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Australia is distinctive amongst the world’s developed nations for the rapidity of its population growth. In 2015-16 our population grew by 338,000 or around 1.4 per cent. It has been growing at this level or more for several years. The result is that an additional one million people are being added to the population every three years.

As can be seen from Table 1, Australia’s current growth is even faster than that of Canada (1.0 per cent) a country which, like Australia, is renowned for its commitment to population growth. By contrast most European countries have very low population growth rates and in a few cases (including Italy) have stopped growing. (Apart from Luxembourg, Australia has the fastest rate of population growth in the OECD.)

Table 1: Population growth and population projections for Australia and selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated population 2015 (millions)</th>
<th>Annual growth rate per cent</th>
<th>Projection to 2050 (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>24</td>
<td>1.4</td>
<td>38</td>
</tr>
<tr>
<td>Canada</td>
<td>36</td>
<td>1.0</td>
<td>44</td>
</tr>
<tr>
<td>USA</td>
<td>322</td>
<td>0.7</td>
<td>389</td>
</tr>
<tr>
<td>UK</td>
<td>65</td>
<td>0.6</td>
<td>75</td>
</tr>
<tr>
<td>France</td>
<td>64</td>
<td>0.4</td>
<td>71</td>
</tr>
<tr>
<td>Italy</td>
<td>60</td>
<td>0.0</td>
<td>57</td>
</tr>
</tbody>
</table>

Populations grow from two sources, natural increase and net overseas migration (NOM). Why are Australia’s growth rates so high? Let’s start with natural increase.

In 2015-16 natural increase contributed 156,000 of the total population expansion of 338,000. This may surprise because Australia’s fertility rate is not high. The measure we use to assess a nation’s fertility is the Total Fertility Rate (TFR). This indicates the number of children a woman would have if she repeated the propensity of women in the ages 15-49 to have children in a particular year.

In 2015 the TFR in Australia was 1.85. If one generation of the population is to replace itself from births the TFR must be around 2.1 (it’s a bit higher than 2.0 because some children die young and some women die during their potential child-bearing years). Australia’s level of 1.85 is similar to that of other developed countries, almost all of whom have TFRs below the replacement rate.

Why then is there currently such a substantial surplus of births over deaths in Australia? The reason is that there is a large number of young women in the child-bearing ages. Their number is a reflection of the high levels of NOM since the 2000s and the heavy concentration of young people and families amongst these newcomers.

Since 2006-7 NOM has averaged 218,300 per year. This level is high, not only in comparison with other countries but in comparison with Australia’s recent past. For example, from 1990-1 to 1999-2000 average annual NOM was 78,600. If NOM stabilises at around 200,000, the contribution of natural increase to Australia’s population growth will gradually diminish over the next few decades. This too, may surprise, given the growth of Australia’s migrant community (detailed shortly) and the common view that migrants have large families.

This is true of some migrant communities, notably those from the Middle East. According to the Australian Bureau of Statistics (ABS), the TFR for Lebanese-born women resident in Australia is around 4. However, for most of the much larger East Asian communities it is well below replacement level. For example, the TFR for Chinese-born women is currently around 1.6. Like that of Australian-born women, their low fertility rate reflects the widening range of work opportunities open to women in Australian society and the increasing costs of raising children.

What this means is that if NOM continues at 200,000 a year and the TFR remains around 1.85 (as is widely assumed) Australia’s population growth will continue strongly, but mainly due to immigration. As Table 1 shows, on these assumptions our population will grow from the current level of 24 million to around 38 million by 2050.

We now turn to the factors shaping Australia’s migration policy settings and some of the economic and social consequences.
The migration impact

Australia’s high net migration level is a consequence of Australian government policy. Australia is a very attractive migration destination. However, the actual inflow of migrants and the duration of their stay reflect the Australian government’s rules.

Successive governments have encouraged migration since 2003 when the construction phase of the China-led resources boom took off. Governments have facilitated the entry of workers on both a permanent and temporary basis. Though the resources construction boom collapsed after 2012 when commodity prices slumped, the Commonwealth government has continued to encourage high migration. (The reasons for this are explored below.)

In order to understand the implications for population growth we first need to clarify the various flows making up NOM and the ways in which these are measured. NOM is the net product of very large movements in and out of Australia on the part of both Australian and overseas-born people. These movements vary in duration. If we are to make sense of population statistics, we need to know who the ABS includes in its count of movers and who is included in the current population stock of residents (24 million as of 2015).

