

MEDICINE IN WAR AND PEACE TIME

During the last two hundred years, an increasingly scientific approach has been taken to medicine and healthcare. This was the result of a better understanding of the human body and concepts about public health, germ theory and sanitation. This approach was applied to medical practices on and near battlefields. A major advance in the twentieth century was the creation of battlefield hospitals or mobile military hospitals. These were temporary hospitals that could usually be packed up and moved around; they were created close to the battle fronts to try to get expert help to those injured as soon as possible.

Alongside this advance was the provision of professional medical staff close to the battlefield. The Royal Army Medical Corps (RAMC) was formed in 1898 and worked alongside the Army Nursing Service, formed in 1881, and then the Queen Alexandra's Imperial Military Nursing Service (QAIMNS), formed in 1902. The men and women of these units were all medical professionals before joining the military, and they brought their knowledge to military hospitals around the world. Men and women from these bodies served very close to the fighting from the start, with many being killed or dying from

illnesses contracted from the injured servicemen.

The necessity of trying to save lives on a daily basis in a warzone has led to some life-changing ideas and practices used to treat a variety of medical conditions. The treatments may not always have been invented during the conflict, but their regular usage has led to their becoming accepted medical practices rather than theoretical or experimental.

The new forms of weaponry of the twentieth century resulted in injuries that were new or different to those in previous conflicts. For medical staff, this meant adapting or

developing new treatments or practices. The staff also became familiar with seeing lots of patients with the same or similar injuries, such as head injuries, limb damage and burns. This familiarity meant that they became adept at treating injuries that may have been rare in peacetime. These experiences and confidence in treating certain injuries helped to contribute to advances in medical science and procedures, resulting in new developments, theories, techniques and medicines. These new skills and understanding quickly spilled into medical practice for civilians as well.

FIRST AND SECOND WORLD WAR ADVANCES

Soldiers serving on the front line or any other dangerous position did not carry full medical kits with them in the First World War (sometimes they carried a bandage); the only people who had any medical kit were medics and those at the Regimental Aid Post. The medical kit was very basic and there was little that could really be done for anyone until they reached the Casualty Clearing Station (in some cases this was a very basic medical/first aid facility, where people would only remain for a few hours, and in other cases it was a basic hospital with beds and some

forms of proper treatment) and, from there, on to a base hospital, sometimes many miles from the front line.

Blood transfusions (replacing lost blood from injuries using blood from other people) were being experimented with for decades before the First World War. However, establishing successful ways of carrying out transfusions from stored blood was first achieved during this period. The huge loss of life and injuries in the early battles, due to the increase in artillery shells and mechanised weapons (machine guns), pushed doctors to find a way

to replace blood soon after the injury. They needed to make the new science around blood transfusions work to save lives. This meant establishing blood transfusion systems in the hospitals very close to the battlefields (including in some Casualty Clearing Stations) which an American doctor* managed using mobile (chilled) storage units in 1916. (*Although America did not enter the war until 1917, there was a group of American doctors who volunteered to for medical service to support the Allied doctors in their work.) Doctors also





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started using saline transfusions (replacing lost fluids, such as water), as well as blood transfusions, all of which saved thousands of lives.

This had an impact on the type of surgery that could be carried out, and doctors became better skilled at preserving veins and preventing artery damage, which, in turn, enabled more limbs to be saved rather than amputated.

The Thomas splint was invented by Welsh doctor Hugh Owen Thomas before the war. He discovered that if a fracture or break of a limb could be properly stabilised by a splint, then the rate of infection to the wound was hugely reduced. An infected broken leg or arm could lead to blood infections, resulting in death or amputation. This development became fully appreciated when it was introduced to the battlefield by Thomas's nephew, Robert Jones. Many soldiers experienced breaks

to their limbs due to the use of artillery fire (shelling) of the trenches, and at the beginning of the war, 80% of all soldiers with a broken femur (leg bone) died as a result of the complications. By 1916, with the widespread use of the Thomas splint, 80% of soldiers with this injury survived.

