

# WAR AND MEDICINE

*"Strange that man who dominates nature has so far departed  
from nature as to be the only animal to wage  
relentless war on his own species. "*

*William Osler*

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## **WAR AND MEDICINE**

I should probably start with some explanations. Over the years, 46 to be exact, I have benefitted from an estimated 1760 grand rounds, and I knew they required a lot of work – little did I realize how all-consuming they could be. Now, not all grand rounds are equal. Some are funny, such as the time a certain faculty member stole and presented another's subject before the victim's time came up; or another time when several in attendance realized the presenter was discussing a subject so esoteric that he would never be asked to present again (and he wasn't).

Other grand rounds are a tour de force in areas of anthropology, social sciences, or evolution that may have medical science relationships. Most are wonderful, purely state-of-the art medical science.

Then there is this grand rounds, which is really about the history of medicine as reflected in warfare. As I am not a scientist, I decided to combine my interest in military history and medicine. Before going any further, I am not a proponent of war; and while there are a few authors who claim the medical benefits of war outweigh the negatives, I am not convinced.

As mankind has evolved, so has warfare. As weapons evolve, tactics and counter-weapons have evolved. Medicine has had to adapt, innovate and evolve, also. Will it ever end? I doubt it, although the British military historian, John Keegan, believes the battlefield is becoming so onerous that humans may not be able to stand it. We may have seen that phenomenon in the first Gulf War where the Iraq Army basically vanished, leaving us with a guerilla war.

## **MEDICINE AND THE MILITARY**

"Military medicine has wider, more impersonal aims. Its ultimate purpose is to conserve the fighting strength of the armed forces."<sup>1</sup> It demands 1) practice of medicine/surgery 2) public health and 3) an organizational structure for the evacuation and long-term care of casualties.

In this statement, there are some obvious tensions between medicine and the military. Firstly, given a limit of resources, medicine must do the most for the command, not the individual. Nowhere could I find this explained as well as in a profane quote from General George Patton. "If you have two wounded soldiers, one with a gunshot wound to the lung and the other with an arm or leg blown off,

you save the son-of-a-bitch with the lung wound and let the \_\_\_\_\_ son-of-a-bitch with an amputated arm or leg go to hell. He is no \_\_\_\_\_ use to us anymore.”<sup>2</sup>

Now before you get too excited, General Patton was nobody’s fool. He understood the role of a democracy protecting its boys. More about that later. His military medical personnel ignored him, anyway.

The second tension is, and always has been, between public health officers and military commanders. Quoting Sir Neil Cantlie, Director General of Medical Services for the British Army: “When, for the first time in history a combatant officer was considered unfit to command a unit on the grounds that he had allowed his men to become ineffective through disease, a new day in military medicine dawned.”<sup>3</sup> That happened in 1943 for the U.S. in the Pacific.

## DEATHS

<u>War</u>	<u>Disease</u>		<u>Combat</u>
Revolutionary	40,000		4,044
Civil Union	224,000		140,000
Confederate	165,000		
Spanish American	2,565		280
Boer War	14,000		7,582
WWI	1	Ratio	1
	55,868	--	
WWII	113,842		291,557
Vietnam	10,785		47,415

## DISEASE AND THE MILITARY

Disease has historically always been a factor in military operations. In the Old Testament, there is instruction on hygiene of army camps. “When the host goeth forth against thine enemies, then keep thee from every wicked thing. If there be among you any man, that is not clean by reason of uncleanness that chanceth him by night then shall he go abroad out of the camp...thou shalt have a place also without the camp whither thou shalt go forth abroad: and thou shalt have a paddle upon thy weapon and it shall be when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee.”<sup>4</sup> The Greeks and Romans understood some major principles of hygiene revolving around avoiding marshes, clean water sources, and burial of excreta and dead animals. This was all without germ theory and knowledge of vectors. In the

Middle Ages, apparently there was regression of knowledge and the story appears to pick up in the 18<sup>th</sup> Century with two British pioneers of military hygiene.

Sir John Pringle (1707-1782) pointed out disease spread by overcrowding in barracks, camps, and hospitals by putrid air and by air from the “corrupted water of marshes.” He also believed dysentery was caused by allowing excreta to lie about the camp. According to Pringle, the prevalent diseases of the British Army were malaria, parasites, typhoid fever, typhus fever, yellow fever, and bacillary dysentery.<sup>5</sup> As we shall see, it took 300 years to change this.

