 'with a very wet foot as my old boots take water like the devil.'⁹² If men could not afford new boots, either shipped from Britain or purchased through official army channels, there were few other avenues for a new pair. Many relied on having their boots repaired by the battalion cobbler.⁹³ Private Coleman's were repeatedly mended 'as I am unable to get new ones.'⁹⁴ Other men who had holes in their boots 'used to think sometimes the mud caked up on your [boots and] puttees kept out some of the

⁸⁹ West, Oral History, Recording 12236.

⁹⁰ Davies, Oral History, Recording 9343.

⁹¹ Austin, Oral History, Recording 33293.

⁹² Oliver Coleman, Diary, entry dated 10 November 1917, Private Papers of O. Coleman, Documents 3875, IWM.

⁹³ *Ibid.*, entry dated 10 November 1917.

⁹⁴ *Ibid.*, entry dated 13 November 1917.

cold.’⁹⁵ However, this hastened the onset of foot conditions. Consequently, men scrounged for second hand boots through unofficial channels. Coleman ‘secured an almost new pair of boots from the A.D.S. [Advanced Dressing Station] dump (salvage).’⁹⁶ Shockingly, one of his pals, Atkins, ‘yesterday got a pair from the same salvage dump and had to take a foot out of one of them.’ He wore them anyway.⁹⁷ Clearly, the men were desperate for well made, protective boots – it was imperative they kept their feet dry and clean.

Even when the men’s boots did not have gaping holes other problems arose. As discussed earlier, even where reasonably dry dugouts provided a space to rest, soldiers’ boots froze when they took them off to sleep. Men turned to their own methods of defrosting. Private Coleman ‘found our boots were frozen stiff — thawed same by candle.’⁹⁸ As the resulting wetness only increased the chances of contracting foot conditions Lance Corporal Sheard ‘soon learnt a thing or two and slept on them [boots], making them into pillows along with our tunics, this kept away the frost.’ His body heat ensured his boots were ready to wear when he awoke.⁹⁹

Some practices simply involved avoiding the water and mud as often as possible, which ultimately did not work. It was necessary to stand in the mud, and other times the techniques soldiers employed notified the enemy of their position. Private Fred Potter of the King’s Liverpool Regiment recounted:

On one occasion two or three of us joined together to stretch our
groundsheets from the parapet...to the parados...and there we were

⁹⁵ Day, Oral History, Recording 24854.

⁹⁶ Coleman, entry dated 23 October 1918.

⁹⁷ *Ibid.*, entry dated 23 October 1918.

⁹⁸ *Ibid.*, entry dated 19 December 1917.

⁹⁹ *Ibid.*, Diary, p. 310.

crouching under this thing on the fire step with our feet resting across the trench on the other side. When the commanding officer came along we got sound berated [sic] for sitting in that fashion because the groundsheets would give away our position. Apparently, standing in wet feet didn't matter!¹⁰⁰

Clearly, these men attempted to use available materials to avoid cold feet. Yet, as Private Christopher Cockburn of the Northumberland Fusiliers recalled, some soldiers' methods for combatting foot conditions 'were very bad,' which 'was standard with the wet, boggy ground...your feet was [sic] never dry.'¹⁰¹ Conclusively, it was a 'survival of the fittest.'¹⁰²

There were many issues that hindered the successful treatment of trench foot in the First World War. Ultimately, most men encountered foot conditions in one form or another. When medical researchers promoted experimental prevention techniques that did not work in the adverse trench environment, soldiers quickly found themselves literally and metaphorically stuck in the mud. Gumboots were sucked into the mire, and socks were perpetually wet. When their feet started smarting and presented early symptoms of foot conditions the soldiers that sought out the MO often received a less than warm welcome. Those that heard about this poor treatment were equally disenchanted with doctors. When all else failed, the men implemented their own prevention methods in the trenches, but the overwhelmingly injurious environment and the ease of contracting foot conditions resulted in men's feet becoming afflicted anyway.

Although no overarching, all-encompassing prevention method was effectively implemented, what is overwhelmingly evident is the development of two diverse

¹⁰⁰ Fred Potter, Oral History, Recording 379, IWM.

¹⁰¹ Christopher Cockburn, Oral History, Recording 9148, IWM.

¹⁰² West, Oral History, Recording 12236.

'systems of medical ideas'. Medical scientists' publications demonstrate biomedical practitioners' efforts to find uniform alternatives for the inadequate structural design of men's service boots and puttees. Medical scientists understood the adversity of the mud in the trenches. Yet trenches in many parts of the line were unquestionably far worse than medical scientists could imagine. Simultaneously, the surveillance of prevention by front line MOs left the soldiers feeling completely disenchanted and bitter. The soldiers themselves attested to the fact that such interventions were less than useful in their diaries, letters, and oral histories. They developed an alternate 'system of ideas' in the form of 'folk medicine'. The men's collaboration and reliance on available materials resulted in a set of methods completely different to those promulgated by medical researchers and MOs. Juxtaposition of the voices of medical personnel with those of soldiers reveals a dichotomous configuration.

Chapter Three

The Persistence of Mustard Gas

*'The weather was good, the trenches were dry, and everything was comfortable...suddenly a shell came over and it spit stuff at us...mustard gas...some men were crying and some were calling for their mothers...it starts to glue your flesh up together.'*¹

Captain Samuel Smith of the Cheshire Regiment could not understand why irritating rashes covered his skin in the summer of 1917. His hacking cough persisted for weeks. It seemed unshakeable. 'I thought I was getting better' he wrote to his sister, 'but today have had a sort of relapse and feel very cheap indeed.'² Friends and family back home sent numerous tonics and remedies to the afflicted captain, but nothing he tried seemed to work. 'What a nuisance I am!' he exclaimed: 'I hate being an invalid.'³ In quarters that looked like 'a quack doctor's booth on Blackpool sands,' after two months Smith realised the source of his problem.⁴ He lived in a poisoned dugout. Mustard gas poisoning caused numerous health problems for Smith, and clearly his 'life was not exactly a picnic.'⁵ Yet, his was only a mild case of poisoning.

¹ Percy F.A. Thomas, Oral History, Recording 35804, Imperial War Museum collections, London (IWM).

² Samuel H. Smith, letter to sister, 30 July 1917, Private Papers of Captain S.H. Smith, Documents 15947, IWM.

³ *Ibid.*

⁴ *Ibid.*

⁵ Samuel H. Smith, letter to sister, 12 Sept 1917, Private Papers of Captain S.H. Smith, Documents 15947, IWM.

The persistence of gas caused lasting problems for soldiers like Smith.⁶ The chemical agent lay active on surfaces for months, invisible and odourless, the initial scent of mustard long-since vanished.⁷ It endured on the surfaces of water-filled shell holes and muddy trenches. Unknowingly, men walked through contaminated areas, and the liquid chemical smeared onto their uniforms. It irritated, blistered, and burnt their skin through their clothes, and it soldered their eyes shut, blinding them temporarily with severe conjunctivitis.⁸ Such an invisible enemy induced fear and anxiety in the men. Gas masks had successfully combatted the chemicals used earlier in the war, but soldiers seemingly had no protection from the 'skin melting' effects of this new liquid concoction.

Chemical warfare has a history that can be documented back to ancient Greece. From that time until the outbreak of the Great War, various armies in various wars had attempted to leverage victory through chemical agents.⁹ The British Government discussed the application of chemicals in warfare in the decades before 1914. During the Crimean War, for example, it considering deploying sulphur fumes during the siege of Sebastopol.¹⁰ With the rise of the chemical industry in the mid-to-late nineteenth century, and mass production of toxic chemical compounds, there

⁶ Persistent gases are those that actively cover surfaces for extended periods of time, increasing the chance of accidental poisoning. For information on persistent gases see: Ladislaus Szinicz, 'Medical Aspects of Sulphur Mustard Poisoning', *Toxicology*, Vol. 214, No. 3 (2005), pp. 198–209; Ryan Mark Johnson, 'A Suffocating Nature: Environment, Culture, and German Chemical Warfare on the Western Front', (P.h.D. Thesis: Temple University, 2013).

⁷ Gases that irritate and blister the skin are known as vesicant agents; mustard gas is one derivative. For information on vesicant gases see: HQ Le; Knudsen, S. J., 'Exposure to a First World War Blistering Agent', *Emergency Medicine Journal*, Vol. 23 (2006), pp. 296–299; Vladimír Pitschmann, 'Overall View of Chemical and Biochemical Weapons', *Toxins*, Vol. 6 (2014), pp. 1761–1784.

⁸ Szinicz, 'Medical Aspects of Sulphur Mustard Poisoning', p. 198.

⁹ Ladislaus Szinicz, 'History of chemical and biological warfare agents', *Toxicology*, Vol. 214, No. 3 (2005), p. 167.

¹⁰ Frederic J. Brown, *Chemical Warfare: A Study in Restraints*, (Princeton, New Jersey: Princeton University Press, 1968), p. 7.

were increasing possibilities for the application of lethal chemical warfare.¹¹ Furthermore, technological developments in shells and artillery provided powerful new delivery systems. The Great War, therefore became the first conflict where massive quantities of lethal gas were employed as a strategic battlefield tactic.¹²

Although mustard gas was not the first chemical agent used, its introduction caused chaos. The Germans first used chlorine gas effectively at the Second Battle of Ypres, on 22 April 1915, and later that year the French introduced phosgene, but both gases were lethal suffocating agents.¹³ They affected the respiratory system and mildly irritated the eyes of soldiers directly hit by the gas cloud but they were non-persistent. Once the gas passed it was no longer an immediate threat, and the men could again breathe freely.

By 1917, the British believed they had gas prevention under control. Small box respirators were supplied as protective equipment to all soldiers.¹⁴ The men could then push through the German's gas attacks mostly unscathed. Paired with the anti-gas defence measures British soldiers practised in the trenches, 'gas lost its critical

¹¹ Pitschmann, 'Overall View of Chemical and Biochemical Weapons', p. 1763; The rise of the chemical industry, specifically in Germany, is described by Keith Suter, 'The Troubled History of Chemical and Biological Warfare', *Contemporary Review*, Vol. 283, No. 1652 (2003), pp. 161–162.

¹² Pitschmann, 'Overall View of Chemical and Biochemical Weapons', p. 1763.