When it is measuring NOM, the ABS is only interested in its contribution to the stock of residents, people who live in Australia (regardless of their citizenship or where they were born). A resident is defined as anyone who enters the country and stays for at least 12 months in the 16 months period after their arrival. People are no longer counted as residents if, after leaving Australia, they stay overseas for at least 12 months of the next 16 months.

You may well wonder how this measurement feat is accomplished. It is a product of the digital revolution.

The Department of Immigration and Border Protection (DIBP) keeps a digital record of each movement in and out of Australia. In order to do this, it gives each person an individual identification number. Records based on these identification numbers are used to calculate the length of stay or absence of the people moving in and out of the country. These records are the basis of the ABS estimates of NOM and of the overall number of Australian residents.

This background is important because NOM is not just about the flow of permanent migrants (that is those allocated permanent residence visas each year). Permanent migrants are just one component of the migrant intake, albeit an important one.

Australia’s current policy (as has been the case since the mid-2000s) has been to issue just over 200,000 permanent-resident visas each year. Most of these are allocated via the skilled migration program. But in addition another 50,000 are issued to family migrants (mostly spouses sponsored by Australian residents). Another 13-15,000 visas are issued to persons on humanitarian or refugee grounds. Skilled, family and humanitarian migrants with permanent visas are the main sources of Australia’s annual population growth from NOM. But they are not the only source.

In recent years the net annual movement of migrants holding temporary visas has added significantly to Australia’s population of residents. This is partly because there has been an increasing number of such arrivals, and partly because some of those holding temporary visas are gaining permanent residence visas while in Australia. (They do this mainly through the permanent entry skilled program.) An increasing number are also staying on for extended periods by moving from one temporary visa status to another. For example, this happens when overseas students, after finishing their courses, obtain a visitor’s visa, or a Working Holiday Maker visa or a 457 visa.

The result is that the stock of temporary migrants in Australia has been increasing and has now reached a very high level. As of December 2015 there were 1.3 million persons holding temporary visas in Australia who are staying long enough to count as residents. This stock includes 328,888 overseas students, 155,000 Working Holiday Makers, and 160,000 holders of 457 visas, all of whom have work rights in Australia. Added to these there were another 513,000 visitors (tourists and the like). They do not have work rights but enforcing this rule is difficult.

With this background we now explore some of the consequences of these migration numbers, starting with the impact on the labour market.

The migrant impact

The labour market

An annual level of NOM of around 200,000 adds some 100,000 to Australia’s workforce. The main impact is on Australia’s labour market for low skilled workers and on that of a few professional occupations.

The impact on the low-skilled labour market derives from the large stock of temporary migrants. These migrants usually seek employment in routine hospitality, retail, cleaning and related jobs. They are very eager to find work. This means that employers can strike a tough bargain as regards wages and conditions. As a result, they are displacing many of the young residents entering the workforce with no post-school qualifications. For this group low-skilled jobs provide important entry level, or starting points, to their work life. Competition from temporary migrants for this type of work is a major explanation for the high unemployment rate (around 13 per cent) for residents aged 15 to 24.
In the professional labour markets migrants tend to be concentrated in just a few occupations. These include ICT professionals, accountants, engineers, nurses and doctors. By far the largest migration-affected occupational group are ICT professionals. In 2015-16 there were 9,733 visas issued to ICT professionals in the permanent skilled program and another 7,452 in the 457 program. This compares with just over 5,000 domestic undergraduate completions in ICT. For each of the occupations listed tensions are rising as a result of migrant competition for limited employment openings.

Given these circumstances, why hasn’t the Australian government eased up on the migrant intake? The main reason is that, since the decline of the construction phase of the mining boom, its prime policy interest in immigration has been to find an alternative boost to the Australian economy. Economic policy makers believe that population growth provides this by adding to consumer demand, especially for housing. The current Governor of the Reserve Bank, Philip Lowe, explains why this boost is so important. In an address to business economists in November 2014, Lowe asserted that population growth is the key to offsetting Australia’s current difficult economic setting. He argued that if Australia continues with the fastest rate of population growth amongst OECD countries this will drive Australia’s economic growth since migrants ‘will require somewhere to live, to work and to play’.

