AUSTRALASIAN FACULTY OF OCCUPATIONAL MEDICINE

INFECTIONS IN THE WORKPLACE

THE ROLE OF THE FACULTY

Occupational Medicine is the study and practice of medicine related to the effects of work on health and health on work.

The primary purpose of The Australasian Faculty of Occupational Medicine of the Royal Australasian College of Physicians is to promote excellence in occupational medicine. Such excellence will be achieved by a multi-dimensional approach that incorporates: -

1. developing and maintaining high standards in the education of occupational physicians;

2. developing high professional and ethical standards for occupational physicians;

3. instituting programs to ensure that Fellows maintain professional competence;

4. promoting research in occupational and environmental medicine;

5. promoting to governments, industry, employer and employee organisations and other bodies the occupational medicine perspective on key health, safety and environmental issues;

6. promoting occupational medicine within the medical profession;

7. providing the Faculty position on current issues surrounding the effects of work on the health of the community - by publishing technical documents and guidelines; and

8. promoting the health of all workers in all occupational environments.

INFECTIONS IN THE WORKPLACE

A report prepared by

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1. AIM OF THE DOCUMENT

The aim of this document is to set out, for the physician working in industry, guidelines for the recognition, prevention and control of infections to which workers may be exposed by virtue of their work, or which may affect their capacity to work.

These steps are necessary for the occupational physician to fulfil a central role ensuring; (a) the individual is fit to do the job (and able to come to work); and (b) that the work is not causing harm or presenting an unacceptable risk to health to the individual or to others.

Prevention of infection is a shared responsibility involving not only employers and employees but also governments, unions and health professionals.

Examples of infectious diseases will be given, but it is not the intention of the document to provide a comprehensive account of all those conditions which may be encountered. Rather it seeks to heighten the occupational physician's awareness of the need for constant vigilance to safeguard the health of workers.

2. BACKGROUND

The reporting of occupational infections goes back to Hippocrates who, in his seminal work "On Airs, Waters, And Places" written in 400 BC, said that if you wish to "investigate medicine properly", including "epidemic diseases", you should look at, among other things, "the mode in which the inhabitants live, and what are their pursuits". Ramazzini (1633-1714), the 'Father of Occupational Medicine', in "De Morbis Artificum", talked about the occupational infections of corpse bearers: "...they are exposed to very dangerous diseases, especially to malignant fevers, and to sudden death, cachexy, dropsy, suffocative catarrh, and other serious diseases." At that time infections amongst handlers of hides was well known and later Jenner (1749-1823) became aware of the cowpox pustules contracted by milkmaids from infected cows.

These observations foreshadowed the work of that great figure of general medicine, Ignaz Philipp Semmelweis (1818-1865), who noted that women who were examined by medical students and doctors who came directly from the autopsy room without washing their hands had a higher mortality than those examined by midwives. A colleague, accidentally cut by a scalpel, died from infection. On the basis of these observations Semmelweis determined that puerperal fever was contagious. This crucial observation illustrates clearly that work can be an infectious hazard to workers and that the infected worker himself can be a hazard. His solution, the washing of hands, reduced obstetric mortality drastically.

The same analytical and preventive approach can be applied today by the occupational physician. The work environment or factors intrinsic to the work

may place the worker or the community at risk of acquiring or transmitting infectious agents.

Infectious diseases and their causative agents still excite many old prejudices, including fear and discrimination of the infected person. Communication, compassion and good information is called for.

The main aim of occupational medicine is prevention. The emphasis is on control of the workplace environment so as to avoid adverse health outcomes. However, when these occur, the occupational physician will also be concerned with appropriate treatment (including first aid) and, where necessary, occupational rehabilitation of the worker back into the workplace.

Dealing with occupational infections requires a broad range of skills and an appreciation of the sometimes complex issues that may be involved. Primary care is often simple though the rarity of some conditions may pose difficulties in detection and management. Strategies for primary, secondary, and tertiary control (see definition of these in appendix B) require expert working knowledge of the mode of transmission of infectious agents, systems of hazard identification, risk assessment and control, development of surveillance programs, and skills in risk communication and education. Occupational infections are frequently under-reported or are just not considered as a possibility - hence there is a lack of good statistics in most occupational groups.

Issues to be considered include the health and safety of others, the economic impact on industry and the rights of the community. This can bring into play legislative requirements such as Equal Opportunity and Disability Discrimination legislation, codes of practice and standards, notification requirements, industrial relations, and personal rights/privacy, as well as the various occupational health and safety laws and Common Law requirements to provide a safe workplace and safe work practices.

3. INTRODUCTION

3.1 Definition

An occupational infection may be simply defined as an infection that is contracted through employment.

A broader definition can be used to sub-classify occupational infections as follows:

An occupational infection is a disease caused by a transmissible agent (bacterium, virus, fungus, parasite, etc.) that is acquired:

(a) by the nature of the work being performed eg. zoonoses in animal handlers, sexually transmitted diseases in sex workers, a wide range of infections in laboratory workers, etc. That is, the infection is *intrinsic to the work*. These are the considered by some to be the 'true occupational diseases';

(b) because of an increased vulnerability arising from work eg. silicotuberculosis; lacerations which subsequently become infected;

(c) from other workers, clients, patients and visitors eg. influenza and other common respiratory diseases in office environments; or

(d) during the course of work eg. Legionnaire's disease, and the various diseases associated with travel.

