Paper 1 – Historic Environment Revision

The British sector of the Western Front: injuries, treatment and the trenches


Overview:
The historic environment study examines the relationship between conditions in a locality – the British sector of the Western Front during the First World War – and their impact on the nature of illness and the provision of medical care, as well as the impact of provision for medical care in the locality in the broader context of developments in medicine in the early twentieth century.

The First World War broke out in 1914 and lasted for four years. The First World War saw a significant technological advancement in the way that countries fought one another: distance weapons such as new types of gun, bombs, gas shells and mines reduced the amount of hand-to-hand combat to almost nothing, while at the same time delivering a set of new, devastating injuries with which doctors were completely unfamiliar. The old problems of surgery – pain, infection and blood loss – had been solved in some respects during the nineteenth century, but the still-new methods had to be further developed for use in field hospitals, and quickly. ***Necessity*** is the mother of invention and these technological advances in warfare were matched by some meteoric developments in medical practice. The brutal conditions that this war created, including the trench system and new types of wounds and disease caused by new weapons and battle techniques, ***triggered*** rapid progress in techniques for treating and healing patients, including solving the problem of blood loss.

You will need to know:
- ☐ Descriptions of conditions in: the Ypres salient, the Somme, Arras and Cambrai.
- ☐ The trench system- its construction and organisation, including frontline and support trenches.
- ☐ The use of mines at Hill 60 near Ypres and the expansion of tunnels, caves and quarries at Arras.
- ☐ Significance for medical treatment of the nature of the terrain and problems of the transport and communications infrastructure.
- ☐ Conditions requiring medical treatment on the Western Front, including the problems of ill health arising from the trench environment e.g. trench foot, trench fever, caused by lice.
- ☐ The nature of wounds from rifles and explosives – the problem of shrapnel, wound infection and increased numbers of head injuries. The effects of gas attacks.
- ☐ The work of the Royal Army Medical Corps (RAMC) and The First Aid Nursing Yeomanry (FANY) in transporting and treating patients - stretcher bearers, horse and motor ambulances.
- ☐ The 'chain of evacuation' (the stages of treatment areas): aid post and field ambulance, dressing station, casualty clearing station, base hospital.
- ☐ The underground hospital at Arras
- ☐ The significance of the Western Front for experiments in surgery and medicine: new techniques in the treatment of wounds and infection - The Thomas splint, Blood transfusion methods, The blood bank at Cambrai, Plastic surgery
- ☐ The significance of the Western Front for experiments in surgery and medicine: new techniques in the treatment of wounds and infection, the Thomas splint, the use of mobile x-ray units, the creation of a blood bank for the Battle of Cambrai.

Student knowledge checklist

Key topic	Details of topic	Have you got notes for this topic?	Can you recall at least 3 facts for this topic?	Action needed (Catch-up notes? Revision?)
The British sector of the Western Front, 1914–18: injuries, treatment and the trenches				
1 The British sector of the Western Front, 1914–18: injuries, treatment and the trenches	The context of the British sector of Western Front and the theatre of war in Flanders and northern France: the Ypres salient, the Somme, Arras and Cambrai.			
	The trench system - its construction and organisation, including frontline and support trenches.			
	The use of mines at Hill 60 near Ypres and the expansion of tunnels, caves and quarries at Arras.			
	The significance for medical treatment of the nature of the terrain and problems of the transport and communications infrastructure.			
	Conditions requiring medical treatment on the Western Front, including the problems of ill health arising from the trench environment.			
	The nature of wounds from rifles and explosives.			
	The problem of shrapnel, wound infection and increased numbers of head injuries.			
	The effects of gas attacks.			
	The work of the RAMC and FANY: The system of transport: stretcher bearers, horse and motor ambulances.			
	The stages of treatment areas: aid post and field ambulance, dressing station, casualty clearing station, base hospital.			
	The role of the underground hospital at Arras.			
	The significance of the Western Front for experiments in new techniques for the treatment of wounds and infection (e.g. saline solution)			
	The significance of the Western Front for the development of the Thomas splint			
	The significance of the Western Front for the use of mobile x-ray units.			
	The significance of the Western Front for the creation of a blood bank for the Battle of Cambrai			
	The understanding of infection and moves towards aseptic surgery in the early twentieth century (1900s)			
	The development of x-rays from 1895 (Wilhelm Roentgen)			
	The development of blood transfusions and developments in the storage of blood in the early twentieth century (1900s)			
2 Knowledge, selection and use of sources for historical enquiries	Knowledge of national sources relevant to the period and issue, e.g. army records, national newspapers, government reports, medical articles.			
	Knowledge of local sources relevant to the period and issue, e.g. personal accounts, photographs, hospital records, army statistics.			
	Recognition of the strengths and weaknesses of different types of source for specific enquiries.			
	Framing of questions relevant to the pursuit of a specific enquiry.			
	Selection of appropriate sources for specific investigations.			

Student Question Structure Guide: Paper 1 - Historic Environment

The British sector of the Western Front: injuries, treatment and the trenches

Question type	Marks / 52	AO	Time in minutes	What is the question asking me to do?	How do I get the marks?	How do I structure my response?
Section A: Historic Environment (10%) - The British sector of the Western Front: injuries, treatment and the trenches						
Q1 *Describe two features of……*	4	AO1	5	- 4 sentences: there is a writing frame to help you! - This is simple question; if you have revised you should score full marks. - Give **two** pieces of information / aspects about the topic given in the question (*e.g. the effects of poison gas*) - Then support each point you make with a specific fact / detailed description. - Include **specific facts and key words:** names, dates statistics and places etc.	Identify (point) and describe (example) **two** features. 1 mark for identifying each feature and 1 for the supporting detail for each. **(1-2 marks x 2)** **e.g.** *Chlorine gas affected the victim's breathing **(1)**. The victim died quickly from suffocation **(1)**.*	**2 x Point-Evidence** **Feature 1** **Point** - *One feature of….. was….* **Evidence** – *For example ….. / This was….. / It affected / meant that….* **Feature 2** **Point** - *Another feature of….. was….* **Evidence** – *For example ….. / This was….. / It affected / meant that….*
Q2a *How useful are Sources A and B for an enquiry into…*	8	AO3	15 (spend 5 minutes reading both sources **first**)	- No introduction or conclusion needed. - FIRST identify the enquiry: what are you trying to find out about? Underline it in the question. - Then imagine you are trying to find out about the topic *without* this source; what do you already know about the topic that this source does/doesn't explore? - Evaluate **content** (what the source says / shows) - Evaluate **provenance** (nature, origin and purpose). Pay close attention to the date and author; is it objective (balanced) and does the date of origin mean the author had all of the facts to give the full picture? - Use **FACTS** to show the source fits with your own knowledge: what do you already know about that enquiry topic and how it is accurate / limited for this enquiry? **- You are more likely to gain marks for saying why each source IS useful than ISN'T useful (limitations).** - You DO NOT have to compare the sources or say which is more valuable - For higher marks, make sure you justify your answers with key words such as '**accuracy**', '**limited**', '**incomplete**', '**typicality**' or '**provenance**'. - Give an overall judgement for how useful each source is to show the examiner that you've considered all aspects together. **Key things to remember about NOP:**	**Level 3 -** The judgement directly answers the question and assesses utility (usefulness) on the basis of content accuracy and limitations, provenance and typicality. The inferences made from both sources are developed with specific detail and explanation. The inferences are supported and challenged by own knowledge and the student explores provenance in their reasoning. **(6-8 marks)** **Level 2** - The judgement directly answers the question and the answer begins to assess utility (usefulness) on the basis of content accuracy and limitations, provenance and typicality. A clear inference is made from both sources supported by precisely selected detail from the source or its provenance. The inference is supported/ challenged by own knowledge. **(3-5 marks)** **Level 1** - A simple judgement supported by general comments about what both	**2 x MAC-NOPE + summary (or SNAPCAT)** ***You do not have to use this structure if it is not helpful to you!*** **Paragraph 1: Content accuracy and typicality (MAC)** **M -** Make a SUPPORTED INFERENCE about the overall **MESSAGE** of the source One thing you can see/quote from the source and what this shows or suggests (what you can guess at) the overall message of the source is. *The message of the source is….* *The content of source A/B makes it useful because it shows… which I can see from ….. / when it states "……."* **A** - Use your CONTENT KNOWLEDGE to show how the source **is ACCURATE** (true) and TYPICAL How does it match your own knowledge? How is it **typical** (does it match what most other sources from that time say) of the period / topic? Use PEE to make sure you have supported + explained why this makes it useful. **Point** - *This is accurate / useful to a historian studying….. / The source's content is typical of the period ….. / This fits with my contextual knowledge…* **Evidence** - *…. because indeed I know that… / ….because I further know that…. Indeed…. / For example….* **Explain -** *So this makes source A/B useful for an enquiry into….because……* **C** - Use your CONTENT KNOWLEDGE to show how the source is not **COMPLETE** (and therefore limited).