James Lind (1716-1794) serving in the Royal Navy published his classic “Treatise on the Scurvy” which was ignored by the Navy. Twenty-eight years later, Sir Gilbert Blane used Lind’s methods and stopped an outbreak of scurvy. The British Navy adopted lemon juice as a prophylactic in 1795.<sup>6</sup> Ironically, Napoleon’s chief medical officer organized military sanitation and infection control measures in the Egyptian campaign. The irony follows.

#### **DISEASE ALTERING MILITARY HISTORY**

Two examples will illustrate the disastrous effect that disease can have on military operations. In the Spring of 1776, American forces invaded Canada but the expedition failed when 60% of the troops developed smallpox. This, in turn, led George Washington to order smallpox inoculation using small doses of smallpox virus. This was 35 years before Dr. Edward Jenner used the cowpox virus.

During the Revolutionary War, the British Army noted hospitals were more dangerous than the battlefield, losing 4,000 in battle and 40,000 to disease.

A second example was a potential major alteration of history by yellow fever. In the late 18<sup>th</sup> Century, Napoleon sent a large body of troops led by his brother-in-law to Santo Domingo and Haiti. The plan was to conquer those countries then invade Spanish Florida and occupy Louisiana. Upon landing, the troops were decimated by yellow fever and the whole plan was scraped.<sup>7</sup> A hundred years would pass before we contained yellow fever.

## INDUSTRIAL WAR

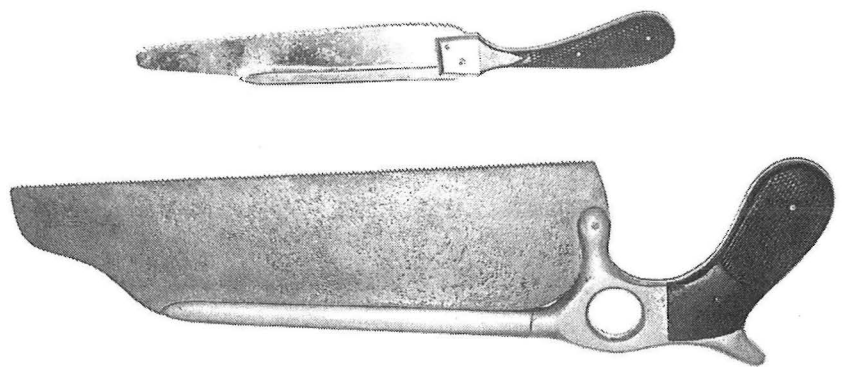
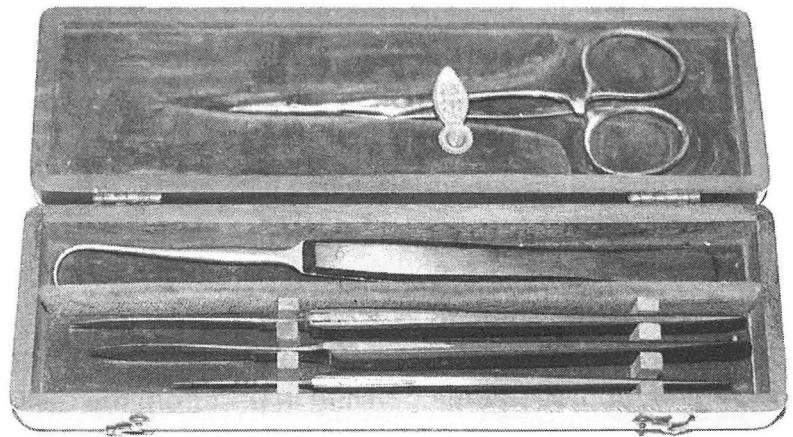
In the mid-19<sup>th</sup> Century, warfare changed in that much larger armies took the field largely as a function of supply and weapons became more sophisticated i.e. rifle and artillery.