The dangers of infection had been recognised for many years, but the First World War was the first time that doctors used biological testing close to the battlefields to try to stop the spread of infectious diseases and limit the seriousness of infected wounds. This biological testing meant that doctors were recognising different infections and bringing in higher rates of sanitation for hospitals, operations and during recovery. Mobile x-ray units were also introduced to try to locate bullets and shrapnel lodged in injured soldiers; if these bits of metal were not located and removed, they could

cause fatal infections. The success of the x-ray machines led to more and more machines being built in order to have them installed in hospitals along the Western Front.

The nature of the First World War and the weapons used meant that many men suffered from terrible burns and physical injuries, but the advances in medicine meant that they survived. As a result, huge advances were made in reconstructive surgery (plastic surgery) and prosthetics (false limbs) for amputees. All of this technology was carried into the civilian world as well. Although many soldiers lost their lives during the First World War, millions more returned home with life-changing injuries; this contributed to the development of skills used for rehabilitation and long-term medical care.







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By the Second World War, penicillin and antibiotics had been developed, although they were still experimental. These were used extensively during this period, and made a huge difference to injured men and women's survival rates. Battlefields are messy places, and it is very easy for a wound to become infected and for infectious diseases to spread. By using antibiotics, the medical teams were able to prevent many of the infections and diseases that had been routine in the First World War. Familiarity with the drugs during the war resulted in their usage becoming

routine for doctors in the civilian world post-1945.

One of the most important advances in medical treatment in the First and Second World Wars was probably the recognition that speed in getting the injured to treatment was essential. French doctors introduced the concept of triage during the First World War – the classifying/sorting out of injured patients to establish who needs the most urgent treatment. Battlefield hospitals with properly trained staff began to be located closer to the fighting zones. Proper chains of support for getting the wounded to treatment began. Aircraft also started to take on this important role.

Fleming's discovery of penicillin in 1928 was initially overlooked, and it was only made into an effective drug during the Second World War, when medical researchers were seeking a method of infection control in troops.

AEROMEDICAL EVACUATION 1917 – 2000 THE FIRST MEDICAL EVACUATION

Aircraft as part of the Royal Flying Corps (part of the forerunner of the RAF – see the first activity for further information) were deployed wherever the British military was positioned during the First world War – mainly in reconnaissance and communication roles. This meant that aircraft were present all over the world for military use.

While most people focus on the Western Front when they think of the First World War, there was also large-scale fighting elsewhere. One major theatre of war was the Middle East. The British Army was involved with large-scale battles across the region, including in Egypt, Palestine and Mesopotamia (modern-day Israel, the Palestinian territories and Irag). In the middle of February 1917, British soldiers of the 2nd Battalion Camel Corps attacked an Ottoman Garrison at Bir el Hassana in the Sinai Desert. Lance Corporal MacGregor was badly injured in the ankle from a gun wound. The Army medics tried to do what they could, but the risk of infection was high and he needed specialist care. However, it would take three days to cover the 44 miles across the mountainous desert to the nearest medical base at El Arish. A British reconnaissance biplane was in the area and offered to take the injured MacGregor to El Arish if he could be strapped to the aircraft. He was then transported to the hospital in 45 minutes, where he was treated properly and survived his injury.







In the Second World War, aircraft started to be used regularly to move the severely wounded from the battle front to hospitals. Aircraft began to be adapted for carrying human cargoes that needed medical treatment.

Towards the end of the Second World War, RAF transport aircraft became involved with large-scale medical transportation, saving the lives of thousands of servicemen and women and civilians.



A key change in medical support by aircraft was demonstrated in the Korean War (1950–53). Much of the fighting in this war took place in mountains and valleys – places difficult to get people into and out of quickly by road. The United States Forces started to use the newly developed helicopters to get into difficult areas in the middle of a battle. It was possible to land a helicopter in a small area, unlike fixed-wing aircraft that needed a



landing strip. This meant that injured soldiers could be strapped to the helicopters in specially designed pods and transported to hospitals in under an hour – where the journey by road might have taken hours or even days. Helicopters were also able to hover above the scene of an accident, allowing the injured to be winched up under the aircraft for speedy removal. These advantages also made the helicopters susceptible to attack, but their advantages outweighed the dangers for many.

During the Korean War, a seriously wounded soldier who arrived at a Mobile Army Surgical Hospital (MASH unit) had a 97% chance of survival after treatment, as long as he was transported there as quickly as possible.