				- NEVER EVER use the word 'biased'. This will not gain marks. - ALL sources are **subjective** in some way because they are written / created by humans. No source is completely **objective**. - ALL sources are useful in some way - Subjective sources are VERY useful for giving us an **insight** into certain points of view; don't ever say 'it's useless because it's biased'. - If it's a cartoon / *The Wiper Times* / *Punch*, it is likely to be satirical, critical, **exaggerated**, subjective (one-sided) because they used humour in order to highlight an issue. - If it's in a popular magazine / newspaper, then it will also probably reflect public opinion at the time and *may* **sensationalise** for effect. - Eyewitnesses from the time are not automatically accurate and reliable! - It doesn't make sense to say 'the source lies'! - If it's a diary / private letter, it will probably reflect honest opinions. - Reflections on the past written a while afterwards might be **romanticised** but not necessarily entirely false. - Remember the author's circumstances e.g. censorship - a soldier might not include the horrific details of his injury in a letter home.	sources tells us or who/what/why/when it was made. The answer gives own knowledge but does not link this to how this makes the source useful or not. **(1-2 marks)** **You must explore both sources for 2+ marks.**	Compare to what you know: what's missing/omitted and is this deliberate? Is some of it misleading as a result? How does this omission affect the usefulness of the source? **Point** - *However, source A/B is limited because it does not show / include / leaves out / omits …..* **Evidence** - *For example…. From my knowledge of the context of the period, I know that…… / For example, it does not include….. / omits the fact that…. / I know that a more typical experience was….* **Explain -** *So this makes source A/B one-sided / less useful / limited for telling us ……. because…..* **<u>Paragraph 2: Provenance (NOPE)</u>** **<u>NOPE -</u>** <u>State the NATURE, ORIGIN and PURPOSE, then EVALUATE how useful (give strengths and weaknesses)</u> **Nature –** what type of source is this? (cartoon / photograph etc) **Origin –** when and how was it created/taken/written? Is this a **typical** perspective? **Purpose –** Why was it created? **Evaluate -** How does this affect how useful the source is? Consider how it is and isn't useful. ***N*** *- The source is … [WHAT – e.g. propaganda, newspaper, satirical cartoon…]* ***O*** *- ..written by ….. when…. [WHO, WHEN]* ***P*** *….with the purpose of….. [WHY]* ***E*** (strengths and weaknesses) - *This would help a historian understand …… because…… / This is typical of the period because…. / This therefore would reflect …. / However, the provenance also makes it limited because…..* **<u>REPEAT FOR SECOND SOURCE – MAC NOPE</u>**
Q2b *How could you follow up Source A to find out more about….*	4	AO3	5	-Simply follow the sentence starters -Make sure you are specific in your answers, i.e. go beyond the broadly generic catch-all categories of 'records', 'diaries', 'a diary of a soldier' = 0 marks -No marks for a question that is not linked to following up Source A, e.g. '*because it would be an interesting question to ask'.* It might be easier to start with b. Question I would ask. -Possible **primary** source ideas: Army records / statistics of ….. / showing…. National newspapers commenting on…. / reflecting Government reports that give details about…. /showing…. Medical articles about… Personal (soldiers, nurses etc) accounts of…. / about…. Photographs of….. / showing…. Hospital records of…. / showing….	**One mark for each of the following:** 1 = selecting a specific, relevant quote or detail to follow up related to the question. 1 = asking a follow-up question related to the selected detail. 1 = suggesting a relevant and specific type of source (e.g. a diary of a surgeon, newspaper, medical records from the Western Front) which would help to explore the question. 1 = making clear how this suggested source would help explore the question. **(1-4 marks**	**<u>Follow the sentence starters:</u>** <u>Detail in Source A that I would follow up:</u> **Must be a quote:** Select a **QUOTE** from the source ONLY – do not write anything else. *I would follow up the comment "……"* <u>Question I would ask:</u> Write a question which links to the topic in the question and the quote/detail you have listed in the answer above. **You will not get the mark if it's not linked.** *Why / what / when / where / what / how …..* <u>What type of source I could use:</u> Give a **specific** primary source – **add 'of' or 'showing' or 'about'.** *XXXX of…. / about….. / reflecting…. / showing…..* <u>How this might help answer my question</u>: Explain how your SOURCE could help answer the question you have written *This would help me to see/understand whether / why / tell me that ….*

Historical context of medicine in 20th century

Use the information on the next page to complete.

Medical Breakthrough	**Specific facts**	**Positives/negatives**
Aseptic surgery		
Development of x-rays		
Blood transfusion/blood storage		

Aseptic Surgery

Lister first used Carbolic Acid to prevent infection in 1865 based on Pasteur's Germ Theory. By the late 1890's, Lister's methods had laid the foundation for aspect surgery. By 1900, most operations were carried out using aseptic surgery

- All medical staff had to wash hands, faces and arms BEFORE entering.
- Rubber gloves and gowns were worn.
- Use of steam sterilisation. A machine called autoclave was invented in 1881 by Chamberland. STERLISED EQUIPMENT USING STEAM.
- Air was sterilised by being pumped over the heating system

Development of x-rays

Development of x-rays was completely accidental by Wilhelm Roentgen in 1895. He was studying the effects of passing an electrical current through a glass tube covered in black paper. He noticed that although everything in the room was dark, a screen about a metre from the equipment began to glow.

1896 radiology departments were opening in a number of hospitals, contributing to advancement of knowledge. First diagnosis based on an x-ray was made by Dr Hall-Edwards at Birmingham General Hospital. However, there were many problems:

- Radiation was 1,500 higher than what is released today. HARMFUL AND LED TO HAIR LOSS OR EXTREME BURNS.
- Taking an x-ray took a long time, 90 minutes for a hand that had to stay still.
- Larger x-ray machines were difficult to move around.
  DANGERS DID NOT PREVENT THE USE OF X-RAYS

Blood transfusions/Blood Storage

Average human body contained around 5 litres of blood. If people lose too much they could go into shock and die.

- James Blundell did the first experiments in human blood transfusions in 1818 to help women under his medical care who lost blood when they gave birth. Between 1818-29 he carried out 10 transfusions with half surviving.
- Blood had to be used as soon as it became available – The donor would be connected to the recipient of the blood.

Problem of transfusion	**Attempted Solution**
Blood clots as soon as it leaves the body. This meant that the tubes that transferred blood could become blocked	Attempts to find chemicals that prevented clotting. In 1894, Almoth Wright, concluded that soluble solutions of certain chemicals could prevent clotting.
Rejection of the transfused blood	In 1901, Austrian doctor Landsteiner discovered existence of 3 different blood groups, A, B and O. In 1902 AB was also found. This would be used to match a donor and recipients blood type before a transfusion. THIS WAS USED FOR THE FIRST TIME IN 1907 BY OTTENBERG.
Infection from unsterilized equipment	Aseptic methods

Exam Practice: Describe 2 features of Aseptic Surgery (4 marks)

Feature 1:

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Feature 2:

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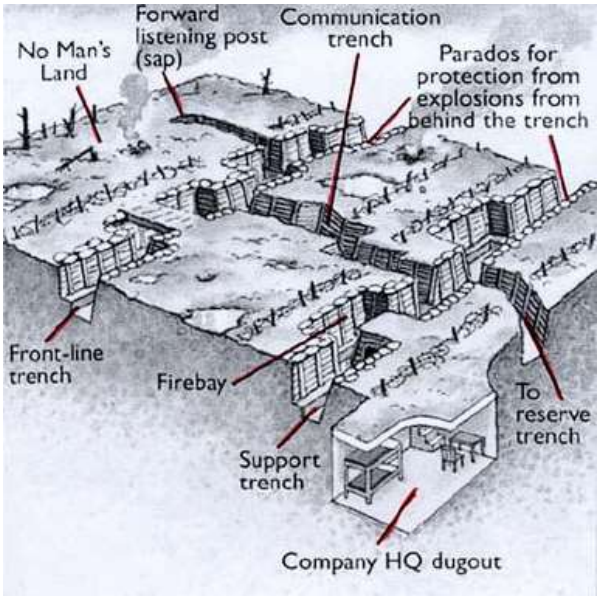
Context of British Sector of Western Front

- Britain declared war on Germany on August 4 1914.
- Germany invaded France through Belgium.
- The British government sent the British Expeditionary Force (BEF) to support the French troops in northern France to try to stop the German advance through Belgium.
- The BEF was outnumbered. Although they stopped the German advance briefly, they were ordered to retreat to the River Marne in order to prevent Paris from falling.
- After the Battle of the Marne, the German forces pulled back to the River Aisne and it was here that trench warfare began.
- A line of trenches was eventually established all the way from the English Channel in the north, to Switzerland in the south.
- Trenches began to be dug in 1914, however a more complex system was put in place from 1915, generally dug to a depth of about 2.5 metres.



Task: Note down the purpose of each aspect of the trench (each aspect in the picture)

Part of Trench	**Facts**
Frontline Trench	Where attacks would be made from
Support Trench	80 metres behind front-line. Soldiers would retreat here if frontline came under attack.
Dugouts	Would be dug into side of trenches where men could take protective cover.
No mans land	Area between two opposing lines of trenches.
Reserve Trench	100 metres behind the support trench. Reserve troops would be mobilised here for a counter-attack if frontline was captured by enemies.
Artillery Emplacements	Prepared position for certain weapons (guns)
Communication trench	Ran between other trenches – SO COMMUNICATION COULD HAPPEN.

The context of the Western Front

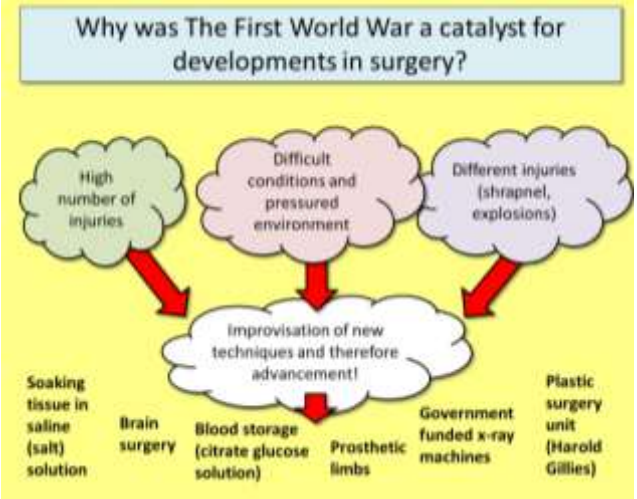
2. <u>Identify and write down</u> at least 3 reasons why WW1 accelerated (sped-up) medical advances.

