# Key considerations on implementation, monitoring, evaluation of echinococcosis control actions

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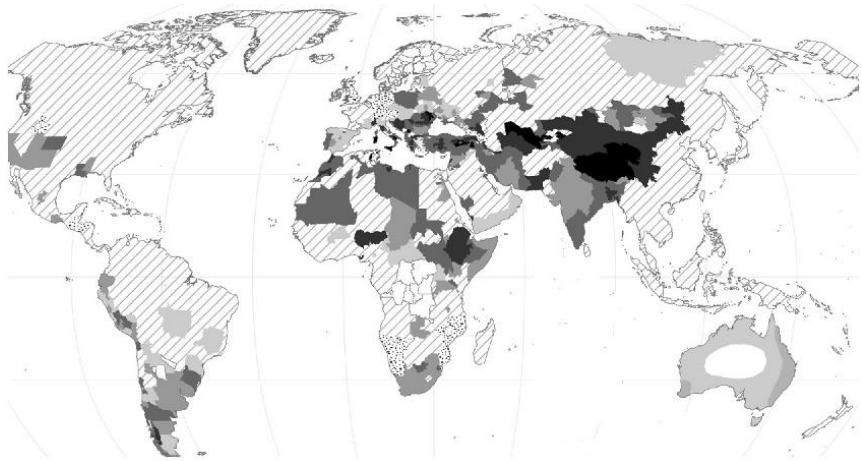
Global Distribution of *Echinooccus granulosus s.l.* transmission
Deplazes et al. 2017 *Adv. Parasitol*. 95:315-492

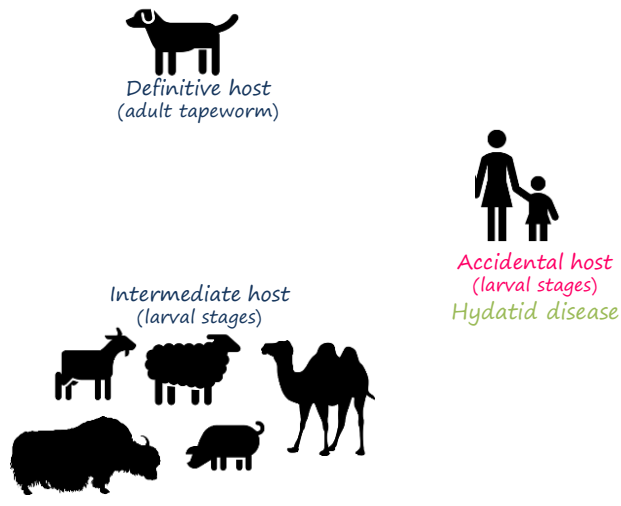


## Principal *Echinococcus* species infecting humans

**Globally**

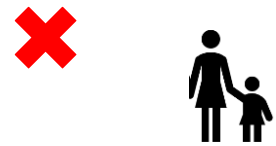
| Species | % human infections | Most important intermediate hosts | Definitive hosts |
|---|---|---|---|
| *E. granulosus* | 88 | sheep | Domestic dog |
| *E. canadensis*<br>G6<br>G7 | 11 | <br>camels (goats S Am)<br>pigs | Domestic dog |
| *E. multilocularis* | <1* | Voles | Fox, wolves, domestic dog |

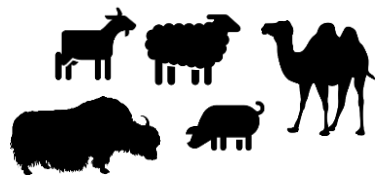
## Life cycle of *E. granulosus s.s / E. canadensis (G6/7)*



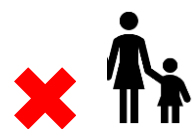
## Interventions to control CE

- **Praziquantel dosing**
- **Elimination of non-owned dogs**
- **Prevent access to offal**

