# Emerging & re-emerging foodborne and zoonotic risks

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# Some of the "new" infectious diseases since I started medicine

1980	HTLV I	1993	Four-corner disease
1980	Hepatitis E	1994	Brazilian HF
1981	Staphylococcal TSS	1994	Hendra virus
1982	E.coli O:157 (EHEC)	1995	Australian Bat Lyssavirus
1982	HTLV II	1996	HHV-8 (Kaposis sarcoma)
1982	Borrelia	1996	var Creutzfeldt-Jakob disease
1983	HIV	1997	Avian influenza, Hong Kong
1983	Helicobacter pylori	1999	Nipah virus
1988	HHV-6	2000	West Nile fever in US
1989	Erlichiosis	2001	Human metapneumovirus
1989	Hepatitis C	2003	SARS coronavirus
1991	Venezuelan HF	2009	Influenza A/H1N1
1992	V. cholerae O139	2012	MERS-CoV

1992 Bacillary angiomatosis

# *"emerging infectio\* disease\*",* PubMed entries, 1973 to 2015



# **Emerging infectious diseases**

"We can define as emerging infections that have newly appeared in the population, or have existed but are rapidly increasing in incidence or geographic range."

> Stephen Morse in *Emerging Infectious Diseases* (1995) http://www.cdc.gov/ncidod/eid/vol1no1/morse.htm

#### Factors in infectious disease emergence

Microbial adaptation & change

Medical care & technology

Technology & industry

Intensive food production Extensive irrigation International travel & commerce

> Transmission route Microbe Human Environment

**Urbanisation** 

development & land use)

**Ecological changes** 

(including economic

Human mobility Refugee crises Liberalised trade

> Breakdown in public health measures

Human demographic & behavioural change

Changing population age structure IDU

Sexual behaviour

Climate change Ecosystem disturbance

after Morse, 1995 & McMichael 2001 & 2004

## Food-borne and zoonotic diseases



# Outline

- Some Tasmanian food-borne & zoonotic risks
  - Tularaemia
  - Q fever
  - Salmonella
    - S. Mississippi
    - S. Typhimurium PT160
    - Antibiotic-resistant serovars
    - Recent trends in food-borne serovars
  - Listeriosis
- Some practical & strategic national responses

# A zoonotic disease we're not supposed to have, but ...

# Tularaemia

- Francisella tularensis
  - 4 subspecies with different
    - Distribution
    - Ecology
    - Virulence
- Transmission
  - Inhalation
    - => Pneumonia, Septicaemia
  - Direct inoculation or insect bite
     => Ulceroglandular
  - Via water or food
     => Oropharyngeal



# Case 1: Zeehan Highway, about 3km on the Queenstown side of the Henty River Bridge



Image: Google Maps



Ringtail possum (*Pseudocheirus peregrinus*) as photographed by its bite victim, Tasmania, Australia, 2011. From Jackson J et al. *Francisella tularensis* subspecies *holarctica*, Tasmania, Australia, 2011. Emerg Infect Dis. 2012; 18(9): 1484-6. <u>http://wwwnc.cdc.gov/eid/article/18/9/11-1856\_article.htm</u>

# Case 1, February 2011

- Remote western Tasmania
- Ring-tailed possum bite to hand
- Ulceroglanduar tularaemia
- Sequencing of genetic material from the affected tissues
  - F. tularensis subspecies holarctica biovar japonica
- Supported by DFA, real-time PCR & serology
- Treatment complicated, prolonged

## Case 1



#### Case 2: Zeehan Highway, 150-200m NW of Westerway Creek



Image: Google Maps

Sites of the two possum encounters during 2011, in February (Case 1) & September (Case 2)



# **Public Health Response**

- Notifications State, national, WHO
- Ruled out non-possum sources of infection
- Assessed likelihood of bioterrorism
- Alerts field & lab workers, animal handlers, vets, doctors, public
- Sought unrecognised or historical cases
- Risk assessment of rainwater tanks
- Multi-agency, human & animal health
  - Field investigation
  - Surveillance
  - Response plans

