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Hello and welcome to the Health Hits podcast.

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I'm your host Tom Fisher.

Keeping up to date with the latest evidence and the newest treatments is an essential part of the job, but I often find myself reading and researching into the history of disease, which is really just the history of human kind.

And no disease had a more devastating impact on human kind than the plague.

I thought I would be researching an ancient and extinct infection but if you thought it was consigned to the history books, think again.

We'll discover what happened during the famous plague of the 14th Century and what it means for us today.

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Its 1347 and the huge Mongol Empire of Genghis Khan, established 100 years earlier, has broken down into smaller states or khanates. The state at the western edge of this old empire was known as the Golden Horde and stretched from modern day Mongolia across Kazakhstan, southern Russia to Ukraine.

With the agreement of the Mongol rulers Italians from the city of Genoa had set up a trading port city at Caffa, modern day Feodosia at the southern tip of Crimea. There was a falling out between them and a Golden Horde army was besieging this city.

Despite its high walls, it seemed this city would easily fall, until the men of the Mongol army were struck down by a sickness and soon there were not enough men to continue the siege. An eye witness account still survives today and tells of how the shattered Mongol army, in what is probably the first example of biological warfare in history, used their great siege engines to fling the bodies of their men over the walls and into Caffa.

The men of course had died from pestilence, the plague, and this was carried in their bodies, and on to the people behind the city walls.

Being a trading port, westbound ships carried the disease into the heart of Europe and by 1353, just 6 years later, all of Europe was decimated. Half the people who lived in Europe were dead, reducing the world's total population by around 100 million souls, in what later became known as the Black Death.

So this was plague, this was what it could do. But what is plague? Why did it spread so fast? Why was it so deadly? And could the Black Death ever happen again?

Well the first thing to say is that the 14th Century outbreak, known as the Black Death, was neither the first nor the last outbreak of plague.

In fact there were 3 great plague pandemics. The first was called the Plague of Justinian, named after the Byzantine Emperor Justinian who ruled at the time of the outbreak in the 6th Century and who, despite contracting the disease actually survived. Much like the vast Mongol empire was destined to do, the Roman Empire had also split and the eastern part became known as the Byzantine Empire. It ruled over the whole

eastern half of the Mediterranean countries and when the plague ripped through it over 25 million people were killed, around 13% of the world's population.

The Black Death was the next pandemic, 600 years later. It is still the deadliest event in human history, resulting in more deaths than even World War I and World War II combined. It changed the course of European History and not surprisingly still lives on in modern culture and consciousness.

The third big outbreak affected China, Russia, India and the Americas. It was a much slower burning outbreak and lasted from the mid 19th Century to the mid 20th Century. This plague is thought to have killed 12 million people.

And it was at this time that a Swiss/French physician working in Honk Kong during the outbreak there, discovered the bacteria that was responsible. His name was Alexander Yersin, and so the plague bacteria is known as *Yersinia pestis*, *pestis* being the Latin for pestilence or plague.

It's a bacteria that lives in the guts of fleas that tend to live on rats or other rodents.

It can be spread to the host rats when the flea bites them to feed, and then carried by the rats until another flea bites them and the bacteria is passed on. The rats themselves seem to have quite a bit of resistance to the plague bacteria and so act like a reservoir, carrying the disease and allowing the fleas to keep becoming infected.

When an infected flea bites a human it can pass this bacteria through the protective outer layer of skin and into the body. Humans haven't evolved resistant to this bacteria and actually the bacteria had developed some perks or add-ons that makes it particularly deadly. These upgrades allow the bacteria to avoid the human immune system, or even partly disable it, allowing the bacteria to replicate and spread within the body against minimal resistance. If our immune systems can't fight the bacteria then we don't stand a chance.

Depending where the infection seeds will determine what kind of plague illness you might experience.

A really common and troublesome bacteria such as *e coli* could cause anything from a urine infection to a chest infection or conjunctivitis.

In the same way, the plague will look different depending on where it settles.

There are two main types, the Bubonic Plague, which seeds in the lymph glands, and the Pneumonic Plague which seeds in the lungs. In either of these cases a third type, Septicaemic Plague, can developed when the bacteria spreads around the body in the bloodstream.

The Bubonic Plague will occur when a flea bite results in bacteria spreading via the lymph system to lymph glands. These are the glands that you will be able to feel enlarged in the neck, the arm pits and the groin in response any infection. The bacteria settles here and starts to divide and grow. This causes the painful massive swelling of these glands known as Bubo from which Bubonic plague takes its name. They may turn black or discharge huge amounts of pus, and you would experience fevers, cramps, shivers, vomiting, delirium, coma and death in perhaps 50% or more of people.

The disease is not airborne but contact with blood or pus from a person with Bubonic Plague can result in infection.

If the infection spreads to the lungs it causes Pneumonic Plague. This is essentially 100% fatal. Even the virus that causes Ebola isn't this deadly.

But in the three or four days before you develop respiratory failure and die, you will be coughing up blood and fluid that is full of bacteria and that will spread to everyone around you as easily as a common cold virus.

And so its likely that the great plagues started slowly, relying on contact with infected rat fleas, but then ran unrestrained from person to person.

And so what of plague now?

Well what really surprised me whilst researching this episode was discovering that plague is still around today. It lives a rat and flea reservoirs and does occasionally cause human outbreaks.

According to the World Health Organisation there have been at least 13 outbreaks of plague since 2000. From Peru, to China, the DRC to India. They are small outbreaks and the local government, the WHO and organisations like Medecins sans Frontieres do a fantastic job to keep them small.

Madagascar has been hit with several outbreaks in recent years, and there is a fantastic documentary by Vice Media which explores the reasons for this and local and international response.

I will leave a link to this video on the resources page of the site www.HealthHits.info.

And so what of treatment?

Well since the first antibiotic was discovered by Alexander Fleming in 1928, the world has changed, and bacterial infections have become much easier to treat and much less deadly as a result.

The CDC lists 7 fairly common antibiotics which will treat the Yersinia Pestis bacteria. One of them is doxycycline, which must surely be given status as a super drug because it will treat infections from plague to chlamydia, as well as being useful in preventing malaria.

Treatment within the first 24 hours or so will increase the survival rate in Bubonic Plague from 50% up to around 90%, Data for survival rates in treated Pneumonic and Septicaemic Plague is hard to find but it is certainly better than the 0% survival rate if left untreated.

So that's been a glimpse into a pretty dark and terrifying world and we should be tremendously grateful that we live in a world where we have antibiotics that can treat infections like this.

However, with the often undisciplined prescribing in human medicine, and the wholesale administration of antibiotics in livestock farming we are fast creating the perfect storm for antibiotic resistant bacteria that cannot be treated

We continue on this path and we end up in a position not dissimilar to our 14th Century ancestors who could do nothing but stand by and watch a bacterial infection run amok across a continent.

There are lots of things we can do differently and we'll cover antibiotics, resistance, and the new technologies that are available to try to improve our use of them, in a future episode.

As I've said there are links available on the site www.HealthHits.info, and if you would like to ask me anything or request a topic that interests you, please contact me through the site or on Twitter or Facebook @HealthHitsPod.

Thank you so much for listening, and please join me for another, episode of Health Hits.