Following the Korean War, this approach using helicopters was quickly adopted by other countries, in particular the UK with the RAF.

MEDICAL EVACUATION 2000 TO TODAY

In the years following the Second World War, the RAF developed a number of strands to its medical support capabilities.

The RAF had its own Medical Services, which have existed since 1918, but it also developed medical evacuations, in-air treatment and search and rescue capabilities. The Search and Rescue services and Mountain Rescue services utilised the role of helicopters for getting into difficult areas. The activities of these two units have saved the lives of thousands of people, especially civilians. There is more information on these roles in the activity on *New Aircraft*. The medical evacuation role is an especially important component of the RAF services, and is used for both military and civilian purposes.





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AEROMEDICAL EVACUATION TEAM

All military aeromedical evacuation is part of the RAF Tactical Medical Wing (TMW), based at RAF Brize Norton. There are two key types of medical evacuation: those taking groups out from a secure site to a hospital in the UK, and those that fly into a combat zone and may be targeted for attack as they try to evacuate injured people.

The first type of evacuation uses large RAF C-17 aircraft to transport injured or ill people while at the same time delivering critical care to the patient. This means that injured servicemen and women who may have just been operated on as a result of extreme injuries (amputations, heart surgery, and so on) can be moved in less than a couple of hours to hospitals back in the UK. The critical care teams can carry out tests and provide medical treatments and trauma support comparable to any intensive care unit based on the ground. The critical care teams are all highly trained medical staff, many of whom will go on to work in civilian hospitals once they leave the military. Their mobile equipment includes all the facilities that you

would expect to see in a hospital, such as heart monitors, ventilators and resuscitation equipment.

This critical care can also be applied to civilians who have been caught up in warzones or affected by terrorist actions. In 2015, there was a terrorist attack on holiday-makers in Tunisia. Of the 38 innocent people killed, 30 were British. A further 39 people had serious injuries. Four of the very seriously injured were British nationals. They were collected from Tunisian hospitals within hours of the attack by the RAF critical care team, who then transported them back to UK hospitals using the specialist facilities on the C-17 aircraft.

The C-17 aircraft require a runway or airstrip to land and take off. They are large aircraft, which can



By Adrian Pingstone (Arpingstone) - Own work, Public Domain, https://commons.wikimedia.org/w/ index.php?curid=4389378

carry 50 stretchers and over 100 medical staff if needed.

The second type of aeromedical evacuation is carried out by the Medical Emergency Response Teams (MERT) – these are carried around in specially adapted Chinook aircraft (helicopters with two sets of blades), which are armed and have protection so that they can fly into hostile areas. These are able to land on small patches of ground in conflict areas, often while a battle is still going on around them. On board the Chinook, there are high-tech medical facilities that turn it into a flying A&E (accident and emergency), with facilities to deal with all types of battlefield injuries, including severe loss of blood and loss of limbs.

On board, the staff are a mixture of specialist doctors and nurses as well as military medics, who are also trained soldiers. If the team are called in while the battle is still continuing, they also have four soldiers to provide protection for the medical team when it lands, leaving the Chinook to get to the injured and get them on board. The MERT teams can carry out blood transfusions while transporting the injured personnel from the conflict area and can anaesthetise the patient before they reach the military hospital, so that they can be operated on immediately.





FACT BOX

One of the busiest years for aeromedical evacuations was 2009, when the number rose from **800** in 2008 to **1,313** the following year.

RAF Medical Services was formed in 1918 from the amalgamation of the Royal Flying Corps and the Royal Naval Air Service.

In 1919, there were **415** medical officers

There are approximately **1,800** personnel, providing medical, nursing, technical and support capabilities

The RAF Medical Services describes itself as the recognised lead authority on casualty evacuation by air, having specialised in the field since the Second World War.

In his second of three blog posts from his recent Afghan deployment, Wing Commander Simon Ling tells us about the work of the RAF's Medical Emergency Response Team.



Although Camp Bastion* is far from the main battlefield and enemy action, our logistics role and location provide tangible reminders as to the sacrifice and costs of this conflict. Our headquarters is located 150 metres from the final approach to the hospital emergency helipad.

