wellcome

How drug-resistant infections are undermining modern medicine – and why more research is needed now

A Rapid Evidence Assessment on the impact of antimicrobial resistance

Introduction

To drive action on drug resistance, we urgently need more data on its impact on human health

Antimicrobial resistance (AMR) – when bacteria and other microbes that cause infections become resistant to medicines that previously killed them – isn't just a problem for the future. It's already costing lives and stopping antibiotics and other antimicrobial drugs from working today. But detailed evidence of the impact of drug-resistant infections on other health conditions is sorely limited. Without it, clear-sighted and wide-ranging policy action is impossible.

Through this Rapid Evidence Assessment, we looked at the relationship between drug-resistant bacterial infections, focusing on antibiotic-resistant infections and conditions from HIV to cancer to diabetes. We found evidence that patients with conditions such as these who also develop drug-resistant infections can be at greater risk of death, face a wide range of serious health problems and frequently need extra medical support. But we highlighted, too, serious gaps in our knowledge of how drug-resistant infections impact on many conditions and patient groups.

We also spoke to clinicians and patients who have experienced how drug-resistant infections are devastating lives today. These included a transplant patient who lives in fear of catching a resistant infection, knowing his weakened immune system means the consequences could be grave. We also heard the story of a young cancer patient – remembered by their doctor in Cambodia – who responded well to initial treatment then contracted a drug-resistant infection and died within days. The stories featured in this summary are far from unusual.

We know the issue of drug-resistant infections has yet to capture the public and patient imagination. Issues from cancer to climate change are seen as more important and more relevant to people's lives – even though cancer treatment, for example, relies on the availability of effective, reliable antibiotics. More research, more data and more visible patient stories are all urgently needed to drastically raise awareness and drive government action.

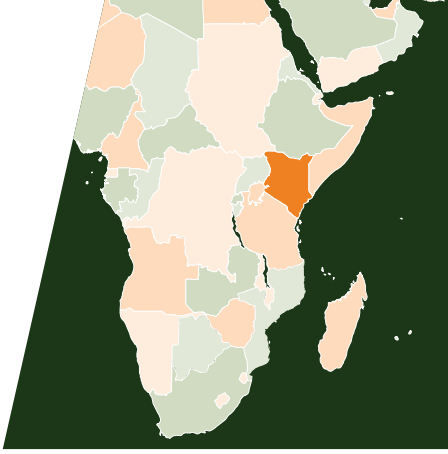
Losing antibiotics and other antimicrobial drugs would send us back to a time when many currently treatable conditions pose devastating risks once again. There is a disconnect between patients' and clinicians' lived experience of drug-resistant infections and the quality and quantity of empirical evidence about the impact of drug resistance. Better research is needed to bridge this gap and guide wider policy change. We hope this report provides a valuable snapshot of why we must act now.

About this review

The report summarises the findings of a Rapid Evidence Assessment (REA) commissioned by The Wellcome Trust in 2020 and carried out by RAND Europe. REAs are a useful way to understand how broad and comprehensive the evidence is on a given subject. This standardised approach is not a complete systematic review, but should be seen as a summary of existing evidence and of current gaps in knowledge.

"Antimicrobial resistance is a pandemic that if we don't address now, it will very soon be too late. But at this moment it is still a pandemic we can control."

Dr Neda Milevska-Kostova, Board Vice Chair of the International Alliance of Patients



1. The impact of drug-resistant infections on surgery

Number of studies found: 11

In summary

Antibiotics are used routinely to prevent infections before, during and after surgery. Losing them could make the risks of complications or death from currently routine surgery much higher. Through this Rapid Evidence Assessment, we found:

Patients who develop drug-resistant infections after surgery can be at higher risk of death

In one study on pancreatic cancer, patients who developed drug-resistant infections after surgery were six times more likely to die than patients with non-resistant infections.

Drug-resistant infections can make surgery less effective

For patients with treatable, non-drug resistant infections, one study showed surgery was successful for 81% of hip replacements and 89% of knee replacements. Those figures dropped dramatically – to 48% and 18% respectively – when patients contracted a drug-resistant infection.

Patients who develop drug-resistant infections after surgery can be more likely to develop major complications

One study found that adult cancer patients who had surgery and developed an infection resistant to more than one type of drug were four times more likely to develop serious complications, such as internal bleeding and heart problems, compared with patients with non-resistant infections or no infection.

Drug-resistant infections mean patients need to stay longer in hospital

Adults who develop a drug-resistant infection during orthopaedic surgery need to spend a third longer in hospital, on average, than adults with infections that can be treated, according to one study.