# Reader's Digest, July 2012



## Reader's Digest, July 2012



 ProMED posting

 Emerging Infectious Diseases 2012; 18(9): 1484-6. DISPATCHES

#### *Francisella tularensis* Subspecies *holarctica*, Tasmania, Australia, 2011

Justin Jackson, Alistair McGregor, Louise Cooley, Jimmy Ng, Mitchell Brown, Chong Wei Ong, Catharine Darcy, and Vitali Sintchenko

We report a case of ulceroglandular tularemia that developed in a woman after she was bitten by a ringtail possum (*Pseudocheirus peregrinus*) in a forest in Tasmania, Australia. *Francisella tularensis* subspecies *holarctica* was identified. This case indicates the emergence of *F. tularensis* type B in the Southern Hemisphere.

# Tularaemia in Tasmania

- The ecology remains largely cryptic
- Advice to at risk is based on general principles
- Clinical vigilance and modern diagnostic methods are our sensors for further cases



A zoonotic disease we're supposed to have ...

# Q fever

• Pan-global distribution ...

except ...



# Q fever

• Pan-global distribution ...

except ...



... and



???

# Q fever notifications, 1995 to 2014

Annual Case count

Annual rate (/10^6)

	Average	Range	Average
ACT	0.65	0 to 2	0.2
NSW	192	128 to 308	2.9
NT	1.4	0 to 5	0.64
QLD	224	131 to 443	5.8
SA	15	4 to 40	0.99
TAS	0.15	0 to 1	0.03
VIC	34	13 to 77	0.69
WA	11	2 to 28	0.48
Australia	479	314 to 792	2.4

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TAS	0.15	0 to 1	0.03	elsewhere
VIC	34	13 to 77	0.69	in Australia
WA	11	2 to 28	0.48	• 3 cases in
Australia	479	314 to 792	2.4	20 years

# Risks?



Geelong

#### Meredith goat's cheese maker's million-dollar push to find Q fever vaccine

October 23, 2015 11:18am
 Mandy Squires Geelong Advertiser



Goat farmer Sandy Cameron. and Dr John Stenos. Picture: Mike Dugdale

THE owner of Meredith Dairy is spending more than \$1 million to fund the development of a vaccine to fight a Q fever outbreak on his property.

# Risks?



Do changing agricultural practices pose a risk of introduction & establishment? Geelong

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#### Salmonella

#### Salmonella in Tasmania, 1995 to 2014



Year

Notifications to CDPU

# Salmonella Mississippi

- Most common serotype in Tasmania
  - Serotype-specific rate very high
  - Environmental exposure, native animals, raw water
  - Very rare elsewhere in Australia
- Restaurant outbreak, late 2012
  - Epidemiological link to salad, mostly Tasmanian
  - Coincident increase in community cases
  - Are we missing foodborne transmission?
  - Changing production or consumption patterns?

# Salmonella Typhimurium PT 160

- Rare in Australia before 2008
- New Zealand

Epidemic and enzootic from ~2000

- Emerged in Hobart in 2008
  - Human cases
    - Suburban & semi-rural
    - Some direct and indirect bird contact
  - Coincident sparrow deaths, isolates of STm 160
  - Infection in other birds & mammals uncommon

# Human Cases of *Salmonella* Typhimurium PT 160, Tasmania, 2008 to late 2015 \*



Year

\* Notifications to CDPU, to 24-Nov-15



*The Birdbath* Katherine Cooper

# Resistant monophasic Salmonella -Tasmania

- Salmonella subsp | ser 4,5, 12:i:- (PT 193)
- Resistant to amp, strep, sulpha
- September 2015
  - 3 cases
  - farmer, abattoir worker, contact with ill calf
  - reports of salmonellosis in cattle (similar time & region)

## Salmonella Typhimurium - Tasmania

- Large egg-associated outbreaks
  - 2005, 2007-08
  - Producer closed
  - Raw egg guideline developed
- Fewer, small outbreaks



