Guide to assessing zoonotic disease risks

Intended audience and use

This is a guide for Department of Primary Industries and Regional Development (DPIRD) officers on assessing the risk of zoonotic disease based on risk indicators such as syndromic presentation, and suggesting precautions that can reduce the risk of contracting a zoonotic disease.

This guide is designed for DPIRD officers working with livestock in Western Australia, and accounts for the possibility of interaction with wildlife (e.g. bats).

Duty of care

The *Occupational Safety and Health Act 1984* describes the general duty of care imposed on employers (section 19) and employees (section 20).

The **employer's responsibility** is to provide employees with a safe working environment and provide any protective equipment required to perform a job safely.

The **employee's responsibility** is to take reasonable care to ensure his or her own safety and health at work and avoid adversely affecting the safety or health of any other person through any act or omission at work.

Zoonotic disease transmission routes

There are several possible routes of infection including direct, indirect, vector-borne and environmental, depending on the disease agent.

- Direct transmission occurs from an infected animal to a person.
- Indirect infection occurs when people have contact with an environment or fomites contaminated by infected animals.
- Vectors may be either mechanical or biological. Mechanical vectors transmit the disease agent between hosts in the same form while biological vectors are essential for development of the agent into an infectious form. Risk assessment and controls may vary between vector forms.
- Environmental pathogens such as *Burkholderia pseudomallei (*melioidosis) and *Cryptococcus neoformans* (cryptococcus) reside in the environment rather than a primarily animal reservoir. These pathogens are typically transmitted via environmental exposure, and are unlikely to be transmitted from infected animals to humans.
- Factors such as age, underlying diseases, immune deficiencies, pregnancy and breaks in the body's defence mechanisms (e.g. intact skin) may render a person more susceptible to infection or serious illness. Table 1 outlines the potential routes of disease transmission and the corresponding infection risk controls.

Table 1: Disease transmission routes and infection risk controls

Routes	Means of transmission	Risk controls
Contact (direct & indirect)	Ingestion, mucous membranes (conjunctivae, nasal or oral mucosa), cutaneous / percutaneous exposure Direct handling / indirect (contaminated fomites)	Standard precautions, e.g. cover cuts, hand hygiene, biosecurity practices
Droplet	Contamination of mucous membranes by splashes, spray and spatter. Requires close contact – droplets do not remain suspended in air and generally travel short distances	Face shields, surgical masks, goggles
Airborne	Inhalation. Very small droplets or components of droplets can remain suspended for long periods	P2 masks (minimum) with proper placement + fit tested. Surgical masks do not adequately protect
Vector	Mosquitoes, fleas, ticks, rats, and other animals	Vector control, insect repellent, protective clothing

Zoonotic disease precautions

There are six levels of control (with examples from animal examination / veterinary pathology) listed from most (1) to least protective (6).

1. Eliminate (don't examine/sample, minimise onlookers)
2. Substitute (minimally invasive sampling as opposed to necropsy)
3. Isolate (avoid unnecessary contact)
4. Engineering controls (workspace design, use of equipment to reduce hazards e.g. flow hoods)
5. Administrative controls (vaccination, protocols e.g. use history to assess risks before physical examination)
6. Personal protective equipment (PPE) (review AVA's biosecurity video on when/how to suit up)

Under the hierarchy of controls, PPE is the last line of defence and all efforts should be made to consider other controls before relying on PPE. **Using multiple approaches to risk mitigation may be more effective than relying on one measure.** Combined approaches include following protocols (e.g. obtaining history and performing risk assessment prior to farm visit), prior vaccination and use of appropriate PPE.

PPE should be used correctly and be in proper working order. When working with live animals, be aware of the possibility of the animal reacting unexpectedly and potentially compromising the integrity of the PPE and the level of protection it confers.

Immunocompromised personnel

People with immune deficiencies and/or who are pregnant have a higher risk of serious complications from zoonotic infections. Staff should discuss their status with their manager if they are immunocompromised. The department may need further medical advice to develop a plan. Examples of immunosuppressive conditions include HIV/AIDS, diabetes mellitus, asplenia, pregnancy, certain malignancies, and therapy for a variety of conditions (e.g. steroids, chemotherapeutic and immunosuppressive agents, radiation). If in doubt, contact your doctor.

