MEDICINE AND ITS PRACTICE DURING THE AMERICAN CIVIL WAR

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ABSTRACT

Although popular belief holds that the American Civil War occurred during the "medical middle ages," this was not true. Over the course of the war, many pioneering physicians, scientists, and civilians contributed to the development of medicine into a modern discipline. Improvements were made to hospitals, including the creation of an efficient ambulance and transportation service. Women volunteers made important discoveries in the areas of sanitation and nutrition, while they cemented a place in medicine for female nurses. The practice of surgery was expanded to include new techniques, while standard practices, such as amputation, were improved. Rising survival rates for surgery in both military and civilian spheres enhanced public confidence in medical practices, which further encouraged doctors to attempt new procedures. Finally, the field of pharmacology was born out of the enormous demand for medicines during the war. While many of the remedies were initially homegrown from natural sources, wartime demands for medicines led to the development and growth of the pharmaceutical industry, and the beginnings of several of today's largest pharmaceutical companies. The efforts of many scientists, physicians, and civilian volunteers during the Civil War not only improved the quality of medical care available to American soldiers, but also spurred improvements in civilian medicine and paved the way for America to take its place in the modern world as a leader in science and healthcare.

The expression of American personality through this war, is not to be looked for in the great campaigns, and the battle fights. It is to be looked for just as much, (and in some respects more,) in the hospitals, among the wounded.[1] -- Walt Whitman

When shots first rang out at Fort Sumter, South Carolina, on April 12, 1861,[2] the United States was set on the path to war. President Abraham Lincoln called upon 75,000 militiamen to serve for a period of 90 days,[3] expecting the conflict to be resolved shortly. However, the war quickly escalated into one of the bloodiest in American history. At the conclusion of more than four years of fighting, at least 600,000 deaths were recorded and the Civil War had irrevocably changed many aspects of American life. Professional medicine experienced a substantial transformation as a result of the pressures of responding to the needs of the war's many infirm soldiers and personnel. Of those who died during the Civil War, more than two-thirds perished from disease,[4] while the remainder succumbed to battlefield injuries. With illness and injury playing such a significant role—some battles were even postponed because of excessive numbers of sick soldiers depleting the ranks—it is no surprise that medicine experienced remarkable transformations. Civil War medicine presents an interesting case—a time before advanced diagnostic equipment and Lister's Germ Theory forever changed the way doctors thought about the causes and treatments of disease and injury. Prevailing public

opinion in pre-war years held that professional medicine was a "dismal failure" and that the sick were more likely to recover as far from a hospital as possible.[5] However, despite lacking modern instruments and knowledge of the microbes that caused most of the diseases they fought, Civil War doctors were still able to take major steps forward in many areas. Significant changes were made to the construction and organization of hospitals, in nursing practices, in surgical techniques and in the development of drugs and growth of the pharmaceutical industry.

At the onset of the Civil War, medicine as a science and profession was, in many ways, substandard. A general indifference to good medical practices hampered the efforts of many early surgeons to clean up filthy camps,[6] while an almost total lack of adequate hospital facilities meant many soldiers went without care for days, sometimes lying where they had fallen on the battlefield for nearly a week before help arrived. The first major task of Civil War surgeons was to create a system of hospitals capable of supporting the immense number of sick and wounded they faced. Pre-war and early war hospitals were makeshift at best—"churches, hotels, warehouses, shops, barns, even private homes were pressed into service as temporary hospitals."[7] First aid was provided on the field or in regimental infirmaries, which were usually tents, where quality of care was poor because of unsanitary conditions and incompetent surgeons who lacked accreditation.[8] Many military leaders were opposed to the creation of general hospitals, as it was believed that men sent away to these hospitals would never return to their regiments after leaving the battlefield for treatment. However, it became clear early in the war that the makeshift hospital system was inadequate, and the first calls for a reformed hospital system came as early as 1861. Subsequently, the hospital and medical transportation systems were significantly reformed.