¹³ Lung-damaging agents with a non-persistent nature are gases that solely affect the respiratory system, with some mild irritation of the eyes. They only present a threat in the immediate vicinity of the gas cloud, the chemicals do not linger on surfaces once the cloud has dissipated. For information on these types of gases see: Jonathan B. Tucker, *War of Nerves: Chemical Warfare from World War I to Al-Qaeda*, (New York: Anchor Books, 2007); The first attempt to deploy chlorine was at the Battle of Bolimów, but the frost froze the chemical, making it ineffective. For information on the use of chlorine gas, especially at the Second Battle of Ypres see: Szinicz, 'History of chemical and biological warfare agents', p. 167; French use of phosgene gas is described by Gerald J. Fitzgerald, 'Chemical Warfare and Medical Response During World War I', *American Journal of Public Health*, Vol. 98, No. 4 (2008), pp. 611–625.

¹⁴ Small box respirators, gas masks easily carried by soldiers, were fully issued to all soldiers by January 1917, as described by Edgar Jones, 'Terror Weapons: The British Experience of Gas and Its Treatment in the First World War', *War in History*, Vol. 21, No. 3 (2014), p. 360.

role.’¹⁵ So, on 12 July 1917, when the Germans unexpectedly dropped shells filled with mustard gas – dichlorethylsulphide – the complacent confidence of the British was shaken. Their ‘unconquerable’ gas prevention methods had failed.¹⁶

Dichlorethylsulphide is a blistering – or vesicant – substance. The colloquial name ‘mustard gas’ arose from the pungent smell produced when the gas shells hit the ground.¹⁷ According to *An Atlas of Gas Poisoning*, the ‘continuously irritant action’ of mustard gas caused dermal necrosis, in which ‘the skin and mucous membranes’ presented signs of ‘a progressive inflammation.’¹⁸ The gas severely burnt sweaty, warm patches of skin – namely the groin, underarms, and upper thighs – which turned ‘an angry red,’ followed by severe blistering.¹⁹ The gas also affected soft mucous membranes such as the eyes and respiratory tract. It caused ‘intense conjunctivitis’ while the ‘lining mucous membranes of the trachea and bronchioles,’ were ‘eventually destroyed and sloughed away.’²⁰ If death occurred, it was often from secondary bacterial infection, most usually septic broncho-pneumonia.²¹

Despite its name, mustard gas was in fact a liquid, which allowed it to settle across trench surfaces. Gas masks only prevented serious effects to the respiratory

¹⁵ Brown, *Chemical Warfare*, pp. 10–11; For information about anti-gas defence in the trenches see Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010).

¹⁶ Lewisite (chlorovinylarsine dichloride) was only introduced after the war. For details see: Szinicz, ‘History of chemical and biological warfare agents’, p. 167.

¹⁷ There were numerous other names for dichlorethylsulphide. For details see: Szinicz, ‘Medical Aspects of Sulphur Mustard Poisoning’, p. 198.

¹⁸ Medical Research Committee, *An Atlas of Gas Poisoning*, (France: British Expeditionary Force, 1918), p. 10; Dermal necrosis is the medical terminology for the death of skin tissue, as detailed in Robert L. Hutchison, ‘Frostbite of the Hand’, *Journal of Hand Surgery*, Vol 39, Issue 9 (2014), pp. 1863–1868.

¹⁹ Medical Research Committee, *An Atlas of Gas Poisoning*, p. 10.

²⁰ *Ibid.*, p. 10.

²¹ *Ibid.*, p. 10.

system, and further problems ensued when soldiers removed their masks, thinking mustard gas was like chlorine and phosgene gases and would quickly disperse.²² The strong whiffs of mustard odour did disappear soon after the shells exploded and it left no visual traces of its existence, so soldiers were completely unaware of its presence. Most unfortunately, its effects only manifested hours after the gassing occurred.²³ The result of this delayed reaction was long hours of inadvertent direct exposure and severe medical problems. Of the 180,100 British soldiers gassed in the war, 120,000 suffered from exposure to mustard gas.²⁴

Chemical warfare was a highly tactical means of waging war and the persistent nature of mustard gas meant chemically affected trenches were poisoned. Mustard gas affected soldiers through their surrounding environment, and this aligns it with medical problems like lice infestation and foot conditions, especially as it contaminated and filtered through uniforms.

Medical scientists did not place much credence on teaching soldiers about the role of uniforms in mustard gas poisoning. In mild cases, the liquid chemical penetrated the woven fabric, causing varying degrees of local irritation.²⁵ The *British Medical Journal (BMJ)* reported 'one severe case in which the gas caused blistering on the abdomen, scrotum, and thighs, although the man was fully clothed.'²⁶ Similarly, *An Atlas of Gas Poisoning* stated one soldier suffered intense burns as 'he

²² *Ibid.*, p. 30.

²³ Szinicz, 'Medical Aspects of Sulphur Mustard Poisoning', p. 198.

²⁴ Timothy C. Marrs, Robert L. Maynard, and Frederick R. Sidell, *Chemical Warfare Agents: Toxicology and Treatment*, (Chichester: John Wiley & Sons, 1996), pp. 139–140.

²⁵ Medical Research Committee, 'Reports of the Chemical Warfare Medical Committee: Gas Poisoning', p. 18, RAMC/2045: Box 426, Wellcome Library, London (WL); 'Report on a Gas Shell Bombardment of Ypres', 7 August 1917, WO 32/5176, The National Archives, London (TNA), in Jones, 'Terror Weapons', p. 362.

²⁶ 'Mustard Gas', *The British Medical Journal (BMJ)*, Vol. 2, No. 2956 (25 August 1917), p. 266.

was not washed afterwards nor was his clothing changed.'²⁷ Despite an awareness of the effects of gas contamination, medical scientists issued no orders for gassed men to remove their uniforms. This may have been an acknowledgement of the difficulty of removing uniforms after a shelling, because gas was often deployed as a prelude to an assault. Men needed to stay in their trenches with their clothes on, despite the fact this facilitated prolonged exposure to the blistering chemicals. When soldiers walked through contaminated trenches their boots tracked mustard gas into their dugouts and sleeping quarters, leading to the sorts of health issues experienced by Captain Smith.²⁸

This chapter argues that the contaminating effects of mustard gas provoked a different response to lice infestation and foot conditions. There was no explicit or implicit dialogue between medical scientists, medical officers (MOs), and soldiers in the trenches on the subject of gas. With lice and trench foot, the conversation was one-way, with biomedical preventions enacted upon the men published in forums such as the *BMJ* and *The Lancet*. Professionals did not adequately reflect on the outcomes of their own work, and did not listen to soldiers' responses to their preventions. Although they were unheard, soldiers freely offered critiques of these biomedical methods, and the failures of medical scientists served as a catalyst to the development of folk medicine preventions by soldiers in the trenches.

The tactical consequences of chemical warfare ensured a very different reception. Secrecy clouded the discussion and promulgation of prevention methods. Forums such as medical journals only rarely addressed the issue of mustard gas,

²⁷ Medical Research Committee, *An Atlas of Gas Poisoning*, p. 30.

²⁸ Medical Research Committee, 'Reports of the Chemical Warfare Medical Committee: Gas Poisoning', p. 4.

and discussion shifted towards anecdotal recounts and the study of specific symptoms.

Medical personnel were only able to combat a few of the symptoms of gas poisoning, and so were acutely interested in prevention.²⁹ Behind closed doors, medical professionals explored various options but quickly reached the conclusion that preventative measures were simply impossible to implement. No new countermeasures were issued at the front line.

This lack of prevention, and even of open discussion about mustard gas, had an immediate impact on soldiers' attitudes and actions. In this case, the overwhelming silence from the 'top' catalysed their responses. The difficulty front line MOs had in dealing with the consequences of gas poisoning exacerbated the issue. Their lack of experience with chemically induced burns and respiratory issues resulted in confused diagnoses and treatment problems that reinforced the bleak and frightening nature of the experience of gas.

This silence between medical professionals and the men influences the way academics discuss the men's reactions to chemical warfare. The works of Edgar Jones discuss the use of gas as a 'terror weapon,' and examine malingering.³⁰ Mark Harrison discusses 'gas neuroses', and Leo van Bergen argues that horror coloured both soldiers' and medical accounts.³¹ What all these works argue is that the horrific

²⁹ Leo van Bergen, 'The Poison Gas Debate in the Interwar Years', *Medicine, Conflict and Survival*, Vol. 24, No. 3 (2008), p. 175.

³⁰ Edgar Jones, 'Terror Weapons: The British Experience of Gas and Its Treatment in the First World War', *War in History*, Vol. 21, No. 3 (2014) pp. 355–375; E. Jones *et al.*, 'Psychological Effects of Chemical Weapons: A Follow-Up Study of First World War Veterans', *Psychological Medicine*, Vol. 38 (2008), pp. 1419–1426; Edgar Jones, Ian Palmer, and Simon Wessely, 'Enduring Beliefs about the Effects of Gassing in War: Qualitative Study', *BMJ*, Vol. 335, No. 1313 (2007), pp. 1–5.

³¹ Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010); van Bergen, 'The Poison Gas Debate in the Interwar Years', p. 175.

symptoms of chemical warfare, and the resounding lack of discussion on prevention methods, influenced the development of an immobilising fear of gas in soldiers. Yet, even though many men did experience an immobilising fear of gas, the examination of soldiers' 'folk medicine' disrupts the dominant historical narrative.

Gas Prevention Before 1917

Between 1915 and 1917, medical scientists did not dare place their methods for preventing gas contamination in open forums, such as medical journals, in case their German counterparts accessed them. Most chemical warfare discussion in journals, especially before the introduction of mustard gas, focussed on symptomatic studies and remedial intervention.³² Article titles ranged from 'What is the Gas?' (focusing on which gases affected which symptoms), to 'The Treatment of Gas Poisoning,' (exploring remedial intervention).³³ One article in *The Lancet* argued that the introduction of gas importantly influenced 'fresh considerations for medical treatment.'³⁴ Nowhere in the pieces did the authors address prevention. This contrasted the focus of most articles that filled medical journals during the war, which proffered preventions for most health issues, including both lice and foot conditions.