A view from Kenya:

"Right now we are just scraping through, adding antibiotics together to address emerging resistant pathogens. Very soon that's not going to be enough."

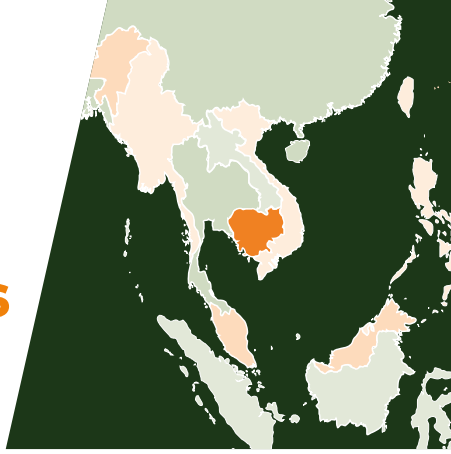
When I've worked in places like Kenya or the Democratic Republic of Congo, if people aren't close to a health facility or don't have the money or transport to travel to one, often they come to a hospital with very advanced disease. Often mothers won't seek help for a hernia until the baby gets very nasty complications, for example.

When that happens, it requires a much bigger surgical procedure, with a much longer hospital stay and higher mortality rate. Complications are quite frequent and the baby is very likely to get an infection and need more treatment with antibiotics. The more that happens, the greater the threat of resistant infections emerging.

I'm very concerned because there are a lot of challenges on multiple levels to get AMR under control. As AMR grows we will have more and more scenarios where we fail to save patients. Right now we are treading on thin ice; we are just managing to scrape through, adding all these antibiotics together to address emerging resistant pathogens. But very soon that's not going to be enough.



Dr Neema Kaseje is a paediatric surgeon and public health specialist who has worked in the Central African Republic, Kenya, the Democratic Republic of Congo, Haiti and Liberia.



2. The impact of drug-resistant infections on organ transplants

Number of studies found: 22

In summary

Effective antibiotics are vital not only to increase the chances of transplants being successful but also to help patients stay healthy in the long term. The studies identified for this review focused on organ and tissue transplants. Through this Rapid Evidence Assessment, we found:

Organ transplant patients are at greater risk of developing drug-resistant infections than patients not receiving an organ transplant

All studies we looked at found that organ transplants leave patients particularly vulnerable to resistant infections. Kidney transplant patients are at particular risk.

More research is needed to understand whether drug-resistant infections increase the risk of death or make treatments less effective

We found evidence that adults who have a liver, heart or kidney transplant are twice as likely to die if they contract a resistant infection, compared with patients with drug-sensitive infections. Two studies also found that resistant infections made treatment less effective. More research is needed to draw definitive conclusions, however.

Resistant infections can lead to further health problems

Two studies in Spain showed that transplant patients who developed a drug-resistant infection were more likely to experience respiratory failure, repeated bloodstream infections and kidney failure than patients with a non-resistant infection.

More research is needed to understand whether patients with drug-resistant infections are more likely to spend time in hospital or require ICU admission

In one study, kidney transplant patients with a resistant infection were 1.5 times more likely to need inpatient care than patients with treatable infections.

Drug-resistant infections can require more intensive treatments

Two studies found that patients with drug-resistant infections are more likely to need invasive medical support, such as mechanical ventilation.

A view from Cambodia:

"If we lose this antibiotic, there is no oral treatment left for typhoid here."

AMR is a frustrating problem that makes me extremely angry. I remember when I started in microbiology in 2001, antimicrobial resistance was a problem then. It's a bit like climate change – a slow-motion train wreck that we can't seem to get on top of. Now we see every day the consequences of AMR on our practice. We have difficulty selecting treatments for infections now because there is so much resistance.

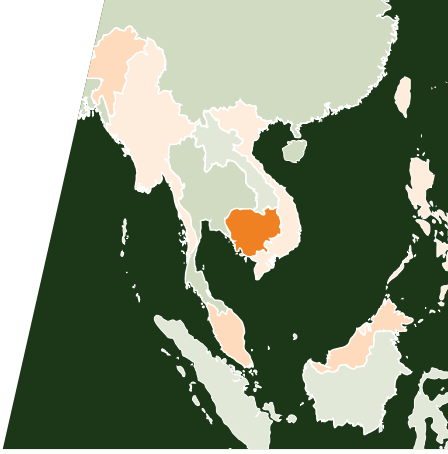
Part of the problem is that there's always one more antibiotic. Doctors won't see there's a problem with AMR and neither will the public as long as you can still get a pill that makes you better. So in places like the US and UK, where there are still drug options, AMR is seen as less of a problem.