The housing market

As policy makers hoped, housing has given an impetus to Australia’s economy since 2012. This has come in the form of new housing construction (mainly units) and the huge investment in established housing on the part of investors and owner-occupiers upgrading their dwelling. Both groups have taken on massive additional mortgage debt in the hope of accruing greater capital gains which they think will flow from ever increasing housing prices. While this investment in established houses does not add to the housing stock it does add to economy wide purchasing power. This occurs through the funds borrowed by banks from overseas to help finance their mortgage lending and through the money accrued by property sellers which they spend or deposit with the banks, who then lend to additional borrowers.

The downside is a crisis in housing affordability. On the basis of household formation projections for Sydney and Melbourne for the decade to 2022, Birrell and McCloskey calculated that 64 per cent of household growth and thus need for extra dwellings in Sydney will be due to net overseas migration as will 54 per cent of the need in Melbourne. These calculations assumed the continuation of current demographic trends.

The tiny units that speculators are building do not meet the growing demand for family-friendly housing. The problem is that all these extra migrant households have been competing for a limited stock of established houses with new households of existing residents, as well as with local investors and owner-upgraders. The result has been a huge surge in the price of the housing stock in Sydney and Melbourne. Aspiring first-home buyers have been largely priced out of these markets.

The distribution and ethnic make-up of Australia’s population

Most of Australia’s migrants come from Asian and Middle Eastern countries. They overwhelmingly locate in metropolitan areas, especially those where there are well established co-ethnic communities. This largely means Sydney and Melbourne. Currently some two thirds of the net migration intake heads for Sydney or Melbourne. This is why Melbourne’s population is growing by 90,000 to 100,000 a year and Sydney’s by 80,000 to 90,000 a year and why the competition for housing has been so fierce in these two cities.

This influx is also affecting the ethnic diversity of Australia’s population. For Australia as a whole, Table 2 shows that, by 2015, some 28 per cent of Australia’s population was born overseas. This is the highest share it has ever attained over the past century. It is far higher than in comparable ‘countries of migration,’ including Canada. The overseas-born comprise 20.6 per cent of Canada’s population and 13 per cent of the US population.

Table 2: Australia’s population by selected countries of birth, 2015

<table>
<thead>
<tr>
<th>Birthplace</th>
<th>Number (thousands)</th>
<th>Share (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>17,100</td>
<td>72</td>
</tr>
<tr>
<td>UK</td>
<td>1,200</td>
<td>11</td>
</tr>
<tr>
<td>New Zealand</td>
<td>611</td>
<td>2.6</td>
</tr>
<tr>
<td>Lebanon</td>
<td>93</td>
<td>0.4</td>
</tr>
<tr>
<td>China</td>
<td>481</td>
<td>2.0</td>
</tr>
<tr>
<td>India</td>
<td>433</td>
<td>1.8</td>
</tr>
<tr>
<td>Other</td>
<td>3,860</td>
<td>16.2</td>
</tr>
<tr>
<td>Total overseas</td>
<td>6,678</td>
<td>28.0</td>
</tr>
<tr>
<td>Total population</td>
<td>23,778</td>
<td></td>
</tr>
</tbody>
</table>

Source: Estimated resident population by countries of birth, 1992-2015, ABS

The overseas-born presence in Sydney and Melbourne, as would be expected from the location patterns just described, is especially marked. Overseas-born persons constitute just over 40 per cent of Sydney’s population and almost 40 per cent of Melbourne’s.
Source

1. Average annual increase from 2006-7 to 2015-16 was 374,600, 58 per cent from net overseas migration. Calculated from Australian Demographic Statistics, Catalogue no. 3101.0, Australian Bureau of Statistics (ABS) (various issues)


3. Calculated from Australian Demographic Statistics, Catalogue no. 3101.0, ABS (various issues)

4. A 457 visa is a temporary visa designed for skilled workers who are sponsored by an Australian employer. They allow the person to work in Australia for up to four years, provided they continue to have a sponsor. See <https://www.border.gov.au/Trav/Visa-1/457-> accessed 11 January 2017.


7. Bob Birrell and David McCloskey, 2016, Sydney and Melbourne’s Housing Affordability Crisis, Report Two: No End in Sight, The Australian Population Research Institute, pp. 3-4

8. Ibid., p. iv
Suggested images

**Figure 1:** Total population growth


**Figure 2:** PERCENTAGE OF MIGRANTS IN SYDNEY BY SUBURB - 2011

http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4102.0main+features102014

**Figure 3:** PERCENTAGE OF MIGRANTS IN MELBOURNE BY SUBURB - 2011

http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4102.0main+features102014
9. Use the internet to research the reasons why the population of some European countries is declining.