3. Can you give <u>three examples</u> of new techniques as a result?

World War One 1914-18 was fought on a scale that had never been experienced before. A million British soldiers died in World War One, and double that amount came home injured. The number and severity of wounds was on a scale that nobody had ever seen before. Even surgeons, being familiar with operations, were not prepared for the terrible wounds that they were expected to treat.

At the Battle of Waterloo in 1815, the main infantry weapon was the muzzle-loading musket, which fired up to four shots a minute. At the Battle of the Somme, just over a century later, machine gunners could fire off 600 rounds a minute. High velocity rounds wreaked havoc in the body, twisting tissue and splintering bone.

Fighting on farmland fertilised by unlearn manure meant that wounds quickly became infected; gangrene was rife. Many surgeons had to unlearn experiences from the South African Conflict (Boer War) (1899-1901) where the climate had been dry and hot. The wet, unsanitary conditions of France presented different problems. Infection was much more likely and disease more evident. Faced with this challenge, new equipment and techniques were invented that, across four years of fighting, would end up saving thousands of lives. British surgeons suffered no shortage of morphine or chloroform during the First World War, so they were able to keep most patients calm and comfortable.



<u>Key Battles in the British Sector of the Western Front</u>

<u>Key Event</u>	<u>Result</u>	<u>Significance</u>
First Battle of Ypres (1914) Autumn of 1914 Germans launched attack on British position to the east and north-east of Ypres.	Britain lost over 50,000 soldiers. BUT THEY HELD ONTO YPRES. Germans extended some control around the edge of Ypres.	Holding onto Ypres meant that Britain controlled the English Channel ports so their supplies and reinforcements could be provided.
Use of mines at Hill60 Germans captured this man-made hill to south-east of Ypres in Dec 1914, giving them strategic advantage. British dug tunnels into hills (offensive mining), placed five mines in tunnels and blew top off hill.	By April 1915 Britain took back Hill 60	Britain took back a strategically important position

Second Battle of Ypres (1915) Began straight after the Battle for Hill 60 was finished. Lasted a month	Britain lost 59,000 men Germans moved 2 miles closer to the town of Ypres	First time Germans used chlorine gas on Western Front
Battle of Somme (1916) Launched 1st July 1916 and aimed to take back land from Germans Ended November 1916	Huge casualties. On first day there were 57,000 injuries. 20,000 men died. Over 400,000 casualties in total.	Use of creeping barrages – artillery launched from the trenches. Use of tanks in warfare – NOT VERY SUCCESSFUL
Tunnels, caves and quarries at Arras In 1916, the British decided to link existing tunnels, caves in quarries in the chalky ground to create an underground network to shelter from German attacks and allow safe movement.	Dug more than 2.5 miles of tunnels in five months.	25,000 men could be stationed in the tunnels, which contained electric lights, running water, a light railway system and fully functional hospitals.
Battle of Arras (1917) April 1917, 24,000 men hiding in tunnels attacks the Germans with aim of breaking through German lines.	Britain advanced 8 miles in first few days but it slowed down by May	Large number of casualties (160,000)
Third Battle of Ypres (1917) Throughout June 1917, British prepared for main attack in Battle of Messines (driven Germans off ridge that formed part of Ypres salient). 31st July- launched attack, marching east from Ypres towards Passchendaele. Campaign ended in November.	Advanced 2 miles on first day. But it began to rain and ground become waterlogged – MANY MEN FELL AND DROWNED. 245,000 BRITISH CASUALTIES	Britain moved edge of salient back by 7 miles.
Battle of Cambrai Artillery barrage changed – LESS WARNINGS FOR THE GERMANS Launched 20th October 1917	Tanks moved easily across barbed wire and their machine guns were effective.	**FIRST LARGE SCALE USE OF TANKS.**

Answer the following questions:

1. Why do you think treatment in medicine advanced as the war went on?
2. Why would digging tunnels be important for system of trenches?
3. What were Britain trying to do in the majority of their attacks during the war?
4. Which areas were important for Britain to hold onto throughout the war?
5. What types of injuries do you think occurred based on the openness of battle?

Problems with transport and communication – Highlight the problem you think had the biggest impact on transport in communication

- Constant shelling left landscape full of craters and destroyed many roads.
- Land often waterlogged.
- Had been farmland, so lots of fertiliser in soil. Meant was lots of bacteria that could infect wounds.
- Stretcher bearers exposed to shelling and gunfire. Physically tiring work.
- Beginning war, military leadership decided not to send any motor ambulances but horse-drawn wagons couldn't cope with numbers casualties.

- Horse-drawn wagons were shaky and often made injuries worse.
- Lack of transport led to soldiers being left to die or taken prisoner.
- Motor vehicles couldn't operate in muddy terrain.

Explain WHY it was the biggest problem they faced

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Development of methods to transport the injured

- Following public appeal for donations, made by *The Times* newspaper, had enough money to buy 512 ambulance wagons within 3 weeks.
- First motor ambulances sent to Western Front in October 1914, as result of work by Red Cross.
- In worst areas, six (rather than the usual two) horses would be used to pull ambulance wagons.
- Wounded men also transported by train or canal in final stage of evacuation to the Base Hospitals on French coast.
- Originally used French good trains but first ambulance train arrived in France in November 1914 (spaces for stretchers). Some later trains even had operating theatres.
- Some of wounded being carried on canals by-passed Base Hospitals to be transferred directly to ships transporting the wounded to Britain.
- Later in the war, some trains sent to France contained operating theatres.
- Canal Barges were used due to the influx of rail travel. They were more comfortable and could bypass Base Hospitals to be transferred back to Britain.

Explain the best development in the methods of transporting the wounded

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Exam Practice: How useful is Source A for an enquiry into transport and communication on the Western Front?
Use the guidance at the start of this booklet!

Photograph taken by Lieutenant John Brooke, an official photographer for the British army on the Western Front. Taken at the third battle of Ypres in August 1917.

ANNOTTATE THE IMAGE BEFORE YOU START – USE THE STRUCTURE GUIDE AT THE START OF THIS BOIOKLET

Message (Supported Inference)

Source A is useful because it shows_____ _____

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Accuracy & Typicality (+ Own knowledge to support)

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Completeness (+ Own knowledge to support)

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NOPE

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Main medical problems on the Western Front

Shells and Shrapnel

- Responsible for 58% of wounds on the Western Front.
- When a shell exploded it could kill or injure immediately.
- Shell explosion scattered shrapnel (FRAGMENTS OF METAL) This could cause injury
- 60% of injury was to arms and legs
- Bullets responsible for 39% of wounds – They could fracture bones and pierce organs
- Brodie helmets used to ricochet bullets.

Trench foot

- Painful swelling of feet caused by standing in cold mud and water.
- Second stage of TF, gangrene set in. FOOT DECOMPOSES.
- Prevention was key, rubbing whale oil into feet and keeping feet dry and regular change socks.
- Amputation used if second stage occurred.

Trench fever

- Flu-like symptoms
- Effected half a million on Western Front.
- Identified that contact with LICE caused it.
- Delousing stations set up to prevent it.

Shellshock

- Tiredness, headaches, nightmares, loss of speech, complete mental breakdown in some cases.
- 80,000 soldiers experienced it.
- NOT WELL UNDERSTOOD AT THE TIME.
- Would have possibly led to treatment back in Britain.
- Some soldiers who suffered with Shellshock accused of being cowards.

Infections

- Shrapnel and bullets carried fabric from clothes into wound. Soil full of bacteria from fertiliser use.
- Soil contained bacteria for tetanus and gas gangrene (produces gas in gangrenous wounds).
- Use of anti-tetanus injections from end 1914 reduced impact tetanus.
- No cure for gas gangrene- bacteria spread quickly and could kill a person in one day.

Gas Attacks

- Gas attacks caused great panic and fear, shown in poetry written after the war.
- NOT A MAJOR CAUSE OF DEATH. Only 6,000 dying as a result of it.
- Gas masks were used from 1915, they developed over time.
- Chlorine used in 1915, led to death by suffocation. Before gas masks were given in 1915, soldiers would soak cotton pads with urine and press them to their faces to stop gas from entering their lungs.
- Britain used chlorine in 1915 however the wind changed and pushed the gas back to the British.
- Phosgene Gas – Using end of 1915 near Ypres. Faster acting than Chlorine and could kill within 2 days.
- Mustard Gas – First used in 1917 – Odourless gas that would work within 12 hours. Caused internal and external blisters.

Task: Create a set of revision cards (cut up paper is fine) with at least one specific fact per condition. *E.g. Gas – Chlorine 1915 – Phosgene 1915 – Mustard 1917 – Only 6000.*

Exam Practice – How useful are Sources B, C for an enquiry into the impact of gas attacks on the Western Front

Source B – **From Dulce et Decorum Est. A poem written by Wilfred Owen in 1917 whilst he was being treated for Shellshock. He serves on the Western Front in 1916-17 and returned in 1918, where he was killed in action shortly before the end of the war. The text in the title and at the end of the poem is in Latin and means 'it is sweet and fitting to die for one's country'**

Gas! Gas! Quick, boys! – An ecstasy of fumbling,
Fitting the clumsy helmets just in time;
But someone still was yelling out and stumbling,
And flound'ring like a man in fire or lime . . .
Dim, through the misty panes and thick green light,
As under a green sea, I saw him drowning.
In all my dreams, before my helpless sight,
He plunges at me, guttering, choking, drowning.
If in some smothering dreams you too could pace
Behind the wagon that we flung him in,
And watch the white eyes writhing in his face,
His hanging face, like a devil's sick of sin;
If you could hear, at every jolt, the blood
Come gargling from the froth-corrupted lungs,
Obscene as cancer, bitter as the cud
Of vile, incurable sores on innocent tongues,
My friend, you would not tell with such high zest
To children ardent for some desperate glory,
The old Lie; Dulce et Decorum est
Pro patria mori

Supported inference

Content accuracy **(+ Own knowledge to support)**

Provenance (NOPE)

Source C – From the notebook of Lance Sergeant Elmer Cotton, who serves in the 5th Northumberland Fusiliers in 1915. He is describing the effects of a chlorine gas attack

It produces a flooding of the lungs. It is the equivalent to drowning, only on fry land. The effects are these – a splitting headache and a terrific thirst (but to drink water is instant death), a knife-edge pain in the lungs and the coughing up of a greenish froth off the stomach and the lungs, finally resulting in death. It is a fiendish death to die.

