

# WORK-RELATED INFECTIOUS AND PARASITIC DISEASES AUSTRALIA

APRIL 2006



Australian Government

Australian Safety and Compensation Council

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ISBN 0 642 32665 7

## FOREWORD

The Australian Safety and Compensation Council (ASCC) leads and coordinates national efforts to prevent workplace death, injury and disease in Australia and aims to improve national workers' compensation arrangements and return to work of injured employees.

Through the quality and relevance of the information it provides, the ASCC seeks to influence the awareness and activities of every person and organisation with a role in improving Australia's occupational health and safety (OHS) performance.

The *National OHS Strategy 2002-2012*, (the National Strategy) which was endorsed by the Workplace Relations Ministers' Council on 24 May 2002, records a commitment by all Australian, State and Territory governments, the Australian Chamber of Commerce and Industry and the Australian Council of Trade Unions, to share the responsibility of ensuring that Australia's performance in work-related health and safety is continuously improved.

The National Strategy sets out five 'national priorities' to achieve short-term and long-term improvements.

The priorities are to:

- reduce high incidence and high severity risks
- improve the capacity of business operators and worker to manage OHS effectively
- prevent occupational disease more effectively
- eliminate hazards at the design stage, and
- strengthen the capacity of government to influence OHS outcomes.

In March 2004 it was agreed by the then National Occupational Health and Safety Commission (NOHSC) that, under the national priority to prevent occupational disease more effectively, eight disease categories would be considered for particular focus under any national action plan. These are work-related musculoskeletal disorders; mental disorders, noise-induced hearing loss; respiratory diseases; occupational cancers; contact dermatitis; infectious and parasitic diseases, and cardiovascular disease.

To assist the setting of national action priorities to prevent these diseases, reports were prepared for members on each disease category. The following report is an extract of the information provided to members on the causes and risk factors for cardiovascular disease, the available data on the magnitude and severity for the disease category within Australia, approaches to prevention and evidence for their effectiveness.

## **ACKNOWLEDGMENTS**

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The author would like to thank Dr Peta Miller, Dr Anthony Hogan and Ms Helen Burbidge all of the NOHSC Office, for assistance with preparing this report.

## **EXECUTIVE SUMMARY**

### ***Background***

The project is a literature-based review of epidemiological studies on work-related infectious and parasitic diseases, including coverage of the magnitude and severity, causes, affected occupational groups and possible prevention approaches, with specific focus on Australia.

### ***Definitions and a consideration of relevant concepts and issues***

Work-related infectious disease is infectious disease that is caused by occupational factors. However, deciding whether a particular type of infection, or circumstance of infection, should be considered to be work-related is not always clear. In particular, this is because of issues of latency and lack of specific work-related features.

There are potentially hundreds of different types of infections that could occur in an occupational context. This report focuses on the more common and/or more important infections associated with occupations in Australia.

### ***Methods***

Most of the information presented in this report is based on published, peer-reviewed literature. Other relevant information from on-line sources has been included where appropriate. No new investigations were undertaken to obtain general information on exposure or risk.

Numeric information on the extent of work-related infectious disease in Australia was obtained from several sources, including national workers' compensation accepted claims and notifications to the National Notifiable Disease Surveillance System.

### ***Main occupational risk factors for infectious disease***

There are hundreds of infectious diseases that have been documented as being related to work or that could reasonably be expected to cause work-related infections. Some of these are common and some extremely rare. Those considered explicitly are diseases that in an Australian context are common, serious and/or have a high public profile. These are Q-fever, Leptospirosis, Brucellosis, Anthrax, other zoonoses, Hepatitis A, Hepatitis B, Hepatitis C, Human immunodeficiency virus (HIV)/AIDS, Legionellosis, Tuberculosis, and other infectious diseases. Infectious diseases in health workers, child care workers and agricultural and meat and livestock workers are also considered.

### ***Overall estimates of work-related infectious disease***

There have been several studies in different countries that have estimated the total burden of work-related disease. The two most recent of these included infectious disease to a limited extent. Diseases that were included were hepatitis B and C, tuberculosis and pneumococcal disease. The estimated Population Attributable Risks (PARs) were 4% for hepatitis B, 3% for hepatitis C, 5% to 6% for tuberculosis and 14% for pneumococcal disease. One of the studies derived an overall infectious disease PAR of 9% for Finland, but the basis for this is not clear, and the figure is likely to be specific for that country.

### ***Estimates of work-related infectious disease in Australia***

There is limited information on the extent of work-related infectious disease in Australia. Information that is available comes from a variety of sources, including published studies, workers' compensation claims data, and the National Notifiable Diseases Surveillance System. Published general practitioner data sources do not provide useable information because infectious disease cases are included in categories that also contain diseases not related to infection.

### ***Estimates of work-related infectious disease in Australia***

There are no comprehensive population-based estimates of work-related infectious disease in Australia. The National Notifiable Disease Surveillance System records six zoonoses that are commonly occupationally-related and that are currently notifiable - anthrax, lyssavirus infection, brucellosis, leptospirosis, ornithosis and Q fever. In 2002, there were 1,155 notifications made for these zoonoses. Most of these can be expected to have been for occupationally-acquired infections.

Workers' compensation data systems are unlikely to be a comprehensive source of information on cases of work-related infectious disease, but should provide some relevant information. Using claims for the whole of Australia over the period 1997/1998 to 2002/2003, there were between 400 and 560 claims each year for infectious disease. These numbers are probably significant underestimates. Comparison with other information suggests workers compensation information underestimates cases of work-related zoonoses by a factor of at least ten.

### ***Approaches to prevention of work-related infectious disease***

Vaccination, standard and additional precautions (also known as universal precautions), hand-washing, education and training and the use of personal protective equipment where appropriate are the main control strategies for the prevention of occupationally-related infection.

Several recent Australian studies have documented that many at-risk worker groups are not fully vaccinated against infectious diseases for which they are at increased risk, suggesting an on-going need for

information and training for both workers and employers on the availability and importance of vaccination for certain work groups.

Similarly, the value of properly instituted standard and additional precautions in the health care setting, and equivalent approaches in other work settings, is widely accepted. However, evidence in Australia suggests the use of such an approach is not comprehensive.

### ***Conclusions***

Work-related infectious disease is an important cause of work-related morbidity in Australia. However, the extent of the problem is difficult to assess accurately. Effective prevention approaches exist for most exposures, but there is evidence that the use of control measures, such as vaccination of at risk workers, is not currently optimal.

Improvements in the control of occupational infectious diseases could be made by concentrating on those occupations that have a higher risk of infection. These include health care workers, child care workers, agricultural workers and meat and livestock workers.