But here in Cambodia, if you go into a provincial hospital with certain E. Coli infections and you're not super rich, you're going to die because there is no drug available to you. One of the biggest things that has annoyed me in recent times is the use of the antibiotic azithromycin for Covid-19. It's now been proven to have no benefits for patients with severe Covid-19, but it had been widely used.

If you lose the use of azithromycin in places like the US and UK, maybe it doesn't seem like a big deal. Kids with an ear infection will be able to get another antibiotic. But if we lose azithromycin in places like Cambodia or Nepal or Pakistan because of drug resistance, there is no oral treatment left for typhoid. It's the last one left. The thought of that makes me furious.



Paul Turner is Director of the Cambodia Oxford Medical Research Unit.



3. The impact of drug-resistant infections on cancer

Number of studies found: 10

In summary

In one recent study, 95% of UK oncologists were concerned about the rise of drug-resistant infections and what it meant for the care of their patients. 46% said they believed drug-resistant infections will make chemotherapy unviable. Through this Rapid Evidence Assessment, we found:

People with cancer may be at greater risk of contracting drug-resistant infections than patients who don't have cancer

Two studies we looked at found that cancer patients are more likely to develop resistant infections: a result of spending a lot of time in hospital as an inpatient and needing to take multiple antibiotics.

Drug-resistant infections may increase the risk of cancer patients dying

In one study from the USA, 75% of cancer patients with a drug-resistant infection died within 28 days, compared with 25% of patients with infections that responded to treatment. The evidence elsewhere was mixed, however, so more research is needed.

Cancer patients with drug-resistant infections are at risk of related health problems

In particular, the evidence we reviewed suggests drug-resistant infections in cancer patients are more likely to lead to ongoing and severe cases of sepsis.

It's not clear whether drug-resistant infections lead to longer hospital stays

Again more evidence is needed to draw clear conclusions, but one study in Italy found that if cancer patients developed infections resistant to multiple antibiotics, they spent longer in hospital than patients without an infection.

A view from Cambodia:

"It seemed like cancer treatment was going well, but because of a resistant infection the patient passed away within days"

I remember one patient, a three-year-old girl, who had been sick for a while. She was at another hospital for nearly a month with a fever before arriving at our hospital. We suspected she had blood cancer so we started to give her chemotherapy, and it seemed like she was responding well.

But chemotherapy drugs also cause your immunity to drop, and the patient contracted an E.coli infection that was resistant to meropenem [often thought of as one of the antibiotics of last resort]. Because of the resistant infection she passed away two days later.

Resistance makes it difficult for clinicians to find the right antibiotics to treat patients and increases the risk of death for patients. It is really frustrating for clinicians because it limits our options and our efforts to treat patients. If resistance stops you helping children, you can often see they are going to die. It's frustrating, scary and sad.

The findings in this report do reflect our experiences. It's true that patients with resistant infections are at higher risk of dying and stay in hospital for longer. We need to re-evaluate the tools that can help tackle this problem, from the community to hospitals to policymakers everywhere. AMR is a major problem, not one coming up in 10 years, but that we are facing now. People everywhere need to focus on it now.



Dr Miliya Thyl is a clinical microbiologist and paediatrician at the Angkor Wat Hospital for Children in Siem Reap, Cambodia.



4. The impact of drug-resistant infections on ICU patients

Number of studies found: 11

In summary

Antibiotics play a central role in ICUs, with up to 70% of patients requiring them on any given day. But ICU patients are also at great risk of developing drug-resistant infections, as they come into close contact with many health professionals and often need invasive treatments. Through this Rapid Evidence Assessment, we found:

Spending time in intensive care increases the chance of developing a drug-resistant infection

All studies we looked at found that organ transplants All six studies we looked at found that ICU patients were at greater risk from resistant infections. This was true for adults and children.

Babies and children are more likely to die if they develop drug-resistant infections in ICUs

One study in China found that rates of death were four times higher among babies and children with drug-resistant pneumonia, compared with children with non-resistant infections.

The evidence is less clear for adults, although older people may be at greater risk of death

While multiple studies showed high mortality rates among ICU patients with drug-resistant infections, more research is needed to compare this with patients with treatable infections. The evidence does indicate, however, that elderly patients may be at greater risk of dying if they contract a resistant infection.

Drug-resistant infections can lead to more time in ICUs

One study from the US found that adults with pneumonia spend an average of three days longer in ICUs if the infection is resistant to antibiotics, while patients with drug-resistant fungal infections typically spent 4.5 days longer in intensive care.