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Standard precautions are the basis of infection control and must be complied with at all times.

Standard precautions
• Cover skin cuts or abrasions. • Use hand hygiene (wash effectively using an alcohol or disinfectant-based handwash). • Use sharps safety (avoid recapping needles, dispose of sharps in sharps container). • Wear closed footwear. • Use protective outerwear. • Q fever vaccination (working with cattle, sheep & goats). • Influenza vaccination (working with poultry). • Always presume that specimens are infectious. Wear gloves during sampling and handling. • Decontaminate containers using a disinfectant for an appropriate contact time.

Indications for additional precautions

Weigh up the context, risk factors, probabilities and consequences surrounding each scenario when deciding which risk mitigations to apply.

When conducting field visits, be aware of the nature of the visit and obtain the history of the cases before undertaking a disease investigation. This history taking includes reviewing property information and obtaining the following information:

- species of the affected animal(s)
- disease syndrome(s)
- origin of animals
- mortality and morbidity
- if any people are affected
- any unusual signs.

Annex A outlines the steps to take before conducting a field visit.

Annex B lists examples of zoonotic diseases that may be encountered in WA and the additional precautions that may need to be taken.

What to do if you have unplanned contact with a suspect animal

- Seek advice from the duty pathologist (phone 9368 3351).
- Minimise exposure, withdraw to a safe area and instruct any other people present to do the same.
- Remove contamination with soap and water. If shower facilities are available, consider taking a shower as soon as possible after exposure.
- Only proceed with examining, sampling and treating the animal if it is safe to do so.
- Consider minimally invasive sampling to allow initial emergency animal disease/zoonosis exclusion before detailed investigation.
- As soon as possible, inform your manager and complete an incident report.

Use effective biosecurity at all times

Many of the precautions and biosecurity measures to be undertaken when a zoonotic disease is suspected are similar to those that should be taken for emergency animal disease investigation.

For example, when visiting a property:

- Do not wear soiled/contaminated clothing or footwear.
- Establish the current known/suspected disease status of the property.
- Check and follow the property's normal biosecurity protocols.
- If practical, get the producer to transport you and equipment on-farm and leave your vehicle in a clean area.
- Create 'clean' and 'dirty' compartments in a vehicle and avoid cross-contamination.
- Clean samples and equipment with detergent prior to leaving property. Detergents / disinfectants can be inactivated by organic material, so manual cleaning is essential.
- Seal samples in plastic bags and rinse the outside packaging. Seal the esky and clean and spray with disinfectant.
- Where exotic/zoonotic disease is suspected, use heavy-duty plastic bags to seal clothing/ boots / equipment / rubbish and then double-bag, zip-tie and disinfect exterior.
- Wash hands/exposed skin with soap or detergent before entering a clean vehicle or leaving property.
- Use non-porous examination and cleaning equipment.

Biosecurity advice for owners in the event of potential zoonotic disease

- Isolate sick or dead animals from other animals and people.
- Keep contact to a minimum. Ensure correct use of PPE for in-contact persons.
- Maintain high standard of personal hygiene including frequent washing of hands and exposed surfaces of the body with soap and water.
- Stop or limit movement of animals and animal products on and off the property.
- Stop or minimise visitors to the property.
- If the animal is dead and there is zoonotic disease risk, inform the animal disposal contractor.
- Advise the owner to seek medical advice or contact Communicable Disease Control (CDC), Department of Health WA on 9388 4800 (office hours) or 9328 0553 (after hours).

Necropsy / animal disposal

The aim of good necropsy practice is to minimise the risk of splashes, aerosols and contamination. There are certain situations where necropsy should not be performed, e.g. suspicion of anthrax, Hendra virus. For necropsy performed in necropsy suites, laboratory protocols must be observed.

When conducting field necropsies, observe the following:

- Ensure everyone present at necropsies wears appropriate PPE (e.g. gloves, masks, face shields or goggles and impermeable protective outerwear). Wear cut-proof gloves to prevent sharps injuries. Use respiratory protection (including environmental controls and masks) when bandsaws or other power equipment are used and where airborne infection risks exist e.g. psittacosis, Hendra virus.
- Avoid or limit unnecessary exposure for other personnel.
- Try to carry out the necropsy close to the disposal site to reduce the area contaminated and consider decontaminating the area.
- Depending on the suspected zoonotic disease, the producer may be encouraged to burn or bury the animal on-site. Consider proximity to watercourses, access by other animals (including vermin/wildlife) when disposing of carcasses.
- Seek advice from the DPIRD duty pathologist (9368 3351) if in doubt.