## **1. INTRODUCTION**

### **1.1 Background and report aims**

This report is a literature-based review of epidemiological studies on work-related infectious disease, including coverage of the magnitude and severity, causes, affected occupational groups and possible prevention approaches, with specific focus on Australia.

### **1.2 Outline of the structure of the report**

The report has eight main sections. These present, in order:

- the scope of the report and a consideration of relevant concepts and issues;
- an outline of the methods used in obtaining information for the report;
- information on the main occupational infectious diseases;
- overall estimates of work-related infectious disease;
- estimates of work-related infectious disease in Australia;
- a summary of what is known about approaches to preventing work-related infectious disease; and
- recent national and OHS jurisdictional actions.

There is almost no direct information on exposure to specific infectious agents, but estimates of prevalence of seropositivity are available for some diseases. These are described in Section 4 for the relevant diseases.

## **2. SCOPE AND RELEVANT ISSUES AND CONCEPTS**

### **2.1 Scope**

#### ***Work-related infectious disease***

Work-related infectious disease is infectious disease that is caused or exacerbated by occupational factors.

Organisms capable of causing an infection in humans are ubiquitous in the environment. This is true for both the occupational and the non-occupational environment. Infections that may arise from workplace exposures, but that could just as easily arise from non-workplace exposures, would not usually be considered work-related infections. An example is the common cold. The likelihood of catching a cold increases

with a person's proximity to others, and so would be higher in a busy workplace than it would be if the person stayed at home on their own. However, this increased risk arises from interaction with work colleagues, rather than from some specific exposure related to work, and would be similarly increased if the person travels to or from work on public transport, or walks around the local shopping center.

In contrast, many people in the general community may contract Hepatitis A, B or C through non-occupational activities, but there are many occupations that carry an increased risk of contracting Hepatitis A, B or C as a direct result of occupational activity. Cases of hepatitis contracted through workplace activities would therefore appropriately be considered to be occupationally-acquired infections.

There are several different factors related to work that can predispose a worker to contracting an infection. These include:

- increased likelihood of an infective organism gaining entry into the body, such as through cuts, needle-stick or other sharps injuries, and dermatitis;
- contact with people who have an increased prevalence of having an infectious disease;
- contact with animals that have an increased prevalence of having an infectious disease;
- working in an area in which a potentially infectious organism is endemic; and
- increased susceptibility to infection due to workplace factors.

This report focuses on the more common and/or more important infections associated with occupations in Australia. For each disease, the basic epidemiology and patho-physiology are briefly considered, along with any specific Australian-based information. High-risk occupations, industries and/or tasks are identified and, where possible, the number of workers at risk estimated.

## **2.2 Relevant issues**

### ***Latency***

The relatively short incubation period (commonly several days to two or three weeks) between exposure and onset of disease for most infectious diseases means that the relationship of an infection to work is commonly very clear. However, identifying this relationship can be a problem for infectious diseases with longer latencies. Most notably, this has been an issue with Human Immunodeficiency Virus (HIV) infection, for which the diagnosis may not be made for several years after exposure and where

exposure can occur in occupational and non-occupational circumstances. This has also been a problem for Hepatitis B (HBV) and Hepatitis C (HCV).

### ***Lack of specific work-related features***

There are no anatomical or pathological differences between infectious disease arising from work exposures and infectious disease arising from non-work exposures. However, if the type of infection is unusual in the general community and known to be a risk factor in a particular occupation, the connection between infection and work can usually be established reasonably easily.

### ***Population attributable risk***

The difficulty establishing the connection between a work exposure and a particular disease case has led many studies of occupational disease to use a Population Attributable Risk (PAR) approach (The PAR is also known as the Population Attributable Fraction or Attributable Fraction (AF)). The PAR is the proportion (often expressed as percentage) of all cases of a particular condition that are due to a particular exposure (or group of exposures). The PAR is dependent on the relative risk of developing the condition due to the exposure, and the proportion of the population that has that exposure.

Few studies have used PAR when considering infectious disease because the required information on the risk associated with exposure, and the prevalence of exposure, is not commonly available.

### ***Zoonoses***

A zoonosis is an infectious disease that can be transmitted to humans but which has an animal as the primary host. Not all zoonotic infections occur in an occupational context, but many do.

## **3. METHODS**

### **3.1 Introduction**

Most of the information presented in this report is based on published, peer-reviewed literature. Other relevant information from on-line sources has been included where appropriate. No new investigations were undertaken to obtain general information on exposure or risk.

### **3.2 Identifying and reviewing relevant literature**

English language literature published up to November 2004 was searched for relevant articles. Initial key words used were "infection" and "infectious", combined with one or more of "employ\*", "job", "occupation", "work" and "Australia". Key words covering specific diseases were also

used. These included "hepatitis", "HIV", "Q-fever", "Q fever", "leptospirosis", "brucellosis", "lyssavirus", "legionellosis" and "tuberculosis".

The searches were conducted through Medline (via PubMed and Ovid) and OSHROM, which incorporates HSELINE, RILOSH, CISDOC, NIOSHTIC, and MEDLINE. Secondary follow-up of sources cited in reference lists was also undertaken.

The relevance of papers to the project was determined by considering the abstracts or the full text of each article identified through the literature search. For major articles, the full text was read, but only the abstracts were used for some less important studies. A final decision on inclusion was reached after the methodology, results and conclusions for each relevant paper were critically appraised.

### **3.3 Data sources**

Numeric information on the extent of work-related infectious disease in Australia was obtained from several sources. National workers compensation information for accepted new claims registered from 1997/1998 to 2002/2003 inclusive came from National Data Set for Workers' Compensation-based Statistics (National Occupational Health and Safety Commission 1987) data and was supplied by NOHSC. Information from the National Notifiable Disease Surveillance System (Yohannes et al. 2004) came from the Department of Health and Ageing web site.

## **4. MAIN OCCUPATIONAL INFECTIOUS DISEASES**

### **4.1 Introduction**

There are hundreds of infectious diseases that have been documented as being related to work or could reasonably be expected to cause work-related infections. Some of these are common and some extremely rare. This section considers those diseases that in an Australian context are common, serious and/or have a high public profile. These are listed in Table 1 (next page). Several relevant review articles are available, covering all infections (Snashall 1996) and zoonoses (Brieseman 1998), including a report by the Australasian Faculty of Occupational Medicine (Australasian Faculty of Occupational Medicine 1999).

