

Science Debate Kit: Antibiotic Resistance

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Debate Kit: Antibiotic Resistance

Should the NHS tell GPs to give back-up prescriptions instead of immediate antibiotics wherever possible?

A structured practice debate on a controversial topic. The different 'rounds' of the debate help students think through the issues and reconsider their opinions. The structure also shows them how to build a discussion and back up their opinions with facts.

You can use all eight characters, or fewer, as you wish.

The minimum is the four essential characters (**in bold**), this gives two for and two against.

Characters

For back-up prescriptions

- **Rowena Brown – GP**
- **Glen Rosewell – Medical Historian**
- Rekha Prasad – Granddaughter
- Jeremy Smart – Farmer

Against back-up prescriptions

- **Angie Smolenska – Antibiotic Researcher**
- **Barry Ashdown – Business Owner**
- Martin Upton – Computer Programmer
- Sarah Manse – Retired GP

Facilitation tips

Ensure pupils know there is no right or wrong answer. Be observant of those who want to speak and are not getting a chance. Encourage students to give a reason for their opinions.

Designed for 11-18 years

For groups who may need extra support you can put the following prompt sentences upon the board:

"I think we should/shouldn't tell GPs to give back-up prescriptions because....."

"I think is the most important point to think about."

Learning notes

Learning objectives:

- To practise discussing and debating issues and expressing an opinion.
- Understand more of the technical, social and ethical issues around antibiotics and antibiotic resistance.

Other learning outcomes:

- Consider social, ethical and factual issues in an integrated way.
- Think about different points of view.
- Learn to back up their opinions with facts.

Curriculum points covered:

- Working scientifically
 - Societal aspects of scientific evidence
 - Developing an argument
- Substantive
 - Explore the issues around the use of antibiotics to control infection, and the spread of antibiotic resistance.

Teacher Notes

Question: Should the NHS tell GPs to give back-up prescriptions instead of immediate antibiotics wherever possible?

Lesson plan

The different 'rounds' of the debate help students think through the issues and reconsider their opinions. The structure also shows them how to build a discussion and back up their opinions with facts.

Starter: 5 minutes.

Has anyone in the class ever taken antibiotics? What did they take them for? Can they say what antibiotics are? What illnesses can they be used to treat? (You may want to recap the difference between viruses and bacteria here). Are there any disadvantages of taking antibiotics?

Do students already have an opinion on whether the NHS should tell GPs to give back-up prescriptions? Ask their opinion and fill in the first question of the **online survey** (debate.imascientist.org.uk/antibiotic-resistance-resources)

Main Activity: 35 minutes.

1) **Split students into** as many **groups** as characters you want to cover.



Designed for 11-18 years

We spoke to an expert in antibiotic prescribing, he said, "People talk about the post-antibiotic era, but for some bacteria, in some places, it's already here." There are patients today in UK hospitals who have infections that none of our antibiotics can treat. All doctors can do is keep them comfortable and hope that their immune system kicks in. The situation is far worse in parts of the developing world and in China, where antibiotic resistant bacteria are more common. Patients there are also unlikely to be able to afford the specialised second and third line antibiotics we might take here.

The economics of new antibiotics

Antibiotic resistance is generally regarded as a grave threat to humanity, (in fact, it was voted by the public as the highest priority topic for the first modern Longitude Prize: longitudeprize.org), however, most drug companies are not doing any research to find new antibiotics. This is mainly because the economics of it don't stack up for them. If somebody discovered a new antibiotic, which could be used to treat infections resistant to our existing drugs, then we would have to use it very sparingly – to prevent resistance spreading. So the drug company wouldn't make much money from it. It costs half a billion pounds to get a new drug to market. And that's assuming you can find a promising drug to start trials on pretty quickly. Most of the 'obvious' drug targets in bacteria have already been exploited. It's hard to know what research to do to even find a new drug that would work.

- 2) Give them their **character cards** – one per group, and give them a few minutes to read them over.
- 3) Get one student in each group to **read out their first section** to the rest of the class. What are the class's initial thoughts? Is there one position they identify with or reject?
- 4) Take it in turns to **read out their fact**. Does it change the way they think? Fill in the second question of the **online survey**.
- 5) **Read the issue**. Any different feelings?
- 6) Each team **asks their question** to the **character of their choice**.