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Sample submission

- Minimise risk to yourself, colleagues, the courier and lab reception by ensuring that all samples are clean, safe and sealed. Tape the submission form on the outside of the esky.
- If zoonotic disease is suspected, notify the lab personally – call ahead (9368 3351) to notify lab receival staff.
- **Cases must be marked as a caution case as a minimum**, if the examination or necropsy required a higher level of caution (as per Annex A and Annex B).

References

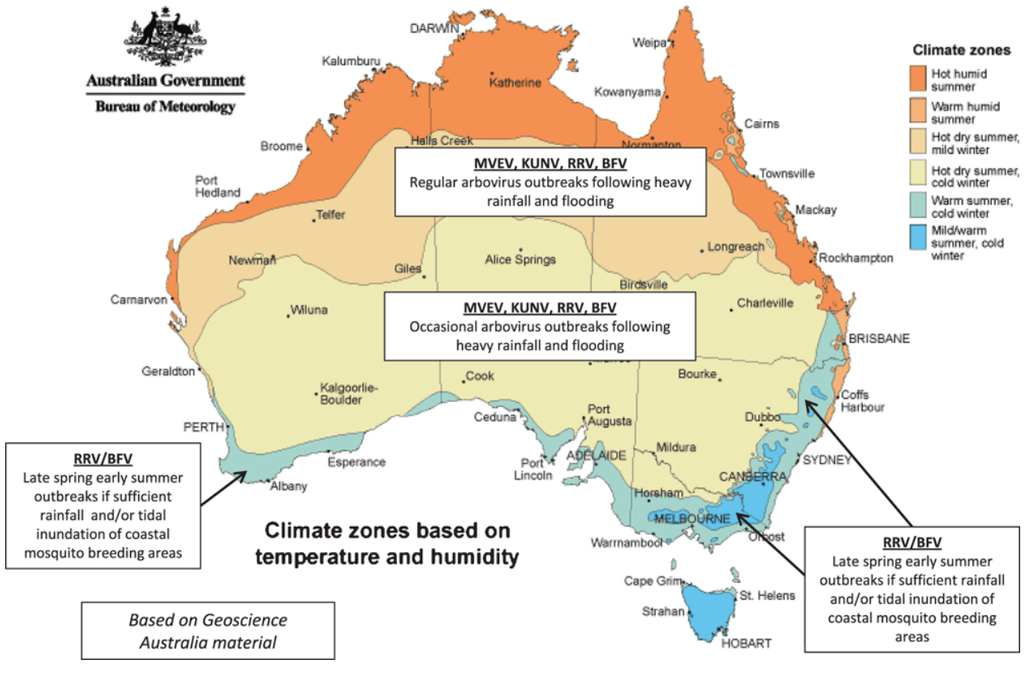
- AVA's Guidelines for Veterinary Personal Biosecurity 2017, 3rd edition
- Government of Western Australia, Department of Health notifiable infectious diseases
- Centers for Disease Control and Prevention, U.S. Department of Health & Human Services
- Queensland Government website: Hendra virus information

Relevant DPIRD documents

- Dealing with aggressive clients
- Job hazard analysis – examinations for disease investigation
- Job hazard analysis – Field veterinary officer field investigation – necropsy
- Job hazard analysis – live animal processing through departmental laboratories
- Job hazard analysis – animal specimen processing through departmental laboratories
- Job hazard analysis – animal carcass processing through departmental laboratories

Figure 1 Australian climatic zones, the predominant endemic arboviruses of human health significance that occur in those regions

http://www.bom.gov.au/climate/averages/maps.shtml



Source: Smith, D.W. (2018, April, published online) Endemic Australian arboviruses of human health significance, Microbiology Australia Vol 39 No 2.

Annex A: Assessing risk of zoonotic disease

Prepare for field visit

The risk assessment process and preparation begins

BEFORE you come into contact with animals or animal products.

1 Consider the nature of the field visit

Routine visit versus disease investigation?