(c) and (d) are *incidental to the work*.

3.2 From the occupational physician's viewpoint

The role of the occupational physician is to (among other matters):

(a) prevent harm from work; and
(b) ensure fitness for work.

Occupational infections can be looked at using that framework viz:

(a) prevent harm from work, ie. prevent the worker contracting diseases such as:
    - zoonoses;
    - wound infections;
    - coincidental infection - travel, air conditioning; and
    - infections from biological wastes.

(b) ensure fitness for work ie. prevent transmission of diseases by such workers as:
    - the health-care worker with tuberculosis;
    - food-handlers in general;
    - workers coincidentally infected by community epidemics such as influenza; and
    - sex workers with sexually transmitted diseases.

3.3 Differentiation from non-occupational

As can be appreciated, the differentiation between occupationally acquired infections and others not so acquired can be difficult, particularly where the condition is a common one such as an upper respiratory tract infection. Occupational infections rarely manifest themselves in pathognomonic form, one notable exception being the pattern of tuberculosis associated with silicosis. History and investigation will be needed to better define associations between rare/infrequent pathogens and occupational disease.

Non-occupational infections can also have an effect on the workplace by causing increased absenteeism eg. respiratory infections (especially influenza epidemics). A return to work during the infectious period may lead to other workers actually being infected at work.

Too early or vigorous rehabilitation in the case of a worker with a non-work-related post-viral syndrome may lead to exacerbation of the problem at work and even generate claims for other conditions such as “stress”.

3.4 Occupational injury facilitating infection

There is another type of occupational infection - the infection of an occupational wound, abrasion, or pre-existing occupational skin condition such as dermatitis. The wounding may be an occupational risk such as in abattoir workers, but the wound itself may become infected with organisms other than those associated with abattoirs. This will still be an occupational infection and, it could be argued, would remain so even if the source of the infective agent were outside the workplace. The workplace had provided the portal of entry. Such infections may be systemic such as HIV, hepatitis B, hepatitis C (these three potentially transmitted in a needlestick injury), or local such as tetanus (with systemic effects), or infections with staphylococcus, streptococcus, wart virus, etc.

3.5 Portals of entry

A crucial matter in prevention is knowledge about the manner of spread of the infecting organism. The three main routes are:

(i) Integumentary:
  (a) Skin (via non-intact skin or parentally)
  (b) Conjunctivae (splash etc.)
(ii) Inhalation
(iii) Ingestion

3.6 Legal aspects - duty of care

Obviously there will also be legal implications beyond merely workers compensation matters. Throughout Australia and New Zealand there is a legal and non-delegable obligation on employers to provide:

(i) safe tools and equipment;
(ii) a safe place of work;
(iii) a safe system of work; and

emanating from this has come an additional component:

(iv) to employ competent fellow employees.

This will have varying consequences for each occupational infectious disease. The employer duty of care extends beyond the worker, in altered form, to members of the general public, contractors, etc.

Employers may also have duties as designers, manufacturers, and suppliers of goods and workers have a duty not to endanger co-workers or others.

We have seen how food contaminated with pesticides can have an adverse effect on exports. Similar situations can arise from infected food-handlers (eg. haemolytic-uraemic syndrome from E. Coli).

3.7 Practical situations

Problems that may arise in the field are:

(a) The placement of persons with pustular skin diseases or active hepatitis A as food handlers.

(b) Potential sequelae of infections such as the HIV positive airline pilot or professional driver who is at risk of acute (eg. sudden diplopia) and long-term effects on the central nervous system.

(c) The HIV /hepatitis B /hepatitis C positive person entering medical school or a health care setting, and their risk to others while performing invasive procedures.

(d) The sex worker with a sexually transmitted disease.

(e) Where pathogens may pose reproductive risks eg. cytomegalovirus, toxoplasmosis, rubella.

Some of the issues raised by these problems are occupational, but others are more concerned with patient safety and control of community communicable diseases - hence other disciplines will be involved.

4. INFECTIONS INTRINSIC TO THE WORK

These are infections that arise as a result of the nature of the work being performed, and specific infections can be matched to specific jobs (see Table 1).

Table 1: Some work environments and their biological hazards(for zoonoses see Table 3)

Infections intrinsic to work	
Aquaculture	Cutaneous infections, marine organisms, see also zoonoses
Ceramic workers	Tuberculosis
Farmers	Hypersensitivity pneumonitis (?an infection), tetanus, see also zoonoses
Foundry workers	Acinetobacter pneumonia, tuberculosis
Health care industry	Blood borne diseases (esp. hepatitis B, HIV, hepatitis C), nosocomial infections, hepatitis A, influenza, tuberculosis
Horticulturalists	Sporotrichosis
Miners	Tuberculosis
Sandblasters	Tuberculosis
Sewerage workers	Hepatitis A, gut pathogens, see also zoonoses
Sex industry	STDs
Steam turbine cleaners	Legionellosis, humidifier fever
Infections incidental to work	
Military	those resulting from overseas postings; rubella, glandular fever
Office work	influenza, respiratory tract infections, legionella, humidifier fever
Overseas work	tropical diseases including malaria, parasitic infections, cholera, typhoid

But job classifications cannot always be relied upon. It is necessary to know what that individual or work group actually does. In the past it was considered that job descriptors gave an accurate indication of hazards to which a worker would be exposed. It is now known that such descriptors as clerk, miner, or labourers are useless for giving a true indication of the risks encountered at work. As an example, the risks of infection to a nurse working in an infectious diseases ward is quite different from that run by a nurse working in ophthalmology.