Yet, even though medical scientists did not discuss their early work on gas countermeasures in journals, they did focus on the establishment of prevention methods.³⁵ The Medical Research Committee created the Chemical Warfare Medical Committee, a separate branch under the direction of Sir Alfred Keogh, Director General of the Army Medical Service (DGAMS). The focus of the physiologists

³² van Bergen, 'The Poison Gas Debate in the Interwar Years', p. 175.

³³ Correspondence, 'What is the Gas?', *The Lancet*, Vol. 186, No. 4795 (24 July 1915), p. 198; J. D. Mortimer, 'The Treatment of Gas Poisoning', *The Lancet*, Vol. 185, No. 4789 (12 June 1915), p. 1262.

³⁴ Annotations, 'Poisons in Warfare', *The Lancet*, Vol. 186, No. 4793 (10 July 1915), p. 81.

³⁵ Jones, 'Terror Weapons', p. 365.

working in the Committee lay on the creation of respiratory protection, and after experimenting with various designs for gas masks, the final form the British settled on was the small box respirator. As its name suggested it was small in size, making it easy to carry and use. Separate eye and nose pieces generally stopped the glass goggles from fogging when the soldiers breathed.³⁶ Secrecy stopped professionals from discussing the development of such preventions in publications, but soldiers knew professionals were working on improving preventative methods because the masks were deployed on the front line. By 1917, British medical professionals thought their efforts had been successful. Gas masks, while still somewhat uncomfortable, were impervious to German gas attacks.³⁷

To deal with the myriad of issues associated with gas attacks, and the limitations of medical officers (MOs), the War Office, in consultation with physiologists and other medical scientists, resolved that specialist officers who understood the nature of gases and overall chemical warfare were needed.³⁸ It was hoped that various gas-specific roles across the ranks would ensure a comprehensive coverage of chemical safety. Aside from the physiologists and other medical scientists working in facilities in Britain, chemical advisors were attached to each of the armies in France.³⁹ They dealt with administration and liaised with the newly created divisional gas schools in Étaples, Rouen, and Havre, which provided

³⁶ H. Hartley, 'Report on German Chemical Warfare Organisation and Policy, 1914–1918', p. 7, WO 142/243, TNA.

³⁷ Tucker, *War of Nerves*, p. 18.

³⁸ Harrison, *The Medical War*, pp. 106–109; Lawrence, Christopher, 'Continuity in Crisis: Medicine, 1914–1945', in W.F. Bynum, Anne Hardy, Stephen Jacyna, Christopher Lawrence, and E.M. Tansey, *The Western Medical Tradition 1800 to 2000*, (Cambridge: Cambridge University Press, 2006), pp. 259–260; Ian R. Whitehead, *Doctors in the Great War*, (London: Leo Cooper, 1999), p. 242.

³⁹ Harrison, *The Medical War*, p. 107.

gas education for prospective gas officers and non-commissioned officers (NCOs).⁴⁰ Gas schools taught these officers about the chemical components of gases, the symptoms of poisoning, and after the lectures, the prospective gas officers walked through a sealed, chlorine-filled room with masks.⁴¹ This simulated, as closely as possible, the experience of gassing in the trenches. In the front line, while medical treatment was left to MOs, gas officers were each attached to a company, and were responsible for prevention and safety in the trenches.⁴² Their responsibilities included making trenches and dug outs 'gas ready', as well as training and protecting the men from gas attacks.⁴³ This training decreased gas-induced casualties, especially between 1915–1917. Ultimately, these front line duties show that the gas officer and NCO themselves served as a preventative measure in the trenches.

These numerous prevention methods mostly performed their protective duty, despite some minor underlying problems.⁴⁴ The introduction of mustard gas completely changed the way the British medical scientists and soldiers formulated understandings of gas prevention in the trenches.

⁴⁰ Lovatt Evans, Draft for Orders on Lectures — Defensive Measures Against Gas Attacks, "Lectures on Gas Defence," PP/CLE/A.3, WL; Lovatt Evans, Letter from RAM College to Headquarters Northern Army, 11 May 1916, "Lectures on Gas Defence," PP/CLE/A.3, WL; Jones, "Terror Weapons," p. 365, states that later schools were opened at Calais, Boulogne, and Abbeville.

⁴¹ Charles Lovatt Evans, Letter from RAM College to Headquarters Northern Army, 11 May 1916, 'Lectures on Gas Defence Millbank Correspondence 1916, Starling 1/C', Contemporary Medical Archives Centre, PP/CLE/A.3, Wellcome Library, London (WL).

⁴² Lovatt Evans, Letter from RAM College to Headquarters Northern Army, 11 May 1916, 'Lectures on Gas Defence', PP/CLE/A.3, WL.

⁴³ Harrison, *The Medical War*, pp. 106–109.

⁴⁴ The works of Edgar Jones, "Terror Weapons: The British Experience of Gas and Its Treatment in the First World War," *War in History* 21, no. 3 (2014): pp. 355–375; and Edward M. Spiers, *Chemical Warfare*, (London: Macmillan, 1986), provide in depth information about the minor problems associated with gas masks, and more importantly with soldiers' gas training.

Mustard Gas and Medical Scientists

In seeking to deal with the new problems presented by mustard gas, medical scientists looked beyond gas masks but continued to see prevention as key. Behind closed doors, liaising with the War Office, medical scientists began designing rudimentary 'proto-hazmat' suits, using the uniform itself to stop contamination. War Office memoranda and The Chemical Warfare Medical Committee reports, unpublished until later the war, recorded experiments with protective clothing that aimed to block gas from seeping onto the men's skin. Some prototypes employed oxidised resins and oils to modify the structure of the woollen uniforms to neutralise the effects of the vesicant agent.⁴⁵ With the United States now in the war, American medical scientists joined the effort to find a prevention and experimented with emulsions and creams for the skin, made from the same oxidised substances used for 'proto-hazmat' suits.⁴⁶

There were, however, problems with these preventions. The Chemical Warfare Medical Committee noted that oxidised resin creams, like the chemical powders implemented for lice, burnt and irritated the skin on direct contact, and their anti-gas qualities only lasted for, at most, 24 hours, leading professionals to question their efficacy.⁴⁷ 'Proto-hazmat' suits were also found to be uncomfortable and ineffective.⁴⁸ The role of chance in gas attacks, and the invisibility of mustard gas contamination, meant that men testing the hot and heavy protective suits found them more of a

⁴⁵ 'Protection against Dichlorethylsulphide by Means of Special Clothing', p. 1, WO 142/108, TNA; common mixtures of oxidised resins and oils are discussed by Medical Research Committee, 'Reports of the Chemical Warfare medical Committee: Gas Poisoning', p. 11.

⁴⁶ Medical Research Committee, 'Reports of the Chemical Warfare Medical Committee: Gas Poisoning', p. 11.

⁴⁷ *Ibid.*, p. 11.

⁴⁸ 'Protection against Dichlorethylsulphide by Means of Special Clothing', p. 1, WO 142/108, TNA.

hindrance than a help.⁴⁹ Because men wearing the suits sweated heavily, if the vesicant agent penetrated the fabric, the burns they received were worse than the ones they suffered in their regular uniform.⁵⁰ This excess sweat also increased the likelihood of contracting other medical conditions, like trench foot. Consequently, researchers in The Chemical Warfare Medical Committee did not advise the implementation of these preventions at the front, and soldiers received no protection from the blistering effects of mustard gas.⁵¹ Furthermore, the secrecy that clouded medical scientists' decisions meant wider medical forums such as the *BMJ* and *The Lancet* did not discuss prevention methods. Most journals only alluded to the creation of preventative gear, as the closing remarks of noted chemist and gas specialists. H.D. Dakin wrote in the *BMJ* that, 'reference *must* be made to an extremely important branch of biochemical work', yet for 'obvious' reasons 'little can be said.'⁵² Medical scientists like Dakin thought that their colleagues needed to know they were producing something, in case the medical community thought they were avoiding their professional duty. Yet, secrecy was still paramount.

As a result, when both sides introduced mustard gas, very few journal articles discussed it at all. Firstly, its late introduction meant medical scientists had less time to research such a new addition, let alone publish their findings on symptoms and remedial intervention. Secondly, even when these scientists conclusively proved the reliability of their research, the nature of chemical warfare, and the particularly unique

⁴⁹ *Ibid.*, p.1.

⁵⁰ Medical Research Committee, 'Reports of the Chemical Warfare Medical Committee: Gas Poisoning', p. 9.

⁵¹ In the Second World War the British introduced gas capes, and even in the First World War the Americans used 'proto-hazmat' kit, like rubber boots, gloves and coats. The British did not. As described by Charles E. Heller, *Chemical Warfare in World War I: The American Experience, 1917–1918*, Leavenworth Papers, No. 10 (Fort Leavenworth: Combat Studies Institute, 1984), pp. 67–68, in Jones, 'Terror Weapons', p. 362.

⁵² H.D. Dakin, 'Biochemistry and War Problems', *BMJ*, Vol. 1, No. 2947 (23 June 1917), p. 833.

nature of mustard gas, meant publishing such findings may have proved disastrous for the British war effort. Hence, only two articles specifically addressed the medical aspects of mustard gas.⁵³ The first was short and vague. It relayed an anecdote of a soldier gassed in the front line, while the second, published towards the end of the war, examined the symptoms of mustard gas poisoning in more detail.⁵⁴ Most medical scientists published their research in journals when conflict ceased, and secrecy was no longer an immediate issue. The fact that there were so few open publications during the war mirrored the secrecy that clouded the creation of prevention methods. Only very specific audiences had access to information on mustard gas, leaving a resounding silence across most of the medical community.

Medical Officers and Gas Officers

The failure of medical scientists to find an answer to mustard gas left medical officers (MOs) with limited tools to deal with the issue. The secrecy attached to mustard gas left them without access to the scholarly literature that had hitherto helped them understand battlefield ailments. Medical historian Ian R. Whitehead rightly argues that ‘such guidance was essential’ as most MOs were entirely unfamiliar with the problems of mustard gas.⁵⁵ What awareness they had came from snippets of classified information relayed to them from medical scientists working in the Chemical Warfare Medical Committee. Only the Assistant Director of Medical Services (ADMS) and the Deputy Assistant Director of Medical Services (DADMS) received comprehensive theoretical instruction on chemical warfare.⁵⁶ Other MOs

⁵³ Across the *BMJ* and *The Lancet*.