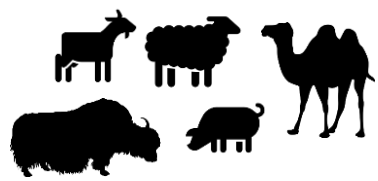




## Interventions to control CE

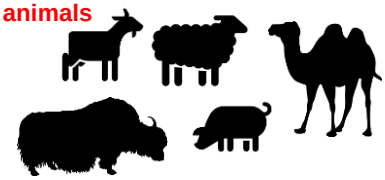


- **Education**
- **Hygiene**



## Interventions to control CE

- **Slaughter controls**
- **Vaccination**
- **Remove of old animals**



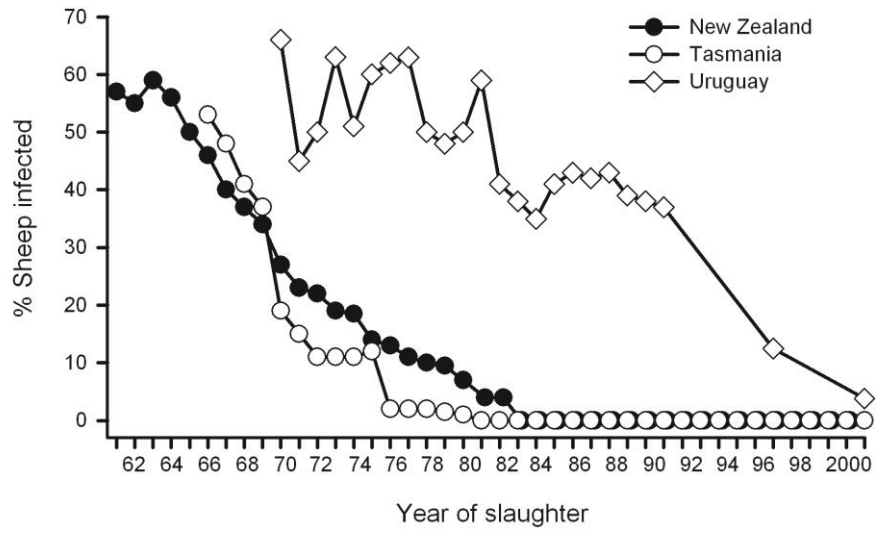
## Control of CE – How to start

- One reason why many CE control programs have failed in the past is because they have tried to implement too many control measures.
- Decisions must be made at the beginning about which control measures would be most effective and which would be feasible to carry out, and concentrate on implementing those measures – unless you have a lot of resources, don't try to do everything!

## Control of CE - Important principals

1. Humans play no role in transmission of echinococcosis. For this reason, diagnosis and treatment of humans with CE/AE has no effect on reducing the incidence of echinococcosis.
2. Public education is ineffective in reducing transmission of echinococcosis
   - Intensive public education campaigns about CE in New Zealand between 1937 and 1959, and in Uruguay between 1970 and 1990, had no effect on the prevalence of CE in humans or sheep (Gemmell & Schantz, 1997)
   - However, it leads to community understanding, acceptance and support for other control measures

The single most effective method for control of CE is dog dosing with praziquantel




Lightowlers 2013 Curr. Top. Microbiol. Immunol., 365:315-335;
after Gemmell 1995, PAHO/HCP/HCV/95/01, redrawn and extended

## How frequently does dog dosing need to be to be?

- Depends on what other control measures are able to be undertaken effectively

| Location | Interval between dog dosing | Other control measures implemented effectively | Time to reach control |
|---|---|---|---|
| Uruguay | 30 days | - | 10 years |
| Rio Negro, Argentina | 3 months | - | 30 years |
| Rio Chico, Argentina | 3 months | Sheep vaccination | 8 years |
| Tierra del Fuego | 6 months | Slaughter control Dog control | 30 years |

- Frequently expressed difficulties with CE control:
  1. Cannot prevent home slaughter
  2. People will not dispose of offal safely
  3. Cannot control stray/feral dogs
  4. Cannot dose dogs reliably/frequently

None of these things are a problem if livestock are vaccinated and not infected

## The EG95 Vaccine for Livestock

- There is only one type of vaccine
- It utilizes a recombinant antigen created in Australia and expressed in bacteria via a plasmid constructed in Australia
- Material was sent from Australia to New Zealand where the first animal trials were undertaken
- Subsequently many trials have been undertaken in New Zealand, Australia and numerous other countries
- Initially vaccine was produced both in Australia and in New Zealand
- The vaccine was licensed by AgResearch (NZ) and the University of Melbourne, equally, for commercial production in China
- For the past >10 years the vaccine has been available from Chongquing Auleon Biologicals (China), Tecnovax (Argentina) and the University of Melbourne
- All produce vaccine containing the same EG95 antigen