A view from the Republic of Macedonia:

"We need a multidisciplinary approach with doctors and microbiologists working together."

At our hospital we've seen many of the issues highlighted in this summary. We see antimicrobial resistance among children in our intensive care unit, especially among children who are chronically ill and so need frequent hospital treatment and are often given antibiotics. Premature babies are also often treated in our ICU, and while survival rates are very good, they will often develop resistant infections, especially if they have had mechanical ventilation for a long time.

We are lacking research about resistance when it should be health policy to focus on AMR at every level, at all hospitals, and for there to be full transparency of results. We need a multidisciplinary approach, with doctors and microbiologists working together and national committees in each country pushing hospitals to respond.



Katerina Stavriki is the Chair of Family Medicine at the Medical Faculty in Skopje, Republic of Macedonia.



5. The impact of drug-resistant infections on diabetes

Number of studies found: 16

In summary

In the UK, around 10% of the annual NHS budget is now spent treating diabetes. The condition leaves patients vulnerable to numerous infections – including skin, soft tissue, bladder and lung infections – because it weakens the immune system. Through this Rapid Evidence Assessment, we found:

More research is needed to understand whether diabetes patients are more likely to develop resistant infections

The evidence here is uncertain. While one study from Brazil found a clear link between diabetes and resistant infections, studies from India and the Netherlands found little difference between people with diabetes and the wider population.

It is unclear whether diabetes patients are at greater risk of dying from drug-resistant infections

One study suggested mortality rates are higher among diabetes patients who have heart surgery and develop a resistant infection. Another found the same was true of diabetes patients who develop drug-resistant infections in their bloodstream. But other research found no difference in mortality between diabetes patients with resistant and non-resistant infections.

Drug-resistant tuberculosis may be a bigger threat for people with diabetes

We looked at seven studies, including research from China, Iran and Mexico, that suggested diabetes patients are more likely to develop drug-resistant TB than the wider population. Other studies were less definitive, however, so again more research is urgently required.

A view from Argentina:

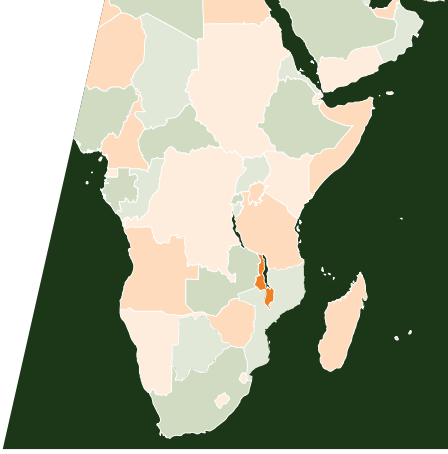
"People are not worried about resistance because they are unaware."

In 20 years I have never heard a patient talking about antimicrobial resistance. It's just not a subject that occupies people's minds. They may be worried about infection, but they are not worried about resistance because they are completely unaware.

And yet if we think about people living with a chronic condition like diabetes, if that person has to use antibiotics a lot then clearly that is going to affect their quality of life. Here in Argentina many people take medicines without a prescription, and some healthcare professionals – usually those with little professional experience – will prescribe antibiotics even if they are not sure they are needed. It's very, very important to counter that with more information and education about AMR.



Liliana Tieri is the Executive Director of the Association for the Care of Diabetes in Argentina.



6. The impact of drug-resistant infections on HIV

Number of studies found: 15

In summary

As a virus that attacks the immune system and reduces the body's ability to protect itself, HIV increases the risk of contracting infections and, therefore, the likelihood of patients needing antibiotics. People living with HIV are also more likely to experience further health problems if they contract a resistant infection. Through this Rapid Evidence Assessment, we found:

People living with HIV are more likely to develop drug-resistant TB

One study estimated that living with HIV makes the risk of developing drug-resistant TB four times higher. More research is needed to understand whether a similar trend can be seen with other drug-resistant infections. It is clear, however, that TB presents serious risks for HIV patients. One study found that 66% of HIV patients with multi-resistant strains of TB died within a year of TB being diagnosed, compared with 27% of patients with non-resistant TB.

People living with HIV and resistant TB are less likely to respond to TB treatment

One study of five eastern European countries found that 63% of HIV patients were cured of non-resistant TB or completed TB treatment without any signs or symptoms of the disease, compared with just 22% of patients with drug-resistant TB.

There are big gaps in our knowledge of how resistant infections affect hospital stays, treatments, ICU visits and treatment success for HIV patients

While one study in South Africa found that treatment for drug-resistant TB was only half as successful for patients living with HIV, another study covering seven countries found that treatment was 10% more successful for HIV patients. This is symptomatic of the serious gaps in our knowledge of the true relationship between drug-resistant infections and HIV.