A disease investigation would bear higher risks than a routine visit (e.g. sample collection from an apparently healthy herd for surveillance). However, the absence of apparent disease does not preclude the possibility of an animal harbouring a zoonotic disease agent.

2 Obtain history before conducting field visit

Collect relevant information to determine if zoonotic disease may be present (clinical signs, any previous history, origin of animals, risk factors, sick people).

If the case has been referred by a third party (private vet/DPIRD staff) and information is incomplete, contact the producer or third party to ascertain the case information. Keep in mind that information on history/clinical signs may not be conveyed comprehensively or accurately.

3 Prepare appropriate PPE

Consider the procedures to be conducted and pack appropriate PPE.

Where significant body or aerosolised fluids are present:

- goggles, faceshield – protect against splashes
- P2 mask – protect against aerosolisation when using bandsaw/machinery
- impermeable apron over overalls/impermeable disposable overalls – protect against splashes.

Consider environmental pathogens (e.g. in soil) – cover cuts, wear waterproof footwear around mud, soil and areas of pooled water, and wear gloves when handling soil or mud-soaked items.

The standard precautions below are the basis of infection control and must be complied with at all times.

- Cover skin cuts or abrasions.
- Use hand hygiene, sharps safety.
- Wear closed footwear and protective outerwear.
- Q fever vaccination (working with cattle, sheep & goats).
- Influenza vaccination (working with poultry).
- Always presume that specimens are infectious.
- Wear gloves during sampling and handling.
- Decontaminate containers.

Consider risk indicators (species/syndromic presentation)

Diseases cannot be determined based on species or syndromic presentation. However, the following can act as risk indicators where zoonotic disease may be present and additional precautions may be required. The following is not to be taken in isolation, and you will need to weigh up the context, risk factors, likelihood and consequences of each scenario when deciding which risk mitigations to apply. *Review Annex A in conjunction with Annex B.*

Species	Bats	• Australian bat lyssavirus is endemic in Australian bats and can infect humans. • It is technically feasible for bats to directly infect humans with Hendra virus though this has not yet been recorded. • Do not handle live bats unless trained and vaccinated. • Be aware that mammals can also be infected if exposed to infected bats.
	Wildlife	• If handling psittacines, consider psittacosis. • Be aware of possibility of zoonosis spillover from wildlife.
Syndromic presentation	Abortion / infertility	• This is considered a syndromic presentation with a high risk of zoonotic disease. Pregnant staff to avoid as there is potential contact with birth fluids. • Avoid / reduce contact with placenta, birth tissues, fetal membranes and aborted foetuses • Ensure PPE is worn as many zoonotic diseases that present with abortion/infertility are transmitted via airborne, droplet and contact.

	Sudden death +/- nervous	• Requires further risk assessment, for example:
		  • Are there many deaths in a short timeframe (infectious/toxic)?
		  • What species? (poultry – HPAI; alpaca/camelids susceptible to crytopcoccusand melioidosis in WA)
		  • Is bleeding from orifices present (anthrax)?
		  • Are there bats located on the property (ABLV, Hendra virus)?
		  • Is the animal imported?

	Diarrhoea	• Most zoonotic diseases that present with diarrhoea are transmitted via contact and risk can be effectively mitigated by standard precautions (gloves, hand hygiene).
	Pruritus / skin lesons	• Most zoonotic diseases that present with pruritus/skin lesions are transmitted via broken skin (contact) and risk can be effectively mitigated by standard precautions (gloves, hand hygiene).

	Respiratory +/- nervous +/- production drop	• Requires further risk assessment:
		  • This combination should be treated with more caution when occurring in poultry (LPAI/HPAI).
		  • Rule out noninfectious causes or management issues (e.g. heat, mechanical failure of feed/water system, ergotism) but investigate nonetheless.
		  • Determine potential exposure to wild birds e.g. biosecurity, feed spill event.

Annex B: Precautions to be taken for zoonotic diseases

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Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions
Bats	**Australian bat lyssavirus (ABLV)** • endemic in bats in Australia • has been detected in bats in WA	• has been detected in bats, humans and horses	• nervous signs • unusual behaviour in bitten animal	• severe • death if untreated	• bite or scratches by infected bats (contact)	• **Do not handle live bat without correct training and high rabies vaccination titres.** • Use double/heavy-duty gloves on top of **standard precautions** if handling dead bat. Identify bat species if possible (take photos). • If bitten or scratched by bat, contact Communicable Disease Control (CDC), Department of Health WA on 9388 4800 (office hours) or 9328 0553 (after hours). Post-exposure prophylaxis as directed by CDC, DOH WA may be required.