Plenary: 10 minutes

Vote for which position they agree with most (if there is one). Fill in the third question of the **online survey**.

Why? Which arguments were the most persuasive? Whose responsibility is it to reduce antibiotic use and resistance?

You may also want to recap what antibiotics can be used to treat, and what antibiotic resistance is. This can be a useful way of checking what they have learned.

Background notes

Antibiotics are drugs that affect bacterial cells, but not our human cells. The first antibiotic identified by modern medicine was penicillin, discovered by Alexander Fleming in 1928.

Although some naturally occurring antibiotics had been used in traditional medicine for at least 2,000 years. The ancient Greeks and Egyptians used extracts of moulds and plants to treat infections.

Most of the antibiotics we've discovered were being made first by plants or fungi. It's obviously useful to plants or fungi to

produce chemicals that stop bacteria being able to attack them. Many commercially produced antibiotics have used these naturally occurring substances and we have piggy-backed on the work that evolution has done for plants and fungi over millions of years. This is why it's increasingly hard to find any new antibiotics.

Antibiotic resistance is when a target bacterium becomes resistant to a particular antibiotic. Some antibiotics are 'easy' for bacteria to evolve resistance to. This is because they fit very exactly to a part of a protein in the bacterial cell and stop it working. It may only take a change of one base-pair of DNA to change that part of the protein so that the drug can't bind any more. It's quite easy for that mutation to happen spontaneously. Other antibiotics fit more loosely, so it takes a big change in the shape of the target protein and therefore more than one mutation to throw them off.

The problem for humans is that bacteria evolve very quickly (a 'generation' for bacteria can be as little as 20 minutes), and also, they swap DNA with each other. Many bacteria can swap DNA with totally unrelated bacteria. And some bacteria even just Hoover up bits of DNA they find in the environment and stick it in their genomes. This means once one bacterium evolves resistance to an antibiotic, it can spread to other bacteria very quickly.

For example, cephalosporins are a class of antibiotics usually used by doctors as a second line of treatment (i.e. where the more commonly used antibiotics can't be used as someone has a bacterium which is resistant to them). Bacteria resistant to cephalosporins were first identified in the late 1990s. Within ten years, cephalosporin resistance was being found around the world, in loads of unrelated bacteria.

The last year will probably have a few resistant bacteria living on their bodies. This isn't usually a problem for them, as most of the bacteria they were infected with have been killed, and their immune system is able to deal with the rest of them. These resistant bacteria can however be a problem for pregnant women, and those with repeated infections or other chronic illnesses.

Antibiotics are painkillers – Antibiotics only kill bacteria and do not have a direct effect on pain, our immunity or inflammation.

Taking antibiotics means you can't drink alcohol – most antibiotics are safe to combine with alcohol. Only metronidazole that is used for particular gut or tooth infections causes a problem with alcohol.

All facts in this kit have been researched. References can be found online at: debate.imascientist.org.uk/antibiotic-resistance-resources

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Debate



Angie Smolenska Antibiotic Researcher

I work trying to discover new drugs that we can use to fight bacteria that are making us ill. It is really hard! They need to kill the bacteria cells, but not our cells. All the 'easy' drugs have already been found, and I don't know if we will find any more antibiotics in my lifetime. This proposal doesn't go far enough. Back-up prescriptions will still mean we use a lot of antibiotics. We need to use a LOT less.

Fact: A recent study shows that 60%-70% of people given a back-up prescription will take the antibiotics.

Issue: Much of modern medicine would be impossible without antibiotics – including deep surgery, or chemotherapy for cancer. Once there are bacteria resistant to all our drugs, we are really in trouble.

Question: Why can't we tell the public, "You can't have antibiotics unless you are really ill"?

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Debate



Barry Ashdown Business Owner

I run my own business as a window cleaner. If I can't work, I can't earn a living. I don't want to let my regular customers down, they might start going elsewhere. If I'm ill and antibiotics could help me, I want them right away, so I can be back at work as soon as possible. I don't accept that without antibiotics we'll return to the dark ages anyway. Better hygiene, and vaccinations, have also made a difference to how long we live these days.

Fact: While only 1 in 4,000 cases of tonsillitis leads to an abscess, taking antibiotics, even if you don't have a complication, can speed up the recovery process by a day.