The hospital environment in fact is one with very many risks for occupational infection, and is worthy of special mention. Potential occupational infections among hospital staff are detailed in Table 2.

Table 2: Occupational infections among hospital staff

Major (with regard to risk and level of concern)
Hepatitis B, HIV, hepatitis C, tuberculosis (especially drug-resistant), multi-resistant staphylococcus aureas (MRSA), cytomegalovirus, rubella, herpes simplex
Occasional
Legionnaire's disease, rubella, epidemic keratoconjunctivitis, herpes infections, other forms of hepatitis, influenza; measles; meningococcal meningitis; mumps; parainfluenza; polio virus; respiratory syncytial virus; rotavirus; streptococcal infections; varicella zoster; corynebacterium diphtheria; neisseria meningitis; pertussis, salmonella species; shigella species; tetanus; chlamydia; coxiella burnetii; chronic paronychia; mycoplasma-pneumoniae; sarcoptes (scabiei); several African haemorrhagic fevers (rare); Creutzfeld-Jakob disease.[1] [2]

4.1 'Prevent harm from occupation' group

Hepatitis B is a good example of a disease where the risk may spread beyond the most easily identifiable exposed groups. It is well known that "Health Professionals" are at risk of acquiring this infection. But there is a wider group who have similar contact and who are usually not considered to be health professionals. These include hospital orderlies, mortuary workers, laundry workers, garbage contractors, plumbers and drivers delivering laundry or contaminated materials to laundry sites. All of these groups may be exposed to needle stick or other sharps injuries.

Hepatitis B in a surgeon is most likely to be occupational even if no specific exposure incident can be recalled. It is known that surgeons, on the basis of several studies, cut themselves frequently and sometimes imperceptibly during surgery and often do not report their 'sharps' injuries. Hepatitis B in a hospital clerk is most likely to be non-occupational since exposure to infectious body fluids should not occur.

In the agricultural field there are the zoonoses, defined by the World Health Organisation as "those diseases and infections that are naturally transmitted

[1] Gantz NM. Occupational Health. Recognising and preventing Work-Related Disease. Eds Levy B S and Wegman DH. Little Brown & Co., Boston, 1995

[2] Schneider WJ. Considerations regarding infection during hospital employment. Journal of Occupational Medicine. 1982;24(1)53-57

between vertebrate animals and man"[3]. Of the more than 70 zoonoses discovered, 60 have been reported in Australia.

Again, whether a zoonosis is occupational will depend upon what the person does. If he or she works in a meat works where animals infected with Coxiella burnetti are being slaughtered, then a resulting bout of Q-fever will be occupational. If a person merely walks past the same meat works on the way for example, to buying a loaf of bread and contracts the same disease, clearly it is non-occupational.

This last situation cannot be ignored by the occupational physician or by management. It comes clearly into their environmental responsibilities. The physician should advise management on the possibility of such environmental contamination - well documented locally and in the world literature - and suggest methods of preventing its occurrence.

4.2 'Fitness for occupation' group

A range of occupational infections can harm abattoir workers, including contamination of occupational wounds by a myriad of possible agents. The abattoir worker is in the same position as other food handlers - he may be infected by what he is handling, but he may also 'infect' what is being handled. To prevent this, among other measures, good personal hygiene is necessary. This is another area in which the occupational physician, in consultation if necessary with public health and other colleagues, may prevent spread of infection into the environment and the customer. The physician may need to delay the return to work of an infected food-handler to prevent product contamination.

The effects of infection on fitness for work can be summarised as:

- the risk of direct transmission
- the risk of product contamination:
  - (i) infection of product
  - (ii) contamination of product
- the risk of worker impairment, and effect on safe work capacity

4.3 The zoonoses

Zoonoses, as already mentioned, can be defined as "those diseases and infections which are naturally transmitted between vertebrate animals and man". [3]

Some common zoonoses and their infective agents are detailed in Table 3.

Table 3: Occupations with some associated zoonoses[4] (adapted)

[3] World Health Organisation. Bacterial and Viral Zoonoses. Technical Report Series No. 682. WHO, Geneva, 1982