Wildlife	**Psittacosis**
	(Chlamydophila psittaci)
	• endemic
		• all birds (especially budgies, lorikeets, cockatiels)
		• less common in mammals
			• mucopurulent discharge from nostril and eyes
			• cough
			• depressed
			• death
				• moderate to severe
				• fever, muscle ache, cough
				• complications can develop
					• inhalation of dust from dried faeces and respiratory secretions of infected animal (airborne)	• Use **standard precautions**.
						• Use additional PPE:
						  ◦ face protection (shield/goggles),
						  ◦ P2 mask.
						• Reduce activities that generate dust and aerosolisation (e.g. wing flapping, wet down feathers when conducting necropsy.
						• Handle birds in well-ventilated area.

High mosquito burden	**Arboviruses** Ross River virus (RRV) Barmah Forest virus (BFV) Murray Valley encephalitis virus (MVEV) Kunjin strain of West Nile virus (WNV) • endemic in Australia, activity related to weather and climate, distribution dependent on climatic zones (see Figure 1)	• maintained in cycles between various mosquito species and bird or mammalian hosts	• environmental conditions (including high rainfall, temperatures and/or tides) that support extensive mosquito breeding • abundance of suitable amplifying animal hosts in the region • recent or ongoing epidemics in humans in locality • See Figure 1 for predominant endemic arboviruses of human health significance according to climatic zones.	RRV and BFV • moderate to severe • painful or swollen joints, sore muscles, skin rashes, fever, fatigue and headaches – may persist for weeks or months MVE, KUN • moderate to severe • fever, drowsiness, headache, stiff neck, nausea, and in severe cases, fits, coma, permanent brain damage or death	• mosquito bites (vector), several different species involved • does not occur directly from infected hosts	• Avoid areas or times when mosquito burden is high. • Use personal insect repellent, active ingredients DEET or picaridin recommended. • Wear long, loose-fitting, light-coloured clothing. • Ensure effective insect screening if not possible to avoid mosquito-prone areas (worksite, accommodation, tents, swags, etc).

Often asymptomatic	**Q fever**
	(Coxiella burnetti)
	• endemic
		• wide range, especially cattle, sheep, goats	• intensive, high-density settings e.g. abattoir, feedlots, stockyards
			• abortion / infertility
				• moderate to severe
				• fever, muscle ache, cough
				• complications can develop
					• inhalation of dust with bacteria (aerosol).
					• direct/indirect contact with infected animal tissue or fluids on broken skin (contact).
					• handling infected animals/tissues/fluids, birthing tissue/fluids and fetus (contact, aerosol)
					• drinking unpasteurised milk from infected animals (ingestion)
						• Use **standard precautions** (includes Q fever vaccination).
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles),
						  ◦ P2 mask,
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron.

Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions

Often asymptomatic (continued)	**Leptospirosis**
	(serovars of *Leptospira interrogans and Leptospira borgpetersenii*)
	• endemic
		• wide range, especially livestock, dogs, rodents, wild animals	• abortion / infertility
			• systemic illness
			• drop in productivity e.g. ill-thrift / reduced milk
			• red urine (in cattle)
				• moderate to severe
				• wide variety of signs including abortion/ infertility, fever and gastrointestinal
				• complications can develop
					• occurs via broken skin (contact) or mucous membranes (droplet) – from urine, body fluids (except saliva), or environment contaminated with urine and body fluids of infected animals (e.g. water or soil).	• Consider the environment you are working in and wear appropriate gear:
						  ◦ wear waterproof footwear around mud, soil and areas of pooled water, and wear gloves when handling soil or mud-soaked items.
						• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron.