10. Draw a Futures Wheel to consider the consequences of a declining population growth in a country.

Student Activities:

1. Define the terms total fertility rate (TFR), natural increase and net overseas migration and explain how each value is calculated.

2. Using the data in Table 1, calculate the absolute increase and the percentage increase in population in Australia from 2015 to 2050.

3. The Australian Government encourages international migration.
   a. Explain why international migration may be advantageous to the Australian economy
   b. Explain how and why immigration in Australia since the 2000s has affected the TFR in Australia.
   c. Identify push and pull factors that influence the migration of people to Australia.


5. Discuss the social and economic impacts of Australia’s immigration policy in large cities such as Sydney and Melbourne.

6. Refer to the maps ‘% of migrants population Sydney by suburb - 2011’ (Figure 2) or the map ‘% of migrants population Melbourne by suburb - 2011’ (Figure 3) on
   For either Sydney or Melbourne:
   a. Describe the spatial distribution of migrants in the city.
   b. Outline factors that may influence the distribution of migrants in the city.

7. The current Governor of the Reserve Bank, Philip Lowe asserted that population growth is the key to offsetting Australia’s current difficult economic setting.
   a. To what extent should economic progress determine Australian’s population policy?
   b. What factors should be considered when determining an optimum population size for Australia?

8. Debate alternative strategies that could be used in a population policy for Australia. The following article provides additional reading http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/RP9697/97rp17
There is little doubt that we are experiencing the greatest population upheaval our world has seen and over the next few decades our world is going to look very different. Falling fertility, increasing life expectancy, accelerated ageing, huge population movements and increasing environmental disruption, will transform our world. Allied to this is the growing need for food supplies and increasing concern for people’s health. We also continue to fail to recognise the complexity of the biophysical environment, the links that exist between animal and human health and how our modification of the natural environment can produce unfavourable health outcomes e.g. the development of drug-resistant bacteria through the use of antibiotics. There is also little doubt that the movement of people and increasing population density and urbanisation can lead to many opportunities for increased interpersonal contact facilitating the spread of drug-resistant bacteria. People carry all kinds of bacteria in and on their bodies which they can shed in communal spaces and in human sewage. Human sewage constitutes a particular problem. Resistant bacteria enter our ageing sewage system and may enter the environment due to sewage spills or dumped storm water.

Eighty-five years ago a petri dish in Alexander Fleming’s laboratory became contaminated by a piece of mould producing a substance (penicillin) that destroyed the bacteria under examination. Within a few years a new wonder drug had emerged which could cure people of bacterial infections. Over the next 50 years a wide range of new antibiotics were discovered allowing people to believe that the age of bacterial infections associated with childbirth, surgery and minor cuts and injuries was drawing to a close. Advances in anti-viral drugs soon followed allowing many to believe that it heralded a new infectious free age. The golden age of antibiotics shifted the causes of death from infectious diseases to cardiovascular disease and cancer. Antibiotics are rightly heralded as one of the most important breakthroughs in modern medicine but years of inappropriate use has seen the rapid development of resistant bacteria.

The reality we now face is that 100 or so years after we found that exposure to micro-organisms caused infectious disease and just 60 years after we found a specific way of fighting them, micro-organisms have struck back. In 1952 staphylococcus aureus bacteria (golden staph) were almost 100% vulnerable to penicillin. Thirty years later this figure had fallen by 90%

Currently we can still treat most infectious diseases as only a few are resistant to what is currently our last line of antibiotics – the colistins, but colistin resistance is already growing in the USA and China. We have not yet entered a post-antibiotic age but we are edging much closer. But what would our world look like if antibiotics were all rendered useless? We only have to go back to pre-1940 days to experience the dominance of infectious diseases as the primary cause of mortality and morbidity.