**Table 1 Work-related infectious diseases specifically considered**

Disease
Q-fever
Leptospirosis
Brucellosis
Anthrax
Other zoonoses
Hepatitis A
Hepatitis B
Hepatitis C
Human immunodeficiency virus (HIV)/AIDS
Legionellosis
Tuberculosis
Other infectious diseases

#### 4.2 Q fever

Q fever is a zoonotic disease caused by infection with an organism called *Coxiella burnetii*. The main symptoms of the disease are fever, myalgia, joint pains, headaches, sweating and photophobia, but there can be serious complications involving many organs. The most common complication is the development of chronic fatigue, which occurs in about 20% of cases, although the validity of this diagnosis remains controversial (Marmion 1997; Marmion et al. 1996).

The main occupational sources of infection are sheep, cattle and goats. Wild animals such as bandicoots (in particular), kangaroos, wallabies and birds also harbour the organism. Infection usually arises through contact with the placental tissue or fluid, or urine, of infected animals.

The main occupations at risk in Australia are abattoir workers, stock workers, stock transporters, shearers, hide processors, farmers, veterinarians and some laboratory workers. Australian studies in the last two decades have shown evidence of infection in 27% of cattle and saleyard workers (Hutson et al. 2000), and 16% (Gilroy et al. 2001; McKelvie 1980), 29% (Shapiro et al. 1990) and 38% (Ackland et al. 1994) of abattoir workers. Several studies have documented outbreaks of Q fever in Australian workers (Ackland et al. 1994; Buckley 1979; Buckley 1980; Gilroy et al. 2001; Hutson et al. 2000; McKelvie 1980; Shapiro et al. 1990; Spelman 1982).

Q fever has been a notifiable disease since 1977. In 2002, there were 761 Q-fever cases notified to the National Notifiable Diseases Surveillance System. Most of these can be expected to have been occupational in origin. There were 515 notifications in 1999, with notification numbers increasing steadily since then. Reasons for the increase in notifications may include increased suspicion of Q fever as a diagnosis by general practitioners delivering the vaccination program, and individual screening for previous exposure to Q fever prior to vaccination (National Notifiable Diseases Surveillance System 2003).

A Q-fever vaccine first became available in the 1940s. A safe and effective form was introduced into Australia in the late 1980s, but this was not made widely available until about 1994. The vaccine has been shown to provide a high level of immunity if given prior to exposure (Ackland et al. 1994; Marmion et al. 1990; Marmion et al. 1984; Shapiro et al. 1990), but post-exposure vaccination does not appear to be effective (Gilroy et al. 2001). All at-risk workers should be vaccinated (Garner et al. 1997; Marmion 1997; National Health and Medical Research Council of Australia 2000).

Several Australian studies over the last decade have shown that the prevalence of Q-fever vaccination in high-risk groups is not comprehensive (Garner et al. 1997; Gilroy et al. 2001; Hutson et al. 2000; Kermode et al. 2003). As a response, the Australian Government set up the National Q Fever Management Program. The program commenced in 2001 and has now been completed in all States and Territories with the exception of Queensland and Victoria, where the Program will run until 30 June 2005. The aim of the program was to reduce the burden of disease arising from Q-fever infection through screening, vaccination and raising awareness. The program covered abattoir workers and workers contracted to abattoirs, sheep shearers, farmers (sheep, dairy and beef cattle), farm employees and unpaid family members working on farms<sup>1</sup>. A report on the evaluation of the program has been prepared for Department of Health and Ageing by the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, and when available results of the evaluation will be made available to members.

There is also a Q fever register, which was set up by the Meat and Livestock Association. The register keeps information on the Q-fever immune status of individuals, with the aim of preventing unnecessary testing of immune status and of identifying non-immune persons so they can be vaccinated before they are exposed to the Q fever organism. It is used by employers and workers to check the immune status of workers (Anonymous 2002)<sup>2</sup>.

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<sup>1</sup> See National Q Fever Management Program. <http://immunise.health.gov.au/qfever/>

<sup>2</sup> See <http://www.qfever.org/index.html>

### 4.3 Leptospirosis

Leptospirosis is a zoonotic infection caused by a range of bacteria called leptospira. There are many strains or "serovars" (over 200). Different serovars are associated with different animal hosts. In Australia three serovars accounted for 64.1% of infections in 2002 (Queensland Health n.d.). These were: Serovar Hardjo found throughout Australia and carried by dairy and meat cattle; Serovar Zannoni, found mainly in North Queensland and carried by rats and small marsupials; and Serovars Australis found mainly in the Northern Territory and North Queensland and carried by native rats and small marsupials.

Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice, red eyes, abdominal pain, diarrhoea, or a rash. Many of these symptoms can be mistaken for other diseases. If the disease is not treated, the patient can develop kidney damage, meningitis, liver failure, and respiratory distress. The illness lasts from a few days to 3 weeks, or longer and is treated with antibiotics. In rare cases, death occurs. In 2002, 52 per cent of cases required hospitalisation with an average stay of 4.7 days. Two cases resulted in extended hospitalisation (28 and 34 days) in Intensive Care with pulmonary haemorrhage and renal failure (Queensland Health n.d.).

The main occupational source of infection is the urine of infected animals and water or soil contaminated by infected urine. Queensland has the highest rate of infection and accounted for 91 of the 155 notifications received by the National Notifiable Diseases Surveillance System in 2002, followed by NSW and Victoria (National Notifiable Disease Surveillance System 2003). In Queensland the banana industry represented the highest incidence in 2002.<sup>3</sup> In the southern States, the highest incidence occurred amongst meatworkers and dairy farmers (Queensland Health, 2003). Farming, especially dairy farming, and abattoir work, are the most common exposure circumstances, but other occupations such as forestry worker, hunter, veterinarian, plumber and transport operator are at increased risk (Brieseman 1998; Mackintosh et al. 1980; Occupational Safety and Health Service 2001; Robinson and Metcalfe 1976). Outbreaks have also occurred in the Australian defence forces (Director-General Defence Health Service 2003).

Infection confers immunity to the specific strain causing the infection, but not to other strains. In Australia vaccination against leptospirosis is available only for disease in livestock. However, some research is being carried out by the *WHO/FAO/OIE Collaborating Centre for Reference and Research on Leptospirosis* in Queensland on potential virulence genes of

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<sup>3</sup> The Queensland Government has recently published guidelines on leptospirosis for the banana industry. Qld Health & DIR Workplace Health & Safety. (2002?) *Leptospirosis: guidelines for the banana industry*. Available at: [http://www.whs.qld.gov.au/endorsedguide/gdelines01\\_02.pdf](http://www.whs.qld.gov.au/endorsedguide/gdelines01_02.pdf)

*Leptospira* and the possible application of this information for the development of a vaccine.

Control measures include the use of personal protective equipment (boots and gloves), thorough washing and clean up (especially rodent control in banana packing sheds).