A view from Malawi:

"AMR is stopping babies living through the first month of their lives."

What the spread of HIV has done in Malawi is created a very large group of people who frequently get severe bacterial infections and so urgently need access to broad-spectrum antibiotics. Those people would die very fast without those drugs. The use of those antibiotics has had a profound effect on people with HIV but, as a result, many bacteria have started to acquire drug-resistant determinants. So combatting HIV at a public health level has also in turn promoted the emergence of antibiotic resistance.

Now actually if you look at people with HIV in Malawi, the burden of bacterial infection is falling because of the rollout of anti-retro viral (ARV) programmes and because of very successful programmes to combat malnutrition and malaria. People here are living far longer on average.

But for me the fulcrum of the AMR story in sub-Saharan African is now around babies. If you look at the UN Sustainable Development Goals, reducing under-five mortality is a massive priority and there have been huge inroads there. But if you look specifically at neonatal sepsis – so patients getting a severe infection in the earliest days of their lives – we have made almost no inroads there. That's the patient group which is now incredibly vulnerable to drug-resistant infections. From a Malawian perspective, that is where the burden of AMR is falling most heavily.

AMR is stopping babies living through the first month of their lives, because they get infections with bacteria that are resistant to third-generation cephalosporins – our antibiotics of first and last resort. The leading bacteria in our unit is klebsiella, which in healthy people doesn't' tend to cause health problems but in small babies very often causes bloodstream infections. Around 90% of our klebsiella bacteria are resistant to cephalosporin antibiotics, which tells you why that population group is now so much at risk.



Dr Nicholas Feasey is a medical microbiologist and infectious disease physician based at the Malawi Liverpool Wellcome Trust Research Programme in Blantyre, Malawi.



7. The impact of drug-resistant infections on infants and children

Number of studies found: 8

In summary

The World Health Organisation estimates that 200,000 new-borns lose their lives every year due to infections that fail to respond to treatments. Very limited data has been published on this subject, but through this Rapid Evidence Assessment, we found:

Newborn babies may be at a greater risk of dying due to drug-resistant infections

One study from Bangladesh found 94% of babies with resistant infections passed away, compared with up to 6% of those with infections that responded to antibiotics. Resistant infections were also found to be a contributing factor to newborn deaths in a study looking at Italy and Brazil. We also reviewed other evidence, however, that suggested no notable difference in death rates among infants with resistant infections.

Sepsis could be a bigger risk for new-borns with drug-resistant infections

We found evidence from a study in Jordan that long-term use of multiple antibiotics in babies can lead to sepsis caused by resistant bacteria. And one review found a link between resistant infections in children and the development of complications including severe sepsis and septic shock.

It's not clear whether resistant infections cause babies to stay in hospital for longer

infections mean newborn babies need to spend more time in hospital. One study found that hospital stays were longer; a second found new-borns with resistant and non-resistant infections spend similar lengths of time in hospital.

A view from Canada:

"When a child dies of an infection, somehow we think we ought to have been able to prevent that"

At the moment there are countries where antimicrobial resistance is less of a problem and others where it is completely out of control. In our setting in Canada, we do have very good antibiotic stewardship but AMR is still definitely affecting our practice.

The first impact is we now need to screen children for AMR. That might sound trivial but it isn't fun. It's putting a piece of medical equipment up a kid's nose and another up their bottom every time they are admitted to hospital, and that wasn't the case when I started practising.

Then if we do find a resistant organism in a patient, we then need to put that child in isolation. It means they can't go downstairs, it means the parents don't have the same level of freedom, and remember we're dealing with kids who – with a diagnosis like acute myeloid leukaemia – could be in hospital for four-to-six months. You can imagine what the psychological impact of that can be. Some families really start to fall apart.

When I started practising we used less strong antibiotics, and now we have to use stronger and stronger antibiotics as the resistance increases. The more resistance you have, the more you have to use powerful antibiotics, the more toxicity that involves, so the more side effects you have and the more drugs you have to use, and the more that increases resistance. It's a spinning wheel.

I've absolutely seen situations where children with cancer develop a fever for a long time, they take antibiotics for a long time, then they get really ill and you discover it's a resistant infection. It's a horrible thing. Clearly it's always terrible and tragic when a child dies of cancer but parents seem to be able to accept that better. They usually have time to say goodbye, too. When a child dies of an infection, somehow we think we ought to have been able to prevent that. And when it happens, it's very quick. Often within 12 hours children go from being fine to passing away.