Animal handlers at quarantine kennels	Rabies
Bone/bonemeal processors	Anthrax
Cattle handlers	Leptospira hardjo, cryptosporidiosis, trichophyton verrucosum, orf, anthrax
Dairy farmers	Leptospira hardjo, Q-fever, brucellosis, cryptosporidiosis, trichophyton verrucosum, anthrax
Deer farmers	Lyme disease, bovine tuberculosis
Farmers, depending on nature of livestock	Leptospirosis, psittacosis, ovine chlamydiosis, Q-fever, hantavirus, Streptococcus suis, Lyme disease, brucellosis, cryptosporidiosis, microsporum nana, orf, anthrax, tuberculosis, anthrax, hstoplasmosis, coccidioidomycosis, cryptosporidiosis, echinococcosis
Field workers	Bubonic plague
Fish farmers and processors	Cutaneous infections eg. erysipelas, Mycobacterium marianum, nanophyetiasis
Grooms	Trichophyton equinum
Knackermen	Anthrax, brucellosis, Leptospira hardjo, Q-fever, trichophyton equinum, Streptococcus suis
Laboratory workers	Lyme disease, Leptospira hardjo, psittacosis, Q-fever, hantavirus, brucellosis, cryptosporidiosis, rabies, Newcastle disease, herpes virus simiae
Meat inspectors	Psittacosis
Meat workers	Q-fever, Streptococcus suis, brucellosis, anthrax, orf, toxoplasmosis
Pet store keepers	Newcastle disease, psittacosis, microsporum canis
Port health inspectors	Rabies
Poultry workers	Psittacosis, Newcastle disease
Sewer workers	Leptospira icterohaemorrhagiae, hantavirus
Shearers	Q-fever, orf
Shepherds	Ovine chlamydiosis, Q-fever, orf
Slaughterhouse workers	Q fever, streptococcus suis, brucellosis, ringworm, orf, anthrax, leptospirosis, tuberculosis, sporotrichosis, toxoplasmosis
Tanneries	Anthrax
Taxidermists	Psittacosis
Veterinarians	Leptospira hardjo, psittacosis, Ovine chlamydiosis, bovine tuberculosis, brucellosis, cryptosporidiosis, trichophyton verrucosum, trichophyton equinum, microsporum canis, microsporum nanum, orf, anthrax, Newcastle disease, rabies, Streptococcus suis, herpes virus simiae
Water industry, sports	Leptospira icterohaemorrhagiae, hantavirus

4.4 Some detailed examples:

4.4.1 Hepatitis B

The reservoir is found in infected humans, especially blood and seminal fluid. Routes of infection are parenteral and via non-intact skin. Symptoms may be of variable severity and include arthralgia, urticaria, jaundice, discolouration of urine, sometimes full-blown serum sickness with glomerulonephritis, sometimes fulminant liver failure and the possible development of the Carrier

[4] Hunter's Diseases of Occupations. 8th Edition. Eds Rafffle PAB, Adams PH, Baxter PJ and Lee WR. Edward Arnold, Sevenoaks, 1994.

State. The diagnosis is serological based on detection of viral antigens and antibodies developed against them. There are also biochemical changes.

Prevention:
Primary prevention: Elimination or reduction of risk by technological change (eg. needless systems/changes in work practices/ training); provision of personal protection such as gloves, face mask; case identification and notification; vaccination and immunoglobulin in the case of an exposure.
Secondary prevention: Management of infection once it has occurred.
Tertiary prevention: Where the disease is established, treatment to reduce long-term effects[5] [6].

4.4.2 Q-fever (based on Stevenson and Hughes)[7]

The most common carriers are cattle, sheep, goats and many pets including cats and tortoises. Infective tissues include birth fluids, placenta and foetal membranes of infected animals - also milk, urine and faeces. The usual route of infection is by inhalation. Symptoms include fever, chills, malaise, fatigue, and a bifrontal headache with retrobulbar pain. Sometimes the infection may lead to a chronic fatigue syndrome state called 'post Q fever fatigue syndrome' which may last for '5 to 10 years or more and is often a disaster for the patients and their families'[8].

Diagnosis: Complement fixation or indirect fluorescent antibody tests.
Phase 1 antibody: rising or persistent elevation - chronic Q-fever infection.
Phase 2 antibody: rising titres - acute infection.
IgM specific antibody: rising titres - very recent or current infection.

Prevention:
Primary prevention: Elimination or reduction of risk by: screening animals; burning or burying placentae and other birth tissues; burning contaminated litter and removing manure from the immediate environment; better ventilation and dust control/changes in work practices; vaccination of workers. Note-gravid uteri of domestic livestock should only be incised in a special isolation room to prevent aerosol spread to the killing floor[7].
Secondary prevention: Tetracycline. Note-must be given early to be effective.

A recent $1.1 million civil damage pay-out for a chronic sequel to Q fever "has sharply focused attention in the industry on the need for vaccine prophylaxis."[8]

4.4.3 Brucellosis

"A systemic bacterial disease with acute or insidious onset, characterised by continued, intermittent or irregular fever of variable duration, headache,

[5] American Public Health Association. Control of Communicable Diseases Manual, 16th edition. Ed. Benenson AS. American Public Health Association, Washington, 1995.
[6] Farrell GC. Acute viral hepatitis. Medical Journal of Australia. 1998;168(11):565-70
[7] Stevenson WJ and Hughes KL Synopsis of zoonoses in Australia, 2nd Ed. Australian Government Publishing Service, Canberra ACT, 1988
[8] Marmion BP. Q fever trilogy: morbidity - deadends - stark choices. Australian and New Zealand Journal of Public Health 1997;21(7):677-679

weakness, profuse sweating, chills, arthralgia, depression, weight loss and generalised aching. Localised suppurative infections of organs, including the liver and spleen, may occur; subclinical disease has been reported and chronic localised infections can occur. The disease may last for several days, months, or occasionally for a year or more if not adequately treated. A combination of Rifampin (RIF) (600-900 mg daily) or streptomycin, and doxycycline (200 mg daily) for at least 6 weeks is the treatment of choice." [5]

Prevention:
Primary prevention: Vaccination of animals; pasteurisation of milk; barrier precautions; care in handling and disposal of placenta, discharges and foetus from an aborted animal; and disinfection of contaminated areas. There is no human vaccine available.
Secondary prevention: Broad-spectrum antibiotics

4.4.4 Leptospirosis [5]

A group of zoonotic bacterial diseases with protean manifestations. Common features are fever with sudden onset, headache, chills, severe myalgia (calves and thighs) and conjunctival suffusion. Other manifestations that may be present are diphasic fever, meningitis, rash (palatal exanthem), haemolytic anaemia, haemorrhage into skin and mucous membranes, hepatorenal failure, jaundice, mental confusion/depression, myocarditis and pulmonary involvement with or without haemoptysis.