#### 4.4 Brucellosis

Brucellosis is a zoonotic infection caused by the *Brucella* bacteria, of which there are five species. The main symptoms are fever, chills, sweating, fatigue, myalgia and headache.

The main hosts are cattle (*brucella abortus*), sheep and goats (*brucella melitensis*), pigs (*brucella suis*) and dogs (*brucella canis*). A brucella eradication campaign resulted in *brucella abortus*, which infects cattle, being eradicated from Australia since 1989 (Skilbeck 1990). Since the eradication of *brucella abortus* in cattle, the main sources of infection are feral pigs (*brucella suis*), accidental exposures to animal *Brucella* vaccine, and exposure to the organism in laboratories. *Brucella suis* is occasionally found in cattle and may lead to infection in farmers, abattoir workers and veterinarians (Brieseman 1998; Queensland Health n.d. and Robinson and Metcalfe 1976).

Many instances of occupationally-related Brucellosis have been documented in Australia (Davos et al. 1981; Gilbert et al. 1980; Jamieson et al. 1981; Robson et al. 1993).

In 2002, there were 40 cases of brucellosis notified to National Notifiable Disease Surveillance System. It is likely that many of these (35 of which occurred in Queensland) were related to the hunting or butchering of feral pigs. The number of notifications in the previous 11 years ranged from 13 to 52 (National Notifiable Diseases Surveillance System 2003).

There is no human *Brucella* vaccine available.

#### 4.5 Anthrax

Anthrax is an infectious diseases caused by *Bacillus anthracis*. The most common symptom is the development of skin lesions, but serious cases can involve the lungs and other organs. The most common sources of anthrax in Australia are livestock.

Abattoir workers, hide tanners and farmers are probably most at risk. However, the disease is rare in Australia, with the last Australian cases being cutaneous anthrax affecting a Brisbane forklift driver in a warehouse in 1998 (National Health and Medical Research Council 2003) and a knackery worker in 1997 (Lester et al. 1997).

A human vaccine exists, but it is not currently registered for use in Australia.



## 4.6 Other zoonoses

There are a range of other zoonoses that can affect Australian workers but that either are commonly due to non-work exposures or are rare. A selection of these are considered here.

### ***Ornithosis***

Ornithosis, (also known as psittacosis), is an atypical pneumonia caused by *Chlamydia psitticai*. Birds, domestic or wild, are the source of infection. Occupations involving the caring, handling or slaughtering of birds are at risk of contracting the disease. Significant outbreaks involving workers have been documented in Australia, including a recent outbreak of 14 cases linked to a duck processing plant in Victoria (Anonymous 2004; Hinton et al. 1993; National Notifiable Diseases Surveillance System 2003). There were 205 notifications of ornithosis to the National Notifiable Diseases Surveillance System in 2002. The proportion of these that were related to work is not known.

### ***Australian bat lyssavirus***

Australian bat lyssavirus (ABL) or lyssavirus (unspecified) is a rabies-like virus that can cause a disease similar to rabies. Separate fatal cases occurred in Australia in 1996 and 1998 (Allworth et al. 1996; Hanna et al. 2000). These involved volunteer bat-handlers, and professional bat handlers are probably the most at-risk occupation. A 2003 survey of reported potential exposures in South East Queensland found that between 1999 and 2003, 9% of notifications were from professional bat handlers and 11% from voluntary bat handlers. An earlier survey covering 1996 to 1999 found a similar result (13%) for professional bat handlers (McCall et al. 2000; Young and McCall 2004). A vaccine is available, but a second dose is often required if treatment is needed after a significant exposure occurs. Vaccination is recommended for bat handlers, veterinarians, wildlife officers and anyone else who is at risk of receiving bites or scratches from bats, as well as workers who will be working for prolonged periods in countries where rabies is endemic (National Health and Medical Research Council 2003). In 2003, eight-four per cent of bat handlers reporting a significant exposure reported they had been previously vaccinated, compared to only 16% reporting this in 1996 (Young and McCall 2004).

### ***Newly recognised zoonoses***

A number of newly recognised viruses, or newly recognised zoonotic viral transmission to humans, have been reported in recent years in Australia, and several of these exposures have occurred in an occupational context (McCormack and Allworth 2002). Two separate outbreaks resulted in one fatal and two non-fatal cases of equinemorbillivirus infection in horse trainers (McCormack et al. 1999; O'Sullivan et al. 1997; Paterson et al. 1998; Selvey et al. 1995). In another incident, two workers at the same

piggery had a flu-like illness that was probably due to a Paramyxoviridae virus contracted from pigs (Chant et al. 1998).

#### **4.7 Hepatitis A**

Hepatitis A is a viral infection that primarily affects the liver. Symptoms include fever, nausea, lack of appetite, abdominal discomfort and jaundice. The illness lasts approximately 1-3 weeks (although some symptoms can persist for several months) and is almost always followed by complete recovery. Hepatitis A does not cause long-term liver disease and deaths from the disease are extremely rare. It is spread by the faecal-oral route. The main occupational source of infection is other persons, with particular groups (such as children, the elderly and indigenous persons living in rural or remote communities) having a higher prevalence of the disease and so posing an increased risk to workers who come into contact with them.

In Australia, the main at-risk occupations are child day-care and preschools workers, carers of intellectually disabled persons, nursing and medical workers in high-risk areas, workers in rural or remote indigenous communities, and sewage workers.

Outbreaks in Australia have been documented in day care centres (Hanna et al. 2001).

There is an effective vaccine available, and the NHMRC recommends that all the above work groups be vaccinated (National Health and Medical Research Council 2003). Soon after exposure, administration of human immunoglobulin is effective at preventing overt infection. Therefore, when a local outbreak is confirmed, immunoglobulin should be given to non-immunised workers at risk (National Health and Medical Research Council 2003). However, the use of Hepatitis A vaccine does not appear to be widespread in some at-risk workers (Thomson et al. 1998).

#### **4.8 Hepatitis B and C**

Viral hepatitis is an infection of the liver caused by one of a wide range of viruses. Fever, malaise and jaundice are typical symptoms, although hepatitis C is often asymptomatic. In an occupational context, hepatitis B (HBV) and hepatitis C (HCV) are the most important.

The main routes of exposure are percutaneous (puncturing the skin) through needle stick injuries, and across mucous membranes or damaged skin, through contact with contaminated body fluids. Any occupation that increases the risk of such exposure increases the risk of contracting HBV or HCV through occupational exposures. Therefore, a wide range of occupations are at increased risk of exposure to HBV and HCV, in particular health care workers, embalmers, persons who handle body substances, clinical laboratory staff, workers in long-term correctional facilities, police, members of the armed forces, emergency services

workers, and business travellers (National Health and Medical Research Council 2003).