Large general hospitals were constructed in major cities. These buildings were designed with many wards radiating out from a long, circular corridor surrounding a central administrative core of buildings.[9] These hospitals contained thousands of beds in well ventilated rooms, and were constructed based on the notion that patients with similar afflictions could be housed together in a single ward, with each ward under the care of surgical and nursing staff. This also aided in the prevention of the spread of infectious disease—a modern concept finally gaining in popularity among medical professionals. The efficiency and large capacity of these general hospitals enabled Civil War doctors to treat over a million patients, with less than a 10% death rate. This design is the precursor of the modern hospital, with designated wings and floors for each medical department. An extensive network of regimental and field hospitals closer to the front lines supported the general hospitals. This was the "three-tiered hospital system" put in place by medical director Jonathan Letterman in 1862.[10] A soldier wounded on the battlefield could expect to be triaged by the medical staff in a manner not unlike the triage system used in modern emergency medicine. At the front line, a surgeon would identify soldiers with wounds considered lethal, list them as "killed in battle," and then focus on those whose injuries were not considered mortal. Lethal injuries at the war's onset included penetrating wounds to the abdomen, chest, and head, while treatable wounds were bullet wounds to the extremities and other less traumatic injuries.[11] Those with treatable wounds were removed from the field once the battle had ended, provided with first aid at small field and regimental hospitals and then transported further to the rear for more definitive care. In this way, soldiers with minimal

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injuries could be treated and remain attached to their regiment, where they could be expected to perform tasks such as assisting with the nursing of other soldiers, and ultimately return to combat. The more severely wounded were transported in a timely manner to better equipped facilities. The transfer of patients was made possible by one of the war's greatest and most admired innovations—the ambulance system.

The original ambulance, created in 1859, consisted of a two-wheeled buggy drawn by horses. Since many areas lacked paved road systems, an ambulance ride over rocky terrain could be nothing short of excruciating, with patients often tumbling and rolling around the back of the buggy, and fresh surgical wounds frequently ripping open in the process. By 1862, the need for a military ambulance corps with trained personnel was obvious. Privately owned ambulance wagons loaded with supplies often could not keep pace with troop movements,[12] and those for the transport of patients were poorly designed and constantly in short supply. They often could not be counted on to provide adequate transportation in time of need. The original litter-bearers in a regiment were usually the drummers, often young boys, who sometimes abandoned their duty out of fear in the heat of battle, leaving the wounded to be carried away by their fellow soldiers.[13] A trained ambulance corps with well designed vehicles stocked with supplies and outfitted for proper patient transport relieved many of these problems, and allowed for efficient, more comfortable transport of the wounded to field hospitals and then to general hospitals in nearby cities. Relieved of the responsibility of carrying their fellow soldiers to the field hospital, many more soldiers remained on the field to fight, expediting the progress of battle. The ambulance system went on to become one of the most highly praised and imitated innovations in the world after its inception in the Civil War. European armies adopted similar systems in their own wars, and in 1867, at the World's Fair, the American Civil War Ambulance was awarded a grand prize. The ambulance and field hospital system devised by the Americans remained in use until World War II, and represent the beginnings of modern emergency medicine.[14]

Two other innovative and original designs in medical transportation emerged during the Civil War—the hospital train and the hospital boat. The newly developed railroad system played an important role, as many patients could be moved with relative ease and comfort during the war's later years in specially-designed hospital train cars. In these cars, beds were strung from the ceiling using rubber slings to minimize pain caused by the jarring ride. A hospital car could hold men in thirty beds as well as on chairs and couches. Nurses attended the patients on the ride and provided for them from a well stocked pantry and medical supply closet.[15] The trains took patients to depot hospitals, which could then send them on via ambulance to general hospitals. Patients could also be expedited to larger hospitals via ship. While never as extensively used as the ambulance and train systems, the floating hospitals played a vital role in the efficient network for movement and treatment of wounded soldiers. The hospital ship was generally confined to use by the Union, where extensive waterways and existing industry facilitated its outfitting and use. Like ambulances and trains, hospital ships were improved as the war progressed to make them more comfortable and functional. However, they did not fall under military command until late in the war. Ships in operation prior to 1865 were maintained and staffed primarily by volunteers. While small ships rarely had doctors, larger boats could expect to have a few surgeons in addition to the nursing staff.[16] In a previously unprecedented situation, many of the nurses on board the hospital

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ships were volunteer women from local wealthy families. This was just one of the many ways women found to involve themselves in the war effort.