Respiratory / Sudden death	**Anthrax**
	(Bacillus anthracis)
	• endemic in Australia
	• last occurred in WA (Walpole) in 1994
		• wide range, especially cattle, sheep	• rapid bloating
			• bloody discharge from orifices
			• occurs following soil disturbance or major weather events
			• access to carcasses/ bones to chew on
				• mild to severe
				• most common is cutaneous form (mild)
				• inhalation form rare, potentially fatal
					• inhalation of spores (aerosol)
					• contamination with infected material via broken skin (contact)
					• eating infected material such as meat or milk (ingestion).
						• Do not perform necropsy until anthrax exclusion testing completed. Contact duty pathologist and manager for advice.
						• Take bloody exudate from bleeding orifices to rule out anthrax. See veterinary sampling guide for anthrax.
						• Use **standard precautions**.
						• Use additional PPE:
						  ◦ face protection (shield/goggles),
						  ◦ P2 mask
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron.

	Hendra virus
	(Equine morbillivirus)
	• no recorded disease in WA
	• flying foxes in northern WA have shown evidence of exposure to Hendra virus
	• present in QLD, NSW 'Hendra belt'
		• horses	• respiratory signs
			• neurological signs
			• rapid onset of clinical signs
			• close contact between flying foxes and horses (e.g. outdoor housing and feeding under trees and bats roosting in barns)
			• introduced horse from QLD, NSW or returning from event in QLD, NSW
				• severe
				• fever, malaise, encephalitis leading to convulsions & coma
				• death
					• close contact with infected equine tissues or bodily fluids (especially respiratory fluids such as mucus)
					• direct bat to human transmission not proven.
						• Use **standard precautions**.
						• Use additional PPE:
						  ◦ face protection (shield/goggles)
						  ◦ P2 mask
						  ◦ impermeable disposal gloves, double-gloved,
						  ◦ impermeable disposable overalls (long sleeves with a hood) / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.
						• Isolate horse from humans, horses and other animals. Limit procedures to necessary procedures for immediate treatment and attending to horse's welfare. Avoid high-risk procedures that could result in high level of exposure to horse's blood, tissues, respiratory secretions and other body fluids.
						• See bats for precautions in event of possible contact with bats.
						• See Queensland Government website on Hendra virus for more information.
						• See bats for precautions relating to bats.

Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions

Respiratory / Sudden death (continued)	**Melioidosis**
	(Burkholderia pseudomallei)
	• environmental pathogen
	• no clearly documented cases of zoonotic transmission
	• endemic in tropical areas of WA (e.g. Derby, Kununurra, Wyndham)
	• sporadic occurrence in southern WA including Gidgegannup, Toodyay and Chittering
		• wide range including mammals, birds, reptiles
		• anecdotally camelids appear particularly susceptible in WA
			• varying clinical signs in different species
			• respiratory signs and acute disease resulting in sudden death in camelids have been observed in cases in WA
				• moderate to severe
				• fever and flu-like symptoms that can lead to further complications and death
					• risk of zoonotic transmission is low
					• occurs via environmental sources (soil & water) by broken skin (contact), mucous membranes (droplet), ingesting contaminated water or soil (ingestion), or inhalation of organism that may become aerosolised during heavy rainfall or strong winds (aerosol).
						• Use **standard precautions**.
						• Consider the environment you are working in and wear appropriate gear:
						  ◦ wear waterproof footwear around mud, soil and areas of pooled water, and wear gloves when handling soil or mud-soaked items
						  ◦ disturbed soil (e.g. due to excavation, flooding or erosion) are higher risk factors.

	Cryptococcus
	(in particular *Cryptococcus. neoformans* and *C. gatti*)
	• environmental pathogen
	• no clearly documented cases of zoonotic transmission
	• occurs worldwide (no specific geographical distribution).
		• wide variety of mammals
		• *C. neoformans* strongly associated with columbiform bird droppings
		• *C. gatti* associated with trees as main reservoir
			• respiratory signs	• moderate to severe
				• respiratory symptoms that can lead to complications and death
					• risk of zoonotic transmission is low
					• occurs via inhalation of yeast particles that become airborne (aerosol)
						• Use **standard precautions**.
						• Consider the environment you are working in and wear appropriate gear:
						  ◦ P2 mask if working in poorly ventilated, dusty environment
						  ◦ consider P2 mask or moving away from areas heavily contaminated by bird faeces or underneath gum trees used by birds as roosts or nests.