An Australian study of HBV seroprevalence in health workers in the 1980s found an overall prevalence of HBV markers of 6%, ranging from 2% in intensive care staff to 16% in dentists, compared to a seroprevalence of 3% in controls (Radvan et al. 1984). Soon after this study was conducted, six health and emergency service workers contracted HBV from contact with a trauma patient who was badly injured (Radvan et al. 1986). Another Australian study of health care workers in the 1980s found an increased seroprevalence only in dentists (Bennett et al. 1985).

At-risk workers are provided high levels of protection through vaccination against HBV. There is currently no vaccine for HCV (Chew 1997; Daniels 1988; Liddle 1996; Wilson and Bandaranayake 1995). A universal program of infant HVB vaccination began in 2000. The NHMRC specifies some work situations for which HBV vaccination is recommended, but all workers should be assessed to determine whether their risk of exposure warrants them being vaccinated. Occupations recommended for vaccination by the NHMRC are persons working in facilities caring for persons with intellectual disabilities; staff of long-term correctional facilities; health-care workers, dentists, embalmers, tattooists and body-piercers; long-term business travellers to regions of high endemicity; and members of the police force or the armed forces and emergency services staff, if their duties are likely to involve exposure. It may be appropriate for other workers to be vaccinated if their work may cause them to be exposed to HBV (National Health and Medical Research Council 2003). Notwithstanding the effectiveness of vaccination, there is evidence of incomplete vaccination in at-risk workers (Wallace et al. 2004).

#### **4.9 Human immunodeficiency virus (HIV)/AIDS**

HIV/AIDS is an acquired disorder of the immune system caused by the Human Immunodeficiency Virus (HIV). The disease typically has a long latency, with often several years before the person has obvious symptoms of the disease. In an occupational setting, infection is most likely to occur through needle-stick or other sharps injury, but it can occur in any situation where there is exchange of body fluids.

There have been a limited number of definite cases of occupationally acquired HIV internationally, and very few in Australia (Dwyer 1990). Health care workers probably have the highest risk, but other occupations such as embalmers, clinical laboratory staff, police, correction officers, security guards and sex workers also have increased risk (Bell 1997; Merchant et al. 2003).

A study of Western Australian dentists and dental hygienists concluded that, while there was undue concern regarding the risks of occupationally-acquired HIV infection in dental practice, there was a need to emphasise

the value and importance of universal precautions (Waddell 1997; Waddell et al. 1994). There is no effective vaccine for HIV/AIDS.

#### **4.10 Legionellosis**

Legionellosis (also known as Legionnaire's disease) is a disease caused by infection with the *Legionella* bacteria. *Legionella pneumophila* is the most common form involved in human infection. It most commonly causes pneumonia, which may be severe.

In an occupational setting, *Legionella* infection usually arises from exposure to a water aerosol from pooled warm water, such as occurs in association with air-conditioning cooling towers. Potting mix and other dust has also been documented as a source (Anonymous 2000a). A range of occupations are associated with legionellosis, including air-conditioning maintenance workers, health care personnel, ship repair workers, gardeners, construction workers, sewerage workers, automotive plant workers, and miners (Stojek and Dutkiewicz 2002).

In 1998, there was an outbreak of three cases linked to one or more cooling towers in Sydney. Two of the affected persons worked together near the cooling towers (Bell et al. 1996; Brown et al. 2001). A more recent report of a large community outbreak of Legionellosis associated with the Melbourne Aquarium documented one staff member with the disease (Anonymous 2000b; Greig et al. 2004). There is no information on the prevalence of occupationally-related *Legionella* infection in Australia, and no available vaccine.

#### **4.11 Tuberculosis**

Tuberculosis (TB) is an infection caused by any of a range of *Mycobacterium* bacilli (*Mycobacterium tuberculosis* is the most commonly involved). It usually affects the lungs, but can affect almost any organ.

Health care workers are the occupational group at highest risk of developing tuberculosis from a work-related exposure. Sixteen per cent of Australian hospital workers were found to have evidence of current or previous TB infection in a recent study (Stuart et al. 2001). Other workers at increased risk include farmers and veterinarians (both at risk from exposure to bovine tuberculosis), clinical laboratory workers and funeral parlour staff. Silicosis also predisposes the worker to developing pulmonary tuberculosis (Anonymous 1995; Breslin 1996; Calvert et al. 2003; McKenna et al. 1996; Saunders 2003; Stuart et al. 2001; Stuart and Grayson 2000; Usui et al. 2000).

Of the 1,028 tuberculosis cases reported in 2002 in Australia, three were persons employed or recently employed in high-risk institutions such as correctional facilities or aged care facilities; and ten cases were employed or recently employed in health care (Samaan et al. 2003).

An Australian survey of hospital employees in the late 1990s found a positive tuberculin (Mantoux) response in 6% to 35% of all employees, with a 50% higher prevalence in health care workers compared to non-health care workers (Stuart et al. 2001). Another Australian study reported a case of mycobacterium bovis in a seal trainer, the first known case of tuberculosis being passed from seals to humans (Thompson et al. 1993).

Recent estimates of attributable fraction were 5% to 6% for pulmonary tuberculosis in the United States (Steenland et al. 2003) and 0.6% for tuberculosis in males in Finland (Nurminen and Karjalainen 2001).

The vaccine to protect against tuberculosis is the BCG (Bacille Calmette-Guérin). The vaccine has limited efficacy in adults, but is the only recommended form of vaccine for this disease. The NHMRC does not explicitly recommend that health care workers be vaccinated with BCG, but many State and Territory health authorities do (National Health and Medical Research Council 2003).

#### **4.12 Other infectious diseases**

This section describes other work-related infections of some relevance in the Australian context.

##### ***Pneumococcal disease***

Pneumococcal pneumonia is a common community infection. The risk of pneumococcal infection is increased by exposure to tobacco smoke, including environmental tobacco smoke. Occupations such as bar worker and restaurant worker, which involve significant exposure to environmental tobacco smoke, have an increased risk of developing pneumococcal disease (Esposito 1992; Nuorti et al. 2000).

##### ***Measles***

Six healthcare workers contracted measles during an epidemic in Australia in 1999 (Lambert et al. 2001). During another outbreak two years later, 70 healthcare workers were identified who had contact with one or more cases. At least one of these developed measles, and only 29% had a definite history of measles vaccination (Skull et al. 2001). A third outbreak soon after also resulted in health worker cases (Kelly et al. 2002). An effective vaccine is available and the NHMRC recommends that health care workers and child care workers born after 1965 be vaccinated (National Health and Medical Research Council 2003).