Supported inference

Content accuracy **(+ Own knowledge to support)**

Provenance (NOPE)

Exam Practice – How useful are Sources B, C for an enquiry into the impact of gas attacks on the Western Front

Exam Practice: How could you follow up Source B to find out more about the effects of gas attacks?

1) Which detail would you follow up?

_____
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2) What question would you ask?

_____
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3) What type of source would you want to answer your question?

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4) Why might that source help you answer your question?

_____
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Work of RAMC and FANY - The system of transport and the stages of treatment

Key Terms:

RAMC: Royal Army Medical Corps
CCS: Casualty Clearing Stations
ADS & MDS: Dressing stations
FANY: First Aid Nursing Yeomanry
Base hospitals
RAP: Regimental Aid Posts

Because of the large number of casualties, it was essential that there was an efficient system to get the wounded from the frontline to a safe area where they could be treated. This system became known as the chain of evacuation.

Stage	**Where were they?**	**Who worked there?**	**What was their role/purpose?**	**How were soldiers transported to them?**
1: Regimental Aid Post (RAP)				
2: Dressing Stations (ADS and MDS)				
3: Casualty Clearing Stations (CCS)				
4: Base Hospitals				

Stage 1: Regimental Aid Post (RAP)

The RAP was generally located within 200m of the frontline, in communication trenches or deserted buildings. It was staffed by a Regimental Medical Officer, with some help from stretcher bearers with first-aid knowledge. Wounded soldiers would either walk in themselves or be carried in by other soldiers.

The purpose of the RAP was to give immediate first aid and to get as many men back to the fighting as possible. It could not deal with serious injuries. These had to be moved to the next stage in the chain of evacuation.

Stage 2: Dressing Stations (ADS and MDS)

In theory, there should have been an Advanced Dressing Station (ADS) about 400m from the RAP and a Main Dressing Station (MDS) a further half a mile back. In practice, this was often not the case and there may only have been one Dressing Station. Where possible, the Dressing Stations were located in abandoned buildings, dug-outs or bunkers, in order to offer protection from enemy shelling. Where these were not available, tents would be used.

Each dressing station would be staffed by ten medical officers, plus medical orderlies and stretcher bearers of the RAMC from a unit known as the Field Ambulance. From 1915, there were also some nurses available for this part of the chain of evacuation. To get to the Dressing Station, men would either walk, if they were able to do so, or be carried in by stretcher in stages.

The Field Ambulance units did not have the facilities to tend to wounded men for more than a week and in theory could only deal with 150 wounded at a time (there would be considerably more during major battles). Men who had been treated would either be returned to their units if they were fit enough to fight, or they would be moved on to the next phase of the chain of evacuation by horse or motor ambulance.

<u>Stage 3: Casualty Clearing Stations (CCS)</u>

Casualty Clearing Stations were located a sufficient distance from the frontline to provide some safety against attack, but close enough to be accessible by ambulance wagons. They were set up in buildings such as factories or schools and were often located near to a railway line to allow the next stage of the chain of evacuation to take place quickly.

When wounded soldiers arrived here, they were divided into three groups. This system was called triage, from the French word for sorting or selecting. Triage helped medical staff make decisions about treatment. The three categories were:

1. The walking wounded. Men who could be patched up and returned to fighting.
2. Those in need of hospital treatment. Once treated for immediate life-threatening injuries, they would be transported to a Base Hospital.
3. Those with no chance of recovery. They would be made comfortable.

<u>Stage 4: Base Hospitals</u>

Base Hospitals on the Western Front were located near the French and Belgian coast, so that the wounded men who were treated there would be close to the ports, from which they could be transported home to Britain. Men were treated in the hospital until they could be returned to Britain for further treatment or were fit enough to return to the fighting.

As the war progressed, Casualty Clearing Stations played an increasingly important role in dealing with wounds instead of Base Hospitals. It had become clear that if contaminated wounds were not dealt with quickly, wounded men were more likely to develop gangrene. In turn, Base Hospitals became increasingly responsible for continuing treatment that was begun in the CCSs, before men were either returned to the frontline or transported back to Britain.

Base Hospitals also experimented with new techniques which, once successful, were used in the CCSs. For example, by dividing patients up into different wards according to their wounds, and by allocating doctors to a specialised ward, it was possible for doctors to become expert in the treatment of particular wounds.

However, when the Germans launched an attack in the spring of 1918, pushing back the frontline, many CCSs had to be pushed back and the Base Hospitals again took over much of the surgery.

<u>Task</u>: Complete the cloze exercise explaining the work of FANY.

The first six FANYs arrived in _____ on 27 October 1914. However, the British would not make use of them so they devoted their energies to helping French and _____ troops.

Finally, in January 1916, the British army decided to allow FANYs to drive _____. They became the first women to carry out this role, replacing British Red Cross male ambulance drivers. They were used to transport _____ troops by ambulance in the Calais region. Although there were never more than 450 FANYs in France, they did open the way for other women who were attached to other organisations, such as the Voluntary Aid Detachments (VADs), to participate in the _____.

FANY did things other than driving ambulances to support the soldiers on the Western Front. They drove supplies such as food and _____ to the frontline. They had a mobile bath unit which provided baths to the soldiers in water heated by the power from the van's _____. They also set up cinemas to help the _____ of soldiers.

morale frontline Belgian clothes wounded ambulances engine France

Exam Practice How useful in Source A for an enquiry into the <u>work carried out by FANY</u>.

Annotate the source (thinking MAC NOPE)

SOURCE A: *From Pat Beauchamp's autobiography, Fanny Goes to War, published in 1919. Beauchamp first worked as a nurse, bringing in the wounded from the trenches, and from 1916 as an ambulance driver. Here she is writing about an account of FANYs from an English newspaper.*

The following is an extract from an account by Mr Beach Thomas in a leading daily:

"Our Yeomanry nurses who, among other work, drive, clean, and manage their own ambulance cars… have done prodigies (wonders) along the Belgian front. One of their latest activities has been to devise and work a peripatetic (travelling) bath… Ten collapsible baths are packed into a motor car which circulates behind the lines. The water is heated by the engine in a cistern in the interior of the car and offers the luxury of a hot bath to several score men."

_____
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Underground hospital at Arras

In November 1916, tunnelling began under the town of Arras. In 800m of tunnels, a fully working hospital was created so close to the frontline that it was, in reality, a Dressing Station. From here, wounded soldiers would move through the chain of evacuation. It was sometimes called Thompson's Cave after the RAMC officer who was responsible for equipping it. The hospital was abandoned during the Battle of Arras in 1917, when it was hit by a shell which destroyed the water supply.

What facilities were available?

- Reserve stretchers
- RAMC office headquarters
- Operation theatre
- Mortuary
- Water stand pump
- Waiting wards
- Able to accommodate 700 soldiers at a time.

Exam Practice: *How could you follow up Source A to find out more about Dressing Stations on the Western Front*

Source A: General Macpherson, published in 1924. He was on the WF from 1914 and in charge of the RAMC from 1916-18. He wrote this history based on official records which he had access to. He is writing about the underground hospital in Arras

Dressing Stations were established in caves, cellars and basements of buildings, protected as strongly as possible with sandbags on the outskirts of the town. The chief of these was in a large subterranean cave, from which stone had been excavated for building the town in the 16th century. It was close to the 3rd Division trenches and only 800 yards from the frontline. Two entrances for stretchers were tunnelled into it from the communication trenches, and an exit tunnelled out from the back into Rue St Quentin, where an approach was constructed for ambulance cars. This cave was fitted with electric light and a piped water supply and was able to accommodate 700 wounded on stretchers in two tiers.

Detail in Source A that I would follow up: _____

_____

Question that I would ask: _____

_____

What type of source I could use: _____

_____

How this might help answer my question: _____

_____

New techniques in treatment of wounds and infection

Wound excision or debridement – this was the cutting away of dead, damaged and infected tissue from around the site of the wound. It needed to be done as soon as possible because infection could spread quickly. After excision, the wound needed to be closed by stitching. If any infected tissue had not been removed before the wound was stitched, the infection would spread again.

What injury or infection could this method help? How successful do you think it could be?

_____
_____
_____
_____

Amputation – if neither wound excision, nor the use of antiseptics succeeded in halting the spread of infection, the only way to deal with it was through the amputation of wounded limbs. By 1918, 240,000 men had lost limbs – many of them because it was the only way to prevent the spread of infection and death.

What injury or infection could this method help? How successful do you think it could be?

_____
_____

The Carrel-Dakin Method – antiseptics, such as carbolic lotion, were inefficient when treating gas gangrene. By 1917, it was agreed that the Carrel-Dakin method, which involved using a sterilised salt solution in the wound through a tube, was the most effective alternative. The solution only lasted for six hours and so had to be made as it was needed. This could be difficult, especially when large numbers of wounded men needed treatment at the same time.

What injury or infection could this method help? How successful do you think it could be?

_____
_____
_____
_____

Using the key underneath source B, highlight information in the sources that says treatment of wounds was effective in one colour. In another colour, highlight treatment for wounds that was ineffective.