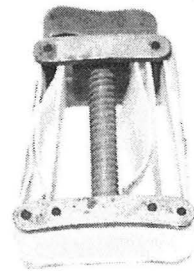
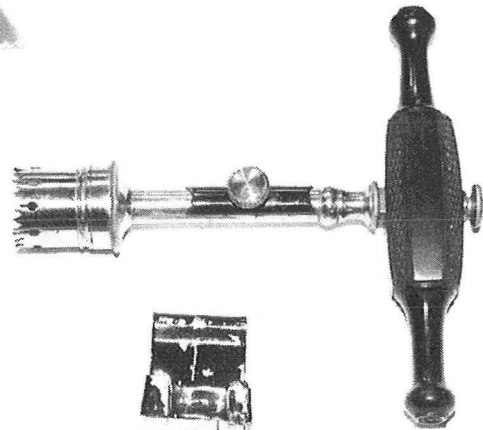
The Crimean War, 1853-56, produced some interesting fallout. The British Army disease rate was so bad that reformists, led by Edwin Chadwick and Florence Nightingale, who was a nurse in the British Army hospital in the Crimea, started a major reform both in the military sector and in England. At peak, the British Army had 60,000 troops in the field and 21,000 died, 4500 from battle injuries and 16,500 from disease (scurvy, dysentery, cholera, typhus, malnutrition, and exposure). Nightingale allied with social reformers showed, using graphs, that soldiers in barracks had a shorter life expectancy than civilians. She influenced hospital barracks and design. Life expectancy in Britain increased from 39 at the end of the Crimean War to 55 in 1910. There is not much agreement about cause but two leading candidates being improved nutrition and better sanitation;<sup>8</sup> both improvements deriving in part from the military disaster.

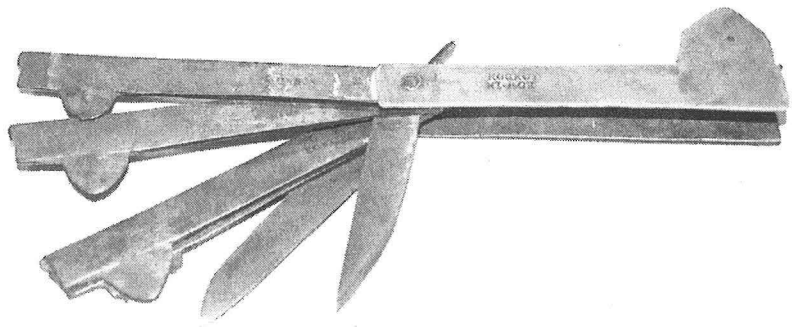
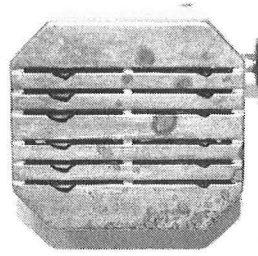
The second “modern war” was the American Civil War. It is said that there were no technological advances made. However, for the first time in any army, surgeon Jonathan Letterman organized an effective and complete ambulance and evaluation service. It was first tested at the Battle of Antietam, September 1862.

This led to development of field hospitals and a medical supply system which was tested at the Battle of Fredericksburg in December, 1862. This plan was adopted and used by all armies until Vietnam.