##### ***SARS***

Severe acute respiratory syndrome (SARS) is a respiratory illness caused by a coronavirus. The disease was first identified in early 2003 and resulted in over 800 deaths within several months, but by August 2003 appeared to have been contained following an international infection

control effort (Whitby and Whitby 2003). Many of the cases were of health workers infected whilst caring for patients with SARS. There were less than ten Australian cases reported during the epidemic, and none of these appeared to be occupationally-related (Fielding et al. 2004).

### **Cellulitis**

One recent report presented two case histories of Australian sewage workers who developed severe cellulitis from workplace exposures (Trethewy et al. 2003).

## **5. OCCUPATIONS AT RISK**

### **5.1 Healthcare workers**

Healthcare workers are at particular risk of developing work-related infection because they are exposed to patients with higher prevalence of infectious disease than the general community, and because they are at significant risk of coming into contact with infectious material through a sharps injury or other exposures. These have been recently reviewed in Australia (Coward 2004) and elsewhere (Sepkowitz 1996a; Sepkowitz 1996b; Sharbaugh 1999). Relevant infections include HAV, HBV, HCV, HIV, TB, measles, mumps, rubella, pertussis, scabies, respiratory syncytial virus, herpes simplex and adenovirus (Coward 2004).

Australian studies have documented transmission of measles (Kelly et al. 2002; Lambert et al. 2001; Skull et al. 2001) and hepatitis B (Radvan et al. 1986) to workers in a health care setting, and prior to the widespread availability of hepatitis B vaccine, prevalence rates of HBV markers were found to be much higher in Australian healthcare workers than in the general population (Radvan et al. 1984).

*Helicobacter pylori* infection is associated with increased risk of developing peptic ulcer disease. Increased rates of *Helicobacter pylori* have been found in Australian carers of intellectually disabled persons in the community (Wallace et al. 2004) and in gastroenterologists (Lin et al. 1994), but to be the same as the community average in Australian dental workers (Lin et al. 1998) and endoscopy nurses (Lin et al. 1994).

Many infections of which healthcare workers are at increased risk can be prevented through vaccination (Swinker 1997). Health care workers most at risk are those directly involved in patient care. An indication of numbers at risk can be gained from 2001 census figures. In that census 142,000 described their profession as registered nurse and 51,000 as personal care and nursing assistants (Australian Bureau of Statistics 2001).

### **5.2 Child care workers**

Child care workers are at risk of exposure to a number of infectious diseases and child care centres are an important source of hepatitis A

infection. Infection control practices can help reduce the spread of infection amongst both staff and children. The NHMRC (2003) recommends that child care workers should be vaccinated against hepatitis A, measles-mumps-rubella (if born after 1965), pertussis and chicken pox (if seronegative).

There have been a number of hepatitis outbreaks in child care centres in Australia, including an outbreak in a Victorian day care centre in 2002 (Hanna et al. 2001, Anon. 2002). A survey undertaken in Victoria in 1996 determined that only 11% of child day care workers were immunised against hepatitis A (Thomson et al., 1998). A later study undertaken in the Bundaberg region of Queensland found that 34.3% of child care workers were immunised against hepatitis A. (Fleming, 2001).

In the 2001 census, 68,000 Australians listed their occupation as child care worker (Australian Bureau of Statistics 2001).

### **5.3 Agricultural workers and meat and livestock workers**

This group of workers are at particular risk of acquiring zoonotic infectious diseases, the most common of which in Australia are Q fever, leptospirosis and brucellosis but there have been recent outbreaks of ornithosis. Of these, an effective vaccine exists only for Q Fever and as outlined in Section 4, a national program on Q Fever management, including vaccination, has been underway since 2001.

Leptospirosis, a serious and potentially fatal disease if untreated, is still a significant problem especially amongst banana growers in Queensland, but also among meat workers and cattle (especially dairy cattle) workers. With the eradication of bovine brucellosis, brucellosis is less of a problem, and it appears that the main source of infection now is feral pigs (especially in Queensland).

## **6. OVERALL ESTIMATES OF THE BURDEN OF WORK-RELATED INFECTIOUS DISEASE**

One recent estimate of the global burden of work-related disease also included an estimate for infection based on "communicable disease". However, this estimate was dominated by infectious diseases common in developing countries, such as schistosomiasis and malaria, which have limited relevance to Australia (Takala 2002). There have been several studies in different countries that have estimated the total burden of work-related disease. The two most recent of these included infectious disease to a limited extent. Diseases that were included were hepatitis B and C, tuberculosis and pneumococcal disease. The estimated PARs were 4% for hepatitis B, 3% for hepatitis C, 5% to 6% for tuberculosis and 14% for pneumococcal disease (Nurminen and Karjalainen 2001; Steenland et al. 2003). One of these derived an overall infectious disease

PAR of 9% for Finland, but the basis for this is not clear, and the figure is likely to be specific for that country.

## 7. THE BURDEN OF WORK-RELATED INFECTIOUS DISEASE IN AUSTRALIA

### 7.1 Introduction

There is limited information on the extent of work-related infectious disease in Australia. Information that is available comes from a variety of sources, including published studies, workers' compensation claims data, and the National Notifiable Diseases Surveillance System. Published general practitioner data sources don't provide useable information because infectious disease cases are included in categories that also contain diseases not related to infection. Information for specific diseases is considered in Section 4 and is summarised here, along with information from workers' compensation systems and the National Notifiable Disease Surveillance System.

### 7.2 Population-based estimates

There are no comprehensive population-based estimates of work-related infectious disease in Australia. The National Notifiable Disease Surveillance System has 55 infectious diseases notifiable at a national level. Many of these are diseases that are commonly occupationally related. Six zoonoses are currently notifiable - anthrax, lyssavirus infection, brucellosis, leptospirosis, ornithosis and Q fever. In 2002, there were 1,155 notifications made for zoonoses (National Notifiable Diseases Surveillance System 2003). Most of these can be expected to have been for occupationally-acquired infections (Table 2).

**Table 2 Notifications of zoonoses to the National Notifiable Disease Surveillance System<sup>1</sup>. Australia, 2002**

Condition	Number	Per cent
<b>Q Fever</b>	761	65.9
<b>Leptospirosis</b>	155	13.4
<b>Brucellosis</b>	40	3.5
<b>Ornithosis</b>	199	17.7
<b>Total<sup>2</sup></b>	1,155	100.0

1: Data from the National Notifiable Disease Surveillance System (National Notifiable Diseases Surveillance System 2003).