☐ Treatment of wounds was effective

☐ Treatment of wounds was ineffective

SOURCE A

From the diary of B.C. Jones, 1915-6. Jones served with the Royal Field Artillery in France from the start of the war until he was wounded in 1915.

7 December. A German shell hit the dugout of our telephone pit. I remembered no more until I woke up in Bethune Casualty Clearing Station Number 33, where I find I have been severely wounded. Left hand blown off, left arm ripped up 12 inches. Scalp wound 6 inches, wound over side of knee (left) 5 inches.

9 December. Operation on upper arm for gangrene (successful).

12 December. I remain here for 8 days then removed to St Omer by hospital barge, very comfortable. I am then removed by train to Etaples. I am then sent to England on the Hospital Ship. Return to Nottingham where I am in bed until the end of February.

3 June 1916. I am eventually transferred to Brighton where I am operated on and re-amputated. Awaiting Roehampton for artificial limb.

SOURCE B

From Ward Muir's Observations of an Orderly, published in 1917. Muir was a Lance Corporal in the RAMC and worked in a hospital in London that received patients from the Western Front at the end of the chain of evacuation.

The majority of stretcher-cases… reached us in by no means a desperate state, for, as I say, they seldom come to England without having been treated previously at a base abroad (except during the periods of heavy fighting. And it is remarkable how often the patient refuses help in getting off the stretcher on to the bed.

Developments in blood transfusions and storage

1915 Use of blood transfusions in British sector on Western Front pioneered by Canadian doctor, Lawrence Bruce Robertson, in the Base Hospital at Boulogne. He used the indirect method, where a syringe and tube was used to transfer the donor blood to the patient.

Geoffrey Keynes, a British doctor and lieutenant in the RAMC, designed a portable blood transfusion kit that was used to provide transfusions close to the frontline in a Casualty Clearing Station. However, it could not use stored blood as there was no available refrigeration. He added a device to the blood bottle which helped prevent clotting. Keynes claimed that his work saved countless lives.

American doctor, Richard Lewisohn discovered that by adding sodium citrate to blood, the need for donor-to-donor transfusion was removed. Patients no longer needed to be in the same room as the donor.

Richard Weil discovered that blood with sodium citrate could be refrigerated and stored for up to two days.

1916 Francis Rous and James Turner found that by adding a citrate glucose solution to blood, it could be stored for a much longer period- up to four weeks.

1917 Blood transfusions were also being administered in the Casualty Clearing Stations as a routine measure in the treatment of shock.

Before the Battle of Cambrai, Oswald Hope Robertson, a British-born American doctor, stored 22 units of universal donor blood in glass bottles. He built a carrying case packed with ice and sawdust and called this a "blood depot". During the battle, he treated 20 severely wounded Canadian soldiers (none of whom were expected to survive) with 26 day old blood. 11 of the 20 men survived. This was the first time that stored blood had been used to treat soldiers in shock.

Task: Find evidence of the following two factors in the above timeline:

☐ **Developments in blood transfusion process.**

☐ **Developments in blood storage.**

Task : A number of key individuals contributed towards that development of blood transfusions and storage. Who do you think made the greatest contribution and why?

_____

_____

_____

_____

The Thomas Splint

- Broken bones were caused by gunshot or shrapnel wounds.
- Major bleeding would be the cause of death if the leg was not kept rigid.
- Many who survived before the Splint would have had their leg amputated.

- Robert Jones worked with his uncle, High Thomas at the end of 19th century, in his medical practice where Thomas had developed a splint to stop joints from moving. When the war started he offered his service. In December 1915, Thomas was sent to Boulogne to instruct medical practitioners how to use the Thomas split. Survival rate went from 20% to 82%

Use of mobile X-rays

- X-rays used from start of war to identify shell fragments and bullets in wounds.
- Two x-rays would be taken from different angles and this helped surgeon to identify the location of shrapnel and bullets.
- THERE WERE SOME PROBLEMS
  1. X-rays could not detect all objects in the body. E.G Fragments of clothing.
  2. Length of time men had to remain still caused problems.
  3. Tubes used in x-ray machines were fragile and overheated quite quickly. Could only be used for around one hour at a time. The improvements on this only happened in 1917, when the US became involved in the war.

Exam practice: How could you follow up Source C to find out more about x-rays on the Western Front? (4)

Source C – From Radiography and Radiotherapeutics, by Robert Knox, published in 1917. This was a textbook on the use of x-rays written by a British doctor.

The need for portable outfits in connections with the war has led to a great development in the provision of motor wagons containing complete x-ray apparatus with all accessories. The mechanism used for driving the wagon i.e. the motor is coupled with a powerful dynamo which delivers a continuous current.

Detail in Source C that I would follow up: _____

_____

Question that I would ask: _____

_____

What type of source I could use: _____

_____

How this might help answer my question: _____

_____

Head Injuries

Task: Use the information provided to summarise the achievements of these two men:

	Key Individual	Achievements
Brain Surgery	**Harvey Cushing (American neurosurgeon)** 	Brain injuries were likely to prove fatal at the start of war because: 1. Infection 2. Moving men through the Chain of evacuation was difficult. 3. Very few doctors who had experience in neurosurgery. Cushing developed new techniques in brain surgery on Western Front. He experimented with magnets to remove shrapnel from the brain. He also used local anaesthetic rather than general. LOCAL MEANT THE BRAIN DID NOT SWELL DURING OPERATION. Operated on 45 patients in 1917 with survival rate of 71% CCS became chosen as centres for brain surgery. Patients remained there for 3 weeks after surgery All head wounds were focused on and examined in more depth Summary: _____ _____ _____ _____ _____ _____ _____ _____
Plastic Surgery	**Harold Gillies (New Zealand doctor specialising in ear, nose and throat surgery)** 	Developed plastic surgery. Gillies was sent to Western Front in 1915. Head injuries that did not kill could cause severe disfigurement. Gillies became interested in facial reconstruction. Men who needed this were returned to Britain. The key hospital who provided this care was Queen's Hospital in Kent. By the end of the war, nearly 12,000 plastic surgery operations were carried out. Summary: _____ _____ _____ _____ _____ _____ _____ _____

Use the infromation on the next few pages to complete the table

Area of medicine/ surgery	What problem did it tackle? (What was the problem before WW1?)	What developments were brought about by war and why they were necessary?	How effective were these developments? Try to give EVIDENCE (facts and figures) to show the IMPACT of the development on casualty rates.
Blood transfusion and storage (first blood bank at Cambrai)			
Use of mobile X-ray machines			
Plastic surgery			
New techniques in the treatment of wounds and infection			
Broken limbs, amputations and the splints			
Head injuries and brain surgery			

The wounds inflicted on millions of soldiers ***accelerated*** the development of new medical techniques and inventions.

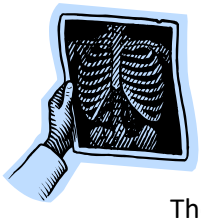
Blood transfusion and storage (first blood bank at Cambrai)

The British Army began the routine use of blood transfusion in treating wounded soldiers. However, the donor had to be present, as the blood was pumped to the recipient. They could not store blood without it clotting. The demand for blood during WW1 was high therefore people needed to find a way to store blood.

In 1901, Karl Landsteiner identified blood types, which meant that they could prevent recipient bodies rejecting donated blood. Then, in 1915, Richard Lewisohn (US doctor) discovered that adding sodium citrate stopped blood clotting and, in 1916, Francis Rous and James Turner found that adding a citrate glucose solution allowed the blood to be stored for longer periods without the cells deteriorating as quickly.

But it was a US Army doctor, Captain Oswald Robertson, who realised the need to stockpile blood before casualties arrived. During the Battle of Cambrai in 1917, he established the first blood bank on the Western Front, using sodium citrate to prevent the blood from coagulating (clotting) and becoming unusable and using Type O blood, which can safely be given to all patients (aka 'universal' blood type). Blood was kept on ice for up to 28 days and then transported to casualty clearing stations for use in life-saving surgery where it was needed most.

Use of mobile X-ray machines



World War One made the use of Roentgen's X-rays (discovered in 1895) far more common as surgeons needed to locate bullets and shrapnel lodged deep within flesh. Governments ordered X-ray machines to be built for the hospitals of the Western Front.

New techniques in the treatment of wounds and infection

The use of explosive weapons meant that many soldiers suffered deep wounds. These wounds often got infected by clothing or shrapnel. Surgeons found that the best way to tackle this type of injury was to cut away infected tissue and soak with a saline (salt) solution.

There was also progress in the speed of treatment. From January 1915 the British military medical machine moved closer to the front line. Casualty clearing stations were now better equipped and, crucially, more surgeons were closer to the battlefield. There were now fewer delays in administering potentially life-saving treatment. Soldiers with wounds that would have been fatal were now more likely to survive.

Broken limbs, amputations and the splint

Between 1914 and 1921 over 41,000 men in the British armed forces lost a limb. Advances in prosthetic limbs included the use of light metal alloys and mechanisms. Technological innovations developed in the First World War had a massive impact on survival rates, such as the Thomas splint, named after pioneering Welsh surgeon Hugh Owen Thomas, which secured a broken leg. At the beginning of the war 80% of all soldiers with a broken femur died. By 1916, 80% of soldiers with this injury survived.

