Introduction to biological safety

Dr Amanda Jones
Lead Biosafety Advisor
The University of Queensland
Outline

• Key learning objectives
• Terminology
• Biosafety basics
• Biological risks
  – Identification
  – Management
  – Controls
Learning outcomes

• Understand –
  – What is biosafety and why is it important?
  – What situations might biological safety be a consideration?
  – Keys ways to manage biosafety
Terminology
Biosafety basics
Identification of biological risks

Viruses

Fungi

Bacteria

Parasites
Identification of biological risks

What is the likelihood of actual exposure to the hazard? Are workers in contact with the mechanism of exposure?

- Bugs
- Animals
- Water
- People
Identification of biological risks
Identification of biological risks

- 1918: 'Spanish flu' H1N1 influenza (~50 million deaths)
- 1937: 1937–1958 'Asian flu' H2N2 influenza (~100,000 deaths)
- 1957: 'Hong Kong flu' H3N2 influenza (~700,000 deaths)
- 1968: 'Russian flu' H1N1 influenza
- 1976: 1977
- 1981: HIV (>30 million deaths)
- 1994: 'Avian flu' H5N1 influenza (>371 deaths)
- 1999: 1999–2002 H9N2 and H7N7 influenza One death
- 2002: 'Swine flu' H1N1 influenza (>15,000 deaths)
- 2009: 'Avian flu' H7N9 influenza 44 deaths
- 2012: 2012–2013 MERS coronavirus 54 deaths
- 2013: 2012

West Nile virus >15,000 deaths in the United States
Ebola virus >1,553 deaths
Hendra virus Four deaths
Nipah virus >250 deaths

Nature Reviews | Immunology
Identification of biological risks

- Cholera
- Typhoid
- Giardia
- Diarrhoea
- Hepatitis A
Identification of biological risks

Human pathogen transmission

- Infection caused by airborne transmission
- Infection caused by contact and faeces
- Infection caused by contaminated water
- Infection caused by pathogens in bloodstream and tissues
Managing biohazards

What are the consequences of exposure:

• Low
• Medium
• High
• Critical/extreme
Scenario 1

- Bubonic plague
- "The black death"
- 50 million people dead in 14th century
Scenario 1

Bubonic plague
- "The black death"
- 50 million people dead in 14th century
- 650 people diagnosed annually
- 1:6 die
- 7 human cases/year in USA
- Researcher at Chicago Uni died from Y. Pestis in 2009
Scenario 2

Ebola virus

- Over 11,000 people dead
Scenario 2

Ebola virus

- Over 11,000 people dead
- Health care workers returned to USA and Spain - subsequent illness and death & transmission to others.
Scenario 3

Smallpox

- Ancient disease spread by human contact.
- Fatal in up to 30% of cases.
- Declared ‘eradicated’ by WHO in 1980
Scenario 3

Smallpox

- Ancient disease spread by human contact.
- Fatal in up to 30% of cases.
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- Lab accident in 1978 from Smallpox, acquired at work.
What are the consequences of exposure:

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Non-traditional exposures

- Workers who don’t know they have been exposed to anything.
- 19% exposed to biological hazards
- 75% exposed to human bodily matter
- 30% exposed to live animals/animal products.
Scenario 4

Cane Field workers

- Dirt
- Sharp equipment
- Potential flammable liquids
Scenario 4

Cane Field workers

- Dirt
- Sharp equipment
- Potential flammable liquids
- Rats, wild pigs, leptospirosis
Scenario 5

Railway workers

- Dirt and debris
- Large moving objects
- Electricity
Scenario 5

Railway workers

- Dirt and debris
- Large moving objects
- Electricity
- Roadkill/animal carcasses, Q fever, tetanus, etc.
Scenario 6

Frequent travellers
- Lack of sleep/exhaustion
- Sore back from cramped seats
- DVT
Scenario 6

Frequent travellers
- Lack of sleep/exhaustion
- Sore back from cramped seats
- DVT
- Other travellers, colds, flu, viruses, measles...
Exposure rates

- ~300,000 workers die each year from communicable diseases caused by work-related exposure.
- 1300 workers per year compensated for diseases caused by animal, human or biological factors.
Exposure test

Do you have biohazards in your workplace?

• Mould?
• People?
• Dirt?
• Sewage?
Do your workers:

- Work in isolation?
- Have an underlying medical conditions?
- Travel for work?
Managing biohazards

Risk treatment:
• Elimination?
• Isolation?
• Engineering controls?
• Behavioural, admin, PPE?
Managing biohazards

Prevention?
Legislation

- GM - Gene Technology Act and Regulations
- Biosecurity Act (C’th) + state Biosecurity acts
- Defence Trade Controls Amendment Act - Defence Strategic Goods Act
- National Health Security Act, Security sensitive biological agents standards
Questions?