### 7.3 Workers' compensation-based estimates

Workers' compensation data systems are unlikely to be a comprehensive source of information on cases of work-related infectious disease, but



should provide some relevant information. Published workers' compensation information at a national level only records cases that result in five or more days off work. Most serious infectious disease cases will probably result in this much time off, but many infectious disease cases will not be serious enough to do so. A sizeable (but unknown) proportion of infectious disease cases will not be formally diagnosed, in which case the connection to work is unlikely to be established and a workers' compensation claim is unlikely to be made. Also, a sizeable minority of workers are not represented in workers' compensation statistics (Macaskill and Driscoll 1998).

Using claims for the whole of the country over the period 1997/1998 to 2002/2003, there were between 395 and 565 claims each year for infectious disease (at a rate of between 3.6 and 7.7 per one hundred thousand employees). These are likely to be significant underestimates. The median time lost per case ranged from 2.2 weeks to 2.8 weeks. (Table 3).

It is noted that many of the zoonoses cases have been assigned to a combined zoonoses category. Although the vast majority of these cases are likely to be due to leptospirosis and Q fever, the data does not reflect this presently. Initial data entry utilised TOOCS 2.0 coding which only offered a combined category (specified zoonoses). While the latter version of TOOCS (2.1) provides specific codes for leptospirosis and Q fever, this coding system has only been adopted by all jurisdictions recently.

The numbers also strongly suggest that the workers' compensation cases are significant underestimates of the number, probably by a factor of at least ten, of work-related infectious disease cases due to zoonoses. There were 761 cases of Q-fever, 155 cases of leptospirosis and 40 cases of brucellosis notified to the National Notifiable Diseases Surveillance System in 2002. Most of these cases can be expected to have been occupational in origin. This compares to 90 cases of Q fever, 20 cases of leptospirosis and 720 total zoonoses cases recorded in workers' compensation data over six years.

**Table 3 Accepted workers' compensation claims<sup>1</sup> for infectious disease. Australia, 1997/1998 to 2002/2003**

Condition	1998	1999	2000	2001	2002	2003
Intestinal Infectious Diseases	20	15	15	25	15	45
Specified Zoonoses	185	155	90	85	95	NP
Q Fever	0	NP	0	10	25	50
Leptospirosis	0	0	0	5	NP	10
Other Zoonoses	NP	NP	0	NP	NP	5
Protozoal diseases	10	5	5	5	10	5
Viral diseases excluding hepatitis	170	210	165	140	115	70
Viral Hepatitis	20	10	25	10	10	10
Specified STDs excluding AIDS	0	NP	0	0	0	0
HIV – AIDS	0	NP	0	NP	0	NP
Mycoses	5	10	5	5	5	10
Other infectious and parasitic diseases	155	130	95	100	130	90
<b>Total</b>	<b>565</b>	<b>540</b>	<b>405</b>	<b>395</b>	<b>415</b>	<b>300</b>
Incidence <sup>3</sup>	7.7	7.1	5.2	5.00	5.1	3.6
Median time lost per case (weeks)	2.2	2.4	2.2	2.4	2.3	2.8

1: Data supplied by NOHSC

2: "NP" means the number is small and cannot be presented for confidentiality reasons

3: Cases of all infectious diseases per 100,000 employees

## 8. APPROACHES TO PREVENTION OF WORK-RELATED INFECTIOUS DISEASE

Some general principles relevant to prevention of work-related infectious disease are reviewed in this section. Details of prevention approaches are available from many sources and are not detailed here. Appendix 1 contains some suggested references.

Vaccination, standard and additional precautions (also known as universal precautions), hand-washing, education and training and the use of personal protective equipment where appropriate are the main control strategies for the prevention of occupationally-related infection.

Vaccination of at-risk workers is the most effective approach when the risk of exposure is significant, the disease can be serious and an effective vaccine is available. This is the case in Australia for certain work groups for

some diseases, including Hepatitis A, Hepatitis B, Q-fever, tuberculosis, measles, rubella, influenza, polio, tetanus and lyssavirus. The need for vaccination is primarily determined by the worker's occupation. For example, an abattoir worker should be vaccinated for Q-fever (if not already immune), whereas a retail butcher normally would not need to be.

Several recent Australian studies have documented that many at-risk worker groups are not fully vaccinated against infectious diseases for which they are at increased risk – health care workers (Murray and Skull 2002; Skull et al. 2001), child care workers (Thomson et al. 1998; Fleming, 2001), community carers of intellectually disabled persons (Wallace et al. 2004), and workers exposed to Q-fever (Bell et al. 1997). Another recent Melbourne hospital study found a very high percentage of surveyed health care workers reported being willing to update their vaccination as recommended, but that only one quarter were fully vaccinated (Smithers et al. 2003). This suggests an on-going need for information and training for both workers and employers on the availability and importance of vaccination for certain work groups. Recommendations on vaccinations for at risk workers are provided in the Immunisation Handbook published by the NHMRC (National Health and Medical Research Council of Australia 2000) (see [Attachment A](#))

Similarly, the value of properly instituted standard and additional precautions in the health care setting, and equivalent approaches in other work settings, is widely accepted. However, evidence in Australia with dentists (Waddell 1997) and anaesthetists (Richards et al. 1997) suggests the use of such an approach is not comprehensive (Department of Health and Ageing 2004).

## **9. AUSTRALIAN PREVENTION ACTIVITY**

All NOHSC members are undertaking a range of general prevention initiatives which ultimately impact on the risk of employees contracting infectious or parasitic diseases. However, most recently this included the declaration in December 2003 of the National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)] 2nd Edition by NOHSC. In addition, all NOHSC stakeholders are undertaking a range of general disease prevention initiatives.

NOHSC guidelines related to the focus of this report include the Legionnaires's disease and related diseases guide and the diseases acquired from animals guide. Although they were produced in 1989, these guides still provide useful and relevant information on risk factors, safe design and worker's safety.