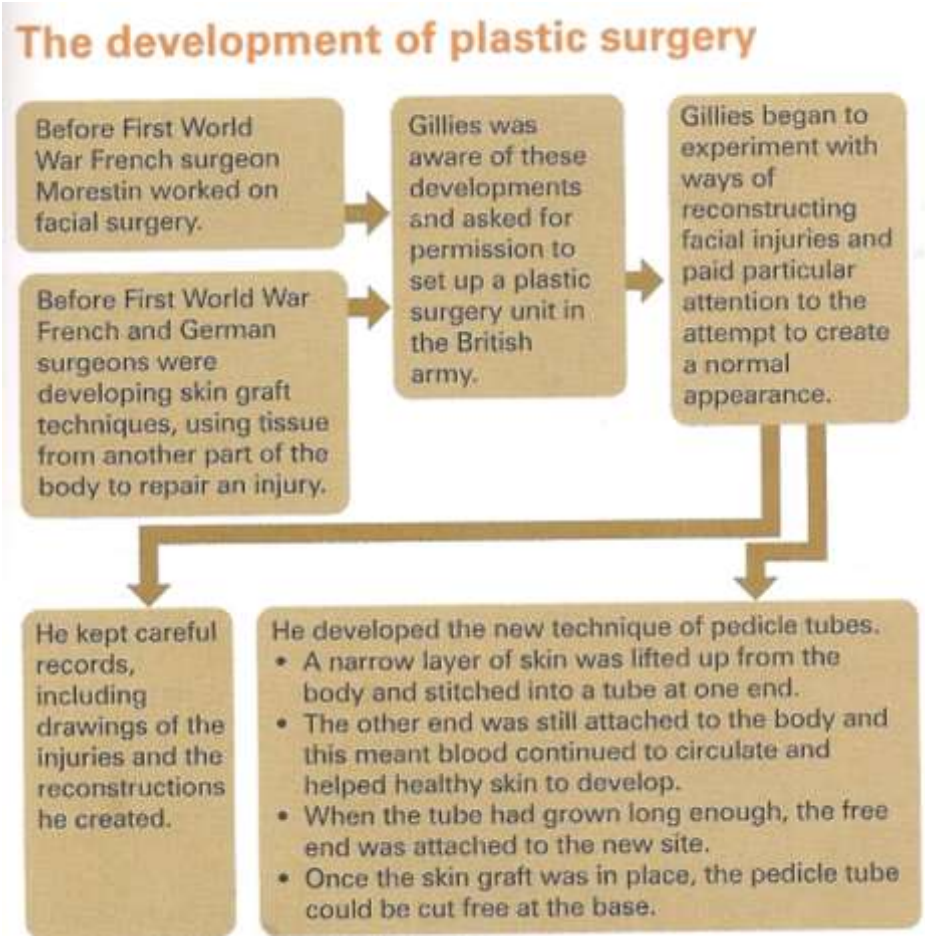
Head injuries and brain surgery

Before the war many surgeons stayed away from working on the brain as it was too complicated and risky. However the war caused huge numbers of brain injuries and surgeons

became more willing to experiment. For example: using rubber bands to control bleeding, saline solution to wash out pulped brain and even magnets were used to pull out metal fragments

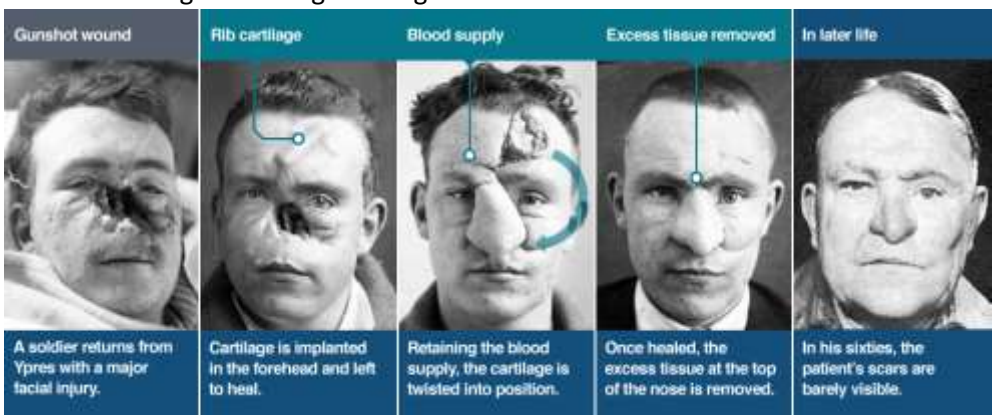
Plastic surgery

For many of those lucky enough to return, the wounds they had suffered in Europe would leave them permanently disfigured. The biggest killer on the battlefield and the cause of many facial injuries was shrapnel. Unlike the straight-line wounds inflicted by bullets, the twisted metal shards produced from a shrapnel blast could rip a face off. Not only that, but the shrapnel's shape would often drag clothing and dirt into the wound. Improved medical care meant that more injured soldiers could be kept alive, but urgently dealing with such devastating injuries was a new challenge.



Harold Gillies was the man the British Army tasked with fixing these grisly wounds. Gillies was shocked by the injuries he saw in the field, and requested that the army set up their own plastic surgery unit. Soon after, a specifically-designed hospital was opened in Sidcup. It treated 2,000 patients after the Battle of the Somme alone. Here Gillies would do some of his finest work. Previously viewed with suspicion, facial reconstruction became an integral part of the post-war healing process. However, in a world before antibiotics, going under the knife for an experimental form of surgery posed as many risks as the trenches themselves.

A series of images showing the stages of facial reconstruction.



Blood transfusion heads and tails

The column on the left shows different stages in the development of blood transfusions. Match each statement with a comment from the right-hand column that explains its significance.

The development of blood transfusions	**Significance**
1 Blood loss was a major problem in surgery because…	**A** … he had identified different blood groups.
2 As the problems of pain and infection were overcome…	**B** … there was no way to replace the blood lost when the patient bled heavily and transfusions usually failed.
3 Clamps and ligatures were used to restrict the flow of blood, but…	**C** … the blood groups of the patient and the donor need to match for a transfusion to be successful.
4 In 1901, Karl Landsteiner announced that…	**D** … the donor needed to be present.
5 Scientists and surgeons now understood that…	**E** … the first blood depot was set up, using Type O blood, which can safely be given to all patients.
6 Transfusions could now be carried out, but…	**F** … a person dies if blood does not circulate around the body, taking oxygen to different parts and organs.
7 In 1915, it was found that adding sodium citrate stopped blood clotting and, in 1916, Francis Rous and James Turner found that…	**G** … more complex operations were attempted, but blood loss remained a problem.
8 During the Battle of Cambrai in 1917…	**H** … adding a citrate glucose solution allowed the blood to be stored for longer periods without the cells deteriorating as quickly.

Recall – complete the practice questions on paper.

You can look back in this booklet or use the summary information on the next 6 pages.

1. Describe **2 features** of the following topics (2 paragraphs per topic)

☐ Trench system
☐ Stretcher bearers
☐ Ambulances
☐ Trench foot
☐ Gas attacks
☐ RAMC
☐ FANY
☐ Dressing stations
☐ Casualty Clearing Stations
☐ Base Hospitals
☐ The underground hospital at Arras
☐ The Thomas splint
☐ Blood transfusions
☐ Plastic surgery

2. List and explain the SIX key battles in the First World War and the types of medical advances shown during them. Write a paragraph per battle.
3. What were the problems with the following transports and communications. (2 paragraphs per topic)

☐ Horse-drawn and motor ambulances
☐ Train, barge and ship ambulances

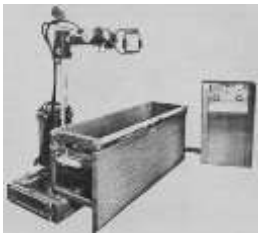
4. What were the main symptoms of Trench Foot? (2 paragraphs)
5. What were the attempted solutions to deal with Trench Foot? (2 paragraphs)
6. What were the main symptoms of Trench fever? (2 paragraphs)
7. What were the attempted solutions to deal with Trench fever? (2 paragraphs)
8. What were the main symptoms of Shellshock? (2 paragraphs)
9. What were the attempted solutions to deal with Shellshock? (2 paragraphs)
10. How did soldiers attempt to prevent injuries from shrapnel, wound infection and head injuries? (2 paragraphs)
11. What were the three types of gas used to attack? What were the effects of them? (2 paragraphs)
12. What were the main stages of the chain of evacuation? (3-4 paragraphs)
13. Write 5 bullet points about the following: RAP, ADS and MDS, CCS
14. How did the FANY help with the treatment of soldiers? (2 paragraphs)
15. Explain the following treatments used to prevent infections from spreading:

☐ Amputation
☐ Carrel-Dakin method
☐ Wound excision or debridement

16. What was the Thomas Splint and how did it treat fractures? (2 paragraphs)
17. What were the problems with using x-ray machines in the First World War? (2 paragraphs)
18. What were the problems with blood transfusions and how were they solved? (2 paragraphs)
19. Whose work led to aseptic surgery being developed in the late 19th century?
20. Name 2 methods used to prevent infection during surgery.
21. Name 2 medical discoveries/inventions made in the 20 years before the war.
22. What was one problem with early x-rays?
23. Why did the war develop into trench warfare?
24. Which major battle cost an estimated 400,000 British lives?
25. At which battle was gas used for the first time?
26. What happened at Hill 60?
27. What was the BEF?
28. At which battle was the first blood bank used?

Summary Info for Whole Unit

Medical advancements in WWI were built on the foundations of 19th century breakthroughs.