While the prevailing attitude of the day dictated that a woman's place was at home, more than 3,200 women would serve as paid nurses in both the Union and Confederate armies,[17] and thousands more served as volunteers in hospitals, on the battlefields and in support organizations. The most significant of these organizations was the Sanitary Commission, which was staffed primarily by women, and had a tremendous impact on the state of healthcare during the war. Inspired by the British Sanitary Commission's work during the Crimean War, the Sanitary Commission was praised as "the most powerful organization for lessening the horrors and reducing the losses of war which mankind has thus far produced."[18] At its inception, the organization was authorized to make recommendations to the government's medical bureau on "inspection of recruits and enlisted men; the sanitary condition of the volunteers; to the means of preserving and restoring the health, and of securing the general comfort and efficiency of troops; to the proper provision of cooks, nurses and hospitals; and to other subjects of like nature."[19] As its influence and impact on healthcare grew, the Commission's role expanded to encompass tasks such as directly providing supplies and care through its own trained staff of nurses. Indeed, the Commission was able to influence the military's appointment of surgeons and the administration that ran the medical bureau, allowing younger, progressive physicians to be given senior positions in which they could push the boundaries of medicine by devising new treatments and procedures. The Sanitary Commission's standards greatly improved the quality of medical care provided to Civil War soldiers, and these principles carried over into public health at the war's end. Its policies, most significantly the changes it effected in the cleanliness of camps and hospitals in order to reduce the spread of infectious disease and improvements female cooks made to the diets of the troops, decreased the ratio of death from illness to death from injury to just two to one. At the war's end, mortality in the army was at one-third its prewar level.[20] The Commission was instrumental in promoting hospital reforms that improved care of the wounded. It was also responsible for chartering, staffing, and maintaining the Union's hospital ships, and the design of hospital train cars.[21] The impact of this volunteer group was enormous, and, given that women ran most of its efforts, truly remarkable for its time. Perhaps unsurprisingly, the Sanitary Commission also inspired the modern day American Red Cross, which was founded by a pioneering female nurse of the Civil War era—Clara Barton.[22]

The nursing profession evolved substantially during the Civil War. Prior to the war, female family members provided nursing care exclusively in the home, and on the battlefield men who were themselves recuperating from injury tended to their fellow soldiers.[23] Stories of soldiers being cared for by other injured soldiers filtered out through the media, and the ensuing public outcry led to groups of female civilians volunteering their time. Inspired by the work of Florence Nightingale during the Crimean War, and under the command of the formidable Dorothea Dix, several groups of women were provided with professional nursing training[24] and sent out to improve conditions in local hospitals. Under Dix alone, more than 3,000 women were trained and served as paid nurses. While their presence in the hospitals was gradually accepted and both surgeons and patients alike valued their contributions, female nurses faced challenges working side by side with male surgeons during the war. As

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nurse Hannah Ropes reported in her diary, nurses and surgeons approached the problem of illness from different angles—the surgeon from the point of view of objective scientific work, and the nurse with "benevolent and healing effect…and…womanly understanding and gentleness."[25] Thus, nurses often found themselves at odds with the agendas of surgeons. Many women, like Ropes, took it upon themselves to protest to the highest authority—the Secretary of War—about the dreadful conditions and surgical practices they observed in early war hospitals.[26] Through persistent hard work, women were able to effect dramatic change in the quality and continuity of care provided to patients, and in so doing, created a place for themselves in professional medicine. Although their determination to be heard caused friction and sometimes resulted in wartime surgeons refusing to take any nurses save nuns into their practice, nursing was transformed into a profession in which women would come to dominate, and the quality of care soldiers and civilians received in general hospitals increased exponentially. After the war, in 1873, the first all female nursing schools were opened, further legitimizing the profession women of the Civil War had worked so hard to create.