This means that with all too frequent regularity our work will be stopped by the noise and shake of helicopters on their final approach to the hospital.

Such reminders have been powerfully reinforced during our evening briefs that have included accounts from hospital staff who sometimes graphically outline their truly amazing work.

These briefs have confirmed beyond any doubt in my mind that the medical care received by our injured, from point of injury to rehabilitation back in the UK, is both pioneering and second to none.

Whilst the work of our trauma teams is simply amazing, it is the work undertaken by the UK's unique Medical Emergency Recovery Team or MERT that will leave a most lasting impression on me.

This unique capability is delivered by a heavily armed RAF Chinook which sits at Bastion ready to respond to battlefield casualties. On board will be a small team of RAF Regiment troops and a specialist medical trauma team. The team often arrives at the point of wounding under enemy fire and provides immediate medical care in what is considered, in life saving terms, as the critical 'golden hour'.

In nearly all cases, this means that a casualty on the battlefield is evacuated and receiving medical care in the Bastion hospital within an hour of wounding, giving the patient the best chance of surviving even the most serious or horrific of injuries.







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Once in hospital, our specialist trauma teams will set to work and simultaneously our aeromedical evacuation desk will organise the deployment of the Critical Care Air Support Team on board an RAF C-17 Transport Aircraft of No 99 Squadron at RAF Brize Norton.

This high readiness team delivers an intensive care unit in the back of a military transport aircraft, and means that within 24hrs of injury a patient can be flown back to the UK in intensive care conditions to Selly Oak Hospital, Birmingham.

Such care is state of the art and the envy of our coalition partners. It is a capability rightly preserved from any military cutbacks or savings. This in its own right is a hugely powerful message in Afghanistan, and one

that serves to reassure all who put their lives at risk on a daily basis.

Despite this wonderful care, the reality of conflict means that we do lose brave serviceman at the hands of enemy action.

Our last week in Afghanistan was particularly challenging, with the loss of four comrades. Attending their vigil ceremony reinforced already powerful imprints on my mind from previous ceremonies; these imprints will endure forever.

Simply put, the vigils typify everything that sets the British armed forces apart as the best in the world. The repatriation of our fallen is a task that is afforded the highest military standards and priority.

The service is attended by the entire garrison numbering over 4,000

personnel and combines a simple yet very powerful blend of prayer, personal citations from commanding officers and comrades, the haunting sound of the Last Post played by a regimental bugler and a one minute silence marked by the firing of a 105mm field gun.

The very public end to the repatriation journey home through Wootton Bassett, now Carterton, evokes strong feeling and emotion back in the UK. But the start of the journey here in theatre is both utterly inspiring and hugely emotional. It is something I will never forget.

By Simon Ling

*Camp Bastion was the main headquarters and military base for the British component of the International Security Assistance Force (2001–2014), a NATO-led security force in Afghanistan.

https://www.rafbf.org/news-and-blogs/afghan-blog-part-2-rafs-medical-emergency-response-team 6 December 2011

THE GOLDEN HOUR AND MODERN CONFLICTS

Data collected by French doctors during the First World War is believed to have led medical teams to first realise the importance of speedy medical treatment and the concept of the 'golden hour'.

The First and Second World War medical records showed that approximately four-fifths of soldiers who were killed died within 60 minutes of their injury. This was usually due to blood loss and traumatic shock. Therefore, procedures have been introduced that attempt to treat all those seriously injured within an hour the golden hour. Aircraft have been crucial to the success of this idea; they have enabled medical teams to get to the injured very quickly and the injured to be delivered to

advanced medical facilities very quickly.

This has led to the introduction of the MERT teams, military medics, the mobile military hospitals and, more recently, the extensive military medical kit that all service personnel carry on them in warzones.

To tackle the blood loss, all service personnel carry tourniquets as well as special bandages that are coated in chitosan, which coagulates blood (clots blood to stop the bleeding see below). The application of these measures is now practised so that it

can be done immediately after injury. This has introduced the concept of the platinum ten minutes - ten minutes to stem the blood flow and therefore save lives. This, alongside the golden hour, is about rapid treatment to save lives and is a practice now used as much as possible by emergency services around the world, in civilian as well as military areas.