1) Due to the work of **Lister with his carbolic spray**, building on the work of Pasteur, by 1900, most operations were carried out using **aseptic** methods.
Changes: All medical staff had to wash their hands, faces and arms before operating. Rubber gloves and gowns were worn, the air was sterilised by being pupled over the heating system. A steam machine called an **autoclave** (invented by French scientist Charles Chamberland in 1881),was used to sterilise surgical equipment.
2) **X-Rays:** The development of the X-Ray was completely accidental. In 1895, Wilhelm Roentgen, a German physicist, was studying the effects of passing an electric current through a glass tube covered in black paper. He noticed that the light rays still penetrated the paper. **Early problems with x-rays:**
• Health risks were not fully understood. The amount of radiation was x1500 the amount released today. Any form of radiation can lead to problems like losing hair or burns
• X-ray machines had very fragile glass which could break
• Taking an x-ray of a hand took about 90 minutes

Blood Transfusions: An average adult's body contains 5 litres of blood, the body will go into shock and die with too much blood loss. This was common in surgery in the 19th century and battle fields. James Blundell in 1818 conducted the first ever human blood transfusion (blood taken from a healthy patient and given to another) in order to help women in childbirth. Half of Blundell's patients survived and many of his techniques were used in WW1. Blood can only be transfused with someone of the same blood group. As storage was a problem, the blood had to be used straight away!
3) **Blood Storage**: **Problems:** Blood clots as soon as it leaves the body, meaning it will block up tubes and be too hard to transfuse / the body will reject blood from a donor unless the blood is compatible with their blood group. In 1901 Austrian Scientist Karl Landsteiner discovered existence of **blood groups**. Later research (Reuben Ottenberg) discovered **O blood group** as **universal donor**. Scientists also discovered how to separate and store crucial blood cells which could then be bottled, packed in ice and used when needed, contributing to the growing blood banks

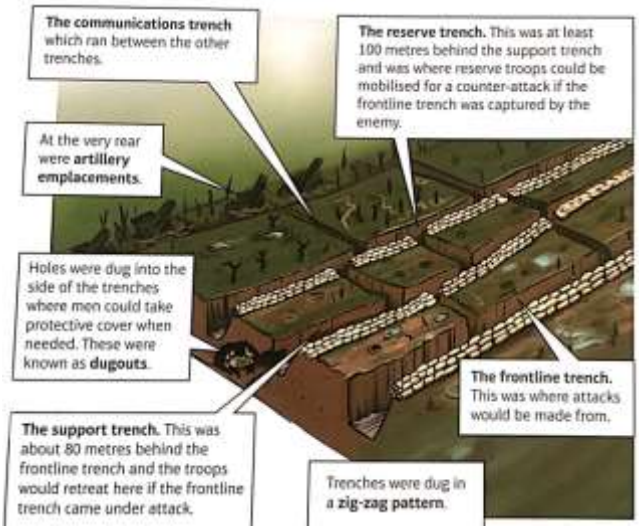
Trench Warfare

Britain declared war on Germany on **August 4th 1914** when Germany invaded France through Belgium.
The British government sent the **B.E.F (British Expeditionary Force)** to northern France to try and stop the German advance.
The BEF had **70,000 professional soldiers** fighting alongside the French army. After the initial fighting, both the British and Germans pulled back their forces.
This is when 'Trench Warfare' began. It became a defensive war using trenches with some offensive attempts to capture the enemy trenches / land.

Advantages of Trenches:
• Easy to make
• Easy to defend
• Cheap to build
• Didn't need lots of men to defend them.

Disadvantages of Trenches:
• Wet and cold
•Hard to get in and out of without being seen by the enemy.
• Trenches were very dirty and unhygienic as there was no running water or flushing toilets.

Conditions in the Trenches:
Summer: Sewage, dead bodies & heat led to horrific smell & disease everywhere
Winter: Bad weather led to flooding, frostbite (6000 cases in December 1914)



Trench Foot: This was an infection of the feet caused by cold, wet and filthy conditions. In the trenches men stood for hours on end in waterlogged trenches without being able to remove wet socks or boots. The cold would cut off the circulation to the foot. Without blood flow the tissue would die (turn gangrenous). By Jan 1915, 27th British Division had lost 12,000 men to Trench Foot! **Remedy:** dry their feet and **change their socks several times a day**, also rubbing **whale oil** into their feet. Once gangrene set in, amputation was the only solution!

Trench Fever: Flu like symptoms with high temperature, headaches and aching muscles. This was a major problem as it affected half a million men. **Solutions:** They worked out it was caused by lice. 'greybacks' as the soldiers called them. Delousing stations were set up. Men were given louse repellent gel, steam machines used. Between July 1917 and July 1918 15% of British soldiers were out of action due to Trench Fever.

Shell Shock: caused a wide range of symptoms, including tiredness, loss of speech, shaking and total mental breakdown. Not well understood by medics. Not Yet disclosed (NYD) was army code for shell shock. 1916- 16,000 cases in 6 months. **Remedy:** Some hospitals had anti- shell shock centres. Given rest, food, and talks to calm them. Then returned to duty. But some accused of cowardice. 80,000 recorded cases, probably many more undocumented.

Nature of Wounds:
Rifles & explosives:

- High explosive **shells and shrapnel (metal fragments from shells) were responsible for 58% of wounds**
- 60% of injuries were to arms and legs
- Bullets were responsible for **39% of wounds**
- Machine guns could fie 450 rounds a minute
- Rifles could fire accurately up to 500 m

Shrapnel, wound infection & head injuries:
• When men were injured, either by shrapnel or bullets, the blast impact destroyed tissue and even bone for inches around the site of impact.
• The dirt alone would have caused infection, but remember the soil here had bacteria from the fertiliser used on the land before the war.
• Gas gangrene is an infection caused by the bacteria that produces gas in the gangrenous wound – it could spread and kill within 1 day!

Other problems: rats, dysentery

60,000 soldiers suffered head and eye injuries. Autumn of 1915 **Brodie Helmets** introduced. This was a steel helmet with a strap that prevented it being thrown off in an explosion. It reduced fatal wounds by 80%.

Gas attacks: Gas attack caused great panic and fear. However only 6,000 British soldiers died from gas. Gas masks were provided in 1915. Initially soldiers improvised using urine soaked cloth to prevent inhaling gas.
Types of gas:

- **Chlorine:** First used by German in Ypres 1915. Led to death by suffocation.
- **Phosgene:** first used 1915 near Ypres. Similar to Chlorine in terms of effects, but worked quicker. Killed in 2 days.
- **Mustard Gas:** First used 1917 by Germans. Odourless, caused internal and external blisters and burning of the skin.

Medical Care

	1914	1918
Medical officers	3,168	13,063
Other ranks (e.g. private)	16,331	131,099

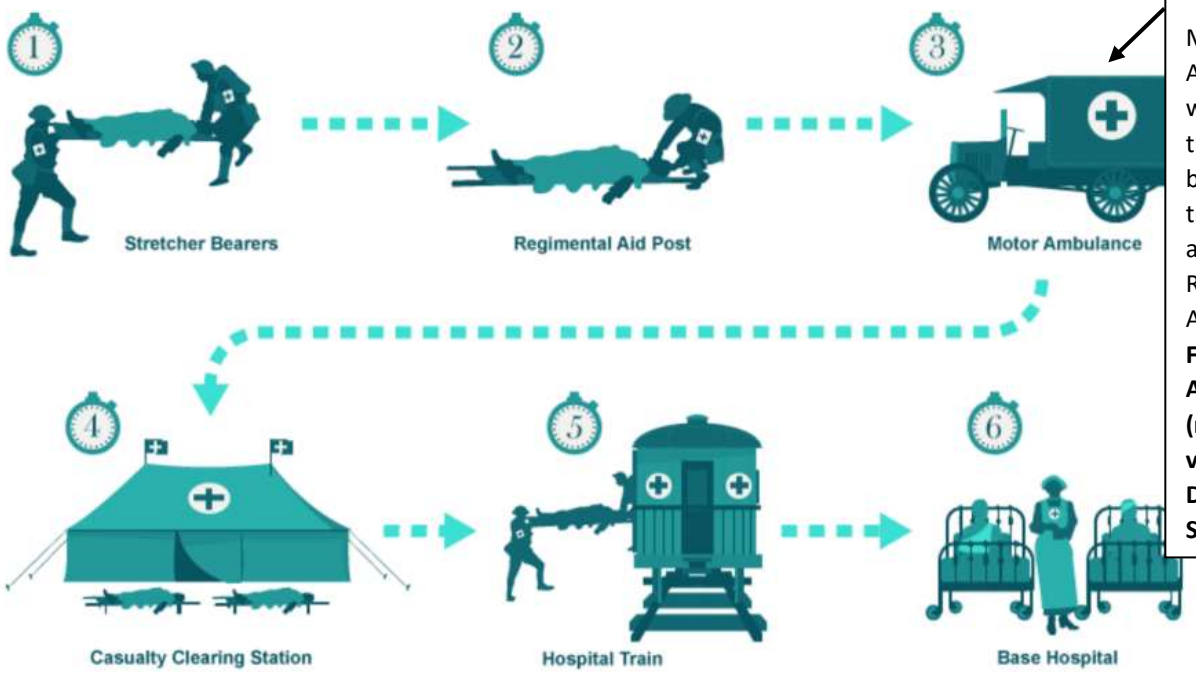
RAMC: Royal Army Medical Corps**.** This branch of the army was responsible for medical care and was founded in 1898. To deal with the large numbers of casualties in WWI, the number of medical professionals increased dramatically (Approx. 3000 1914 - → 13,000 1918!). More than half of Britain's doctors were serving with the armed forces, most of them on the Western Front.

FANY: First Aid Nursing Yeomanry. FANY was founded in 1907, the first women's voluntary organisation to send volunteers to the Western Front. It provided front line support for medical services e.g. driving ambulances, driving supplies such as food and clothes to the front line. They had a mobile bath unit (40 men an hour!).They set up cinemas to help morale.