Globally we are clearly moving in the wrong direction, and as Covid-19 has shown, we are very much a global community now. It's not good enough for centres where AMR isn't yet a huge problem to say: 'We're really good at this'. If problems occur in some places, they will eventually occur everywhere.



Lillian Sung is a Paediatric Oncologist, Professor and Senior Scientist at The Hospital for Sick Children in Toronto, Canada.



8. The impact of drug-resistant infections on immunodeficiency

Number of studies found: 7

In summary

There are many factors that can weaken an individual's immune system – blood and bone marrow disorders, cancer treatments, the side effects of medicines. All of these lead to patients being less able to fight off infections – and more dependent on antibiotics. Through this Rapid Evidence Assessment, we found:

Patients with weakened immune systems are more likely to contract drug-resistant infections

Studies from Saudi Arabia and Taiwan, and a broader review looking at older patients, female patients, care home residents and people with kidney disease and diabetes, all found that patients with weak immune systems are more likely to develop drug resistant-infections.

It's not clear if patients with weak immune systems are more likely to die from drug-resistant infections or to face more health problems

We found three articles that linked weakened immune systems to higher mortality rates – one review and two individual case studies. This evidence base is too small, though, to draw definitive conclusions. Similarly, there was too little data to indicate whether patients with drug-resistant infections are more likely to have further health problems.

A view from Australia:

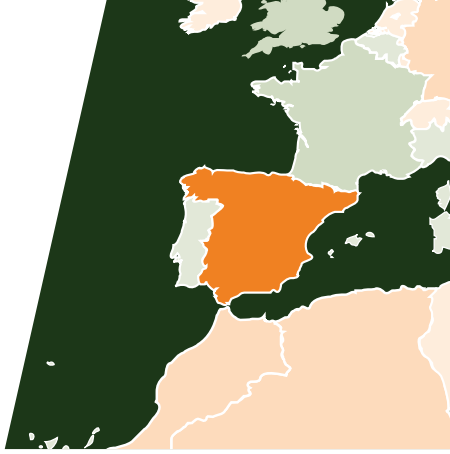
"Patients and doctors must work more in collaboration."

I was diagnosed with a bone marrow cancer in the early 1990s, and during treatment my immune system was badly compromised. I developed sepsis, which left me in a coma in ICU for three days. I was in ICU for ten days in total. The IV antibiotics given to me knocked off the sepsis causing bacteria and certainly saved my life, so I support careful husbanding of such targeted antibiotics to ensure they continue to prove effective for future patients, especially those like me with compromised immune systems. However, another recommended outcome of the episode was that I was put on a permanent prophylactic dose of low dose antibiotics to reduce the chances of future episodes of sepsis and this use of antibiotics is equally necessary.

Every individual's situation is unique, and I'm involved in a lot of work to help clinicians focus on each patient's individual needs. It's about getting better outcomes for everybody, with patients and doctors working in collaboration to achieve public benefit.



As well as being a bone marrow transplant patient, Russell McGowan is an expert advisor on patient perspectives based in Canberra, Australia.



9. The impact of drug-resistant infections on liver and kidney disease

Number of studies found: 3

In summary

The World Health Organisation estimates that 200,000 new-borns lose their lives every year due to infections that fail to respond to treatments. Very limited data has been published on this subject, but through this Rapid Evidence Assessment, we found:

Several risk factors can make patients more likely to develop resistant infections

One review found that liver transplant patients are at particular risk of developing infections if they have recently been in contact with health services, have taken antibiotics for a long period, have recently been infected by drug-resistant bacteria or have taken certain types of antibiotics.

Patients with liver and kidney disease are at risk of death from drug-resistant infections

infection are more likely to die than those with infections resistant to fewer antibiotics. Two other articles found that liver and kidney patients are both at increased risk of death from resistant infections.

Drug-resistant infections may lead to further health problems

Liver disease patients who develop drug-resistant infections can be at greater risk of kidney damage, liver failure and septic shock. Much of the evidence for this is weak, however, so further high-quality studies are needed to confirm this finding.

It's not clear whether resistant infections lead to treatment failure

We saw evidence that drug-resistant infections can both increase the risk of liver transplants being rejected and limit treatment options for kidney disease. Higher quality data is needed, however, to draw comparisons with patients who do not have resistant infections.

Patients with drug-resistant infections may need to spend longer in hospital

While again there is limited data to make a comparison with patients who have non-resistant infections, studies showed that resistant infections can extend hospital stays for liver patients by up to a third.