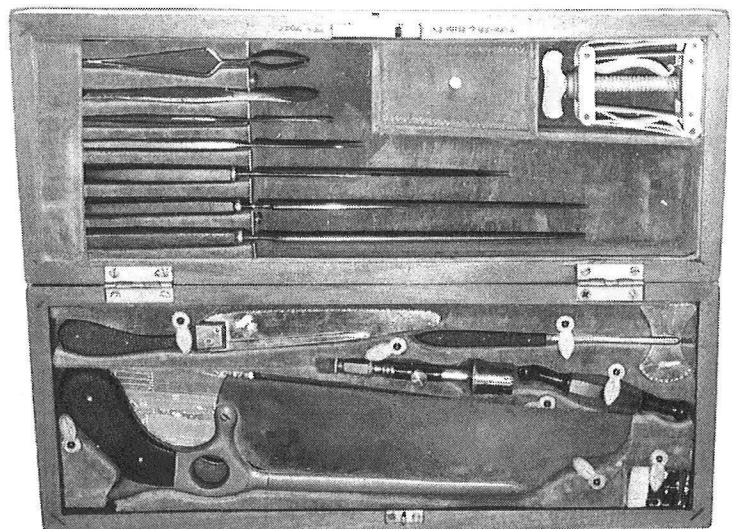
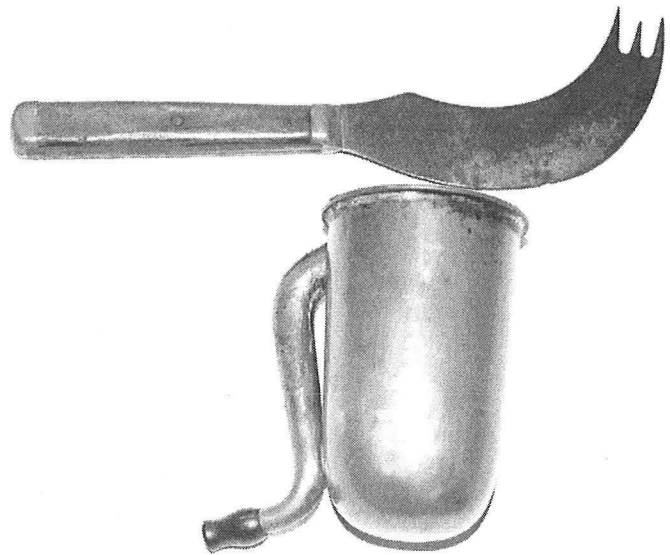
Even though there was no “breakthrough” in care during the Civil War, it might be of interest to look at the state of wound care in the Civil War. I am indebted to Mr. Richard Ahlstrom for the following pictures of a complete surgical toolset. Note the stains caused by blood. Washing and sterilization were unknown.













## CIVIL WAR

<u>PROCEDURE</u>	<u>MORTALITY</u>
<b>Limb conservation</b>	18%
- amputation	26%
- excision of portion	28%
<b>Wound</b>	
- upper extremity	12%
- lower extremity	40%
- chest wound	62%
- abdominal wound	87%
<b>Septicemia</b>	97%
<b>Strep gangrene</b>	46%

from *Medics at War*<sup>9</sup>

Two interesting facts. In the Union Army, there were 1,120,000 cases of malaria with a death rate of 0.5%. The very popular treatment was quinine in whiskey, which may explain the high incidence or diagnosis rate. The Union also had 16,000 cases of smallpox, killing 37%. Doctors did not escape. Thirty-nine (39) died of wounds and 297 died of disease. Dr. Mary Walker, one of seven women physicians, received the Congressional Medal of Honor.

The Boer War of 1899-1902 produced two noteworthy events. The British Army with 557,653 serving had 57,684 cases of typhoid with 8,225 deaths or 14%. However, army physician, Sir Almroth Wright succeeded in using killed cultures of typhoid bacilli by injection as vaccination. In 1897, he published his results on 18 volunteers. The British experience was not encouraging, most likely because of his personality (he was not well-liked). It was abandoned. In 1908, Captain Frederick Russell of the U.S. Army was sent to Europe to study the typhoid vaccination and upon return, a special board found the data convincing and recommended human trials; initially, on medical officers, then enlisted and other volunteers. In 1911, the vaccination became mandatory in the U.S. Army. As a result, we had only 1,529 cases out of 4,500,000 troops with 227 deaths in WWI. The German and Austria armies had 65,000 and 125,000.<sup>10</sup>

The second feature of the Boer War was the social reforms promulgated as a matter of national security. In Manchester, 60% failed the entrance exam for the army. In York Leeds & Sheffield, 47% failed and 26% more were rejected secondary to hearing, vision, teeth, and ill health, or dull intellect.<sup>11</sup> Major General Sir John Frederick Maurice suggested environmental living conditions were at fault ú slums. This influenced debate on social policy for many years that

resulted in recommendations that social reformers had been pushing for 20 years. Germany and Japan had already instituted many.

One of the great military-based medical triumphs was the yellow fever story. We have already discussed how yellow fever decimated Napoleon's army in the Caribbean and it continued to kill troops and civilians alike. In Baton Rouge, LA between 1819 to 1824, 26 of 100 soldiers stationed here for 1 year died.