⁵⁴ The only two British journal articles that specifically discuss mustard gas are: ‘Mustard Gas’, *BMJ*, Vol. 2, No. 2956 (25 August 1917), p. 266; ‘War Gas Poisoning’, *BMJ*, Vol. 2, No. 3006 (10 August 1918), pp. 138–139.

⁵⁵ Whitehead, *Doctors in the Great War*, p. 166.

⁵⁶ Whitehead, *Doctors in the Great War*, p. 168.

attended a five-day lecture series that taught them how to use gas masks and examined certain medical aspects of chemical warfare, but this was the extent of the practical training they received.⁵⁷ One publication exclusively published for MOs, that was widely read, was *An Atlas of Gas Poisoning*, which had been published with 'the permission of the Director-General of Medical Services, B.E.F. [British Expeditionary Force].'⁵⁸ While compiled exclusively for MOs, its immediate usefulness in the trenches was limited. The work, for example, illustrated 'only the chief features in the pathology of the lesions produced by the Enemy Gas.'⁵⁹ The Atlas noted its own limitations, providing, at best, an education 'for Officers who are not already familiar with the subject by experience in the field.'⁶⁰

Many MOs expressed confusion when presented with gas-related casualties. Often, MOs identified the wrong chemicals in attacks and consequently proffered incorrect diagnoses.⁶¹ The *BMJ* article 'War Gas Poisoning' documented that the 'mixture of shells' the Germans deployed severely influenced a front line doctor's ability to diagnose 'the symptoms reported by patients,' stating that they were 'very confusing.'⁶² Also, as front line doctors located themselves in their quarters back down the communication trench from the soldiers, they were too far away to limit exposure when gas shells dropped.⁶³ Lieutenant C.D. Douglas, physiologist and The

⁵⁷ Lovatt Evans, Letter from Colonel Horrocks, November 1915, 'Lectures on Gas Defence', PP/CLE/A.3, WL; Lovatt Evans, Letter from S. Herbert Clark to Major Starling, 13 June 1916, 'Lectures on Gas Defence', PP/CLE/A.3, WL.

⁵⁸ Medical Research Committee, *An Atlas of Gas Poisoning*, p. 1.

⁵⁹ *Ibid.*, p. 1.

⁶⁰ *Ibid.*, p. 7.

⁶¹ Jones, 'Terror Weapons', p. 365.

⁶² 'War Gas Poisoning', p. 138.

⁶³ The British Medical Association, *British Medicine in the War, 1914–1917*, (London: The British Medical Association, 1917), p. 124.

Chemical Warfare Medical Committee's consulting gas pathologist recalled 'that nearly all medical officers are terrified of the mere mention of gas poisoning.'⁶⁴ When soldiers already had little trust in MOs, it was disheartening that they had problems diagnosing and treating gas poisoning.

When mustard gas shells started flying across no-man's land in 1917, the problems gas officers and NCOs faced grew worse. Gas officers had listened in lectures and provided adequate assistance in the trenches during suffocating gas attacks, but could no longer prevent gas poisoning. Soldiers recorded many instances where prevention did not go according to plan. Corporal Ivor Watkins of the Welsh Regiment noted that the death of his battalion's sole gas officer meant that nobody sounded the gas gong during an overnight attack.⁶⁵ The mustard gas filtered down into the cellars where the men slept, and consequently, by morning all of the sleeping soldiers were temporarily blind, their eyes 'burning like hell.'⁶⁶ Another instance recalled by Captain Barclay Buxton of the Duke of Wellington's Regiment was the appointment of a gas officer to his battalion, but 'of course, the difference between this [mustard gas] and ordinary gas,' was that 'when the ordinary gas came over you saw the cloud coming and you saw it go.'⁶⁷ Gas officers were no longer able to predict when the men could safely remove their helmets. The persistent vesicant nature of mustard gas overrode gas officers' skills and training.

If most medical scientists and front line MOs did not know about the secretive prevention methods explored behind closed doors, and the work of gas officers no longer provided adequate protection, the soldiers fighting at the front certainly did not

⁶⁴ C. G. Douglas, letter to A. B. Soltau, 13 March 1918, WO 142/104, TNA.

⁶⁵ Ivor Watkins, Oral History, Recording 12232, IWM.

⁶⁶ *Ibid.*, Oral History, Recording 12232.

⁶⁷ Barclay Buxton, Oral History, Recording 299, IWM.

know what to expect. This influenced their understandings of, and reactions to, mustard gas.

Soldiers' Responses

'Rumour that Fritz is using a new gas which eats through the helmet and blinds one,' Private Oliver Coleman of the 88th Field Ambulance wrote in his diary.⁶⁸ The fear of mustard gas, born from bitter experience, shows up in men's personal records. Lance Corporal Ernest Sheard of the West Yorkshire Regiment documented the fear his pal Simons felt. Every time he heard the gas horn sound 'he began shaking like a leaf...he was absolutely afraid of gas after his experience on the Somme.'⁶⁹ The sights and sounds of these frightened men were etched into most soldiers' memories. For Private Reg Coldridge of the Devonshire Regiment, the memory of 'one poor chap' never left him. He 'was crying cause he couldn't find his gas mask when it was hanging around his neck.'⁷⁰ Other men claimed it was the shock and suddenness of gas attacks that made them fearful. Lance Corporal Percy Thomas of the King's Royal Rifle Corps recalled that when 'the weather was good, the trenches were dry, and everything was comfortable,' it was terrifying when 'suddenly a shell came over and it spit...mustard gas.' He recalled 'it starts to glue your flesh up together.'⁷¹ The terrible experiences in these recollections show it was not surprising that soldiers responded to mustard gas with fear.

The men's descriptions of the truly horrific symptoms they endured also present a shocking picture. The poisoned body of Corporal Alexander Burnett of the Royal Scots Fusiliers came out 'in big blisters in between the legs, round the bottom

⁶⁸ Coleman, Diary, entry dated 27 July 1917.

⁶⁹ Ernest Sheard, Diary, p. 276, Private Papers of E. Sheard, Documents 12021, IWM.

⁷⁰ Reg Coldridge, Oral History, Recording 24864, IWM.

⁷¹ Thomas, Oral History, Recording 35804.

and under the arms.⁷² Often poison-filled blisters broke and became infected over and over, scarring the skin of affected soldiers. Corporal Percy Webb of the Dorsetshire Regiment had 'great holes in my back as big as an [sic] half crown.'⁷³ Private Horace Manton, who picked up a contaminated sack, did not feel the gas seep 'right through [his] clothing,' only discovering his plight when he too felt 'every bit of skin come off' his back.⁷⁴ It was not unusual for soldiers to hear stories of their injured pals, and the details surrounding their wounds did not ease their anxiety about mustard gas.

Unsurprisingly, this fear, mixed with an undertone of anger, coloured the men's reflections on the lack of professional prevention methods. Captain Buxton stated that 'they didn't give us any other protection, our gas masks only protected the face,' and when professionals did not educate the men on the conjunctivitis produced by mustard gas their responses were bitter and fearful.⁷⁵ For Corporal Watkins, losing his sight 'was the most terrifying experience' he ever had. He was 'only nineteen at that time.'⁷⁶ Often men lashed out at their MOs for failing to provide adequate assistance, as did Lance Corporal Thomas who snapped at his MO, Mr. Jackson, saying 'you ought to have been here, you'd have been in a worse pickle.'⁷⁷ Soldiers' felt the lack of medical preventions strongly, and detailed their emotional responses in their diaries, letters, and, later, in their oral testimonies. These emotions

⁷² Alexander Burnett, Oral History, Recording 8342, IWM.

⁷³ Percy Webb, Oral History, Recording 578, IWM.

⁷⁴ Horace Manton, Oral History, Recording 9756, IWM.

⁷⁵ Buxton, Oral History, Recording 299; Richard Gwinnell, Diary, p. 129, Private Papers of R. Gwinnell, Documents 11601, IWM: 'we were continually putting on our respirators, but not always soon enough'.

⁷⁶ Watkins, Oral History, Recording 12232.

⁷⁷ Thomas, Oral History, Recording 35804.

understandably shape most scholarly works, yet, historians have not examined all of the reactions the fear of gas catalysed in the men.

Two major responses to mustard gas that have drawn historical attention are gas neuroses and malingering, the latter being most prevalent when the symptoms of suffocating gas could be easily mimicked. Historians like Edgar Jones, Mark Harrison, and Leo van Bergen all posit that soldiers felt they had little hope because there was little they could do to prevent the pain and terror of mustard gas attacks.⁷⁸ Many men experienced both gas neuroses or used gas as an excuse to mangle and the consequences of fear endured, for some, many years after the war's end. Yet, the focus on these reactions in academic literature presents problems when investigating efforts at mustard gas prevention. Often this discourse of immobilising fear overlooks, and hence downplays, the men's ability to endure the harsh conditions in the trenches. It underestimates their strength in adversity. Lance Corporal Sheard recalled, after his 'first experience of dealing with a mutilated body,' that he was 'never afraid of handling such cases again.'⁷⁹ Corporal George Singleton of the King's Liverpool Regiment said 'death and destruction was nought...you could get used to anything, and you got used to that.'⁸⁰ This attitude nuances the academic argument that both gas neuroses and malingering were the two most prevalent reactions to gas. In fact, they only provide a facet of the men's reactions.

There are also further issues with the historiography of chemical warfare's connection between neuroses, malingering and mustard gas. As early as 1915, the Deputy Director General of Medical Services (DDGMS) had realised the connection

⁷⁸ Harrison, *The Medical War*, p. 109; van Bergen, "The Poison Gas Debate in the Interwar Years," p. 175–176; Jones, "Terror Weapons," pp. 362–364.

⁷⁹ Sheard, *Diary*, p. 65.