**Antimicrobial Resistance as a Threat to Global Health**

Increased resistance to antibiotics poses one of the greatest threats to global health of our time. Drugs that were once lifesavers have become worthless with common infections returning. In 1998 the UK’s House of Lords declared resistance to antibiotics to constitute a major threat to public health and two years later the WHO was equally despondent stating that “In the last century medical advances and enhanced knowledge of the origins and causes of disease have led to an unprecedented increase in longevity and quality of life for those fortunate enough to enjoy access to drugs and vaccines. With those gifts has come a kind of complacency that could well lead humanity into the same straits as the fabled hare who slept while the turtle crept, and thereby lost the race… Our grandparents lived
during an age without antibiotics. So could many of our grandchildren. We have the means to ensure antibiotics remain effective, but we are running out of time. Our window of opportunity to help those impoverished by infectious diseases is closing". (Epilogue, Overcoming Antimicrobial Resistance, WHO Report on Infectious Disease, 2000). Nothing could be closer to the truth. In the USA each year at least two million people acquire serious infections with bacteria that are resistant to one or more of the antibiotics specifically designed to treat them. Antimicrobial infections are causing more than 700,000 deaths a year world-wide and the number is expected to grow to about 10,000,000 deaths annually by the year 2050

Figure 2: Deaths attributable to antimicrobial resistance every year by 2050. Credit: Review on Antimicrobial Resistance: Tackling Crises for the Health and Welfare of Nations, 2016. (Wikimedia Commons).

Across the USA and Europe today antimicrobial infections claim more than 50,000 lives each year and in the USA alone, more than 2,000,000 people become ill from serious infections and 23,000 died. In addition, 250,000 Americans require hospitalisation for Clostridium Difficile infection of which as many as 14,000 ultimately die. Very few studies have comprehensively examined the impact of antimicrobial resistance on people.

One of the major concerns about antimicrobial resistance is that our modern health care systems rely heavily on antibiotics. Surgery patients, for example, are administered prophylactic antibiotics to protect against possible bacterial infection. If antibiotics fail to work this process becomes ineffectual and surgery becomes much more dangerous, particularly in the case of procedures such as hip replacements. Antibiotics also play an important part in cancer treatments which often suppress patient’s immune systems making them much more susceptible to infections. Without effective antibiotics chemotherapy would become a far riskier proposition. We do not really know how many people might get infections when currently used antibiotics give up nor do we know how many people might run the risk and still elect for surgery or other medical procedures.

Our Failure to Fully Understand the Biophysical Environment and the Microbial World

There is little doubt that we have underestimated the power and resilience of the microbial world and have shown considerable complacency in recognising the importance of infectious disease and the role of the biophysical environment. The biophysical environment is a powerful ever-changing force and we have severely underestimated the role it plays in our lives and in particular its significance with respect to infectious disease. The microbial world has revealed a dynamism that confirms the strength of evolution in the natural world. Our optimistic assault on microbes rested on the false assumption that we were confronting stationary targets against which we could simply level magic antibiotic bullets. The emergence of antimicrobial resistance underscores the reality that infectious diseases are dynamic, that mutation and change are facts of microbial life and that microbes regularly change in accordance with changes in their environment.

What Contributes to Antimicrobial Resistance?

Recently the UN issued a statement stating that “common and life threatening infections like pneumonia, gonorrhoea and post-operative infections, as well as HIV, TB and malaria are increasingly becoming untreatable because of antimicrobial resistance”. There are five major causes in our society today that contribute to antimicrobial resistance.

1. Excessive human consumption of antibiotics often related to poor prescription practices. The WHO estimates than more than half of all medicines are today inappropriately prescribed or sold and a significant half of all patients fail to take them correctly. Witness the number of people who suffering from a severe cold go to see their GP and ask for a prescription for an antibiotic just in case their cold develops persists or gets worse. Most take these antibiotic immediately despite the fact that they have no effect on their cold. Seventy years ago Fleming sounded a warning. He stated that there was a danger that ignorant people may easily overdose themselves and by exposing microbes to non-lethal quantities of the drug, make them resistant. It would also seem that many doctors
still prescribe antibiotics based on their immediate assessment of a patient’s symptoms, just as antibiotics were originally used 60 years ago.

2. Taking antibiotics for too short a time also contributes in an important way to the emergence of antimicrobial resistance and basically means that they will overwhelm the most susceptible bacteria but those which possess partial resistance will survive and linger.

3. The use of antibiotics in agriculture, animal husbandry and the fishing industry is also a critically important issue. In 1950 a chance discovery in a laboratory showed that antibiotics made animals grow faster. Since then farmers all over the world have pumped antibiotics into their animals even after evidence emerged that bacterial resistance could pass from animals to humans.

![Figure 3: Antibiotic resistance from the farm to the table. Credit: CDC Food Safety (Wikimedia Commons).](image)

4. Waste from human sewage as well as from hospitals and pharmaceutical companies also plays a major part with antibiotics waste being regularly released into soil, streams, rivers and lakes creating a perfect environment for microbial resistance to foster and spread.