In 1881, Dr. Carlos Finlay of Havana advanced the theory that the mosquito was the intermedia host. He had done no experiments and never proved his point. In 1897, Dr. Sanarelli of Italy claimed to have found the specific organism causing yellow fever. Walter Reed and James Carroll of the Army Medical Corps were sent to investigate and they reported the "bacillus of Sanarelli" was a coliform and not the cause. In 1900, Drs. Reed, Carroll, Lazear, and Agramontes of the U.S. Army were sent to study the infectious diseases of Cuba. Firstly, they proved that yellow fever was not a fomite transmitted disease. Then they proved it was a mosquito-borne infection and the mosquito had to bite the infected person early in the disease and then the virus "incubated" in the mosquito for approximately 12 days. Dr. Lazear died of the disease and Dr. Carroll was infected but survived. Dr. Gorgas was then able to clear Havana of yellow fever in 3 months and ultimately reduce the incidence in Panama, allowing the construction of the Panama Canal.

#### **DISEASES**

<u>Disease/War</u>	<u>Cases</u>	<u>% Death</u>
Smallpox/Civil	16,609	37%
Malaria/WWII		1-45% (Japanese)
Yellow Fever (Civil)		26%
Typhoid/Civil/WWII		7-14% (60% Japanese)
VD		??
Typhus/WWI	25,000,000 (Russia)	3 million E. Europe WWI or 12%

World War I was the first major conflict where battle deaths outnumbered disease deaths. This was a result of many factors, but remember, antibiotics were still a dream. Several noteworthy events: Major Carol Darnall discovered water chlorination in 1910. In 1911, typhoid vaccinations was mandatory and in 1917, Major Hugh Young convinced General Jack Pershing on a plan for venereal disease control that was very successful using unit discipline, education, and condoms.

Blood transfusion was attempted but was difficult as it was direct transfusion. Debridement to prevent gas gangrene and wound sepsis was instituted as was delayed primary closure. Plastic surgery and maxillofacial surgery were instituted. Gas gangrene and tetanus still caused 10% of deaths in field hospitals. Two great names pop up. Almonroth Wright and Alexander Fleming showed that antiseptic solutions being used actually worsened the wounds. The Carrell-Dakin solution was recommended (a constant irrigation sodium hypochlorite solution). It was not adopted until WWII.

Of course the largest disease problem the Americans faced was influenza, which killed 1/67 American soldiers. There was tremendous research but no answers at that time. Of passing interest was the tremendous death rate from typhus on the Eastern front and almost none on the Western.

A remarkable workaround arose at the end of WWI. To get compound fractures home, Winnett Orr, MD, a Nebraska boy, applied solid plaster casts totally immobilizing the wound. In spite of the stench, the wounds healed quickly and there was no gas gangrene. During the Spanish Civil War, Dr. Jose Trueta applied Orr's methods with astounding success. With the fall of the Republican army and evacuation of his casualties to France, the French saw his evacuations and reported the success, 6 cases of gas gangrene/1000 compound fractures. In 1939, the Trueta-Orr method of treating compound fractures was overwhelmingly adopted in England during the Blitz.

### **ANTIBIOTIC ERA**

In the years between world wars, a German medical orderly had sworn to find an antibacterial agent. Working for I.G. Farben, he developed a red dye, Prontosil, which cured mice and his daughter of infection. He did not receive a patent because the active ingredient sulfonamide had been synthesized in 1907 but not developed. He did receive a Nobel Prize in 1939. This was the start of a wound care revolution, as well as infectious illness revolution.

The next story to me is amazing. In 1928, the same Alexander Fleming mentioned above noticed that penicillium notatum inhibited staphylococcus aureus in culture. However, he could not purify or stabilize the substance. Later, Howard Florey and Ernest Chain at Oxford starting with a 25-pound Medical Research Council grant and a \$5,000 Rockefeller Foundation grant set to work but a practical use never surfaced. On May 25, 1940, experiments on mice demonstrated effectiveness without harming the mice. They were culturing mold

in flasks, bedpans, and every other container conceivable but it was not commercially viable. Drs. Floney and Heatley approached the U.S. and the Office of Scientific Research and Development sent them to the U.S. Department of Agriculture Research Laboratory at Peoria, Illinois. Enter Robert Coghill, Chief of the Fermentation Division (read whisky production). Andrew Moyer, a chemist working with Heatley, was charged with putting production on an industrial scale. However, the first Flemings mold was not ideal. A large solicitation of soil samples was started and contrary to legend, a housewife in Peoria, Illinois submitted the best. In early 1943, Pfizer opened a plant using 50-gal deep vat fermentation with a 7000-gal capacity. In October 1943, the first shipment of 100,000,000 units was sent to SW Pacific. By the end of 1943, 21 billion units shipped, in 1944, 1633 billion units, and in 1945, 7052 billion units.<sup>12</sup>