## Monitoring the effectiveness of a control program

1. Diagnosis of infection in dogs
2. Diagnosis of infection in livestock
3. Diagnosis of infection in children

## 1. Diagnosis of infection in dogs

- Eggs in feces (useful if control measures are only implemented in dogs)
- Coproantigen test (not available commercially outside China; complex to develop; not 100% specific; requires rigorous validation)
- CoproPCR (not available commercially; complex to undertake; requires rigorous validation)

2. Diagnosis of infection in livestock
   - Only possible at necropsy
   - Only effective in animals ≥2 years of age
   - Highly specific

3. Diagnosis of infection in children
   - US diagnosis simple and effective
   - Only suitable after a program has been underway for several years
   - Is the most meaningful measure of success

## Cautionary note:

Care must be taken to monitor control programs using tests that have high specificity

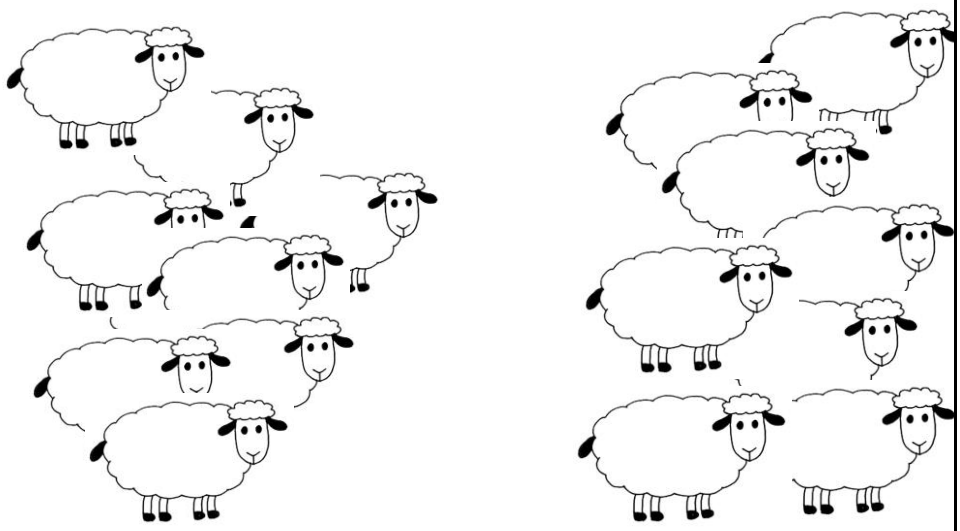
Reason:

Because all false positives in a monitoring test will be interpreted as failures of the control program

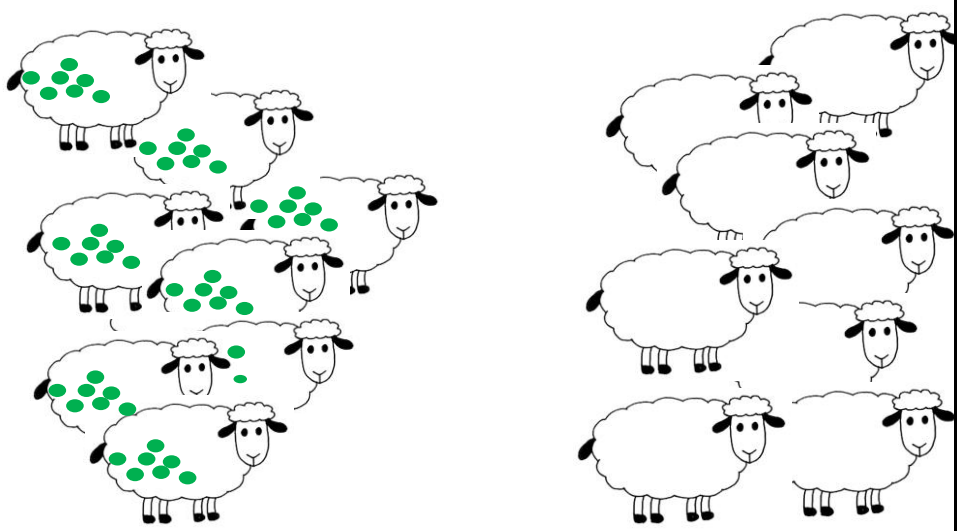
Do NOT use serology for diagnosis of CE in animals

NONE of the tests that have published good results for specificity have been evaluated adequately… just because claims are published does not make them true (unfortunately).