NEW MEDICINE IN RECENT CONFLICTS

The British Forces were part of the **International Security Assistance** Force in Afghanistan in 2001 to 2014, based for much of that time in Helmand Province, with the base camp at Bastion. They were engaged with fighting the Taliban, who used IEDs as a popular form of attack. An IED is an improvised explosive device – a home-made bomb, which the Taliban liked to bury just under the ground so that it would detonate if someone stepped on it or drove over it. They caused huge numbers of injuries to the lower body for servicemen and women and Afghan civilians. Lower body injuries usually result in a high loss of blood, limb damage or loss, and spinal injuries; to save lives or limbs, immediate emergency care was required – the golden hour principle was of extreme importance in these cases.

By the end of the conflict in Afghanistan, US and British military doctors and medical staff expected to save 90% of all those who were injured. It is difficult to compare this statistic to those of previous conflicts, as many of those who were killed in action (KIA) during the two World Wars did not get to medical help in time; therefore, it is not known whether they could have been saved if the same procedures had been applied.

As a result of participation in the conflicts in Afghanistan and Iraq, a key area of medical development in recent years has been in prosthetic limbs and mobility improvement post-injury. Better treatment immediately after injury has allowed surgeons to save more arteries and preserve physical connections, thus reducing amputations and spinal problems, which were regular consequences of the injuries obtained in Afghanistan. For those servicemen and women who have lost limbs, the development of prosthetic limbs has been essential.

The advances in this area have also made a huge difference in the civilian world. For those not personally affected by limb loss, the most obvious place to see the advances that have occurred is in events such as the Paralympics and the Invictus Games.

While companies and military doctors are continually looking for ways to save lives on the battlefields, all conflicts in the modern period have also led to continued improvements post-injury. Rehabilitation medical care continues to develop, as do studies into non-visible injuries, such as PTSD (post-traumatic stress disorders). The need for these medical services goes up as more lives are saved on the battlefields. All of these services have a direct influence on and relationship with the medical treatments and services that are provided in civilian hospitals and the medical services that we all use.

A recent medical advance used in battlefield medicine that will soon be in civilian use is chitosan. Chitosan is a type of sugar powder made from ground-up crustaceans, such as prawns, crabs and lobster. According to the Journal of Molecular Pharmaceutics & Organic Process Research (January 2017):

Chitosan's properties allow it to rapidly clot blood, and it has recently gained approval in the United States and Europe for use in bandages and other hemostatic agents. Chitosan hemostatic products have been shown in testing by the U.S. Marine Corps to quickly stop bleeding and to reduce blood loss, and result in 100% survival of otherwise lethal arterial wounds in swine. Chitosan hemostatic products reduce blood loss in comparison to gauze dressings and increase patient survival. Chitosan hemostatic products have been sold to the U.S. Army and are currently used by the UK military. Both the US and UK have already used the bandages on the battlefields of Iraq and Afghanistan. Chitosan is hypoallergenic and has natural antibacterial properties, which further support its use in field bandages. Chitosan's hemostatic properties also allow it to reduce pain by blocking nerve endings.

FACT: Roman soldiers are known to have carried tourniquets (a band or tie that wraps around a wound to stop the blood flow, thus limiting the bleeding) with them to treat battlefield injuries.





USING THIS INFORMATION

This historical and factual information can be combined with the introductory film and resources from the resource section on this RAF100 schools site for exploring some creative ideas in a school club/ informal club, or for a more curriculum-based lesson.

Below are the ideas and inquiry questions that these materials could support.

In addition to the historical information above, case studies and extra information are available in the resource section. These include biographies and aircraft technology case studies.

KEY QUESTIONS FOR EXPLORATION IN ANY SETTING:

- What medical kit did soldiers carry in the First World War?
- Who are some of the different medical staff that are employed as part of the military?
- What are the key differences that aircraft have made to battlefield procedures?
- How did helicopters make a difference during the Korean War (1950–53)?
- What is the golden hour?
- What is the platinum ten minutes?

HOW TO USE THIS MATERIAL IN A HISTORY CLUB OR LUNCHTIME/ AFTER-SCHOOL/INFORMAL CLUB

These ideas are suitable for a mixture of age groups and abilities. They can also be used with the interactive map to begin a local history investigation.

