Chapter Four: Looking Back Looking Forward

Where are we now?

Global burden of communicable disease

In the 21st century, we live in an unequal world where social disadvantage still leads to endemic infections for many people. Communicable diseases represent over 40% of the global burden of disease, although most of this is borne by developing countries[41]. The World Health Organization (WHO) works with limited resources to control diseases of poverty such as tuberculosis and malaria, to support childhood vaccination, and to respond to global emergencies such as HIV and SARS.

Box 4.1 An Unequal World

Cross-infection thrives in conditions of overcrowding and poor hygiene, and when health services are less developed. Consequently, infectious diseases have a disproportionate impact in developing countries, and amongst Indigenous and other disadvantaged groups within developed countries. For example, treatable infectious diseases such as otitis media, bronchitis, pneumonia, diarrhoea, and streptococcal skin-sores are still frequent in some Aboriginal & Torres Strait Islander communities. Such conditions contribute to hearing and educational impairments and malnutrition in childhood, and to lung disease, kidney disease, hypertension, heart disease, and to premature mortality in later life.

How is Australia situated?

In our lucky country, most Australians are at lower risk of infectious disease[40]. In developed societies like ours, individuals and families have easier access to knowledge, clean water and food, housing, sanitation and other facilities. Australians are thus better able to inform themselves about public health measures and to protect themselves by breaking chains of microbial transmission involving faecal contamination, respiratory secretions, body contact and body piercing. Basic prevention is straightforward: hand-washing, condom use, personal hygiene and careful preparation and storage of food. Vaccination in accordance with the recommended Australian Schedule prevents many diseases of childhood and greatly reduces the impact of influenza and other diseases in later life[70].

Australia's public health preparedness has hitherto kept most diseases at bay, but history has taught us that new threats will continue to emerge.

LEARNING FROM THE PAST AND THE PRESENT

To help prepare for future disease threats, we can learn from the past and the present. We need to understand how human behaviour can influence disease transmission, the evolution of causal microbes, and the emergence of new diseases. We have many examples from the remote and recent past. We know that population movement and mixing at times of war, famine and social unrest are major determinants of epidemics. Indeed, with modern transport, we live in a much 'smaller' world.

Box 4.2 A Smaller World

If each of us is only "six handshakes" away from any other person on the planet, it is little wonder that diseases can spread around the world so quickly.

We know that HIV has been spread around the world by people using rapid transport, by men working away from their families and by changes in sexual activity. We know that blood-borne diseases have been driven by dirty needles and by the epidemic of intravenous drug-use. We know that BSE and v-CJD arose because of changes in cattle feeding practices. We know that de-deforestation and other human impacts on the global environment have affected the risk of malaria and other vector-borne communicable diseases. We know that the imprudent use of antibiotics has contributed to emergence of pathogens that are increasingly resistant to treatment. We also know that medical advances such as transplant surgery, blood transfusion, intensive care, steroids, and anti-cancer treatments have been of great benefit to individual patients. Yet we also know that because of these advances, more people are vulnerable to infections which spread so easily in a busy hospital environment.

Robert Koch - In the 1880's he discovered the TB microbe and laid many foundations for microbiology. His main rival was Louis Pasteur. (see Appendix 2). Photo with permission from The Wellcome Trust

REALISING THE FUTURE

GLOBAL KNOWLEDGE - EXPERTS AND THE MEDIA

In a knowledge-rich world, served by the Internet, we have almost instant access to health information. Our major challenge is to interpret and evaluate and to transfer current knowledge into improved communicable disease control and practice for the public good.

In years past, when we understood less, but when the ravages of communicable disease were there for everyone to see, the community was more prepared to act on expert advice. Today, in an increasingly complex world, although the experts have more knowledge to communicate, their knowledge can be fragmented and discipline-based. Furthermore, experts must often compete to be heard. We may need to synthesise differing views, to integrate clinical, public health, social and biomedical knowledge and to create an interdisciplinary perspective to better serve the public interest.