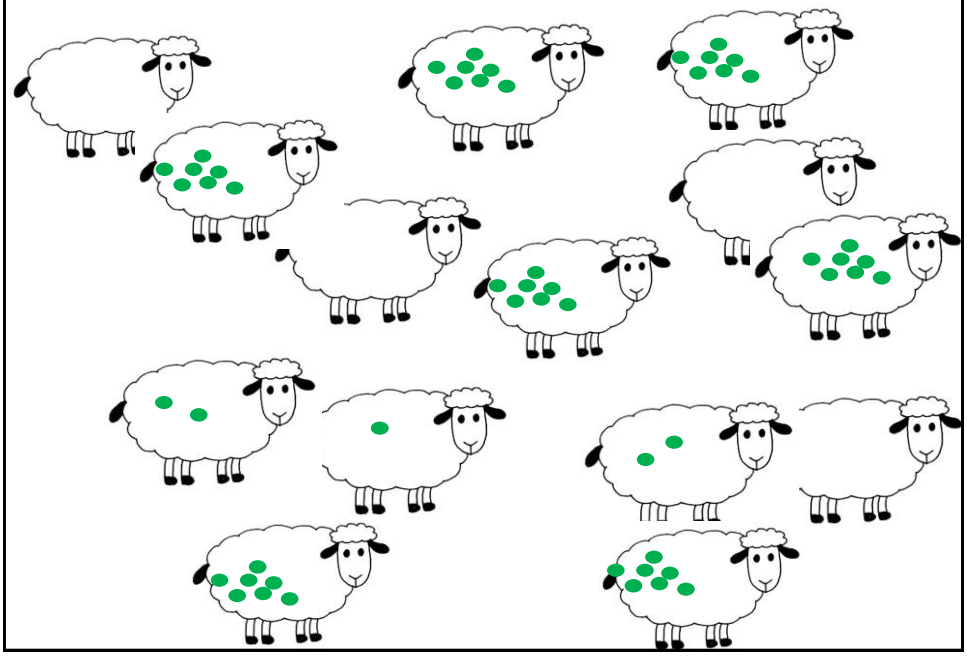
Almost all evaluations of serological tests for CE in sheep have used infected and uninfected animals from different sources



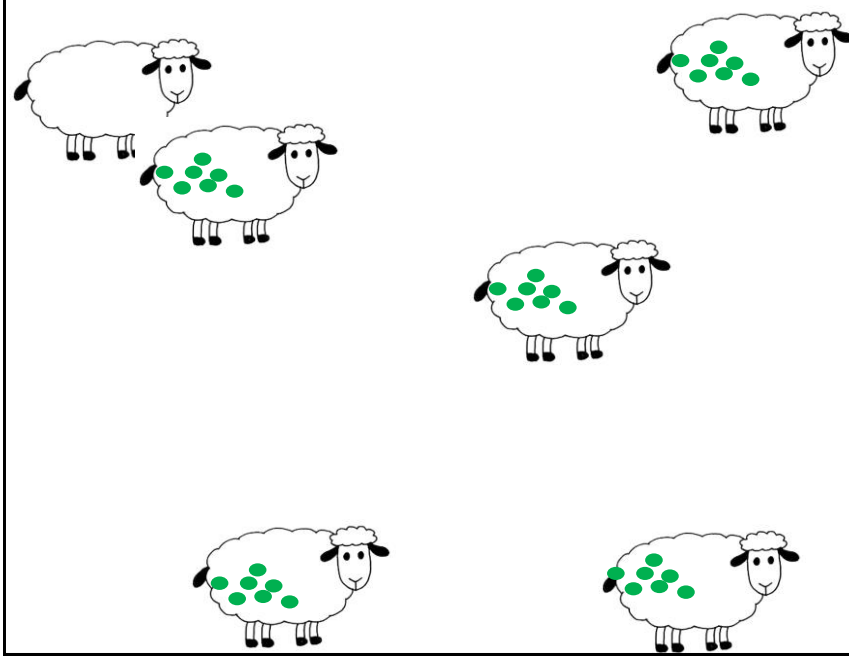
These different groups may have different levels of infection with, or exposure to, cross-reacting parasites (*Taenia* sp or other)