There was a transient ethics fight in the military about who should get the penicillin. Whether self-inflicted disease, i.e. syphilis or gonorrhea versus war wounds.<sup>13</sup> Remember the military imperative of getting the most men into combat readiness! Even Winston Churchill got involved but production of penicillin quickly resolved the issue. By June, 1944, the use of penicillin had become the standard of care for wounds, as well as infections. Robert Coghill stated, "Penicillin is a more-or-less direct.... by-product of the war. It has probably saved more lives and eased much more suffering than the whole war has cost us." The Germans never developed it and Japan starting with German data never got it.

### **SHOCK**

The second great medical legacy of WWII was the treatment and/or prevention of shock. By pushing medical care forward, closer to the point of injury, many lives were saved and much infection and complications of shock prevented. Before the war resulting from the studies of WWI plasma acquisition and storage had been perfected (dried and reconstituted at the point of need.) The unity of resuscitation 1) volume (plasma) 2) surgery 3) red cells (whole blood) was pushed. In 1941, it was considered out of the question to supply blood to the combat zone. By mid-1943, we were using whole blood. The story of the organization of the blood banks and the movement of the blood to the fronts is wonderful.

We used 13,000,000 pts of plasma, 10,000,000 dried and 388,000 pts of blood during the war.

## AIR EVACUATION

The third major evolution of WWII was air evacuation. This had been initially used in WWI by sticking a casualty into the dead-space of a fuselage which was neither comfortable or comforting to the patient. This was nothing more than proof of principle as so few were moved by air. However, during WWII starting at Guadalcanal, New Guinea, and North Africa, air transport using fixed wing aircraft developed rapidly and contributed a lot to ease the load on forward hospitals and shorten the time to definitive care. It was all ad hoc and there was no formal medical evacuation organization as there was later. Transports would come forward with supplies and return loaded with stretcher cases. The first use of a helicopter for air evacuation was in the Philippines in 1944.<sup>14</sup> The helicopter came into major use in the Korean War and made Dr. Letterman's ambulance and medical evacuation system partly obsolete. By Vietnam, I remember no ground ambulances.

Hospital mortality in Korea was 2.4%. In Vietnam, the hospital mortality rose to 2.6% and the conventional wisdom which makes sense is that because of the rapid response and truly courageous flying by the helicopter crews, men arrived at the hospital alive but not salvageable. In previous wars, they would have died at the Battalion aid station or in transit. If you subtract deaths within 24 hours, the death rate in Vietnam was 1%.

In Vietnam, 70% of admissions were tropical illnesses, primarily malaria, amoebiasis, and giardiasis (which was not a human pathogen according to the U.S. texts.)

## WORLD WAR II<sup>15</sup>

	<u>1939</u>	<u>1945</u>
Men & Women in Military	~300,000	16,112,566
Doctors in Military	1,939	56,000
Nurses in Military	1,091	75,000

Back to WWII. There were several diseases that dropped to insignificant as a result of sanitation, immunization, or a combination. Plague, yellow fever, typhus



(102 cases, 1 fatality) tetanus (12 cases, 6 avoided immunization).<sup>16</sup> Gas gangrene was not a major issue because of antibiotics.

Battle fatigue, “blast concussion, combat psychosis, all synonyms for a psychiatric state characterized by weariness, baseless alarm, stuporousness, withdrawal, tenseness, violent behavior, Parkinson-like tremor, delusions, or even hallucinations. All wars have produced a similar syndrome. Early in WWII, two individuals devised a simple effective therapy. Both moved treatment forward. The essence was bathing, sleep, and food. Col. Martin Berezin prescribed “P&S” (pick and shovel).<sup>17</sup> 85-90% returned to their unit in the American Division on Guadalcanal. In North Africa, Capt Frederick Hanson, using the same basic technique, got 60% back to full duty.