For women in the South, working as a nurse was very different. Because of Southern social constraints, many women were kept away from hospitals entirely, and of those who did find work in the hospitals, many labored as cooks, mended clothing, made slings and dressings, and entertained patients rather than providing direct medical care. This task was reserved almost exclusively for male nurses in the various hospital wards.[27] Southern women, however, were just as active in other volunteer positions. This included fundraising and organizing supplies for delivery to the troops and growing medicinal plants, most notably poppies for opium production, to support the Confederate pharmacy industry.[28] Although their jobs were less structured than those of their Northern counterparts, Southern women filled many vital supporting medical roles.

With support from organizations such as the Sanitary Commission and led by strong, determined women like Dorothea Dix, women succeeded in creating a niche for themselves as nurses and medical assistants during the Civil War. Many of their ideas and practices led to improvements in the health and safety of soldiers, and the care they provided in the hospitals, whether through direct patient contact or organization of supplies, ensured the caliber of healthcare available to the average Civil War soldier was second to none. Unsurprisingly, many of the war's most pioneering female nurses were also suffragists.[29] The expanded sphere of influence they enjoyed during the war would further the cause for women's rights at the war's end. Women's medical schools soon followed and the first female doctors were already practicing, albeit unofficially, during the Civil War itself.

Pioneering surgeons and scientists improved many existing procedures during the war, most famously the amputation, which was the most widely practiced and perhaps most notorious of all wartime surgical interventions. Estimates put the number of amputations performed during the war at over 50,000,[30] a staggering figure that illustrates the intensity and brutality of the conflict, and the incredible task the medical system faced if it was successfully to treat the wounded. Many believed that the best way to prevent infection and further injury and to maximize a soldier's chance of recovery was to remove the patient to a hospital and operate as soon after the injury as possible.[31] This process was expedited by the new ambulance service and hospital system, which enabled surgeons to reach their patients more efficiently and quickly. The amputation was often necessitated by two related causes. The

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first, gunshot wounds from the minie ball, a .58 caliber slug, were often so destructive and debilitating that limb reconstruction was near impossible and full amputation was considered the more "conservative approach,"[32] as it was more likely to ensure the survival of the patient. Since the minie ball often crushed bone up to three inches from the site of bullet impact, it is easy to see how surgeons, pressed for time and operating under trying conditions, often reached for the quickest and most assured option for recovery. The second were severe infections, such as gangrene. Lacking understanding of infection, many surgeons attempted to amputate in order to stave off its spread. However, by the war's end, many would come to question this practice,[33] concluding that cutting into a gangrenous wound would increase the likelihood of infection spreading into otherwise healthy tissue. These two situations often went together, as a healing amputation stump from a minie ball injury was at risk for gangrene, the treatment of which sometimes led to further resection of the affected limb in an effort to halt the spread of infection.

There were two major amputation techniques: the flap method, in which a piece of skin was used to cover the amputation site, and the circular method, which cut straight through the limb and left the site open. Surgeons favored the circular method, because it was faster and easier to perform in poor light, as was often the case in regimental field hospitals. The doctor used a modified chainsaw, which gave the Civil War surgeon his enduring nickname—Sawbones—and could be completed in less than ten minutes. At this rate, a dexterous surgeon could perform many operations each day—a fact that contributed in no small way to another enduring image of Civil War surgery—the pile of amputated limbs outside every regimental hospital after a battle. Nevertheless, the decisiveness and speed of Civil War amputations lowered fatality rates dramatically, especially if the operation was performed during the first 48 hours after injury. The civilian death rate for amputations was as high as 50% when the war began, but Civil War surgeons recorded a rate of death of only 26.3% during the war itself,[34] a dramatic improvement caused in no small part by their efficiency. This number is all the more significant considering that the French, who pioneered the amputation as a standard military medical practice during the Napoleonic Wars[35] and who were considered the best in the world at it, achieved a 76% mortality rate during the Franco-Prussian War, five years after the Civil War ended.[36]

While mastery of swift operations was responsible for the recovery of many soldiers, the use of surgical anesthesia was the defining characteristic of Civil War medicine that allowed physicians to pioneer new techniques and spread their use into civilian medical practice at war's end. Not only did light anesthesia in the form of chloroform, ether, or some combination of the two provide effective pain relief during minor procedures, it enabled surgeons to attempt longer, more complex operations. Decreased death rates, resulting in part from the small quantity of anesthetic used, accelerated its acceptance by younger physicians. Coupled with forthcoming developments in aseptic surgical practice, anesthesia provided the doctors with the boost they needed to develop new, effective, safe surgical techniques that could be used in civilian medicine after the war.