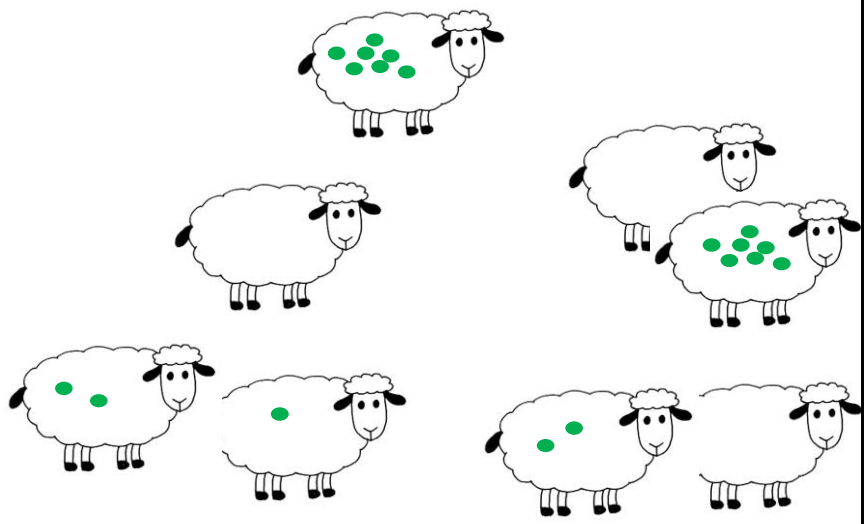
To have any value in monitoring a control program, a test must be able to differentiate infected from uninfected animals from the same flock



These animals test must positive



These animals test must test negative, irrespective of their infection with/exposure to irrelevant parasites



How to get adequate samples to evaluate a serological test:

- Obtain blood samples from randomly selected animals in a flock that is known to contain some animals infected with *E. granulosus*
- After slaughtering the animals, examine them thoroughly for the presence on *E. granulosus*
- Blind-test the samples in serological assay. Calculate the specificity and sensitivity of the test

Good example where testing of different groups of animals led to a large error in a test's specificity:

- Gonzalez et al. 1990 (Am J Trop Med Hyg 43:194-9) and Tsang et al. 1991 (Vet Immunol Immunopath 29:69-78) described a serological test for cysticercosis (EITB) that was 100% specific
- Garcia et al. 2016 undertook extensive necropsy analysis of 180 serologically positive animals, only 16 were actually infected. Test specificity 9%!!

A similarly scientifically rigorous approach needs to be taken to validate a coproantigen of coproPCR test for canine echinococcosis

- It is not sufficient to rely only on faecal samples from known infected, and known uninfected dogs
- The test needs to identify only dogs with *E. granulosus*, irrespective of their other life history
- To validate a test adequately, fecal samples need to be collected from dogs in a known *E. granulosus* endemic area, the animals must be necropsied and the infection levels with *E. granulosus* and other parasites defined
- This evaluation must be repeated when any new reagent (eg batch of antibody) is used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# Control programme Kyrgyzstan