5. Over the last 10 years most of the big pharmaceutical companies have lost interest in developing new antibiotics. For them there is little profit in such an undertaking and most of their resources are now directed towards diseases such as diabetes and obesity. The failure of the pharmaceutical industry to invest heavily in the search for, and development of new antibiotic drugs is without doubt a critical issue. Many antibiotics are no longer effective and their production has ceased. There seems little doubt that we should be investing in new antibiotics to which bacteria will at first have no resistance. Unfortunately, many of the drugs in our armoury which we have persisted with, are decades old. In this governments must bear some of the blame. The US National Institutes of Health (NIH), for example, the world’s single largest investor in health research, allocated only 1.2% of its grant money to funding antimicrobial research between 2009 and 2014 compared with almost 19% allocated to cancer research.

**A Post-Antimicrobial Future?**

What sort of society would we be looking at in a post-antibiotic era? Are we, as some are now saying, facing an antibiotic apocalypse? There is no doubt that life in the 21st century is different than it was 70-80 years ago. There are now more of us, we are growing older, we live closer together in higher residential densities, we are far more mobile than ever before often travelling long distances across continents with hundreds or thousands of others, we generally live in a cleaner world which ironically some argue makes us more susceptible to infections, and we have become exceedingly dependent upon antibiotic drugs. We also live at a time when old long-established diseases have re-emerged and so-called new infections burst forth. Superbugs thought to have spread from animals have destroyed our last line of antibiotic defence and now threaten global health.

Recently scientists identified a new mutation dubbed MCR-1 gene which is resistant to colistin our antibiotic of last resort. If MCR-1 becomes global and the gene allies itself with other antibiotic resistant genes, which is probably inevitable, then we will be entering a post-antibiotic era where common infections could kill again and surgery and cancer therapies which rely heavily on antibiotics would be under threat.
Planning for the Future

What should we do now? Can we better control how we use antibiotics, not over-using them, or not finishing a course of drugs? Can we discover new antibiotic drugs? It seems clear that we need to address the following issues.

1. Critically we need to appreciate the links that exist between demographic change and the growth of antibiotic resistance. Increasing population movement, greater population densities and urban growth as well as ageing populations have created an environment conducive for the spread of antibiotic resistance. We need to address issues of public and personal hygiene and sanitation. Hygiene and sanitation were both critical in the control of infectious disease in the 19th century. Two hundred years later nothing has really changed. We certainly need to take more interest in the discharge of antibiotic waste into our sewerage system as well as into our rivers, lakes and oceans. Given that a large proportion of infections originate in health-care facilities we need to provide better surveillance of such facilities and encourage better personal hygiene in all health-care workers.

2. We need to control and raise awareness of the unnecessary use of antibiotics in food production in livestock farming and the fishery industry. The use of antibiotics here has moved away from simply treating ill animals or protecting them from infection, to one that is dominated by concerns about promoting growth. It is well known that our overuse of antibiotics in agriculture helps promote the emergence of resistant strains and the danger of these spreading to humans is closely associated with our consumption of animal products as well as our contact with animals. We also need to appreciate the links between wild and domesticated animals and our health.

3. We need to promote research into new antibiotics and find alternatives to antibiotic use. To achieve this it is critical to provide better incentives for investment in, and the development of, new antibiotic drugs as well as the improvement of existing ones. There also needs to be considerable improvements in how drugs are prescribed and delivered.

Further Reading

Centers for Disease Control, Antibiotic Resistance Threats in the United States, CDC, Atlanta 2013.


Student Activities:

1. Construct a mind-map of reasons why antibiotic resistance has arisen.

2. Explain why rapid urbanisations in less developed regions of the world have increased the risk of infections requiring antibiotics.

3. Use the PMI thinking tool to evaluate the use of antibiotics in food production. Write a conclusion on whether antibiotics should be used in food production.

4. Use the internet to research how fast food companies rank in their use of antibiotics in food production. http://www.consumerreports.org/food-safety/more-fast-food-restaurants-serving-no-antibiotic-meat/ Debate the following “Food available in supermarkets and restaurants should be labelled according to the use of antibiotics used in the production of the food”.

5. Using the information in http://www.bbc.com/news/health-30416844 compare the deaths attributable to antimicrobial resistance every year compare to other major causes of death.


   - Discuss this statement in relation to meeting sustainable development goals by 2030?
   - Why might the use of antibiotics be described as a ‘tragedy of the commons’ requiring a global response?


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