Prevention:
Primary prevention: Segregation of infected domestic animals; prevention of contamination of human living, working and recreational areas by urine of infected animals; immunisation of farm and pet animals; wearing of boots, gloves and aprons. Immunity to the specific serovar follows infection or (occasionally) immunisation
Secondary prevention: Doxycycline and penicillin G have been shown to be effective in double-blind, placebo-controlled trials; penicillin G and amoxicillin were effective as late as 7 days into an illness. Prompt specific treatment, as early in the illness as possible, is essential.

4.4.5 Orf [5]

A proliferative cutaneous viral disease transmissible to humans by contact with infected sheep and goats, and occasionally wild ungulates (deer, reindeer). The lesion in the human, usually solitary and located on hands, arms or face, is a red to violet vesiculonodule, maculopapule or pustule, progressing to a weeping nodule with central umbilication. There may be several lesions, each measuring up to 3 cm in diameter, lasting 3-6 weeks. With secondary bacterial infection, lesions may become pustular. Regional adenitis occurs in a minority of cases. Erythema multiforme and erythema multiforme bullosum are rare complications. Disseminated disease and serious ocular damage have been reported.

Prevention:

Primary prevention: Ensuring general cleanliness of animal housing areas; good personal hygiene and washing the exposed area with soap and water. There is no human vaccine available. The efficacy and safety of Parapoxvirus vaccines in animals has not been fully determined.
Secondary prevention: None.

4.4.6 Hydatid [5]

The tapeworm Echinococcus granulosus is the most common species of Echinococcus and causes cystic hydatid disease. Hydatid cysts enlarge slowly, requiring several years for development. Developed cysts generally are 1-7 cm in diameter, but may exceed 10 cm. Infections may be asymptomatic until cysts cause noticeable mass effect; then, signs and symptoms vary according to location, cyst size and number. Ruptured or leaking cysts can cause severe anaphylactoid reactions and may release protoscolices that can produce daughter cysts. Cysts are typically spherical, thick-walled and unilocular and are most frequently found in the liver and lungs, although they may also occur in other organs.

Prevention:
Primary prevention: Interruption of transmission from intermediate to definitive hosts by preventing access of dogs to uncooked viscera, including the supervision of livestock slaughtering and safe disposal of infected viscera; incineration or deep-burying of infected organs from dead intermediate hosts; periodical treatment of high-risk dogs; reduction of dog populations to the occupational need for them; observation by field and laboratory personnel of strict safety precautions to avoid ingestion of tapeworm eggs. There is no vaccine available;
Secondary/tertiary prevention: Surgical resection of isolated cysts is the most common treatment; however, mebendazole (Vermox) and albendazole (Zentel) have been used successfully and may be the preferred treatment in many cases. If a primary cyst ruptures, praziquantel (Biltricide), a protoscolicidal agent, reduces the probability of secondary cysts.

5. INCIDENTAL OCCUPATIONAL INFECTION

This second group includes infections which are acquired at work from co-workers, but which are not an integral part of the work process. Some of these infections are detailed in table 4.

Table 4: Other infectious diseases acquired at work

Influenza	Meningitis
Scabies	Tinea
Tuberculosis	Salmonellosis
Hepatitis A	Shigellosis
Herpes simplex	Head lice
Rubella	Viral gut infection
Pertussis	

Some of these are infections of little consequence to either the worker or the organisation. Others may have a significant effect on absenteeism and work performance. Influenza has perhaps the greatest potential of the common infectious diseases of this type to cause major morbidity - even mortality - with gross disruption to the workplace. It has been the subject of several studies looking at the effectiveness and, more specifically, the cost-effectiveness of immunisation programs.

Infections may be acquired by droplet spread as in the case of influenza above, but it may also be acquired because workers in certain areas are in a position to pass on infection to unsuspecting colleagues. An example would be canteen staff with hepatitis A, where due to poor personal hygiene, the passage of hepatitis A virus via the faeco-oral route is possible.

It may be difficult or impossible to determine whether some of these infections are, in a given cases or set of cases, occupational. If their incidence in the general community is equal to or higher than that inside the workplace and there are no identifiable clusters of infection associated with work-related sources - such as hospital patients - then it would unreasonable to presume an occupational causation. If there are, for some reason, strong suspicions of occupational causation despite the preceding factors, typing of some organisms is available to assist in demonstration of source.

5.1 Some detailed examples:

5.1.1 Influenza

An acute viral disease of the respiratory tract characterised by fever, headache, myalgia, prostration, coryza, sore throat and cough. Cough is often severe and protracted, but other manifestations are usually self-limited with recovery in 2-7 days. Recognition is commonly by epidemiological characteristics; sporadic cases can be identified only by laboratory procedures. Influenza in children may be indistinguishable from disease caused by other respiratory viruses. Influenza virus may cause the clinical picture of the common cold, croup, bronchiolitis, viral pneumonia and undifferentiated acute respiratory disease. GI tract manifestations (nausea, vomiting, and diarrhoea) may accompany the respiratory phase, particularly in children, and have been reported in up to 25% of children in school outbreaks of influenza B and A (H1N1).