With instant global communication, the media are also well informed about health matters, with an increasing interest in communicable diseases. The media role is to inform the public, promote discussion, and test the rationale for expert opinion and government policy.

RESEARCH TO GROW NEW KNOWLEDGE

New knowledge comes from research, which is sometimes epoch-making. We have all heard of the DNA double-helix, first described by Watson and Crick in 1953 (see Appendix 2). Knowledge of DNA has had far-reaching implications, spawning the sciences of molecular biology and molecular genetics and providing us with the means to understand the inner workings of all microbes and living things.

Most research is incremental, building on existing knowledge to find useful advances. Some research findings depend on serendipity, as in the discovery of penicillin by Alexander Fleming in 1928, and the discovery of *Helicobacter pylori* as a cause of peptic ulcer by Barry Marshall in Perth in 1980. Yet as Louis Pasteur said so many years ago: "Chance favours the prepared mind".

It is not yet widely understood that recent research has further blurred the edge between communicable and non-communicable disease. Many more diseases are now known to originate from infection. Certain microbes have now been shown to cause infertility, some pre-term births and birth defects, and some cancers, as well as peptic ulcers. Such new knowledge provides new opportunities for prevention or treatment (see Table 4.1).

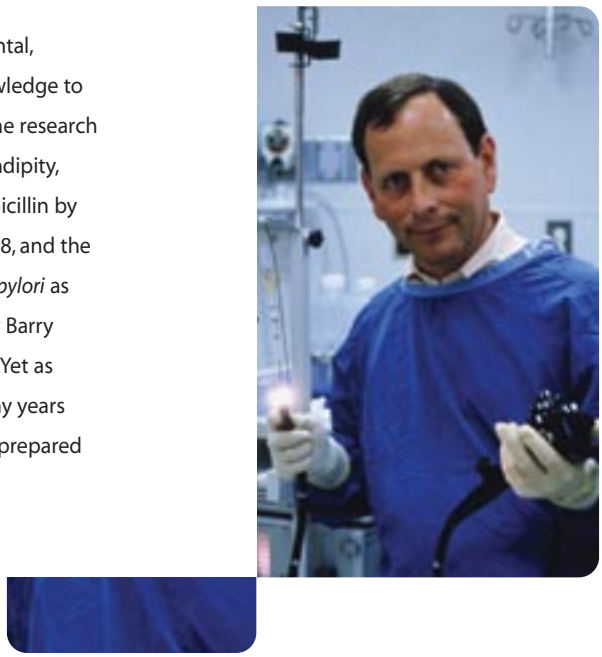


TABLE 4.1 CONDITIONS NOT PREVIOUSLY REGARDED AS COMMUNICABLE

Condition	Responsible microbe	Status	Prevention	Treatment
Infertility	Gonococcus Chlamydia	Late complication of acute infection	Safe sex Safe sex	Antibiotics for acute infection
Preterm birth	Changes in vaginal flora (bacterial vaginosis)	Strong circumstantial evidence	Antibiotic treatment	
Birth defects	Rubella virus Cytomegalovirus (CMV)	Complication of maternal infection	Rubella vaccine No CMV vaccine	
Cervical cancer	Papillomavirus	5-40 years after acute infection	Safe sex New vaccine under trial	
Liver cancer	Hepatitis B virus Hepatitis C virus (HCV)	10-40 years after acute infection	Hepatitis B vaccine No HCV vaccine	Treat HCV infection with interferon & ribavirin
Peptic ulcer Gastric cancer	Helicobacter	Complication of stomach infection	Good hygiene Trial vaccine	Antibiotic treatment

Australian Research in Communicable Diseases

Australia can be proud of its communicable disease researchers (see Appendix 3). We remember Mac Burnet as a world leader in virology and a Nobel Prize-winner in immunology. Frank Fenner was honoured as Australian Scientist of the Year for 2002 for his work on myxomatosis virus (helping to rid Australia of the rabbit plagues seen in the 1940s) and also for his work on the global eradication of smallpox. Peter Doherty, Australia's only living Nobel Prize-winner, was recognised for work on the T-cell immune response to viruses that now underpins new vaccine strategies. Leaders such as Burnet, Fenner, Ada, Nossal and Doherty also established the intellectual tradition that has put later generations of Australians at the forefront of virological, immunological, vaccine and public health research.