⁸⁰ George Singleton, Oral History, Recording 24553, IWM.

between gas poisoning and soldiers making excuses to malingering.⁸¹ By 1917, medical personnel had evacuated 58 per cent of gas casualties to Britain, causing a severe decrease in front line manpower.⁸² This spurred new forward methods for treatment, that no longer shipped gassed soldiers straight back to Britain, and instead immediately sent all gas casualties to Not Yet Diagnosed Gas Centres. Serious cases were evacuated to Casualty Clearing Stations (CCS) that had attached gas specialists.⁸³ The *BMJ* documented that gas patients who were 'making good progress' were 'returned as soon as possible to army discipline.' The reason was the belief that 'prolonged stay in hospitals, either primary or auxiliary,' particularly exaggerated unshakeable 'neurotic conditions.'⁸⁴ Neither malingerers or gas neurotic soldiers no longer had an easy ticket home. Further, the symptoms of mustard gas poisoning were almost impossible to feign. This meant potential malingerers were unable to mimic mustard gas poisoning to get back to Britain. When Corporal Burnett experienced mustard gas poisoning he knew 'there was no question of me being sent back...you just got used to it.'⁸⁵ Similarly, Private James Watson of the Northumberland Fusiliers exclaimed he 'never got a Blighty, never!'⁸⁶ Hence, the overwhelming emphasis on both gas neuroses and malingering in academic discourse, albeit important, is potentially not as significant post-1917 for the study of mustard gas.

⁸¹ Whitehead, *Doctors in the Great War*, p. 242.

⁸² C.G. Douglas, 'Note on the Invaliding Factors amongst Casualties Caused by Di-chloro-ethyl-sulphide', 10 January 1918, p. 1, WO 142/102, TNA.

⁸³ Whitehead, *Doctors in the Great War*, p. 242.

⁸⁴ 'War Gas Poisoning', p. 139; malingering was also considered a 'neurotic condition' by medical personnel, as described by Mark Turner, 'Malingering', *The British Journal of Psychiatry*, Vol. 171, No. 5 (November 1997), pp. 409–411.

⁸⁵ Burnett, Oral History, Recording 8342.

⁸⁶ James W. Watson, Oral History, Recording 11040, IWM.

What comes to the fore in the front line soldier's experience, then, is another reaction that the fear of gas catalysed in the men. This response to mustard gas, unexplored by academics, was in fact extremely mobilising, and surprisingly preventative rather than remedial. Like lice infestations and foot conditions, soldiers practised 'folk medicine'. Importantly, this problematises the existing historiographical orthodoxy on soldiers' reactions to mustard gas, and provides a new response to the role of preventative medicine in chemical warfare.

As established, the men in the trenches did not have any professional guidance to help them create their own preventions for mustard gas. The men had also seen how ineffective the medical scientists' methods for lice and foot conditions had been, and expanded and improving on medical scientists' ideas, or used their failure to contrive contrasting procedures. With mustard gas, the silence of medical scientists, and the lack of available materials in the trenches to protect against the blistering power of mustard gas, meant protective options were few and far between. The men did, however, create what they saw as preventative methods. Their 'folk medicinal' practices had varying degrees of preventative success, but like trench foot, it is not efficacy that is the important measure. What is important is that soldiers again relied on their own system of ideas.

Working as a medical orderly on the western front, Lance Corporal Ernest Sheard built on existing medical responses to gas attacks when creating his prevention methods. It was well known that MOs treated gassed men by placing ammonia phials up their nostrils. Many soldiers, such as Lance Corporal Thomas, recalled their MO, 'came round with phials of ammonia, and you'd stuff 'em up your nose,' getting 'another dose of gas.'⁸⁷ The ammonia worked to counteract and

⁸⁷ Thomas, Oral History, Recording 35804.

neutralise the chemicals used in gas attacks, and cleared soldiers' airways, allowing them to breathe more easily.⁸⁸

Sheard appropriated ammonia phials for a preventative purpose. When mustard gas shells dropped, he broke them around the corners of the gas-protected medical quarters, while simultaneously wearing his gas mask.⁸⁹ Sometimes he 'made little progress' with his work because 'the glasses in our masks were continually getting bleared with moisture.'⁹⁰ But by breaking the ammonia phials, Sheard thought he had a small chance of neutralising the air and avoiding burns and poisoning in those moments when he and his fellow orderlies had to 'take our masks off.'⁹¹ It had been seen to work effectively for suffocating gases, and so he carried on using it for mustard attacks, though it can be assumed that its efficacy most likely dwindled. Sheard thought, however, that it was better than not doing anything at all.⁹²

Scottish Regiments, and other regiments who persisted with wearing kilts in the trenches, faced a unique problem when mustard gas was present. Their uniforms allowed the chemical to quickly reach unprotected and sweaty areas of their bodies. Private Horace Manton of the London Regiment, a self proclaimed 'proud Lutonian,' was drafted out to the London Scots Brigade, as 'so many of them had left and they needed anybody to fill the ranks.'⁹³ While serving with their brigade he had to wear a kilt, temporarily replacing his usual trousers.⁹⁴ A draughty kilt with nothing underneath was a problem in the poor trench conditions, but it was very risky when mustard gas

⁸⁸ Medical Research Committee, *An Atlas of Gas Poisoning*, p. 18.

⁸⁹ Sheard, Diary, Documents 12021, pp. 276–279.

⁹⁰ *Ibid.*, p. 279.

⁹¹ *Ibid.*, p. 279.

⁹² *Ibid.*, pp. 276–279.

⁹³ Manton, Oral History, Recording 9756.

⁹⁴ *Ibid.*

shells began dropping. The threat of the blistering effect of the gas 'going onto their private parts' influenced the men to wear 'bloomers...like ladies ones from the old days,' under their kilts.⁹⁵ They hoped the bloomers would provide a protective layer between potentially gas-affected environments and their groins. Obviously, like other items of men's uniforms, the gas went straight through the bloomers, but the men still used them as a form of protection.

Other men relied on their knowledge of chemistry to prevent gas poisoning. Signaller George Robinson of the Royal Engineers recalled his reaction to mustard gas attacks while out of the line. As he was not part of a combat unit, he recalled that most of the men in his brigade had lost their gas masks, and he himself frequently left his gas mask in the camp.⁹⁶ With mustard gas, he presumed that masks provided limited protection. In the 'scrappy, nasty part of war,' he also turned to his own solutions: 'I thought: we'll get out of this...get out to the fields.'⁹⁷ There, he cleverly climbed a tree as the 'gas was heavier than air you see,' and the effects of the liquid reached only 'seven or eight feet at the most.'⁹⁸ In this way, Robinson escaped the attack. Although he may have had issues with the persistence of mustard gas upon leaving the tree, he did not remember experiencing any symptoms of poisoning.

Robinson's preventative method did not come without consequences though. He understood that 'if I'd been with an officer I'd have been shot!'⁹⁹ Clearly this conveys the seriousness of avoiding duty. Robinson's awareness shows that men who tried anything to prevent gas poisoning knew the risks such methods presented.

⁹⁵ *Ibid.*

⁹⁶ George E. Robinson, Oral History, Recording 11269, IWM.

⁹⁷ *Ibid.*

⁹⁸ *Ibid.*

⁹⁹ *Ibid.*

For these soldiers, the choice of avoiding poisoning in the face of a coward's death evidently reveals the necessity of escaping the horrific fate mustard gas had in store. The men had clear priorities.

While mustard gas posed an extreme threat for the overall British war effort, it changed the way professional gas prevention and intervention was conceived and conducted. As chemical warfare was an intrinsic tool of the military, strict secrecy shrouded its experimentation and information processes. Ultimately, when medical scientists decided not to implement any preventative measures for mustard gas in the trenches front line medical personnel, who were used to such direction, were rattled. In turn this shook the British army's reliance on preventative medicine.

In scholarly journals, medical discourse shifted focus towards symptomatic studies and remedial intervention. More often, however, articles did not discuss chemical warfare at all, in terms of either prevention or intervention. Evidently, MOs could no longer rely on these sources of medical knowledge to treat gas poisoning, and often subsequently misdiagnosed chemical injuries. So, the instalment of gas specialists across the ranks aimed to prevent men succumbing to poisoning. These officers, however, faced just as many problems as MOs, and the introduction of mustard gas completely overrode their skills and training.

This lack of professional preventions, and even the lack of open discussion about mustard gas, naturally instilled fear and anxiety in the soldiers. Yet, unlike most historiography, which poses that men's emotional responses spawned two forms of immobilising fear: gas neuroses and malingering, it also fostered another response. The men created their own preventative methods. Even though this response was often driven by fear or anxiety it was not immobilising. In fact, it actively worked to present solutions that most medical personnel could not provide. By examining this

response, not only does it trouble existing historical narratives, it also definitively conveys that two systems of medical ideas were at play in the trenches. While medical scientists worked on 'top down' gas safety methods, soldiers practised their own 'folk medicine' in the trenches.

Conclusion

The View from Below

*'There was hardly anybody who could understand the misery of it all. You can't imagine unless you experienced it. It was really quite frightening.'*¹

When reflecting on his time in the British army, Gunner Tom Brennan of the Royal Garrison Artillery remembered as clear as day that preventative biomedicine was 'severe.'² When he succumbed to trench foot, he was just like the 'hundreds of chaps with the same thing' in the clearing station at which he arrived. Brennan was snide about the medical professionals who, despite the multitudes of suffering men, 'were going to punish chaps that had trench feet, because they issued whale oil, and you were supposed, every night, to rub your feet with whale oil.'³ This oral testimony reveals the bitter regard numerous soldiers felt for preventative biomedicine. What Brennan felt, like many soldiers who found themselves in a similar position, was that medical researchers and practitioners did not reflect on the prevention methods they promoted, nor did they listen to the responses of the men in the trenches. Brennan contested that 'there was no way' of rubbing whale oil onto their feet every night, even when they were out of the front line. 'One provision in a tent with about six or eight other fellows you couldn't possibly manage it.'⁴ This view 'from below' shows that soldiers thought there were issues with biomedical preventions.

¹ John E. Davis, Oral History, Recording 18835, Imperial War Museum collections, London (IWM).

² Tom Brennan, Oral History, Recording 24534, IWM.

³ Brennan, Oral History, Recording 24534.

⁴ Brennan, Oral History, Recording 24534.