For information on prevention activities coordinated by other agencies, readers are directed to the following websites:

The Department of Health and Ageing [www.health.gov.au](http://www.health.gov.au)

National Occupational Health and Safety Commission [www.nohsc.gov.au](http://www.nohsc.gov.au)

WHO/ FAO/ OIE Collaborating Centre for Reference and Research on Leptospirosis <http://www.health.qld.gov.au>

Queensland Division of Workplace Health and Safety  
<http://www.whs.qld.gov.au/>

NSW WorkCover Authority <http://www.workcover.nsw.gov.au/default.htm>

Victorian WorkCover Authority  
<http://www.workcover.vic.gov.au/dir090/vwa/home.nsf>

WorkSafe Western Australia <http://www.safetyline.wa.gov.au/>

South Australian WorkCover Authority <http://www.workcover.com/> or  
Workplace Services South Australia <http://www.eric.sa.gov.au/home.jsp>

Workplace Standards Tasmania <http://www.wst.tas.gov.au/node/WST.htm>

Northern Territory WorkSafe <http://www.nt.gov.au/deet/worksafe/>

ACT WorkCover <http://www.workcover.act.gov.au/>

Comcare <http://www.comcare.gov.au/>

The Australian Council of Trade Unions (ACTU) <http://www.actu.asn.au/>

The Australian Chamber of Commerce and Industry (ACCI)  
<http://www.acci.asn.au/>

Australasian Faculty of Occupational Medicine (AFOM)  
<http://www.racp.edu.au/afom/>

Royal Australian College of Physicians (RACP) <http://www.racp.edu.au>

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## **11. GLOSSARY**

HAV	Hepatitis A
HBV	Hepatitis B
HCV	Hepatitis C
HIV	Human Immunodeficiency Virus
NDS	National Data Set for Compensation-based Statistics
NOHSC	National Occupational Health and Safety Commission

## **APPENDIX 1 Useful references regarding the prevention of work-related infectious disease**

### **Vaccination**

NHMRC, 2003 The Australian immunisation handbook. 8th edition. (National Health and Medical Research Council 2003)

### **Health care workers, Hepatitis A, B and C, HIV**

Bolyard et al, 1998 Guideline for infection control in healthcare personnel, 1998. Hospital Infection Control Practices Advisory Committee. (Bolyard et al. 1998)

Cooper, 1993 Prevention of HIV and HBV transmission in general practice. (Cooper 1993)

Coward, 2004 Occupational infectious disease risks in health care workers. (Coward 2004)

NHMRC, 1996 Infection control in the health care setting. Guidelines for the prevention of transmission of infectious diseases. (National Health and Medical Research Council 1996)

NOHSC National code of practice for the control of work-related exposure to Hepatitis and HIV (blood-borne) viruses {NOHSC:2010(2003)}. (National Occupational Health and Safety Commission 2003)

Swinker, 1997 Occupational infections in health care workers: prevention and intervention. (Swinker 1997)

### **Child care workers**

NHMRC, 2001 Staying healthy in child care. Available at: [www.nhmrc.gov.au/publications/pdf/ch40.pdf](http://www.nhmrc.gov.au/publications/pdf/ch40.pdf)

Viral Hepatitis Prevention Board

The child care worker: hepatitis A and other infectious diseases. <http://www.whs.qld.gov.au/guide/gde64.pdf>

### **Q fever**

Australian Q-fever register

<http://www.qfever.org/>

National Q fever management program

<http://immunise.health.gov.au/qfever/>

### **Leptospirosis**

- WHO, 2003 Human leptospirosis: guidance for diagnosis, surveillance and control. Available at:  
[http://www.who.int/csr/don/en/WHO\\_CDS\\_CSR\\_EPH\\_2002.23.pdf](http://www.who.int/csr/don/en/WHO_CDS_CSR_EPH_2002.23.pdf)
- Queensland Govt. Leptospirosis: guidelines for the banana industry. Available at:  
[http://www.whs.qld.gov.au/endorsedguide/gdelines01\\_02.pdf](http://www.whs.qld.gov.au/endorsedguide/gdelines01_02.pdf)

### **Lyssavirus**

- Young et al, 2004 Trends in potential exposure to Australian bat lyssavirus in South East Queensland, 1996 to 2003. (Young and McCall 2004)

## ATTACHMENT A: Recommended vaccinations for those at risk of occupationally-acquired vaccine preventable diseases

**Table A.1. Recommended vaccinations for those at risk of occupationally-acquired vaccine preventable diseases**  
(<http://www1.health.gov.au/immhandbook/>)

Disease/vaccine	Health-care workers (HCWs)*	Other occupations
Hepatitis B	All HCWs directly involved in patient care, embalming or the handling of human blood or tissues	<ul style="list-style-type: none"> <li>Police, members of the armed forces and emergency services, depending upon the duties to which they are assigned</li> <li>Carers of the intellectually disabled</li> <li>Staff of correctional services facilities</li> </ul>
Hepatitis A	HCWs who frequently attend paediatric patients from rural and remote Indigenous communities <i>or</i> HCWs who work with rural and remote Indigenous communities.	<ul style="list-style-type: none"> <li>Other workers who live with, or make frequent visits to, remote Indigenous communities</li> <li>Sewerage workers</li> <li>Child-care and pre-school staff</li> <li>Carers of the intellectually disabled</li> </ul>
Influenza	All HCWs <i>or</i> Staff of nursing homes and long term care facilities	<ul style="list-style-type: none"> <li>Providers of home care to persons at risk of high influenza morbidity</li> </ul>
Measles-mumps-rubella †	HCWs born during or since 1966	<ul style="list-style-type: none"> <li>Child-care staff (born during or since 1966)</li> </ul>
Varicella	All seronegative health-care workers directly involved in patient care	<ul style="list-style-type: none"> <li>Seronegative child-care staff and primary school teachers</li> </ul>
Pertussis (using dTpa)	HCWs in paediatric and maternity departments	<ul style="list-style-type: none"> <li>Child-care staff</li> </ul>
Tuberculosis	As recommended by the State/Territory TB control authorities	<ul style="list-style-type: none"> <li>Check with State/Territory TB control authorities</li> </ul>



Disease/vaccine	Health-care workers (HCWs) *	Other occupations
Q fever	Laboratory personnel handling veterinary specimens	<ul style="list-style-type: none"> <li>• Abattoir workers and contract workers in abattoirs</li> <li>• Truck drivers transporting livestock to abattoirs</li> <li>• Veterinarians</li> <li>• Sheep shearers and sheep, cattle and dairy farmers</li> <li>• Persons culling/processing kangaroos</li> <li>• Tanning and hide workers</li> <li>• Those who come into regular contact with bats (both flying foxes and microbats), including bat-handlers, wildlife officers and veterinarians.</li> </ul>
Australian bat lyssavirus (ABL) and rabies	Laboratory personnel handling either bat tissues or ABL or rabies virus	
Anthrax, plague, poxviruses, typhoid, yellow fever, meningococcal disease	Laboratory personnel working with these infectious agents on a routine basis	
Japanese encephalitis	HCWs assigned to the outer Torres Strait Islands for a month or more during the wet season	<ul style="list-style-type: none"> <li>• Other workers assigned to the outer Torres Strait Islands for a month or more during the wet season</li> </ul>
Laboratory personnel working with this infectious agent		
*Work activities, rather than job title, should be considered on an individual basis to ensure an appropriate level of protection is afforded to each HCW.		
†All adults born during or since 1966 should have evidence of receiving 2 doses of MMR vaccine.		