Prevention:
Primary prevention: Attention to basic personal hygiene; warding against unprotected coughs and sneezes and hand-to-mucous membrane transmission; immunisation with available killed-virus vaccines may provide 70%-80% protection against infection in healthy young adults when the vaccine antigen closely matches the circulating strains of virus
Secondary prevention: Amantadine hydrochloride (Symmetrel, Symadine) or rimantadine hydrochloride (Flumadine) is effective in the chemoprophylaxis of influenza A, but not influenza type B.

Note - With respect to vaccination there have been several studies looking at the cost-benefit of vaccinating workforces. It is necessary to particularly consider vulnerable workers, such as those suffering from chronic cardiac, renal or respiratory disease, and vulnerable occupations such as health-care workers.

5.1.2 Hepatitis A[5]

Onset is usually abrupt with fever, malaise, anorexia, nausea and abdominal discomfort, followed within a few days by jaundice. The disease varies in clinical severity from a mild illness lasting 1-2 weeks, to a severely disabling disease lasting several months (rare). Convalescence often is prolonged. In general, severity increases with age, but complete recovery without sequelae or recurrences is the rule. Many infections are asymptomatic; many are mild and without jaundice, especially in children, and recognisable only by liver function tests. The reported case-fatality rate is low (<1/1,000) but higher case-fatality rates have been reported among children <5 years of age (1.5/1,000) and among persons >50 years of age (27/1,000).

Prevention:
Primary prevention: Provision of good sanitation and personal hygiene, with special emphasis on careful hand-washing and sanitary disposal of faeces; provision of proper water treatment and distribution systems, and sewage disposal; vaccination, immunoglobulin
Secondary prevention: Immunoglobulin

5.1.3 Legionnaires' Disease[5]

An acute bacterial disease with two currently recognised, distinct clinical and epidemiological manifestations: Legionnaire disease (ICD-10 A48.1) and Pontiac fever (ICD-10 A48.2). Both are characterised initially by anorexia, malaise, myalgia and headache. Within a day, there is usually a rapidly rising fever associated with chills. Temperatures commonly reach 39°-40.5°C (102°-105°F). A non-productive cough, abdominal pain and diarrhoea are common. In Legionnaire disease, chest radiograph may show patchy or focal areas of consolidation that may progress to bilateral involvement and ultimately to respiratory failure; the case-fatality rate has been as high as 39% in hospitalised cases of Legionnaire disease; it is generally higher in those with compromised immunity.

Prevention:
Primary prevention: Periodical mechanical cleaning of cooling towers to remove scale and sediment, and draining when not in use; use of appropriate biocides to limit the growth of slime-forming organisms; and avoidance of tap water use in respiratory therapy devices. Immunisation is not available.
Secondary prevention: Erythromycin appears to be the agent of choice; the newer macrolides, clarithromycin and azithromycin, may be effective. Rifampin may be a valuable adjunct but should not be used alone.

As with Q fever, this condition may occur in the workforce - eg. the staff in a hospital which has a poorly maintained air conditioning system in which

legionella is growing freely - but there may also be environmental spread to nearby residents.

6. PARTICULAR PROBLEMS OF TRAVEL

An increasing number of Australian and New Zealand workers and their families are spending extended periods of work assignment in developing nations. The nature of these expatriate placements is such that the employer is responsible for health measures as a consequence of relocation to these regions, irrespective of whether adverse health events occur directly associated with the work site. The employer takes responsibility for the health for the employee and family at all times during the expatriate relocation.

A major health factor in developing nations is that of infectious disease. Diseases such as hepatitis A and B, malaria, tuberculosis and typhoid are a significant risk. In some regions, conditions such as rabies, Japanese encephalitis, yellow fever, and meningococcal meningitis may also need to be considered. Diseases such as measles, mumps, rubella, diphtheria may also have a higher incidence and it is important to ensure routine vaccination schedules are up to date.

In many cases vaccination programs or, in the case of malaria, preventative medications are available to reduce risk in infectious disease. For adequate scheduling of vaccination individuals may need to be seen many weeks prior to departure.

It is also important that the expatriate worker and family are adequately counselled regarding health risks in developing nations. This counselling will include advice on proper selection, storage, cleaning, and preparation of food and advice regarding safe water consumption. Clear advice should also be given regarding the control of vector-borne disease through proper screening of the home, correct clothing and use of insect repellents when necessary. In some regions disease risk may occur from other environmental pathogens such as schistosomiasis (fresh water swimming), scrub typhus or tick-borne diseases and further specific advice may be required. This may be particularly so with workers who venture outside of urban regions, such as exploration geologists or aid workers.

Correct management of infectious disease may also require the development of reliable contact with treating practitioners in the region. If reliable medical treatment is not readily available specific medication may need to be given to families with advice on how to treat various conditions eg. diarrhoea, until medical advice can be sought.

This subject has been extensively covered in a publication of the former Australasian College of Occupational Medicine[9].

7. THE ROLE OF THE OCCUPATIONAL PHYSICIAN

[9] Australian College of Occupational Medicine. Working overseas. ACOM, Melbourne, 1989

Occupational physicians are well placed to operate within the complex milieu that is the interaction between individuals, the workplace, industry and society. The ability of occupational physicians to work across and in collaboration with many disciplines with a mix of clinical and public health skills places them in a unique position.