Yet, most medical histories focus on the overall efficacy of medicine in the First World War.⁵ With a dominant narrative describing the conflict as the first in which more soldiers died of wounds than of disease and contamination, and an abundance of available supporting statistics, it is easy to see why most historical works focus on the apparent achievements of British military medicine. Medical historian Mark Harrison states that the 113,000 deaths from disease compared to the 167,000 deaths from wounds, meaning a ratio of success of 0.68:1.⁶ Similarly, Christopher Lawrence uses the rise in RAMC figures from 20,000 medical workers of all ranks in 1914, to 13,000 officers and 154,000 other ranks by the end of the conflict, to imply correlation with the 93 per cent of sick and injured returned to 'some form of military duty.'⁷

With such strong and clear voices of wartime medical scientists and doctors to be found in dominant medical records, the story painted often seems to be one of success. When examining the 'big picture' of medical prevention and intervention across the entire war this may be the case. Yet, as biomedical models mostly relied on statistics and numbers to represent success in such a rapidly changing and chaotic environment as a theatre of war, their conclusions did not always present the full story, and therefore neither do most historians. They both neglect the voices of

⁵ Roger Cooter, "War and Modern Medicine," in *Companion Encyclopedia of the History of Medicine*, vol. 2, edited by W.F. Bynum & R. Porter, (London: Routledge, 1994), pp. 1536–1573. On pp. 1553–1556, he argues that the extreme efficacy of medicine even spurred the non-compliance of soldiers because being treated effectively meant being sent back into the trenches. This, however, does not account for soldiers voices that describe the environment and medical conditions they suffered in the trenches. Most soldiers document the horrors of trench life and diseases, it was not something they willingly chose to endure. If Cooter had investigated soldiers' own responses they would have clearly shown that patient non-compliance did not stem from remedial medicine being too effective, but preventative medicine not being effective enough.

⁶ Mark Harrison, *The Medical War: British Military Medicine in the First World War*, (Oxford: Oxford University Press, 2010), p. 292.

⁷ Christopher Lawrence, "Continuity in Crisis, Medicine 1914–1945," in W.F. Bynum et al., *The Western Medical Tradition, 1800–2000*, (Cambridge: Cambridge University Press, 2006), p. 253.

the men, like Brennan, who experienced the results of preventative biomedicine. Though these soldiers' responses to biomedical prevention do not definitively represent an overarching survey, the numerous and coinciding statements across various historical sources convincingly reveal that biomedical prevention methods were not always as effective as medical scientists and practitioners, and some medical historians, believe.

This thesis, however, does not posit that efficacy is a measure of historical significance. Rather, in outlining the less than effective outcomes of preventative biomedicine, this thesis demonstrates why soldiers required another form of medical knowledge to combat uniform contamination. This highlights the importance of historically examining preventative medicine, regardless of efficacy. Studying the prevention methods medical scientists and practitioners implemented alongside those practised by soldiers demonstrates that two different strands of medical knowledge existed and, at times, interplayed and juxtaposed each other.

Examining the men's records reveals that they not only formulated a distinct discussion and concept of contaminants in the trenches, they also relied on their own preventative methods for lice-infested clothes, poorly constructed, leaky boots, and uniforms that provided no protection from and even harboured, toxic chemical residue. The fact that insurmountable differences exist between these three medical problems, and yet soldiers still implemented their own methods of prevention for all three issues, demonstrates the widespread and overarching nature of soldiers' preventative medicine.

What this thesis reveals then, is that two 'systems of medical ideas', practised by both medical professionals and the soldiers in the trenches, existed

simultaneously. Reflecting on the actualities of preventative biomedicine in the trenches helps explain why this was the case.

As discussed throughout this thesis, preventative biomedicine, when applied on the front line, did not provide the answers most medical personnel and soldiers thought it would. The specific reasons for why this was the case differed from condition to condition. Medical scientists and other professionals overlooked lice prevention when troops shipped into theatres of war. With four or more decades of 'sanitised' urban areas, the problem of body lice was not at the forefront of the minds of either medical personnel or soldiers.⁸ From the beginning, then, preventions for lice worked in overdrive to attempt alleviation for an already growing problem. Further, medical scientists working in laboratories and military hospitals in Britain, and general hospitals in France, were unaware of the realities of life in the trenches. The logistics of most prevention methods presented by researchers did not fit with soldiers who had been ordered to remain in their positions in the trenches, and to keep their uniform on their bodies at all times. So, when researchers recommended baths, chemical powders, and ointments to combat lice infestation, it was not surprising that soldiers had infrequent, if any, opportunities to perform such preventions while in forward areas.

Both trench foot and chemical warfare, however, were new, and often jarring for medical scientists who had no prior knowledge of either their cause or symptoms, let alone how to prevent them. Even when they had a better understanding of the adverse trench environment, the new and emergent nature of these medical problems meant that prevention relied on trial-and-error-inspired experimentation. Often, this experimentation occurred at the expense of the men's health, as the thick

⁸ Denis Gerard Dubord, "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," (Ph.D., Thesis, University of Victoria, 2009), p. 84–85.

mud sucked gumboots under the morass, and the constant rain and slush kept socks always soaked. Similarly, the oxidised resin creams for mustard gas prevention burnt and irritated soldiers' skin on direct contact, and their anti-gas qualities generally only lasted for around 24 hours. Furthermore, 'proto-hazmat' suits were uncomfortable and ineffective. Consequently, unlike previous instances of gas prevention, researchers did not advise the implementation of any of these methods at the front, and soldiers received no protection from the blistering effects of mustard gas.⁹ Unmistakably, what the medical-scientific responses to all three of these conditions demonstrated was a lack of practical insight.

Other problems with preventative biomedicine lay with the power of the dominant medical discourse in publications such as the *BMJ* and *The Lancet*. Even in the cases where front line MOs witnessed first hand the failings of biomedical preventions, only some turned to their own devices. This was primarily the case with lice infestations. Yet, more frequently, the overwhelming majority of MOs gave unfailing support to medical scientists and their ineffective preventions, even when the soldiers they cared for clearly knew, and expressed dissatisfaction with, their poor quality. Some front line MOs even wrote into medical journals praising such preventative medicine, outlining how their own experiments supported the general consensus of researchers' findings.

When biomedical preventions for mustard gas did not fill the pages of medical publications, front line medical personnel, who were used to such direction, did not know where to turn for practical information and prevention methods. As MOs could no longer rely on these sources of medical knowledge they could not prevent the

⁹ Charles E. Heller, *Chemical Warfare in World War I: The American Experience, 1917–1918*, Leavenworth Papers, No. 10 (Fort Leavenworth: Combat Studies Institute, 1984), in Edgar Jones, "Terror Weapons: The British Experience of Gas and Its Treatment in the First World War," *War in History* 21, no. 3 (2014): p. 362.

effects of mustard gas at all and even subsequently misdiagnosed numerous cases of gas poisoning.

Further instances of interplay and juxtaposition between the two 'systems of medical ideas' are most apparent in the relationships (or lack thereof) between front line medical and gas personnel, and soldiers. Their interactions act as an exemplar for the wider issues evident between the two medical systems. As rightly argued by historians G.D. Sheffield and Clare Rhoden, the role of MOs, as Royal Army Medical Corps (RAMC) officers, meant they followed orders to send every able man back to front line duty.¹⁰ Paired with the problems of 'malingering', some MOs no longer had time for seemingly 'trivial' medical problems, like trench foot. Gas officers and NCOs, even when they listened in lectures and provided adequate assistance in the trenches during gas attacks, could no longer prevent gas poisoning, as the persistent vesicant nature of mustard gas overrode their skills and training.

What the outcomes of these relationships reveal is that they were built on mistrust and doubt. Evidently, this presented the perfect recipe for increased medical problems on the front line. Men avoided sound medical assistance when they presented symptoms of swollen feet, and often did not listen to the gas officer when mustard gas shells exploded around them. This prevented men from receiving, oftentimes, adequate to comprehensive biomedical care.

It is not surprising then, with so many varying factors standing in the way of preventative biomedicine, that soldiers practised their own methods in the trenches. As Private John Davis of the Duke of Cornwall's Light Infantry wrote, 'there was

¹⁰ G. D. Sheffield, *Leadership in the Trenches: Officer-Man Relations, Morale and Discipline in the British Army in the Era of the First World War*, (London: Palgrave Macmillan Ltd., 2000); Clare Rhoden, "Another Perspective on Australian Discipline in the Great War: The Egalitarian Bargain," *War in History* 19, No. 4 (2012): pp. 445–463.

hardly anybody who could understand the misery of it all.’¹¹ Reflecting on the conditions that contaminated his uniform, he strongly declared that ‘you can’t imagine unless you experienced it...it was really quite frightening.’¹² So, with a firm reliance on the voices of the soldiers who experienced extreme trench environments and ensuing contaminants, this thesis provides a fresh perspective on preventative medicine.

Numerous men used the theories of medical scientists to fashion more useful ways to implement biomedical methods in the trenches. Bathing was popular among soldiers stuck with the constant company of lice. Waiting weeks for a trip to the divisional baths was far less compelling, however, than constructing makeshift alternatives in the trenches from petrol tin halves. Provisions of whale oil were far more useful when applied inside the socks and boots alongside rubbing it on the feet, while ammonia phials were used to neutralise the toxic mustard gas-filled air inside larger spaces such as dugouts and medical quarters.

Other methods relied on altering, repairing or decontaminating existing uniforms. Some soldiers tried to rid themselves of lice, or at least keep them at bay, by turning their uniforms inside out. Others left their uniforms underwater in a stream or buried them in the ground. Leaky service boots were constantly mended, and frozen boots were thawed with rationed candles. When mended and over-worn uniforms ceased to assist the suffering soldiers, they searched for fresh uniforms, sometimes by any means necessary. Smarting and swollen feet thrust soldiers into a search for better boots in advanced dressing station salvage dumps, removing severed feet and body parts often lodged inside their new takings. Meanwhile,

¹¹ Davis, Oral History, Recording 18835.

¹² Davis, Oral History, Recording 18835.

Scottish Regiments donned ladies bloomers to protect their exposed skin from the tainted gas-filled trenches.

Finally, when men devised no ingenious methods or found no new uniforms, often their last chance was to try to avoid contamination at all costs. Some men climbed trees to rise above the burst of mustard gas shells. Other men sat on the firing step, with their backs against the parapet and their feet raised in the air, hoping their boots would stay dry.

What the prevention methods of the soldiers in the trenches demonstrate is a collaboration between men presented with no other viable options. The necessity of exterminating vermin, finding adequate boots, or shelter from toxic chemicals often outweighed the other constant dangers of warfare that surrounded soldiers on a daily basis. According to the men's own records, outside combat, these three medical maladies were clearly some of the worst problems they faced in the trenches — both for their health and for their personal comfort. The intervention methods they practiced were informed by the environment that surrounded them, and the materials they had access to in the trenches.