SHOW THE FILM: MEDICINE

PROVIDE THE HISTORICAL INFORMATION OR READ IT TO STUDENTS.

Key question:

What were the key turning points in the development of aeromedical evacuation?

Ask students/young people to work in pairs and list key turning points in aeromedical evacuation, with each turning point described briefly on a separate slip of paper. Allow time for students to place these in order, from most to least important. If possible, lead a discussion where students can challenge the ideas of other pairs.

Then ask them to present their conclusions in some of the following ways (you might want to use some of the questions from the box to get them thinking)

- Create a timeline of the development of aeromedical evacuation (showing the key turning points in the process).
- Design a poster that shows the changes to aeromedical evacuation over time (showing the key turning points in the process).
- Write a newspaper article about medicine in warfare (referring to the key turning points in the process).
- Create a display for the school/class/ group noticeboard about the RAF's role in medical support (referring to the key turning points in the process).

Now use some of the information that has been collected to start investigating the local history of an airbase near you – this can be done starting with the interactive map. Explore which of the airbases have been used for medical evacuations – what can you find out about them?

Find out about the base. Identify what other information or understanding of an historical period is needed to tell the story of that base.

LESSONS IN SUPPORT OF THE CURRICULUM AND/OR EXAMINATIONS



GUIDANCE ON HOW THIS MATERIAL COULD BE USED IN A LESSON ABOUT:

- 1. The First World War or Britain in the World Since 1945
- 2. Medicine through Time/War and British Society

1. THE FIRST WORLD WAR AND SECOND WORLD WAR , OR WAR AND MEDICINE

Ages 11 years and above

The suggested idea for a lesson here can be used as a different approach for teaching about the First World War and/or the Second World War; it can be combined with other lessons for exploring these conflicts; it can be used to look at a theme over a 100-year period; or it can be used as an extension homework piece.

Suggested key question:

What were the key developments to battlefield medical practices during the twentieth century, using the information provided?

Show the film: Medicine

Using the film and the information above, ask pupils to create a timeline of battlefield medicine from 1914 to 2014. The timeline should include key procedures and why they were introduced. Students should highlight what technology or development made the procedure possible, and they should highlight what the outcome of the development was if it is mentioned in the information or the film. **Finish:** What **do the students think** is the most important change or procedure introduced during that 100-year period? Explain their arguments.

Extension: Investigate the role of nurses during the First/Second World war – why was what they did significant?





2. MEDICINE THROUGH TIME/WAR AND BRITISH SOCIETY

Ages 14 and above

Suggested here is a way of using the information and the film to explore medicine in warfare and some of the changes.

Alternatively, the resources here can form the beginning of a further investigation into how aircraft technology has been developed to support medical procedures and activities.

Suggested key question:

Have aircraft played a significant role in the success of the golden hour concept in the last 100 years?

or

How far did the use of aircraft transform emergency medicine?

Show the film: Medicine

Explain: The blood that runs through our veins is one of the most significant elements of our biology.

Throughout history, mankind's relationship to blood has taken on magical and mythical beliefs. It is tied into religious ideas as well as practical ones. Doctors and scientists have tried to understand blood and the human body's relationship for centuries, but real strides forward in understanding have been established in the last two hundred years.

Using the information above, can students create a graphic depiction (like an infographic) or an ideas map of practices and medical procedures used to try to save injured service personnel, particularly ensuring that they don't die through loss of blood?

Using the information above, ask students to create a timeline of key steps or decisions that have led to the development of the golden hour principle and how it can be implemented in a battle zone.

Ask the students to identify what things might stop someone who is injured from having the appropriate care in that hour.

Ask the students to identify whether there are any key stages in which the use of aircraft appear to be essential in offering medical support in a warzone.

Can the students reach a conclusion about whether aircraft played a significant role in the success of the golden hour concept in the last 100 years? What are their arguments?

Finish by discussing the role of aircraft in emergency medicine.

Extension: Find out about medical evacuations in civilian circumstances.

Using the physics/STEM support materials: The STEM activity is designed to show an aspect of technology that demonstrates some of the thinking in the past. The STEM activity here is about accurately dropping something and calculating how to ensure something lands where you want it – try to understand how that technology affects decisions about actions and how it could be improved.