Australian biological research is still very healthy, supported by government funding through the Australian Research Council (ARC), CSIRO, the National Health and Medical Research Council (NHMRC), and other sources. Communicable disease research has been highly competitive both locally and internationally. For example, an Australian HIV vaccine consortium, initially funded through Health and Ageing and NHMRC, has recently won additional research and development support from the US National Institutes of Health as well as from the biotechnology industry. A Biosecurity CRC (Cooperative Research Centre for Emerging Infectious Diseases) has recently been established with support from Government, universities, CSIRO, health and agricultural agencies and industry.

NHMRC[36] and other agencies will continue to fund communicable disease research on a competitive basis, and consider urgent proposals for emerging diseases. For example, in the SARS crisis, NHMRC provided emergency funding to help Australian public health laboratories to develop and validate the tests needed to detect the SARS coronavirus.

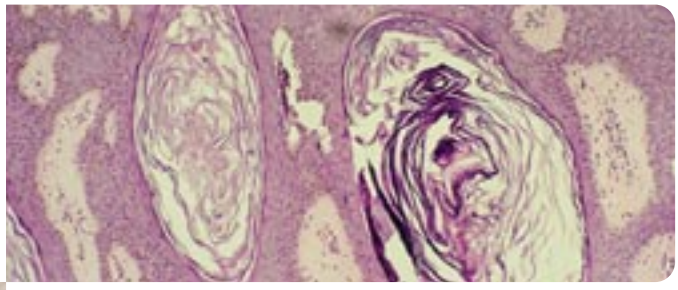
The Australian public can have every confidence that its communicable disease researchers will be able to respond to any future emergencies.

TECHNOLOGY - NEW UNDERSTANDING AND NEW TOOLS

Future research and development will yield medical and public health innovations to support improvements in disease control. Biomedical science is providing new vaccines and other molecular tools for the prevention, diagnosis and treatment of communicable disease. New insights are flowing from reading the DNA or RNA sequences of microbial genes, and from the knowledge this gives about the protein antigens and enzymes that help the microbe to invade. New techniques can even 'knock out' the particular genes that affect microbial pathogenicity to produce harmless strains as potential vaccine candidates.

Gene-based approaches to antimicrobial discovery are now concentrating on understanding more about the organism, its genetic material and its chemical pathways rather that simply screening thousands of compounds for their ability to kill microbes. Useful new agents for treatment may have effects on RNA or DNA or the pathways for making cell constituents. New studies of bacterial communication via small signal molecules known as 'pheromones' also hold promise. If scientists can understand the natural signals that trigger microbial multiplication and virulence, they may be able to provide artificial signals that will permanently switch off the growth of pathogens, and provide new tools for disease control.

The possibilities for disease control in the future, based on knowledge both new and old, seem endless and exciting.



Box 4.3 Rediscovering ecological approaches

For centuries, we may have been inadvertently practising ecological approaches to disease control. For example, by isolating influenza patients with the most severe symptoms, and preventing them from infecting others, we may have given a selective advantage to influenza variants causing milder symptoms.

It has long been known that the normal microbes on our skin and in our bowel can help to prevent invasion by more damaging organisms. Indeed, part of the danger from antibiotic resistant pathogens comes from the fact that antibiotic treatment can kill the 'normal flora' that would otherwise keep pathogens in check. It may seem incongruous to treat patients with bacteria, yet the live bacteria in yoghurt and probiotic capsules have been used to treat thrush and gastro intestinal disturbance after antibiotic administration. Similar ecological approaches, to re-introduce normal bacteria into the respiratory tract, are now being trialled to prevent otitis media. There is a growing area of research directed towards a better understanding of the interactions between normal flora and potential pathogens.