This provides a launching pad for future researches to investigate what influenced the medical understandings and practices of soldiers outside the British Expeditionary Force. Using the conclusions from this thesis to undertake a commonwealth-wide comparison, or even a cross-trench analysis with the German Military would answer the call from medical historian Gert Brieger to draw 'comparisons across cultural, national, and social lines.'¹³ Such a study would highlight the influence of surrounding environments and cultural understandings in the development of medical knowledge and practice. It would also establish whether

¹³ Gert Brieger, "The Historiography of Medicine," in *Companion Encyclopedia of the History of Medicine*, vol. 1, edited by W.F. Bynum & R. Porter, (London: Routledge, 1994), p. 38.

soldiers developed numerous, or a more a universal and overarching 'system of medical ideas' that cut across cultural, national, and social divides.

The studies in this thesis clearly show that British soldiers practised 'folk medicine' in the trenches. Even the fact that soldiers recorded their practises in diaries, letters, and later in oral testimonies, conveys that they spent time reflecting on the gravity and momentousness of their medical ideas and actions. With such powerful documentation, consistent over such a long timespan, it is extremely surprising that the voices and opinions of these soldiers, reflecting on contaminated uniforms and preventative medicine, have been overlooked in the historical record.

This thesis, however, goes further than writing a straight 'history from below.' Not only do voices previously excluded from such historical conversations now present an entirely new and fascinating viewpoint, but they also outline the construction of a new set of prevention methods. Medical historian Roger Cooter has called for research in 'the history of medicine and war' that reveals 'more than we have yet dared to imagine about...the daily practice of medicine as we know it.'¹⁴

When medicine is understood as a 'system of medical ideas,' there is ostensibly no reason that the prevention methods soldiers practiced in the trenches cannot also be understood as a form of medical practice. What this achieves, then, is a reformulation of the boundaries that constitute medicine and medical prevention. Further, this thesis demonstrates not only the stark contrast between both 'systems of medical ideas,' but also the dialogue and interplay between them. It conveys the importance of examining medical ideas and practises that occur outside of the dominant medical system, as often they present an account that troubles the

¹⁴ Cooter, "War and Modern Medicine," p. 1564.

significance, and therefore the prioritisation, of elite forms of medicine and medical practice.

Bibliography

Primary Sources

Imperial War Museum, London Sound Recordings

- Albert Day, Recording 24854.
- Albert Hurst, Recording 11582.
- Alexander Burnett, Recording 8342.
- Alfred West, Recording 12236.
- Barclay Buxton, Recording 299.
- Bert Sprason, Recording 32815.
- Christopher Cockburn, Recording 9148.
- Donald A. Hodge, Recording 11341.
- Ernest Bell, Recording 26870.
- Frank Austin, Recording 33293.
- Fred Potter, Recording 379.
- George A. Nichols, Recording 26874.
- George E. Robinson, Recording 11269.
- George Singleton, Recording 24553.
- Horace Manton, Recording 9756.
- Ivor Watkins, Recording 12232.
- James E. Taylor, Recording 11045.
- James W. Watson, Recording 11040.
- John E. Davis, Recording 18835.
- Leonard G. Davies, Recording 9343.
- Percy F.A. Thomas, Recording 35804.
- Percy Spong, Recording 24525.
- Percy Webb, Recording 578.
- Reg Coldridge, Recording 24864.

R.H. Lawson, Recording 24882.

Tom Brennan, Recording 24534.

Ulick B. Burke, Recording 569.

Walter Hopes, Recording 29169.

William Davies, Recording 564.

Private Papers

Captain B.A. West, Documents 537.

E. Sheard, Documents 12021.

Major E.S.B. Hamilton MC RAMC, Documents 150.

F.E. Harris, Documents 14979.

Captain G.E. Spicer MC, Documents 6904.

H.J. Youngman, Documents 16008.

J.H. Butlin, Documents 7915.

Private Morsley, Documents 15334.

Lieutenant N King-Wilson, Documents 12259.

O. Coleman, Documents 3875.

Richard Gwinnell, Diary, Private Papers of R. Gwinnell, Documents 11601.

R. Read, Diary, Private Papers of R. Read, Documents 923.

Captain S.H. Smith, Documents 15947.

The National Archives, London – Kew

War Office

WO 32/5176.

WO 95/44.

WO 95/198.

WO 142/102.

WO 142/104.

WO 142/108.

WO 142/243.

The Wellcome Library, London

Archives and Manuscripts Collection

PP/CLE/A.3: Box 1.

Royal Army Medical Corps Muniments Collection

RAMC/1217: Box 266.

RAMC/2045: Box 426.

Published Primary Sources

Anon. "Poisons in Warfare." *The Lancet* 186, no. 4793 (10 July 1915): p. 81.

Anon, "The Etiology of 'Trench Frost-Bite,'" *BMJ* 1, no. 2825 (20 February 1915): pp. 352–353.

Anon. "The Duties of a Sanitary Section in the Field." *The British Medical Journal* 1, no. 2875 (5 February 1916): p. 215.

Anon. "Flies, Lice and Mosquitoes." *The British Medical Journal* 1, no. 2841 (June 12 1915): p. 1006.

Anon. "Lice." *The British Medical Journal* 1, no. 2890 (20 May 1916): p. 734.

Anon. "The Treatment of Wounds in War." *The British Medical Journal* 1, no. 2992 (4 May 1918): p. 516.

Anon. "Trench Frost-Bite." *The British Medical Journal* 2, no. 2869 (25 December 1915): pp. 933–934.

Anon. "'Puttees' and 'Frost-Bite.'" *The British Medical Journal* 1, no. 2829 (20 March 1915): pp. 514–515.

Anon. "Military Hygiene and the Efficiency of the Soldier." *The British Medical Journal* 1, no. 2828 (13 March 1915): pp. 472–474.

Anon. "Mustard Gas." *The British Medical Journal* 2, no. 2956 (25 August 1917): p. 266.

Anon. "War Gas Poisoning" *The British Medical Journal* 2, no. 3006 (10 August 1918): pp. 138–139.

Anon. "What is the Gas?" *The Lancet* 186, no. (24 July 1915), p. 198.

Blackham, Robert J., *Military Sanitation: A Handbook for Soldiers*, (London: John Bale, Sons & Danielson, 1920).

- Cummings, Bruce F. *The Louse and Its Relation to Disease*. London: British Museum (Natural History), 1915.
- Dakin, H. D. "Biochemistry and War Problems." *The British Medical Journal* 1, no. 2947 (23 June 1917): pp. 833–837.
- Delépine, S. "Some of the Effects of Exposure to Wet Cold and Their Prevention." *The British Medical Journal* 2, no. 2868 (18 December 1915): pp. 888–892.
- Hansard, Tennant. 69. 8 February 1915. col. 290, in Harrison, Mark. *The Medical War: British Military Medicine in the First World War*. Oxford: Oxford University Press, 2010.
- Hughes, B. "The Causes and Prevention of Trench Foot." *The British Medical Journal* 1, no. 2890 (20 May 1916): pp. 712–714.
- Lelean, P.S. "Military Hygiene and the Efficiency of the Soldier." *The British Medical Journal* 1, no. 2826 (27 February 1915): p. 380.
- Lelean, P.S. *Sanitation in War*. London: J. & A. Churchill, 1915.
- Lorrain Smith, J., Ritchie, J., Dawson, J. "On the Pathology of Trench Frost-Bite." *The Lancet* 187, no. 4802 (11 September 1915): pp. 595–598
- Medical Research Committee. *An Atlas of Gas Poisoning*. France: British Expeditionary Force, 1918.
- Monckton Copeman, S. "Note on a Successful Method for the Extermination of Vermin Infesting Troops." *The British Medical Journal* 1, no. 2823 (6 February 1915): pp. 247–248.
- Mortimer, J.D. "The Treatment of Gas Poisoning." *The Lancet* 185, no. 4789 (12 June 1915): p. 1262.
- Nepean Longridge, C. "A Note on the Cause and Prevention of Trench Foot." *The Lancet* 189, no. 4872 (13 January 1917): pp. 62–63.
- Norman Goode, H. "A Brief Account of a Method of Providing Baths for the Soldier in the Field." *The Lancet* 187, no. 4825 (19 February 1916): pp. 422–424.
- Parlane Kinloch, J. "An Investigation of the Best Methods of Destroying Lice and Other Body Vermin." *The British Medical Journal* 1, no. 2842, (19 June 1915): pp. 1038–1041.
- Peacock, A.D. "The Louse Problem at the Western Front." *The British Medical Journal* 1, no. 2892 (3 June 1916): pp. 784–788.
- Shipley, A.E. "Insects and War." *The British Medical Journal* 2, no. 2803 (19 September 1914): pp. 497–499.
- Shipley, A.E. *The Minor Horrors of War*. London: Smith Elder & Co., 1915.

The British Medical Association. *British Medicine in the War, 1914–1917*. London: The British Medical Association, 1917.

Turner, P. “The Treatment of Trench Feet and Allied Conditions by Bier’s Method of Passive Hyperaemia.” *The Lancet* 190, no. 4913 (27 October 1917): pp. 638–640.

Secondary Sources

Atenstaedt, Robert L. “Trench Foot: The Medical Response in the First World War.” *Wilderness and Environmental Medicine* 17, Issue 4 (2006): pp. 282–289.

Atenstaedt, R.L.. “The Response to Trench Diseases in World War I: A Triumph of Public Health Science.” *Public Health* 121 (2007): pp. 634–639.

Brand, Jeanne L. *Doctors and the State: The British Medical Profession and Government Action in Public Health, 1870–1912*. Baltimore: The Johns Hopkins Press, 1965.

Brieger, Gert. “The Historiography of Medicine,” in *Companion Encyclopedia of the History of Medicine*, vol. 1, edited by W.F. Bynum & R. Porter, London: Routledge, 1994, pp. 24–44.

Brown, Frederic J. *Chemical Warfare: A Study in Restraints*. Princeton, New Jersey: Princeton University Press, 1968.

Burr, Robert E. “Trench Foot.” *Journal of Wilderness Medicine* 3, no. 4 (1993): pp. 348–352.