New surgical procedures attempted during the Civil War were varied in their nature and aim and included such techniques as the repair of hernias and sucking chest wounds. Dr. Benjamin Howard developed a new technique for the sealing of chest wounds, and despite a dismal success rate during the Civil War, with continued improvement it was still in use

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during World War I. Elements of this technique remain in place today.[37] Although the benefits of many of these procedures often were undone by the spread of infection through unsanitary operating and living conditions, the work of the physicians in devising these techniques laid the groundwork for future improvements. Surgeons also attempted rudimentary neurosurgery by lifting bone fragments off the brain to alleviate pressure, tracheotomies to aid the breathing of those with traumatic head and neck injuries, and plastic surgery to repair facial injuries. The willingness of Civil War surgeons to attempt new procedures not only gave many patients whose injuries previously would have been deemed hopeless a chance to survive, but substantially increased the public's confidence in professional medicine and the surgeons' confidence in their ability to do good. In the words of one Confederate surgeon, "I have lost much, but I have gained much, especially as a medical man. I return home a better surgeon, a better doctor."[38] This success enabled doctors to gain respect from the public after the war, when newly devised surgical techniques helped lower mortality rates for previously untreatable conditions. The widespread increase in surgery led to the beginning of surgical-training programs, and a general increase in the quality of medical education, which improved public respect for physicians. The increase in successful operations led to a demand for postoperative care and rehabilitation. The overhauled hospital system included convalescent facilities for the burgeoning field of rehabilitative medicine. In these hospitals, patients were kept in newly designed traction splinting devices to ensure straight healing of broken bones, and amputees were fitted with prosthetic devices—many of which became so sophisticated by the war's end that "even double-arm amputees [could]…write…and dress and feed themselves."[39] Here again, professional medicine found an ally in the industrial revolution for its new technological needs. Convalescence and recovery from injury and disease also were improved by advances in pharmacology.

The pressures of providing mass-produced pharmaceutical products to support the two armies during the war spurred the development of pharmacy as a science and business in America. Statistics show that before the end of the war, physicians had recorded slightly more than six million cases of illness and treatment.[40] The role of pharmacy as a science was critical; disease was rampant among the troops, and serious illness not only consumed precious resources, but decreased the number of soldiers available for active duty and demoralized those who remained healthy.[41] While the course of the war was decided through military campaigns, the outcome of battles often was dependent on the state of health of the armies. Indeed, more men were lost to disease in the camps than to fighting during the Civil War.[42]

At the onset of the war, pharmacy as a field was still in its infancy; only six schools of pharmacy existed in 1861[43] and the field itself carried low status and low pay.[44] Many physicians were their own pharmacist, which underscored the prevailing belief in the inferiority of pharmacology. However, despite these obstacles, the production and dispensing of medicines remained vital to the functioning of the military during the Civil War and the hospital stewards who performed these jobs developed a number of allies in their fight for enhanced recognition in military and civilian medicine.

Without several important drugs first used in large quantities during the Civil War, surgeons and physicians would have struggled to treat many of the most common situations they faced. These drugs included ether and chloroform as anesthetics for operations and other

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painful medical procedures; morphine and other opium derivatives as pain killers; alcohol, believed to be a stimulant at the time and prescribed in a variety of situations, quinine; used both as a prophylactic and in the treatment of malaria; and the controversial calomel, a compound containing mercury. All of these remedies carried some risk aside from the chemical action of the compound in question, as precise dosing levels had not yet been devised. Much of the information pertaining to the safety of drugs was discovered through trial and error on the battlefield. Fortunately, extensive record keeping allowed knowledge of drug safety and efficacy to be collected for future reference. Records detailing the uses and effects of these medicines reveal much disagreement from scientists, pharmacists, and physicians on the safety and efficacy of the drugs they prescribed.