PUBLIC HEALTH AND CLINICAL SKILLS

In the SARS crisis, Australia drew on its deep expertise in public health, in clinical and laboratory diagnosis, and in treatment of communicable diseases, just as it has in other past emergencies (see also Chapter 3). The knowledge base of Australian communicable disease experts, supported by a cooperative ethos, and by linkages though governments and professional associations, underpins our capacity to detect and manage the disease problems that we already know about and to respond effectively to new diseases that may emerge in future.

Clinical and public health experts, understanding the importance of public communication, have also taken the time to provide input to this report to inform stakeholders about the complex scientific, clinical and social issues that arise in communicable disease control.

INVOLVING THE PUBLIC

PUBLIC UNDERSTANDING, TRUST AND CONFIDENCE

In historical times, people trusted family and friends to protect them and provide safe food and water. In contemporary democracies, we trust governments, as well as our fellow citizens, to protect us. When we buy food we are confident that it will be safe. When eating food prepared by others, we trust the take-away or restaurant. Without such mutual trust, our society could not function.

Threats from communicable disease and from bio-terrorism can affect our society in two ways. First, there is the small but real threat of harm from a disease epidemic or terrorist act. More insidiously, fear could supervene if we can no longer trust each other or no longer trust the safety of the civic institutions and services (food, water, mail etc) that we have hitherto taken for granted. Public confidence can be best supported by frank communication to improve community awareness and understanding of the issues. If public confidence breaks down in one area, as it did in the UK during the BSE crisis, it can have flow-on effects in others, as with the loss of confidence in measles, mumps, rubella (MMR) vaccination by the UK public.

Community support for communicable diseases cannot always be taken for granted. Only the older generations remember the epidemics and infections of the past and there may be limited public understanding of the measures, often invisible, needed for disease control. Effective prevention is rarely acknowledged, and may be missed only when it breaks down, as happened with diphtheria immunisation in post-Gorbachev Russia.

SARS has provided the latest of several wake-up calls about communicable diseases. While other diseases have emerged in recent years, none have spread as rapidly as SARS. We could not have anticipated the economic costs of SARS to global tourism and trade. During the outbreak, government leadership enhanced public awareness and supported intersectorial involvement in disease prevention and control measures. SARS has provided a trial of our plans and preparations for microbial threats. Across all sectors we have seen increasing collaboration between agencies and professional disciplines, with stronger international linkages and strategic plans for response, research and frank commmunication. The public deserves no less.

A public with better understanding of communicable diseases will not only be able to take better care of itself, but also to better question, support and influence the decisions made by government and by experts. In the longer term, this will provide greater public trust and confidence.

CONCLUSION

This report, *'Protecting Australia against Communicable Disease: Everybody's Business'* is intended to help the Australian public to understand the challenges from infectious diseases. Until the 1980s, we might reasonably have been asked: 'Why worry? Haven't we in this country been on top of communicable diseases for decades now?' Yet HIV, BSE and variant-CJD changed all that. Furthermore, we saw the US epidemic of West Nile virus from 1999, followed by anthrax in the USA and 'white powder' scares in 2001, and the global emergence of SARS in 2003.

The underlying messages in this report are simple. Firstly, if Australians understand more about communicable diseases, they will be more able to protect themselves through hygiene, safe-sex, vaccination, and the prudent use of antibiotics. Secondly, many communicable disease problems, including SARS, BSE, variant-CJD, HIV and hospital acquired infections are the unintended consequences of changes in human society and behaviour. Thirdly, because microbial agents causing communicable disease can evolve quickly to exploit new opportunities, or to escape our interventions, we cannot predict how they will change, and we may never finally win the arms race against them. Fourthly, with global threats from terrorism, there is the possibility that microbial agents, new or old, might be spread deliberately. The risks are low, but we have already seen, following the white powder "false alarms" around the world, how fear can cause public alarm that is out of proportion to the real threat.