The occupational physician “adds value” in the overall prevention and management of occupational infections, by initial detection of the infection, connection of the infection with the work environment, provision of strategies for the prevention of infection of others in the workplace, determining, in consultation with others, the time for return of the individual to the workplace and the circumstances of that return.

7.1 Recognition of an occupational infection

The occupational physician may sometimes be the first to recognise that an infectious disease, in a particular patient, is occupational in origin. The following approach may be used[10]:

(a) A comparison of the date of onset of symptoms with occupational history.
(b) Evaluation of the results of any past biological or medical monitoring and previous physical examinations (and symptomatology).
(c) Evaluation of various laboratory tests (performed on the patient) for suspected disease agents[11].
(d) Checking on the existence of the same infection or the same symptoms in co-workers and, thereby, detection of clusters (guidelines for such detection issued by CDC Atlanta, Georgia).
(e) Assessing the workplace.
(f) Reviewing the relevant literature.

This may sometimes be done in co-ordination with an infectious disease physician if there are difficulties. In addition to specific treatment of the individual affected, the results of this approach, if an occupational infection is demonstrated, will lead to:

(a) prevention of the disease in other workers performing the same work and preventing recurrence of the disease in the individual being treated;
(b) provision of worker's compensation for the affected individual;
(c) broader public health implications; and
(d) compulsory notification in some cases (see NH&MRC list - appendix)

With respect to point (a), the occupational physician may make recommendations, in concert with appropriate colleagues that may go well beyond treatment and vaccination.

[10] Le Leu LA. Occupational infections. GPCME File 1993 Oct 6-19;vol 1(16):239-43
[11] Occupational Safety and Health Administration (United States). A Brief Guide to Recordkeeping Requirements for Occupational Injuries and Illnesses (OMB No. 1220-0029), Chapter IV. OSHA, Washington ,1986.

7.2 Hierarchy of hazard control

The hierarchy of hazard control, with which the occupational physician is familiar, is just as relevant here as in other settings.

The standard occupational medical approaches can be adopted for the prevention of occupational infections but complementing and overlapping with, rather than countering, normal well-developed approaches to infection control. These standard approaches can be summarised thus:

(a) **Elimination** of causative agent eg.
- Smallpox - treatment of all human reservoirs
- Brucellosis - herd immunity.

(b) **Substitution** of causative agent - this approach is not appropriate for occupational infections although the mechanism of vaccination, in itself, has been a form of substitution of the more infectious with the less or not infectious in order to generate immunity.

(c) **Isolation** of causative agent eg.
- Early case identification in humans or animals
- Early treatment in the 'quarantine' situation.

(d) **Ventilation** of workplace - hospitals, abattoirs - control of aerosols.

(e) **Administrative controls** eg.
- Requiring persons who are to perform invasive procedures/ exposure-prone procedures to demonstrate immunity against hepatitis B.

(f) **Work-practices** eg.
- Food-handling practices (Hazard Analysis of Critical Control Points - HACCP in food industry)
- No-touch techniques
- Universal precautions in hospitals
- Effective cleaning of abattoirs.

(g) **Personal protection** eg.
- Masks, gloves, aprons
- Personal hygiene
- Immunisation where possible[12]
- Health surveillance eg. maintenance of immunity in health-care workers at risk from hepatitis B; checking serology in workers exposed to brucellosis; radiology where appropriate.

(h) **Staff education and training** eg.
- Proper reporting of sharps injuries
- Reporting of symptoms and accidents
- Correct management of abrasions/cuts

[12] National Health and Medical Research Council. The Australian Immunisation Procedures Handbook, 6th edition, AGPS, Canberra, 1997

- Good workplace hygiene and personal hygiene.

7.3 Consultation about medical management and other aspects

The methods chosen will depend upon the known manner of transmission of the infecting organism. Infections are unique in respect of occupational diseases in that chemoprophylaxis and vaccination may be available.

The occupational physician is well placed to consult, for preventive purposes, with:

- employees, employers, unions
- OH & S committees and representatives
- WorkSafe Australia, state and federal health departments, OSH in New Zealand
- infectious diseases physicians, microbiologists, epidemiologists, occupational hygienists.

7.4 Return to work

The Occupational Physician is skilled in contributing to successful returns to work in collaboration with other partners such as the employee, employer, union, rehabilitation provider, infectious diseases physician, etc. He or she can provide a scheme of hours, and restrictions, which will make the return to work as safe as possible for all concerned.

7.5 Education

Education to workers, industry and the community on:

- the presence of hazards
- the nature of risk
- preventive strategies
- early hazard and disease recognition
- availability of services
- risk communication and debriefing
- occupational first aid
- a better understanding of disease transmission and the prevention of discrimination.

Risk communication itself is an area where the occupational physician's input may be vital.

The occupational physician may be required to talk to workers and management about what occupational infections are likely in a given setting and what that likelihood is.

For example, a worker may have been diagnosed as having hepatitis A. This may cause fear and apprehension in their co-workers. The occupational physician should be well equipped to act in calming down this situation,

answer questions to the best of his or her knowledge or obtain other expert information.

8. CONCLUSIONS

The occupational physician is in an ideal position to recognise and, in conjunction with other health professionals, to take steps to ensure that individuals affected by an occupational infection are properly managed and further cases are prevented.