While the necessity of anesthesia was never questioned in earnest after the war began, both ether and chloroform carry inherent risks. Ether is flammable, and many operations were performed by candlelight in tents. Chloroform, if given in high doses, is toxic. The solution often was to use a mixture of the two chemicals in order to provide the safest and most effective anesthetic. Although the mixing was done by eye into a handkerchief held over the patient's nose and mouth, a standard practice for this procedure was established and by war's end, was carried out universally in Civil War era surgery. Likewise, although quinine proved its efficacy in treating the symptoms of malaria, preventing the contraction of malaria if given prophylactically,[45] and providing mild pain relief in small doses, large doses of quinine were toxic and a dose of eight grams was fatal. Civil War physicians discovered this fact when patients who had been given large doses of quinine began exhibiting symptoms of cinchonism—quinine poisoning. However, there was no argument that quinine was an indispensable drug for both the North and South, and physicians soon described the effective quinine dose for a variety of conditions—be daily prophylactic treatment to prevent malaria, treatment of malaria itself, or pain relief. Unfortunately, the experience with calomel, alcohol, and opiates was substantially different. Opiates and other narcotics such as morphine were used liberally as painkillers, even when the situation did not call for them. While the efficacy of these compounds was never in doubt, a substantial portion of the army returned to civilian life hopelessly addicted to them. This was both a problem of physicians lacking sufficient knowledge of the chemicals they were prescribing, and the unregulated nature of the growing pharmaceutical industry.[46] Drug addiction among civilians and returning army veterans was a substantial problem, especially in the South, at the war's end. Much has been written about the use of alcohol and calomel as treatments during the war - that so much was written during the war itself indicates the extent of disagreement about the use of these drugs. Alcohol was variously categorized as a stimulant, a stimulant with secondary sedative effects, and a "near" stimulant.[47] Despite these disagreements, alcohol remained in use as the liquid base for the suspensions in which powdered medicines were delivered, and as a beverage prescribed to troops in a wide variety of situations, regardless of its obvious lack of efficacy. Calomel, on the other hand, was stricken from army supply tables by Surgeon General William Hammond in 1863. Based on medical records available to him, Hammond concluded, much to the chagrin of many of his contemporaries, that prescribing chunks of solid mercurial compounds was doing far more harm than good.[48] Calomel was believed, wrongly, by prescribing physicians to clear up "congestion in the portal circulation" of the liver—believed to be the source of many ailments.[49] This was yet another remnant of the "medical middle ages" and

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the Hippocratic concept of balancing the four humors of the body in order to maintain health. While the negative properties of calomel, mercury-poisoning being one of them, were recognized by most prescribing physicians during the war, the use of calomel as an indiscriminate cure-all remained popular, and it remained available to physicians via special request despite its removal from the official supply tables. Hammond was ultimately removed from office by his fellow surgeons for his bold move, but his decision promoted professional discourse on the usefulness of many of the standard remedies doctors had come to rely on. Hammond received both legal and medical exoneration in 1879, when his removal from office was not only acknowledged as wrong, but the medical community had also come to agree that calomel, along with antimony and other heavy metal compounds, was detrimental to the health of those to whom it was prescribed.[50]

The high demand created by the war for pharmaceutical products catalyzed the growth of pharmacy as a science and business in America in ways never previously experienced. Although this growth relied on emergent technology provided by the industrial revolution, a substantial number of medicines were still derived from natural rather than synthetic sources. Civilians, mostly women, were enlisted by the government to grow a diverse array of medicinal plants, and were often reimbursed for their efforts.[51] Plants included garden poppies for opium production[52] and quinine, extracted from the bark of the cinchona tree. Lacking the industry available in the North for synthesizing compounds, the South relied much more heavily on homegrown ingredients and remedies, and attention was dedicated to finding suitable natural alternatives to ingredients that were not available in the South.[53] (Because the Union naval blockade prevented ships laden with medical supplies from reaching southern states, more traditional remedies and ingredients were unavailable.) A network of pharmaceutical laboratories was established in major southern cities, including Columbia, South Carolina, and Montgomery, Alabama. In this fashion, the South created its own wartime pharmaceutical industry, although the majority of the businesses that would develop into modern pharmaceutical companies were centered in the North, especially Philadelphia. In the North, the U. S. Army itself never created an independent pharmaceutical manufacturing laboratory, preferring instead to contract out the work to businesses, which further spurred the development of these corporations into some of the world's largest modern pharmaceutical companies. Names such as Wyeth, Pfizer, and Squibb are all easily recognizable in the modern pharmaceutical industry, and all found the growth of their young businesses stimulated by wartime production demands. Indeed, they benefited significantly from the war.