A view from Spain:

"I have lost friends to sepsis... it is horrible. It makes you feel so fragile."

As kidney patients we are already very fragile in the face of infections. Now everyone is wearing facemasks because of Covid-19 but we have been doing it for years! Our immune systems are compromised, so we are likely to have a lot of infections.

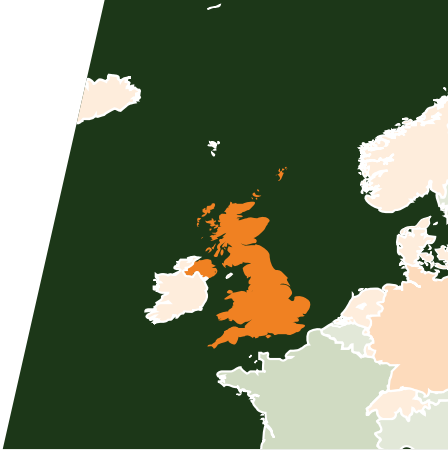
One problem is that as a kidney patient whenever you go to a doctor with a fever or feeling bad, they almost always prescribe antibiotics in case there is an infection or to prevent more serious infections. But among kidney patients we are now seeing a lot of resistance to treatments, because of these years and years of taking antibiotics. It's also the case that – similarly to women during pregnancy – we are not able to take all medicines, because our immune systems are compromised. Imagine if we develop an infection that is resistant to one type of antibiotic and we are not able to take the alternative option. What can we do at that point?

I am sad to say that I have lost friends to sepsis, most often related to catheter infections. Believe me it is horrible. It is a terrible way to die. It makes you feel so fragile. And drug resistance is also affecting kidney patients' quality of life. It's already the case that people don't want to travel to certain places because of the increased risks they would face if they became unwell.

We are facing a silent killer. Resistance is a huge threat but we act like we are not even aware of it. Step by step, year by year, resistance is growing, and this presents a huge threat for kidney patients.



Daniel Gallego is President of the European Kidney Patients Federation.



10. The impact of drug-resistant infections on physical trauma

Number of studies found: 5

In summary

Worldwide, more people under 45 die from traumatic injuries – from falls or road accidents, for example – than any other cause. Infections in patients who survive these injuries are common, often because bacteria enter the body through open wounds. Through this Rapid Evidence Assessment, we found:

It's not clear whether drug-resistant infections increase the risk of death for trauma patients

While one study in the US found that burn patients with resistant infections were more likely to die (and to experience multiple organ failure and serious kidney problems), other research suggested that drug-resistant infections had no impact on mortality rates.

It's also unclear whether resistant infections lead to longer hospital stays

One study focused on US military personnel did find that patients with drug-resistant infections typically spend almost three times longer in hospital, but more research is needed. Studies also suggested that trauma patients with resistant infections are more likely to need mechanical ventilation.

A view from the United Kingdom:

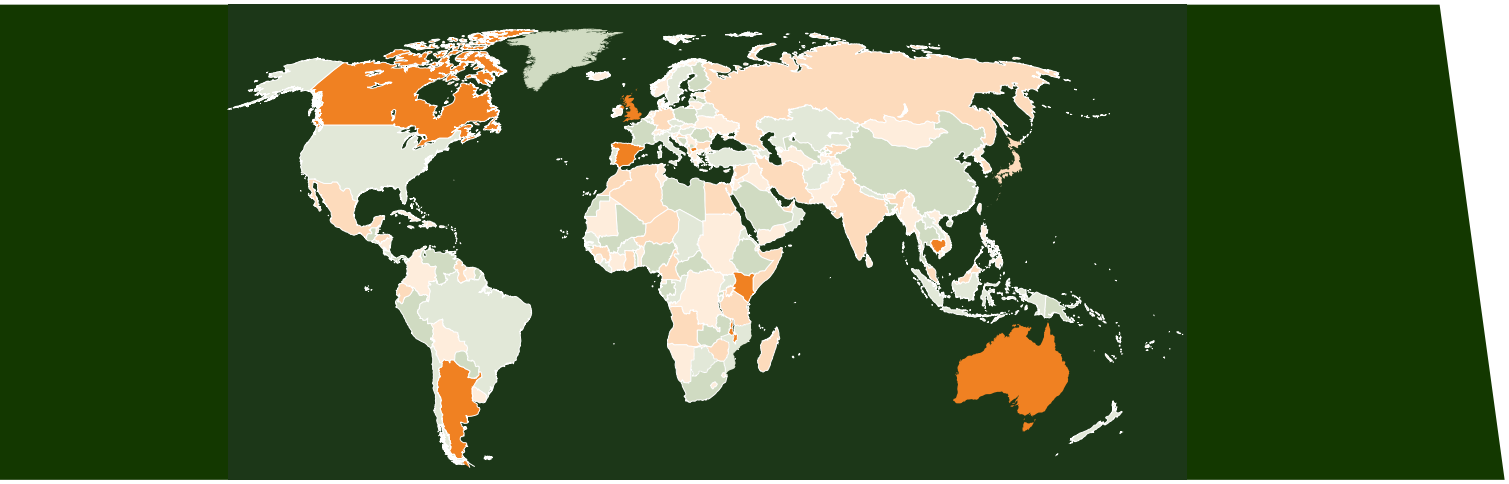
"There was a lack of clarity and understanding about which antibiotics to use."