Bynum, W.F. “The Rise of Science in Medicine, 1850–1913,” in Bynum, W.F., Anne Hardy, Stephen Jacyna, Christopher Lawrence, and E.M. Tansey. *The Western Medical Tradition 1800 to 2000*. Cambridge: Cambridge University Press, 2006, pp. 111–246.

Bynum, W.F., Anne Hardy, Stephen Jacyna, Christopher Lawrence, and E.M. Tansey. *The Western Medical Tradition 1800 to 2000*. Cambridge: Cambridge University Press, 2006.

Cooter, Roger. “War and Modern Medicine,” in *Companion Encyclopedia of the History of Medicine*, vol. 2, edited by W.F. Bynum & Roy Porter. London: Routledge, 1993, pp. 1536–73.

Cooter, Roger, Mark Harrison, and Steve Sturdy, eds. *War, Medicine and Modernity*. Stroud: Sutton Publishing, 1998.

Dubord, Denis Gerard. “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.” Ph.D., Thesis, University of Victoria, 2009.

Ellis, Harold. “The Outbreak of the First World War and the Medical Profession.” *British Journal of Hospital Medicine* 75, no. 8 (2014): p. 476.

Fitzgerald, Gerald J. “Chemical Warfare and Medical Response During World War I.” *American Journal of Public Health* 98, no. 4 (2008): pp. 611–625.

- Foucault, Cedric, Philippe Brouqui, and Didier Raoult. "Bartonella Quintana Characteristics and Clinical Management." *Emerging Infectious Diseases* 12, no. 2 (February 2006): p. 217.
- Gorsky, Martin. "Local Leadership in Public Health: The Role of the Medical Officer of Health in Britain, 1872–1974," *Journal of Epidemiology and Community Health* 61, no. 6 (11 June 2007): pp. 468–472.
- Harrison, Mark. *The Medical War: British Military Medicine in the First World War*. Oxford: Oxford University Press, 2010.
- Heller, Charles E. *Chemical Warfare in Word War I: The American Experience, 1917–1918*. Leavenworth Papers, no. 10. Fort Leavenworth: Combat Studies Institute, 1984. in Edgar Jones. "Terror Weapons: The British Experience of Gas and Its Treatment in the First World War." *War in History* 21, no. 3 (2014): p. 362.
- Hitchcock, Tim. "A New History from Below." *History Workshop Journal* 57 (Spring 2004): pp. 294–298.
- Hutching, Megan. "After Action: Oral History and War," in *The Oxford Handbook of Oral History*, edited by Donald A. Ritchie. New York: Oxford University Press, 2011, pp. 233–243.
- Hutchison, Richard L. "Frostbite of the Hand." *Journal of Hand Surgery* 39, Issue 9 (2014): pp. 1863–1868.
- Johnson, Ryan Mark. "A Suffocating Nature: Environment, Culture, and German Chemical Warfare on the Western Front." Ph.D., Thesis: Temple University, 2013.
- Jones, Edgar. "The Psychology of Killing: The Combat Experience of British Soldiers during the First World War." *Journal of Contemporary History* 41, no. 2 (April 2006): pp. 229–246.
- Jones, Edgar. "Terror Weapons: The British Experience of Gas and Its Treatment in the First World War." *War in History* 21, no. 3 (2014): pp. 355–375.
- Jones, E., B. Everett, S. Ironside, L. Palmer, and S. Wessely. "Psychological Effects of Chemical Weapons: A Follow-Up Study of First World War Veterans." *Psychological Medicine* 38 (2008): pp. 1419–1426.
- Jones, Edgar, Ian Palmer, and Simon Wessely. "Enduring Beliefs about the Effects of Gassing in War: Qualitative Study." *The British Medical Journal* 335, No. 1313 (2007): pp. 1–5.
- Kearns, Gerry. "Private Property and Public Health Reform in England 1830–1870." *Social Science and Medicine* 26, no. 1 (1988): pp. 187–199.
- Kenyon, Tim. "Oral History and the Epistemology of Testimony." *Social Epistemology* 30, Issue 1 (2016): pp. 45–66.
- Lawrence, Christopher. "Continuity in Crisis, Medicine 1914–1945," in Bynum W.F., Anne Hardy, Stephen Jacyna, Christopher Lawrence, and E.M. Tansey. *The*

- Western Medical Tradition 1800 to 2000*. Cambridge: Cambridge University Press, 2006, pp. 247–390.
- Le, HQ and S.J. Knudsen. “Exposure to a First World War Blistering Agent.” *Emergency Medicine Journal* 23 (2006): pp. 296–299.
- Loux, Françoise. “Folk Medicine,” in *Companion Encyclopedia of the History of Medicine*, vol. 1, edited by W.F. Bynum and Roy Porter. London: Routledge, 1993, pp. 661–675.
- Marrs, Timothy C., Robert L. Maynard, Frederick R. Sidell. *Chemical Warfare Agents: Toxicology and Treatment*. Chichester: John Wiley & Sons, 1996.
- Mohr, William J., Kamrun Jenabzadeh, and David H. Ahrenholz. “Cold Injury.” *Hand Clinics* 25, Issue 4 (2009): pp. 481–496.
- Moore, Christopher, *Roger. Sausage & Whippet: A Miscellany of Trench Lingo from the Great War*. London: Headline Publishing Group, 2012.
- Pitschmann, Vladimír. “Overall View of Chemical and Biochemical Weapons.” *Toxins* 6 (2014): pp. 1761–1784.
- Porter, Dorothy. “Public Health,” in *Companion Encyclopedia of the History of Medicine*, vol. 2, edited by W.F. Bynum and Roy Porter. London: Routledge, 1993, pp. 1231–1261.
- Porter, Roy, ed. *The Cambridge History of Medicine*. Cambridge: Cambridge University Press, 2006.
- Raoult, Didier, Olivier Dutour, Linda Houhamdi, Rimantas Jankauskas, Pierre-Edouard Fournier, Yann Ardagna, Michel Signori, Vu Dang La, Yves Macia, and Gérard Aboudharam. “Evidence for Louse-Transmitted Diseases in Soldiers of Napoleon’s Grand Army in Vilnius.” *The Journal of Infectious Diseases* 193, no. 1 (1 January 2006): pp. 112–120.
- Reznick, Jeffery S. *Healing the Nation: Soldiers and the Culture of Caregiving in Britain during the Great War*. Manchester: Manchester University Press, 2004.
- Rhoden, Clare. “Another Perspective on Australian Discipline in the Great War: The Egalitarian Bargain.” *War in History* 19, No. 4 (2012): pp. 445–463.
- Rosenberg, Charles E. *Explaining Epidemics and Other Studies in the History of Medicine*. Cambridge: Cambridge University Press, 1992.
- Sharpe, Jim. “History From Below,” in *New Perspectives on Historical Writing*, edited by Peter Burke. Pennsylvania: The Pennsylvania State University Press, 2001, pp. 25–42.
- Sheffield, G. D. *Leadership in the Trenches: Officer-Man Relations, Morale and Discipline in the British Army in the Era of the First World War*. London: Palgrave Macmillan Ltd., 2000.

- Siraisi, Nancy G. *Medieval & Early Renaissance Medicine: An Introduction to Knowledge and Practice*. Chicago: University of Chicago Press, 1990.
- Smith, Norma. "Oral History and Grounded Theory Procedures as Research Methodology for Studies in Race, Gender and Class." *Race, Gender and Class* 9, no. 3 (2000): pp. 121–138.
- Spiers, Edward M. *Chemical Warfare*, London: Macmillan, 1986, in Edgar Jones. "Terror Weapons The British Experience of Gas and Its Treatment in the First World War." *War in History* 21, no. 3 (2014): p. 365.
- Suter, Keith. "The Troubled History of Chemical and Biological Warfare." *Contemporary Review* 283, no. 1652 (2003): pp. 161–165.
- Szinicz, Ladislaus. "History of chemical and biological warfare agents." *Toxicology* 214, no. 3 (2005): pp. 167–181.
- Szinicz, Ladislaus. "Medical Aspects of Sulphur Mustard Poisoning." *Toxicology* 214, no. 3 (2005): pp. 198–209.
- Thompson, Paul. *Voices of the Past: Oral History*. 3rd ed. Oxford: Oxford University Press, 2000.
- Thompson, Alistair. "Memory and Remembering in Oral History," in *The Oxford Handbook of Oral History*, edited by Donald A. Ritchie. New York: Oxford University Press, 2011, pp. 77–95.
- Tucker, Jonathan B. *War of Nerves: Chemical Warfare from World War I to Al-Qaeda*. New York: Anchor Books, 2007.
- Tumblety, Joan, ed. *Memory and History: Understanding Memory as Source and Subject*. London: Routledge, 2013.
- Turner, Mark. "Malingering." *The British Journal of Psychiatry* 171, no. 5 (November 1997): pp. 409–411.
- Ugolini, Laura. "War-stained: British Combatants and Uniforms, 1914–18." *War and Society* 33, no. 3 (August 2014): pp. 155–171.
- Ungley, C.C., G D. Channell, and R.L. Richards. "The Immersion Foot Syndrome." *Wilderness and Environmental Medicine* 14, Issue 2 (June 2003): pp. 135–141.
- van Bergen, Leo. "The Poison Gas Debate in the Interwar Years." *Medicine, Conflict and Survival* 24, No. 3 (2008): pp. 174–187.
- Vinten-Johansen, Peter, Howard Brody, Nigel Paneth, Stephen Rachman, and Michael Rip. *Cholera, Chloroform, and the Science of Medicine: A Life of John Snow*. New York: Oxford University Press, 2003.
- Whitehead, Ian R. "Not a Doctor's Work? The Role of British Regimental Medical Officers in the Field," in *Facing Armageddon: The First World War Experienced*, edited by Hugh Cecil and Peter H. Liddle. London: Leo Cooper, 1996, pp. 466–474.

Whitehead, Ian R. *Doctors in the Great War*. London: L. Cooper, 1999.

Wilcox, Vanda “‘Weeping Tears of Blood’: Exploring Italian Soldiers’ Emotions in the First World War.” *Modern Italy* 17, no. 2 (2012): pp. 171–184.

Worboys, Michael. *Spreading Germs: Disease Theories and Medical Practice in Britain, 1865–1900*. Cambridge: Cambridge University Press, 2000.

World Health Organisation. “Exposure to Benzene: A Major Public Health Concern.” <http://www.who.int/ipcs/features/benzene.pdf>.