Echinococcus Transmission and Control

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What is *Echinococcus*?
• A genus comprising tapeworms that infect carnivores, mainly canids but also vulpids and more rarely also felids

• The eggs of this tapeworm are infective to a range of herbivorous and omnivorous species, including humans
• *Echinococcus* is not a food-borne parasitic infection for humans
• Human infection occurs through accidental ingestion of *E. granulosus* eggs (passed into the environment in dog faeces
• Control centres around stopping transmission from dogs to domestic livestock through the control of tapeworm infection in domestic dogs
Two morphologically distinct life cycle stages

Images from the Tasmanian Hydatid Control Campaign
Why is *E. granulosus* important?

- It can infect people causing serious morbidity and in extreme situations, death.
- Infects livestock causing ill-thrift.
- Infects wildlife causing morbidity and death in intermediate hosts.
Human hydatid cysts

Liver 70%
Lungs 20%
Other 10%
Echinococcus species

- *Echinococcus granulosus*
- *E. multilocularis*
- *E. oligarthus*
- *E. vogeli*
- *E. shiquicus***

*Only species that occurs in Australia*

***Zoonotic status not known*
Echinococcus species

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Echinococcus: world distribution
Echinococcus granulosus is the most important member of the genus in terms of global distribution and public health impact.
Echinococcus granulosus

Tapeworms in definitive hosts (carnivores – canids/vulpids)

Cysts in internal organs of intermediate host

Eggs ingested by herbivorous/omnivorous intermediate hosts

Eggs in faeces/environment.
Domestic animal transmission

Tasmanian Hydatid Control Campaign
Origin of Australian *Echinococcus*

- *Echinococcus granulosus* arrived in Australia with domestic animals (dogs and sheep) during settlement
Distribution of *E. granulosus* in Australia
Between 80-100 cases of human hydatidosis diagnosed, nationally, each year

Wildlife transmission (reservoir)
Predator/prey interaction
Australian wildlife reservoir hosts
Native wildlife is highly susceptible to *E.granulosus*
Urban dingo spreading eggs of *E. granulosus*?

Images by M Goullet

E. granulosus can transmit to humans in hot and dry environmental conditions if assisted by human behaviour............ an example.....the Turkana District of north western Kenya
Location of the Turkana District
Turkana District topography
Our Camp in Turkana
Turkana are nomadic pastoralists
Turkana livestock

...also goats
Weather

- Hot and dry (day time ambient 40-45°C; at soil level 50-60°C)
Rainfall

- Short wet season
Sources of drinking water
Hydatidosis in the Turkana
Really bad environmental conditions for optimal transmission of *E. granulosus*!

So why are so many people infected?
The Turkana have a special relationship with their dogs
Dogs are intimately involved in most aspects of Turkana life
Dogs act as assistant child minders
Turkana women more commonly infected than men
Control of *E. granulosus* transmission

- Do not allow dogs access to offal (domestic & wild animals)
- Confine dogs; offal pits
- Treat dogs with de-worming products
- Feed dry/tinned/cooked food
- Public education
- Vaccination of livestock*
Monitor control success through.....

- Meat inspection
Monitoring infection/reinfection in dogs

- Post mortem examination

- Purging with arecoline hydrobromide
Immunodiagnostic methods

• Serological diagnosis

• Coproantigen detection
Treatment for dogs

Praziquantel
5mg/kg
E. multilocularis
Occurrence

- Northern hemisphere
  - Russia
  - China
  - Japan
  - Northern Canada
  - Parts of the USA
Risk factors associated with human *E. multilocularis* infection.

- Living in a rural environment, on or near a farm.
- Engaged in full-time/part-time farming or gardening.
- Owning a free-ranging dog and/or cat.
- Changed land use (forest cleared for agriculture/pasture)
Echinococcus multilocularis
(Alveolar echinococcosis)
Echinococcus multilocularis in Europe
(Data and some images supplied by Dr Daniel Hegglin, University of Zurich, Switzerland)
Distribution of *Echinococcus multilocularis* in Europe 1990
Distribution of *Echinococcus multilocularis* in Europe 2006.
(Dark green: highly endemic)
Recent reports from new geographical locations

Post 1990, *E. multilocularis* has been reported in...

- Denmark.
- Netherlands.
- Belgium.
- Lithuania.
- Poland.
- Slovakia
- Latvia.
- Estonia.
Hunting bag & foxes found dead in Switzerland 1968-2004
Annual hunting bag of foxes in Baden-Württemberg.
Annual hunting bag of foxes in Baden-Württemberg. 
(Arrow = start of oral rabies vaccination program)
Human alveolar echinococcosis & hunting statistics

(Schweiger et al. 2007, Emerging Infectious Diseases)
Now there is a potential risk for urban transmission via dogs and cats

- Dogs/cats catching/eating rodents
Since *E. granulosus* and *E. multilocularis* have such contrasting lifecycles and epidemiology, the OIE Ad Hoc Working Group on Zoonoses has addressed these parasites in separate chapters of the Terrestrial Code. A revised Chapter 8.4 will cover infection with *E. granulosus* and a new chapter will cover infection with *E. multilocularis*. 