I broke my leg falling from a horse in 2005, and over the next 10 years needed to have a series of frames fitted to help the bone heal properly. From the beginning there was a lack of clarity and a lack of understanding about the correct dosage and the type of antibiotic I needed. My consultant gave me one antibiotic and my GP prescribed me another.

I kept on having more and more frequent infections, every few months for several years, and the courses of antibiotics I needed lasted longer and the doses kept increasing. I got to a point where I stopped committing to doing things, because the infections could come at any time and were extremely painful. I did being to worry that an infection would come that the doctors weren't able to get on top of.



Annabelle Armitage now speaks about her experience for Antibiotic Research UK, the UK's only charity dedicated to combating antibiotic resistance.



Conclusion

There are fundamental gaps in the evidence – but it is not yet too late to respond.

There is, as this summary makes clear, an urgent need for wide-ranging, high-quality research into the consequences of antimicrobial resistance for other areas of healthcare. As RAND Europe's researchers gathered existing evidence across numerous conditions and healthcare areas, they were rarely able to draw definitive conclusions. The limits of previous studies made it possible only to paint a broad picture of how AMR is undermining modern medicine. We also know there is more literature connecting AMR to specific health conditions, but finding it was difficult and would require a much more systematic approach to collection.

Making existing data more easily searchable and accessible would make it far easier for decisions to be made based on data. The trends that were identified – of links between resistant infections and greater mortality risks, for example – were overwhelmingly negative, but urgent research is needed to understand the impact of AMR and to drive an immediate and ambitious policy response.

We were unable to feature numerous health conditions in this summary due to a lack of previous research. We included abortions, asthma, childbirth, Common Variable Immune Deficiency, dermatological conditions, dental health, rheumatological conditions and strokes in our literature search, but no studies were found into any of these.

The scale and scope of research needs to increase dramatically and without delay – in a wide range of ways. We need better data and a more systematic review and synthesis of existing data on how to prevent, identify, treat and control drug-resistant infections, including in relation to specific conditions. We need to understand more about the impacts of other types of AMR, beyond bacterial infections. We need better modelling to understand the true future implications of resistant infections. And we need data to be captured and shared and used in decision making far more effectively, so it can drive local, national and global responses – including in the low- and middle-income countries that stand to benefit the most from tackling AMR.

There are now two possibilities ahead of us. In the first scenario, the world's approach to stemming the spread of antimicrobial resistance is transformed. As a result, infectious diseases are brought under control in affected communities and the dangers of drug-resistant infections are greatly reduced. A century of medical progress is safeguarded. In the second scenario, however, drug-resistant infections become more common and more deadly, meaning routine medical procedures become increasingly dangerous or stop being effective, and common infections become untreatable.

To ensure we follow the first path, the need for more research and more action is clear and immediate. At Wellcome we are working to ensure this through work to:

- Mobilise national action on drug-resistant infections to ensure countries respond to the AMR crisis effectively
- Push for the development of a sustainable antibiotics pipeline, so new antibiotics become available around the world
- Encourage the appropriate use of antibiotics, so the drivers of drug-resistance are reduced.

With drug-resistant infections increasingly undermining modern medicine, we must transform the global approach to stemming their rise and spread.

Wellcome supports science to solve the urgent health challenges facing everyone. We support discovery research into life, health and wellbeing, and we're taking on three worldwide health challenges: mental health, global heating and infectious diseases.

Wellcome Trust, 215 Euston Road, London NW1 2BE, United Kingdom
T +44 (0)20 7611 8888, E contact@wellcome.org, wellcome.org

The Wellcome Trust is a charity registered in England and Wales, no. 210183.
Its sole trustee is The Wellcome Trust Limited, a company registered in England and Wales, no. 2711000
(whose registered office is at 215 Euston Road, London NW1 2BE, UK). 07/2021