Editorial

Antibiotic resistance – what we need to do about it

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Resistance to antimicrobials is a continuing and growing problem. Nearly all the bacteria that our patients and we have contact with in the healthcare system are now more resistant than 20 years ago. Many of these resistant bacteria are difficult to treat. In Australia common examples are MRSA, vancomycin resistant enterococci (VRE) and bacteria carrying extended spectrum beta-lactamase genes (ESBLs) – most often *E. coli* and *Klebsiella* spp. But we also have other infections for which we may have no effective antibiotics, for example *Acinetobacter* spp, *Pseudomonas* spp and other multi-resistant Gram-negative rods. If, however, you want truly frightening figures, look at developing countries such as China [1]. While we worry here about heading towards a 'post-antibiotic' era, for huge numbers of people in the developing world that is already the reality. Even with common but serious infections (e.g. *E. coli* bacteraemia), no effective antibiotic therapy may be available.

How did we get to this situation? Mainly by the inappropriate and overuse of antibiotics. Poor sanitation, poor hygiene and less than perfect infection control practices then result in allowing these resistant bacteria to spread more widely – and often rapidly. Once the 'genie' is out of the bottle (i.e. the development of resistant bacteria), eliminating these resistant bacteria and the genes that encode for this resistance, is almost impossible. Good infection control practices, improved hygiene and good sanitation, however, can slow the spread of resistant bacteria. Infection control is a key element in stopping this problem from becoming worse, especially in our healthcare institutions. If done effectively and diligently we can decrease the numbers of infections that occur.

We know what we need to do to control MRSA and other resistant bacteria in the healthcare sector [2, 3]. These basic components involve good infection control, better measurement and better antibiotic use through:

- Hand hygiene – use of alcohol-based handrub and gloves.
- Decontamination of environment and shared equipment.
- Contact precautions for infected and colonised patients.
- Effective programmes that prevent common infections (intravascular catheter sepsis, surgical site infections etc).
- Improvements in hospital design to include more single rooms for patients.
- Active surveillance and screening.
- Good antibiotic stewardship.

Lowering the usage of the total amounts of all antibiotics is the key factor to control the spread of these resistant bacteria. This means more prudent use of antibiotics and having better controls on how, what types and where antibiotics are used.

This is an issue that involves all in the community, not just those in the healthcare sector. Antibiotics, wherever they are used, in people, hospitals and in the agriculture sector, have important effects. Large numbers of antibiotic resistance bacteria develop and then spread as the result of the widespread use of antibiotics in food animals. Often the antibiotics used in the agriculture sector were from inappropriate use of very large volumes of these antibiotics. Avoparcin (a glycopeptide antibiotic similar to vancomycin) was used extensively in Australia and Europe as a routine in-feed growth promoter. Not surprisingly, this led to the development, spread and persistence of VRE in food animals. These VRE strains (carrying the vanA gene) then spread through the food chain (especially poultry) to the general population [4].

In many areas of the world we now have *E. coli* ESBLs (resistant to third generation cephalosporins) developing in food animals as a result of third and fourth generation cephalosporin use (poultry, cattle and pigs) and then these multi-resistant bacteria spreading to people through the food chain [5]. We have seen exactly the same situation happen with fluoroquinolones (FQ). When FQ are used in food animals, resistant bacteria develop and these resistant bacteria then spread to people [6]. Luckily the latter has not occurred in Australia, as we were one of the few countries in the world that never approved FQ use in food animals. Not surprisingly, here we still have low levels of FQ resistance in most bacteria, especially *E. coli*. Internationally, the frequent occurrence of resistant *Campylobacter* spp and also multi-resistant *Salmonella* spp is predominantly caused by the inappropriate use of antibiotics in food animals.

We seem blinded by the obvious. Whenever and wherever we use antibiotics (particularly in large quantities), antibiotic resistant bacteria will develop. Then, through poor hygiene and /or poor infection control practices (in hospitals, the community and in animals), these resistant bacteria will spread. Antibiotic resistance rates are still rising but unfortunately there are very few new antibiotic classes likely to be available in the next decade. We know all the key elements that are needed to stop resistance rates from rising and indeed help get them lower. Yet we don't seem to be doing anything effective about it.

So what do we need to do better? We need to measure and report in a timely fashion what is going on with resistant bacteria, not only in the hospital environment but in our foods and everywhere else where adequate resistance bacteria is likely to spread and develop. We need to measure both antibiotic use and resistance rates. We need to do this in a meaningful way where we can truly compare what is going on between hospitals, in the community and preferably internationally. These resistant bacteria get onto 747s and move around the world with people. They also move around the world in foods. We need much better and timely information if we really want to have an impact. We need to act locally but know that our actions will have a national and preferably a global impact by persuading our local, national and international colleagues to do the same.

We need to be measuring basic performance parameters in our healthcare system such as the numbers of MRSA infections. We also need to know how many colonised patients we have with MRSA. We need to have measures of serious infections such as *Staphylococcus aureus* bacteraemia and then how many of these are MRSA or MSSA and which ones are healthcare related [7, 8]. We need to not only know how often they occur but why. What were the preventable factors and what policies or procedures do we need to change so that the same infection does not occur in other patients [8]. Measure, intervene, and then measure again are key components of any quality improvement (QI) programme.

Our measurements and remedial actions need to be much more transparent. If one hospital has three times the rate of serious MRSA infections compared to another hospital, we need to ask why and learn from the hospital that has the lower rate. In England in 2002, despite a lot of protestations by many in the healthcare sector, the government mandated that all MRSA bacteraemia was notifiable. Indeed, much to the chagrin of many, each individual hospital trust had their numbers and MRSA bacteraemia rates put on the web [9]. While one can argue about how these figures should be interpreted [10, 11], there seems no doubt that it has had an impact. MRSA blood stream infections have fallen 17% in England from 7,700 episodes in 2003/04 to 6,378 in 2006/07 after, previously, continually rising. There is a 35% associated mortality with MRSA bacteraemia, so this translates to 500 fewer deaths per year. The UK government and health authorities are putting much more effort and resources toward infection control – not always to the most appropriate areas, but at least it is improving.

We need to turn this into a national QI programme with challenging end points to try and achieve at least a 50% reduction in MRSA bacteraemia within 5 years. It needs to have the same emphasis and resources as are put towards our road toll (healthcare associated infections are likely to cause more deaths each year than the roads). We should not accept that this cannot be done. There are numerous QI programmes showing 50% reductions in infection rates. The Netherlands and Denmark, despite being surrounded by countries with high MRSA rates, have kept their own MRSA rates very low [12, 13]. Western Australia has managed to keep multi-resistant strains of MRSA at low numbers in their hospitals [14]. This requires a lot of effort and some extra resources, but it can be done.

We in the healthcare profession need to seize control of this agenda and do something about it. In most areas of Australia we have only been scratching at the surface for the last 40 to 50 years. We need to do much more in collecting meaningful and consistent measurements. Most importantly, we need to act on what we are measuring; otherwise we will find it will be mandated on us [15]. This has already occurred in the US and in the UK; it is very likely to occur here as well. We need to 'seize' our colleagues in medicine, nursing and hospital administration and get them to recognise that this is a major problem and then work together to become much more effective than we are now.

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