 Phage types of sporadic disease now mostly similar to mainland Australia

# Salmonella - Australia

- Highest rates ever, almost everywhere
- S. Typhimurium
  - 40 50% of cases in most states
  - Major contributor to overall increase, esp. egg-associated phage types
- Emerging evidence of *S*. Typhimurium linked to eggs
  - Salmonella outbreaks with egg-containing vehicles, 2001 to 2012 (n=166) \*
    - 150 were S. Typhimurium (PT 170/108, PT 44, PT9)
  - Trace-backs & environmental testing \*
    - ~50% of tested farms had strains of *S*. Typhimurium matching outbreak strain
  - Source attribution studies #
    - Modelled South Australian data for 2000 to 2010
    - Eggs were major source (~50%) of human salmonellosis
- Risk of contamination per egg very low, but ...
  - Egg consumption massive
  - Pooled eggs amplify risk

\* OzFoodNet data (unpublished) # Glass K et al. Bayesian Source Attribution of Salmonellosis in South Australia. Risk Anal. 2015 Jul 1 (in press)

#### Listeriosis – National surveillance 1.0

- Virgin chicken wrap outbreak, 2009
- Surveillance activities woven together
  - Commonwealth & jurisdictional Health Depts
  - Public Health Labs
  - Diagnostic and testing Labs
  - Limitations
    - Typing nomenclature complex, interpretation difficult
    - Lack of central coordination & regular reporting

## Listeriosis – National surveillance 2.0

- OzFoodNet Epidemiological coordination
- Agreed suite of typing & nomenclature

Molecular serotype	Binary Type	PFGE patterns	MLVA	MLST
1/2c, 3c	82	8E:110B:2T	04-20-20-04-03-13-10-04-00	9

- Regular reporting
- More potential links identified
  - Cases with shared typing more, smaller clusters
  - Case & product "pairs". Significance?

- 3 cases, all at high risk
  - Onset 30 September 2012
  - Onset 15 September 2013
  - Onset 11 August 2014
- All exposed to hospital during incubation

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- All exposed to hospital during incubation
- All same molecular subtype
- Extensive investigation, testing & cleaning after second & third cases
  - Implicated subtype detected after third case in kitchen equipment & sandwiches
- Low *Listeria* diets?

## Listeriosis – National surveillance 3.0

- Further building on existing processes
  - Efficient use of genomics, laboratory capacity, bioinformatics
  - Epidemiological hub (OzFoodNet)
  - Fortnightly reporting



# Challenges – 1

- Genomics & bioinformatics
- Culture independent diagnostics
- Cost, clinical versus public health imperatives

- Underlying determinants of EIDs

   political, economic, industrial, legal, social
- Risk communication

# Challenges – 2

- Infection control & prevention around EIDs
  - Practically often straightforward
  - But emerging pathogens may be unfamiliar
    - (first responders, animal & human health clinical and laboratory agencies)
    - Different processes
    - Difficult risk communication
- Managing public health aspects of EID needs ...
  - "One Health" thinking & relationships & capacity
  - Engaged hospital & healthcare services
    - particularly IPC and S&Q domains

#### Practical & Strategic National Responses

# Series of National Guidelines (SoNGs)

- Avian influenza ٠
- Dengue ۲
- Ebolavirus •
- Haemophilus influenzae type b ۲
- Hendra virus ٠
- Hepatitis A ٠
- Hepatitis C ٠
- HIV •
- Invasive Meningococcal Disease ۲
- Influenza ۲
- Legionellosis ٠

#### Measles •

- **MERS-CoV** •
- **Murray Valley Encephalitis** •
- Pertussis •
- **Rabies & ABLV** •
- Syphilis •
- Trachoma
- **Tuberculosis**

#### http://www.health.gov.au/cdnasongs

# National Framework for Communicable Disease Control



- Focus of initial Implementation Plan ...
  - Leadership & governance
  - Surveillance & public health laboratory testing
  - Information systems & research capacity

http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-natframe-communic-disease-control.htm

#### Practical & Strategic National Responses

- Emergency Response Plan for Communicable Diseases of National Significance
- Networks such as OzFoodNet
- Centres and CREs for EIDs, Biosecurity, Emergency Responses, Antimicrobial Resistance ...

# Thank-you

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  - Michelle Harlock (OzFoodNet, Tas)
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  - CDNA
  - NCEPH, ANU
  - UTas
  - MDU, University of Melbourne
  - ... in Infectious Diseases, Infection Control, Microbiology, Public Health



Sheoak on Second Bluff Lola Burrows