Excluding treatment of specific infections, the management of occupational infections should be seen as an important competency of a qualified occupational physician.

Where specific preventive measures are available, and justifiable on the basis of risk, the occupational physician will advise workers and management of the need for such protection. Where emergency prophylaxis may be required, and its presence at the workplace is justifiable on the basis of risk, the occupational physician will also provide advice.

An important aspect of the occupational physician's work in relation to occupational infections will be education of workers at risk, and the development, in concert with the workplace, of hazard reduction systems including safe work-practices.

Finally, any infectious disease can be occupational but we know that some infections are strongly associated with particular workplaces or work activities. The Australasian Faculty of Occupational Medicine wishes to play an active role in increasing the level of worker awareness of occupational infections, ensuring that appropriate preventive measures are taken in the workplace, and that this source of preventable occupational morbidity is minimised.

9. IMPORTANT REFERENCE MATERIAL

In the assessment and investigation of possible occupational diseases it is useful for the occupational physician to have available the following:

Berenson AS (Ed.) **Control of Communicable Diseases in Man (16th Ed.),** American Public Health Association, Washington DC, 1990. This has been used extensively here and all disease summaries that refer to this reference consist of verbatim or near verbatim quotes from it. These are used with kind permission of the American Public Health Association.

Stevenson WJ, Hughes KL
Synopsis of Zoonoses in Australia (2nd Ed.)
Australian Government Publishing Service
Canberra ACT, 1988

Appendix A – National Health and Medical Research Council – recommendation from the 133rd Council Session, Hobart 3-4 June 1992. Notifiable Diseases

Note that this is a recommendation and may not always have been enacted in Statutes.

AIDS
Arbovirus infection
Botulism (excluding infant botulism)
Brucellosis
Campylobacteriosis
Chlamydial disease
Cholera
Diphtheria
Gonococcal infection
Haemophilus influenzae type b infection
Hepatitis A
Hepatitis B
Hepatitis C
HIV infection
Hydatid infection
Legionellosis
Leprosy
Leptospirosis
Listeriosis
Malaria
Measles
Meningococcal infection
Mumps
Plague
Pertussis
Poliomyelitis
Q Fever
Rabies
Rubella (congenital)
Salmonellosis (not elsewhere classified)
Shigellosis
Syphilis
Tetanus
Tuberculosis
Typhoid and paratyphoid
Viral haemorrhagic fever
Viral hepatitis (not elsewhere classified)
Yellow fever
Yersiniosis

Appendix B – Definitions

1. Primary prevention:

The prevention of any possibility of introduction of disease into a person

2. Secondary prevention:

The appropriate treatment of a disease to prevent its adverse effects.

3. Tertiary prevention:

This deals with the prevention of long-term sequelae after a disease has occurred eg. monitoring after hepatitis B for active hepatitis with view to treatment by interferon to prevent cirrhosis etc.

It also includes follow-up eg. if a surgeon has hepatitis B or AIDS do his or her patients need to be checked?

Appendix C: sample policy on Hepatitis B immunisation
(based on Royal North Shore Hospital policy)

POLICY ON HEPATITIS B IMMUNISATION

DEFINITIONS

HEPATITIS B:

Hepatitis B is a blood borne disease and constitutes a major and growing worldwide health problem.

The hepatitis B virus (HBV) causes hepatitis B and infection may cause acute or chronic hepatitis. In many instances the infected individual will be completely asymptomatic and become a hepatitis B carrier. There are approximately 200 million carriers worldwide.

Hepatitis B is a common cause of liver disease and can lead to primary liver cancer and cirrhosis of the liver.

OCCUPATIONAL RISK

Direct risk:

"Direct risk" groups include all Health Care Workers who have direct contact with patients, blood, body fluids or human tissue. Occupational groups in this category include nurses, doctors, paramedical and laboratory personnel.

Indirect risk:

"Indirect risk" arises from "downstream exposures" and may occur as a result of incorrect disposal of contaminated waste. Occupational groups in this category include maintenance, cleaning, catering and laundry personnel.

Negligible risk:

"Negligible risk" pertains to all health care workers whose occupation does not involve contact with blood, body fluids or human tissue. Occupational groups in this category include clerical and administrative personnel.

POLICY:

The hospital is committed to protect the health, safety and welfare of all employees and believes that a healthy, safe working environment is in the best interests of all.

HBV is carried in the blood and body fluids of infected individuals. As with other blood borne disease such as HIV, there is no way of knowing if a person has hepatitis B just by looking.

The hospital recognises that many health care workers may potentially be exposed to blood, body substances and human tissue.

The hospital strongly recommends that all employees with potential for exposure to blood and body substances are immunised against hepatitis B.

Immunisation is also available to employees who have little or not contact with blood or body substances.

IMMUNISATION TIMES:

(as relevant to individual organisation)

The immunisation program consists of three vaccinations over a six-month period. It should not be assumed that immunity would develop after completing the course. It is recommended that employees have their blood screened for hepatitis B antibodies three months after course completion. It is the employee's responsibility to remember when screening is due.

NB: ALTHOUGH IMMUNITY TO HEPATITIS B IS CLEARLY OF BENEFIT, IT SHOULD NOT BE A SUBSTITUTE FOR SAFE WORK PRACTICE AND THE OBSERVATION OF UNIVERSAL PRECAUTIONS.

Immunisation is free of charge and available through Occupational Health.