Far from being stuck in the medical middle ages, the medicine of the Civil War was rather at a significant crossroads between the traditions of the past, the demands of war, and the discoveries of the modern day. When, in 1865, Joseph Lister proposed his Germ Theory of bacterial infections and subsequently began to promote antiseptic practices, the process of leaving the middle ages of medicine begun by Civil War surgeons and scientists was complete. The improvements produced by Civil War physicians provided the framework, and all that remained at the war's end was a catalyst to hasten the beginnings of modern professional medicine. Lister's work provided this impetus.

The enormous number of cases a war provides its physicians and scientists to study and treat allows for significant practice in situations uncommon to everyday life, and the

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experience gained in such fashion can be extrapolated to treatment of the civilian population. Out of the myriad needs of Civil War troops came the beginnings of the modern hospital system, new emergency medical transportation, the development of professional nursing, new surgical techniques with growing success rates, the development of pharmacy as an important facet of medical science, and the rise of the pharmaceutical industry. The physician, from his lowly status in pre-war America, became a figure of success and prestige, thanks to the efforts of thousands of Civil War doctors. The Civil War could not have occurred without the support of its medical staff, suppliers, and volunteers, and medicine in America could not have been modernized so quickly without the war. The success in the transformation of so many areas of American medicine is further underscored by the speed with which developments were imitated by European countries during their own wars—France and Prussia adopted the ambulance and field hospital system—while many English medical schools remodeled their curriculums to include field experience like that gained by American medical students during the war. Papers and journals across the world praised the developments that came out of the war, cementing the American position as a leader in modern healthcare.

It has been said that, "medicine is probably the only non-belligerent profession in which progress has been made as the direct result of war."[54] Perhaps nowhere is this more apparent than in the impact of the Civil War on the modernizing of professional medicine. Facing millions of sick and injured soldiers, physicians and other medical professionals found themselves not only confronted with the challenge of providing for their care, but with extraordinary opportunities to contribute to education, research, and innovation.

NOTES

[1] Davis, 23.
[2] McPherson, 273.
[3] McPherson, 274.
[4] Johnston, 29.
[5] McPherson, 486.
[6] Bollet, 17.
[7] McPherson, 477.
[8] Bollet, 18.
[9] Bollet, 222.
[10] Flannery, 92.
[11] Bollet, 99.
[12] Canale, 14.
[13] McPherson, 484.
[14] Bollet, 137.
[15] Bollet, 109.
[16] Bollet, 112, 115.
[17] Flannery, 50.
[18] Flannery, 51.
[19] "Annexes…", 229.
[20] Kramer, 458.
[21] McPherson, 482-483.
[22] Kramer, 455.

[23] Bollet, 405.
[24] Bollet, 408.
[25] Brumgardt, 33.
[26] Brumgardt, 6.
[27] Berlin, 8.
[28] Flannery, 66.
[29] Bollet, 423.
[30] Johnston, 29.
[31] Canale, 17.
[32] Bollet, 148.
[33] Breeden, 211.
[34] Bollet, 152.
[35] Walker, 193.
[36] Bollet, 153.
[37] Bollet, 174-176.
[38] Bollet 83.
[39] Bollet, 160.
[40] Flannery, 22.
[41] Bollet, 269.
[42] Steiner, 3.
[43] Flannery, 25.
[44] Flannery, 87.
[45] Bollet, 237.
[46] Flannery, 236.
[47] Flannery, 38.
[48] Flannery, 150.
[49] Flannery, 149.
[50] Bollet, 236.
[51] Hambrecht, 1223.
[52] Flannery, 66.
[53] Hambrecht, 1226.
[54] Canale, 16.

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