A second syndrome was recognized and called the “Old Sergeant Syndrome” when the old veterans started breaking. This was nicely depicted in the *Band of Brothers*.

The British believe depending on intensity of combat that 200 days is the limit and rotation is needed.<sup>18</sup>

A very interesting phenomenon occurred in the U.S. at the outbreak of WWII. The global scope and importance of the war was anticipated. For instance, academic historians were plucked from college campuses and placed in positions where they could record the history as it was made. Another example is the Manhattan Project urged by Albert Einstein among others. It, in turn, created the most formidable weapon today with many medical spinoffs, some good, some bad.

Affecting us on a daily basis was the creation of interconnecting elite scientific organizations which were think tanks, policy boards, and implementing agencies. At the apex of these groups was the Office of Scientific Research and Development (OSRD) headed by Vannevar Bush. Under this organization was the Committee on Medical Research (CMR) and the Division of Medical Sciences (DMS) of the National Research Council (NRC). By 1943, there were 52 committees and subcommittees with 300 experts and liaison officers. Most knew each other and these organizations interlocked.

In addition, the Army set up the Army Epidemiological Board under the Dean of Yale Medical School. At the same time, Col. James Simmons (Army), Capt. Charles Stephenson (Navy), and Rollo Dyer of NIH decided to create the U.S.



Typhus Commission by snookering Franklin Roosevelt into thinking it had something to do with polio. It consisted of army, navy, public health, and Rockefeller Foundation people. It was reorganized by General Stanhope Bayne-Jones (former Yale dean) and General Leon Fox in Egypt. Meanwhile, a chick-embryo vaccine produced by Herald Cox of the USDA was working. A dust gun used by Fred Saper of the Rockefeller Foundation using DDT stopped a typhus epidemic in North Africa and Naples later,<sup>19</sup> a combination of the high tech and low tech. (DDT synthesized in 1874 and found to be insecticidal in 1939).

These organizations changed medicine forever by: 1) opening federal support and 2) increasing public awareness of the usefulness of medical research.<sup>20</sup>

### JAPANESE FIELD HOSPITAL

NEW GUINEA	
<u>Disease</u>	<u>Death Rate</u>
Malaria	45%
	(US 1%)
Wounded	55%
Dysentery	60%
GUADALCANAL	
Disease	10,700
Killed in action	8,500
Prisoner	1,000
Unaccounted	4,500

One last point is the role of democracy. I mentioned earlier that General Patton understood. Well, he had to learn the hard way. A democratic society will not tolerate poor treatment or senseless squandering of its sons, brothers, daughters, sisters. In contrast, the medical care in totalitarian states was terrible, or poor at best. It is said that in 1904 in its war with Russia, the Japanese care was a model and was studied. Thirty-five years later, it was considered honorable to die for the emperor and little effort was made to care for casualties.

In conclusion, while war is terrible, a great waste of resources and lives, there have been benefits derived. Most would have happened eventually, some perhaps not.

I would like to thank a number of people who have helped with this talk.

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Sandie Miller – Slides and manuscript  
Ann Jones - Wife

## Bibliography

1. Fighting for Life. American Military Medicine in World War II, Albert Cowdrey.
2. Quoted in Fighting for Life, p.112.
3. Quoted in Fighting for Life, p.178.
4. Old Testament, Deuteronomy, XXIII, 9-12.
5. Clinical Excepts, v17, #6, 1943.
6. Clinical Excepts, v17, #6, 1943.
7. Some Important Contributions to Medical Science by Military Surgeons, *The Journal of the Oklahoma State Medical Association*, 1936.
8. War and Medicine, Welcome Collection,  
Deutsches Hygiene – Museum, Dresden
9. Medics at War, John Greenwood, PhD and F. Clifton Berry, Jr.
10. Some Important Contributions to Medical Science by Military Surgeons, Robert Putteman, *The Journal of the Oklahoma State Medical Association*, 1936.
11. Fighting Fit Health Medicine and War in the Twentieth Century, Kevin Brown.
12. Ibid.
13. Ibid.
14. Ibid.
15. Ibid.
16. The History of Preventative Medicine in World War II, Tom Whayne, Public Health Reports 74:170, 1959.
17. Fighting for Life American Military Medicine in World War II, Albert Cowdrey.
18. Ibid.
19. Ibid.
20. Ibid.