Issue: My time is important to me, and I have a family to support.

Question: Why should my business – and my family – suffer, just because of something that might happen.

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Debate



Rekha Prasad Granddaughter

I was really close to my Granny, she was the kindest woman. Last year she had a hip operation. She got an antibiotic resistant infection. You think modern medicine can fix everything, but there was nothing doctors could do for her and she died. I miss her every day.

Fact: People who have taken antibiotics will still have some resistant bacteria living in their gut and on their bodies up to a year later.

Issue: A few resistant bacteria probably won't harm you if you are otherwise healthy. But they could be a death sentence for someone like my Gran if you pass them on.

Question: Do people realise that you can pass resistant bacteria on to others even when you have no symptoms, just by using the same door handle?

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Debate



Sarah Manse Retired GP

I loved being a GP and working in the NHS. But it seemed like every year there were more forms to fill in. In the end I took early retirement because I couldn't take it any more. Of course we should be careful with antibiotics - sometimes patients wanted them for viral infections, and that really made me cross! But GPs know medicine and should be allowed to make their own decisions, not told what to prescribe by managers far away.

Fact: It takes more than ten years of study to become a GP. Five years at medical school, and then at least another six years of on-the-job training.

Issue: Every patient and every situation is different. GPs are trained to consider all these things up and decide what to prescribe.

Question: Do you want your treatment to be decided by policy, or by a trained GP?

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Debate

Martin Upton Computer Programmer



Science is great. Look at all the fab things it's invented – cars, X-Boxes, cookie-dough ice cream... I think **back-up prescriptions are really defeatist**. Rationing out our antibiotics like a mean person with his money. We should be optimistic and find new antibiotics. We just need scientists to focus on this issue, and governments to put money into it.

Fact: Most drug companies have abandoned their research into new antibiotics, because it costs so much to develop new drugs and they wouldn't make enough profit as antibiotics are only used for about 7 days and new developed ones are saved for patients in hospital.

Issue: I think science can do anything if we make it a priority and invest in it.

Question: Why aren't governments putting loads of money into the search for new antibiotics, instead of making us suffer?

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Debate

Glen Rosewell Medical Historian



I study 19th Century medicine, a time before antibiotics were discovered. Because of that I know about what a **world without antibiotics would be like and it scares me**. Before antibiotics, people could get an infection from something as simple as a scratch, which could turn into blood poisoning and kill them. I don't want my children living in that world, so I think we should try everything we can.

Fact: In the 1890s, 1 in 7 children in Britain would die before their first birthday, mostly of infectious diseases we could easily cure today.

Issue: The more we use antibiotics, the more antibiotic resistant bacteria emerge and spread.

Question: Isn't it worth putting up with minor illnesses a bit more, if it means antibiotics still work, and we can save people's lives when they get a serious illness?

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Debate

Rowena Brown GP



I am worried about antibiotic resistance. And I know GPs **over-prescribing antibiotics is part of what causes it**. But I also feel pressure from patients to give them something to help them. A back-up prescription means I can give the patient something, but also explain why they should wait a bit first, to see if they get better without it. And also give them advice on looking after themselves.

Fact: 80% of patients' prescriptions for antibiotics are from GPs. The remaining 20% are mainly in hospitals, often for seriously ill patients.

Issue: If I can say it's NHS policy, that makes it easier for me. I don't feel like the bad guy!

Question: Should it be down to individual GPs to reduce antibiotic use, or should the NHS overall have a clearer policy?

Whose responsibility is it to make sure our drugs keep working?

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Debate

Jeremy Smart Farmer



Some people blame farmers for antibiotic resistance, but it's not our fault. Some farmers used to put **antibiotics in feed, to make the animals grow bigger, but that was banned in the EU in 2006**. Now we can only give antibiotics to ill animals with a prescription from a vet. It's humans over-using antibiotics that causes the problems.

Fact: In Europe, when the Netherlands had the highest rate of antibiotic use in animals, they still had very low rates of antibiotic resistant bacteria in humans. Probably because people in the Netherlands have almost the lowest use of antibiotics in humans across Europe.

Issue: People need to take responsibility for the problems they've created, not blame it on farm animals.

Question: Do you think about the threat of antibiotic resistance, when you demand antibiotics for a sore throat?

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