Transport: Problems

- Constant shelling and the type of terrain that the soldiers were fighting on left the **landscape full of craters and holes destroying many roads.** This led to problems transporting injured men away from the frontline
- Before the war this region had been used as farmland, **using fertiliser which meant there was lots of bacteria in the soil** leading to infected wounds
- Stretcher Bearers would carry away the large numbers of wounded from the frontline (day and night) **exposing themselves to shelling and gunfire**.
- The British initially relied on horse drawn ambulances to collect and carry the wounded. This was a mistake! Men were shaken about on the terrain, worsening their injuries. A British newspaper appeal led to 512 motor ambulance being sent to help. Motorised vehicles still ran into difficulty on the muddy terrain, so both horses and motors were used.
- Many injured soldiers were transported to hospitals on the French/ Belgian coast by trains. Some trains even had operating theatres. There were concerns that the number of injured transported on trains was slowing down the war effort. As a result they began using canals to transport patients to hospitals on barges.

Men who were injured on the Western Front needed to be moved away in stages depending on the severity of their injuries.



Careful!

Motor Ambulance was used to transport but stage of treatment after Regimental Aid Post was **Field Ambulance (not a vehicle)/ Dressing Station**

Chain of Evacuation:

1) **Stretcher Bearers-** carried dead and wounded. Carried basic medical supplies (bandages/morphine). 16 per battalion of 1000 men. 4 men to carry a stretcher (up to 8 in difficult conditions).
2) **Regimental Aid Post** –close to the front line. Could be in dug out, ruined building or behind a wall, sometimes in firing trench. Staffed by one medical officer/ up to 30 orderlies. Bandaged light wounds, sent more severe cases to Dressing Station.
3) **Field ambulance-** mobile medical unit that set up dressing stations. Could care for soldier for up to a week. Located about a mile from front line in derelict buildings, dugouts or tents. 10 medical officers plus orderlies. Sorted wounded into groups by severity of injury (known as **Triage).** Capacity for 150 wounded, but sometimes dealt with many more.
4) **Casualty Clearing Stations** were large and better equipped, located in tents, huts, factories or schools. Between 7 and 12 miles from the fighting. About 7 doctors (+nurses/staff). By 1917 performing more operations than base hospitals. Had operating theatres, mobile X-Ray machines, wards, beds. Beds for about 50 men. Could handle approx. 1000 casualties at a time.

5) **Base Hospitals** were situated near ports on the coast. Were civilian hospitals or repurposed buildings. Some could handle 2,500 patients. Injured travelled to them by train, motor ambulance or canal (barge). Had several medical staff (doctors/nurses). Had operating theatres, X-Rays, labs, specialised departments (gas poisoning dept.).

Underground Hospital at Arras: Also known as Thompson's cave, the hospital was close to the front line in the tunnels under the town. Had 700 beds, an operating theatre and a mortuary. Had electricity and water.

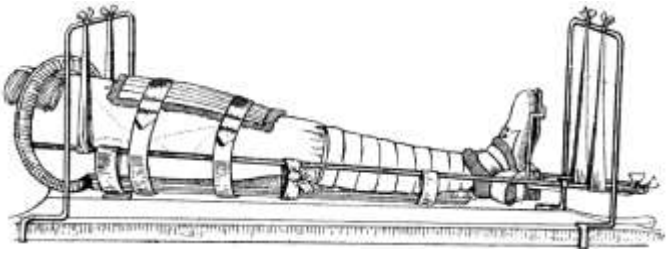
Treatments

Wounds and Infections
Aseptic surgery was very difficult because of the conditions in trenches. Carbolic acid proved ineffective for gas gangrene. New techniques were needed!

Wound Excision / Debridement: Cutting away dead, damaged, infected tissue from around the site of the wound. Making sure to remove all shrapnel/ fragments. Needed to be done quickly to prevent infection spread. Kept wound open for use of antiseptics (immediate sewing trapped infection). Wound stitch up afterwards. Resulted in larger wounds but prevented infection.
Carrel-Dakin method for gas gangrene: cleaning the wound with a sterilised salt solution. Solution only stayed usable for 6 hours. Had to be made on the go.
Amputation: If excision or antiseptics failed, amputation was necessary. By 1918, 240,000 men had lost limbs to stop spread of infection.

The Thomas Splint: In 1914/15, men with a gunshot or shrapnel wound to the leg only had a 20% chance of survival **Problems:**

- Compound fractures pierced the skin = infection and broken bone inside the leg
- If the femur (thigh bone) was fractured this would lead to massive muscle damage and bleeding into the thigh.
- The splints they originally used didn't keep the leg rigid so by the time they arrived at the CCS the patient would have lost a lot of blood, would be in shock and maybe already developing gas gangrene. Those who survived had their leg amputated at the CCS.
- **Solution:** The Thomas Splint was developed in the late 19th Century by Hugh Thomas and was designed to stop joints moving.



X-Rays were used from the start of the war, essential to identify shell fragments and bullet wounds that if not removed from the body could cause infection. Two X-Rays were taken from different angles to help the surgeon locate the shrapnel and bullets.
Problems with X-Rays on the Western Front:

- X-Rays couldn't detect all objects in the body e.g. fragments of clothing
- The length of time a wounded man had to remain still was several minutes which could cause problems depending on the wound
- The tubes used in X-Ray machines were fragile and overheated very quickly therefore could only be used for about an hour at a time to then cool down (due to demand for x-rays and overheating problem the solution was to have 3 machines in rotation)

Mobile X-Rays
Prevented deaths on the front line by letting medics see bullet injuries and sped up process. There were 6 mobile x-ray units operating in the British sector of the Western Front that could be called upon. Setting up the mobile unit took some time: A tent was attached to the back of the van with a table where stretchers could be placed. The x-ray machine was placed next to the table linked to the engine. Equipment for processing the x-ray films was set up inside the van. Image Quality wasn't as good as the static x-ray from a hospital but was sufficient in identifying the shrapnel and bullets.

Blood Transfusions: Syringe & tube was used to transfer the donor blood to the patient before surgery and to prevent them going into shock. Those who didn't reject the blood generally survived so due to this success they started doing transfusions in

the CCSs as a matter of routine. Geoffrey Keynes, a British doctor and lieutenant in the RAMC, designed a **portable blood transfusion kit** that was used closer to the front line

- 1915: American doctor Richard Lewishon discovered that by **adding Sodium Citrate to blood stopped it from clotting**, the need for donor-to-donor transfusion was removed
- 1915: Richard Weil discovered that **blood with sodium citrate could be refrigerated and stored for up to 2 days**
- 1916: Francis Rous and James Turner found that by adding **citrate glucose solution to blood, it could be stored for much longer – up to 4 weeks**. When planning a big attack, they could now ask for donations in the weeks before to prepare for the demand!

Head Injuries and Brain Surgery: Injuries to the brain were very likely to prove fatal at the start of the war because:
• The issue of infection applied just as much to the head as other parts of the body
• There were difficulties involved in moving men with head injuries through the chain of evacuation as they were unconscious or confused
• There were very few doctors who had experience of neurosurgery (nervous system, brain & spinal)

Solutions:

- Patients were operated on at CCS, as quicker operation led to a better survival rate.
- Patients were kept for up to three weeks to make sure they were recovered.
- Even minor head injuries were carefully examined just in case.
- Harvey Cushing developed new techniques in brain surgery using **magnets to remove metal fragments**. He used **local anaesthetics** when operating as general anaesthetics made the **brain swell**.

Plastic Surgery
The development of plastic surgery was largely the world of Doctor **Harold Gillies**. Before the war he was an ENT (ear, nose and throat) surgeon. He was sent to the Western Front in January 1915. Head injuries that didn't kill could cause severe disfigurement. This led Gillies to become interested in **facial reconstruction**. By November 1915, 7 hospitals in France had specialist areas for dealing with wounds needing plastic surgery. By the end of the war, nearly 12,000 operations had been carried out!

The 4 Key Battles:

- The Ypres Salient
- The Battle of the Somme
- Arras
- Cambrai

The Ypres Salient

Salient: An area of a battlefield that extends into enemy territory, so that it is surrounded on three sides, therefore vulnerable.

First Battle of Ypres: October-November 1914

Autumn 1914, Germany launched an attack to the east and north east of Ypres. Britain lost 50,000 troops but managed to keep hold of Ypres meaning they controlled the English Channel ports. The Germans had extended their control around the edge of the Ypres Salient as far as the village of Messines.

Battle on Hill 60, April 1915

Hill 60 was a man-made hill to the south-east of Ypres that the Germans had captured. The British tunnelled in and exploded 5 mines, taking back the hill.

Second battle of Ypres, April –May 1915

Immediately following the battle for Hill 60, the Second Battle of Ypres began. A sequence of battles over a period of a month. This was the **first time the Germans used CHLORINE GAS** on the Western Front. British losses were 59,000 men.

July- November 1916: Battle of the Somme.

British tried to take ground from the Germans. Notable for high casualties. 1 July 1916 -Day 1 casualties: 57,000 / deaths: 20,000. **Tactics: Creeping Barrage (Going over the top):** Artillery launched from the trenches towards the German lines just ahead of the British infantry as it advanced. **First use of tanks**: Tanks were not used effectively, they had a lot of technical problems and of course the terrain wasn't appropriate.

Third Battle of Ypres, July- November 1917
The British used creeping barrage attack to make small gains to break out of the Ypres salient. The awful weather left the ground waterlogged and many drowned.

Arras, April-May 1917

Arras was easy to **tunnel** through due to it being very chalky. British decided to link these existing tunnels, caves and quarries to create an **underground network around Arras** to act as a shelter to the Germans. **24,000 men who had been hiding in the tunnels dug near the German trenches and attacked**. Initially it seemed they had been successful with an **advance of 8 miles**. Following this early success, there was virtually no further advancement or progress.160, 000 casualties (British & Canadian).

Battle of Cambrai, November to December 1917
British army threatened rear of the German line at Calais. Artillery barrage changed so that less warning of the attack was given to the Germans. **First LARGE SCALE use of tanks (nearly 500)**. Could move easily across the barbed wire and their machine guns were very effective, however on the 2nd day less effective.