	Highly pathogenic avian influenza (HPAI)
	(Influenza A virus – highly pathogenic strains)
	• occurred in Australia
	• no recorded cases in WA
		• poultry	• high morbidity (respiratory signs, depression)
			• high mortality (e.g. >0.5% per day in poultry farms)
			• exposure to wild birds (water birds)
			• close proximity to water bodies with water birds
				• moderate to severe
				• flu-like symptoms that can lead to complications and death
					• infrequent transmission from birds to humans
					• transmission occurs via close contact with infected tissues and body fluids (contact, aerosol, droplets)
						• Use **standard precautions** (includes influenza vaccination).
						• Use additional PPE:
						  ◦ face protection (shield/goggles)
						  ◦ P2 respirator
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

	Newcastle disease (Avian paramyxovirus serotype 1 virus – virulent and avirulent) • occurred in Australia	• poultry	• morbidity (respiratory signs, depression, reduced production) • mortality (e.g. >0.5% per day in poultry farms) • virulent strains tend to have higher morbidity and mortality (>0.5% per day) than avirulent strains.	• mild • self-limiting conjunctivitis	• transmission via handling infected birds (direct contact)	• Use **standard precautions**.

Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions
Nervous	**Streptococcosis** *(Streptococcus suis)* • can be found in tonsils of healthy pigs	• pigs	• can occur at any age and also be asymptomatic • more common in young pigs	• moderate to severe • fever, meningitis, permanent hearing loss in 50% • toxic shock syndrome • death	• rarely transmitted from animals • usually transmitted through broken skin (direct contact), to lesser extent via fomites (indirect contact), aerosol or ingestion	• Use **standard precautions**.
	Listeriosis *(Listeria monocytogenes)* • endemic	• ruminants, • pigs (rare)	• encephalitis that affects all ages • epidemic in feedlot cattle or sheep	• moderate to severe • wide variety of symptoms (from foodborne to systemic presentations) • immunocompromised personnel at higher risk	• in listeria encephalitis, *L. monocytogenes* usually confined to brain and presents little risk of transmission unless brain removed	• Use **standard precautions**.

Abortion/ infertility	**Q fever**
	(Coxiella burnetti)
	• endemic
		• wide range, especially cattle, sheep, goats	• intensive, high density settings e.g. abattoir, feedlots, stockyards
			• abortion / infertility
				• moderate to severe
				• fever, muscle ache, cough
				• complications can develop
					• inhalation of dust with bacteria (aerosol)
					• direct / indirect contact with infected animal tissue or fluids on broken skin (contact).
					• handling infected animals / tissues / fluids, birthing tissue / fluids and fetus (contact, aerosol)
					• drinking unpasteurised milk from infected animals (ingestion)
						• Use **standard precautions** (includes Q fever vaccination).
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ P2 mask
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

	Leptospirosis
	(serovars of *Leptospira interrogans and Leptospira borgpetersenii*)
	• endemic
		• wide range, especially livestock, dogs, rodents, wild animals	• abortion / infertility
			• systemic illness
			• drop in productivity e.g. ill-thrift / reduced milk
			• red urine (in cattle)
				• moderate to severe
				• wide variety of signs including abortion / infertility, fever and gastrointestinal
				• complications can develop
					• broken skin (contact) or mucous membranes (droplet) – from urine, body fluids (except saliva), or environment contaminated with urine and body fluids of infected animals (e.g. water or soil)	• Consider the environment you are working in and wear appropriate gear:
						  ◦ wear waterproof footwear around mud, soil and areas of pooled water, and wear gloves when handling soil or mud-soaked items.
						• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions

Abortion/ infertility (continued)	**<u>Brucellosis</u>**
	(Brucella suis)
	• present in Australia, exotic to WA
	• Australia free of *B. abortus*, *melitensis* and *canis.*
	• ***B. ovis* not zoonotic.**
		• pigs	• exposure of pigs to feral pigs	• moderate to severe
				• intermittent fever
				• malaise
				• chronic illness can last for year or more even after treatment
				• death
					• broken skin (contact) or mucous membranes (droplet) –body fluids, tissue
					• drinking unpasteurised milk from infected animals (ingestion).
					• rarely via inhalation (aerosol) and this is usually in laboratory setting
						• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

	Psittacosis
	(Chlamydia psittaci)
	• endemic
		• horses	• abortions, sick neonate foals
			• abnormal placenta
				• moderate to severe
				• fever, muscle ache, cough
				• complications can develop
					• inhalation (aerosol), handling equine abortions, sick neonate foals (contact, droplet)	• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron.

	Toxoplasmosis
	(Toxoplasma gondii)
	• endemic
		• abortion syndrome in sheep
		• affects wide range of mammals, especially Australian marsupials that present as neuro or sudden death syndrome
			• abortion
			• exposure to cats, vermin
				• disease is rare, mostly asymptomatic – human seroprevalence in Australia approx. 50%
				• moderate to severe
				• wide variety of symptoms (from food-borne to systemic presentations)
				• immunocompromised personnel at higher risk
					• eating tissue cysts via faecal-oral route (ingestion) – this route is most prominent for infected cats	• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

	Listeriosis
	(Listeria ivanovii)
	• *L. ivanovii* less widespread in environment compared to *L. monocytogenes*
		• ruminants (especially sheep)	• abortions
			• feedlot or housed ruminants with access to poor quality silage
				• moderate to severe
				• wide variety of symptoms (from foodborne to systemic presentations)
				• immunocompromised personnel at higher risk
					• listeriosis in humans due to *L. ivanovii* is rare. Most cases are due to ingestion of contaminated foodstuffs rather than contact with animals	• Use **standard precautions**.
						• Use additional PPE especially if dealing with birthing / abortion / infertility issues:
						  ◦ face protection (shield/goggles)
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

Diarrhoea	***E. coli*** **Salmonellosis** **Campylobacteriosis** **Yersiniosis** **Cryptosporidiosis** • endemic	• wide range, poultry, cattle, sheep, goats, horses, pigs etc	• animals may be asymptomatic	• mild to severe • gastrointestinal symptoms for humans – may be mild or severe • complications can lead to death	• faecal-oral contact, e.g. when hands contaminated with infected faecal material contacts mouth (ingestion)	• Use **standard precautions**.

Risk indicator	Zoonotic disease	Species	Other supporting risk indicators	Consequence in humans	Transmission mode from animals to humans	Precautions

Production drop	**Low pathogenic avian influenza (LPAI)**
	(Influenza A virus – low pathogenic strains)
	• endemic
		• poultry	• reduced production (>10% drop in egg production over 2-3 days, or
			• appearance of 5% abnormal eggs (misshapen, abnormal colour) over 2–3 days
				• mild to severe
				• incidental, less likely than HPAI to transmit to humans
				• serious LPAI H7N9 only in China to date
					• infrequent transmission from birds to humans
					• transmitted by close contact with infected tissues and body fluids (contact, aerosol, droplets)
						• Use **standard precautions** (includes influenza vaccination).
						• Use additional PPE:
						  ◦ face protection (shield/goggles)
						  ◦ P2 respirator
						  ◦ impermeable disposable overalls / cotton or disposable overalls with splash-proof apron
						  ◦ rubber boots.

Skin lesions	**Erysipelas** *(Erysipelothrix rhusiopathiae)* • endemic – resides in tonsillar tissue of up to 50% of healthy pigs in intensive swine production, shed in faeces or oronasal secretions	• pigs • sheep	• skin lesions (diamond red lesions), accompanied by fever / lameness / sudden death in pigs • arthritis in sheep	• mild to severe • cutaneous form most common, self-limiting skin lesions • rare severe systemic form • death	• most commonly transmitted via broken skin (contact)	• Use **standard precautions**.
	Orf (scabby mouth virus) • endemic	• sheep, goat	• lesions usually found on lips, muzzle, in mouth or teats	• mild to moderate • self-limiting skin lesion with fever • complications can arise in immunocompromised to cause more progressive lesions	• broken skin (contact)	• Use **standard precautions**.
	Dermatophilosis *(Dermatophilus congolensis)*	• cattle, sheep, goats, horses (esp. cattle)	• superficial exudative dermatitis • distribution along areas of skin exposed to prolonged wetting	• mild to moderate • development of non-painful pustules on the hands and arms, rupture to form shallow red ulcers that heal leaving scars	• broken skin (contact)	• Use **standard precautions**.
	Ringworm (Dermatophytosis) • Endemic	• wide range, most mammals	• hairless, crusty, circular areas on skin	• mild • self-limiting skin lesions	• broken skin (contact)	• Use **standard precautions**.

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