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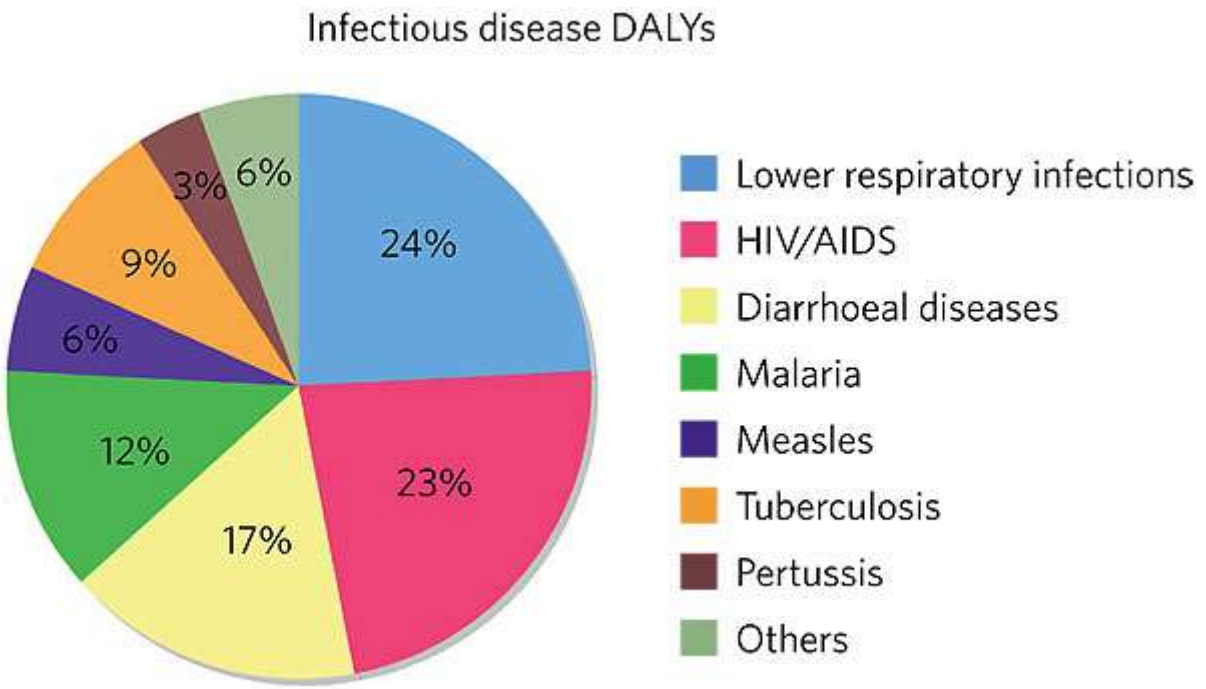
University of Zurich

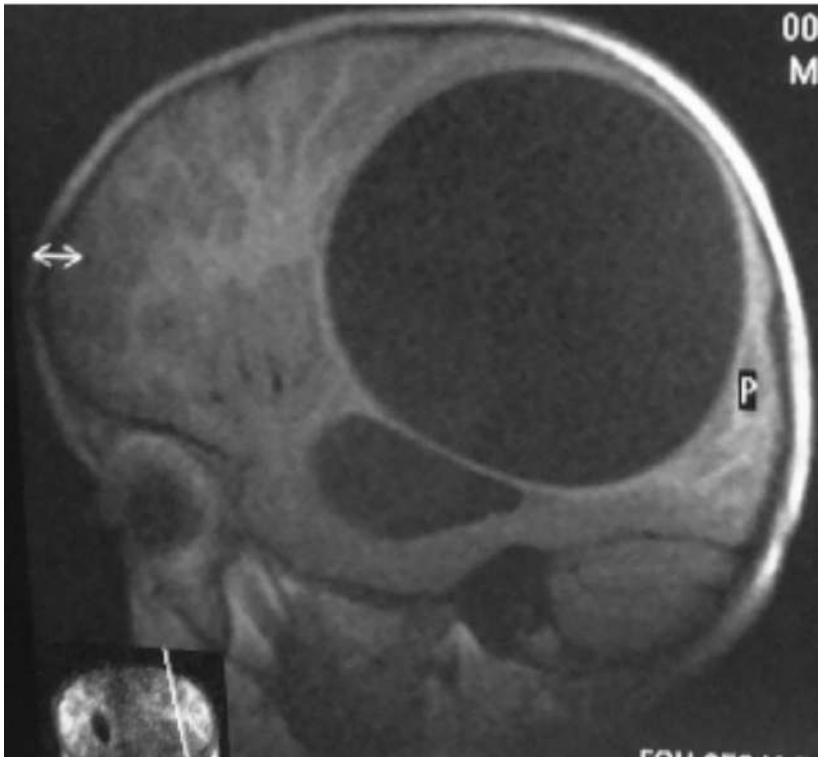
# Is it Worth Controlling?

- Burden of Diseases
- Globally
- Locally



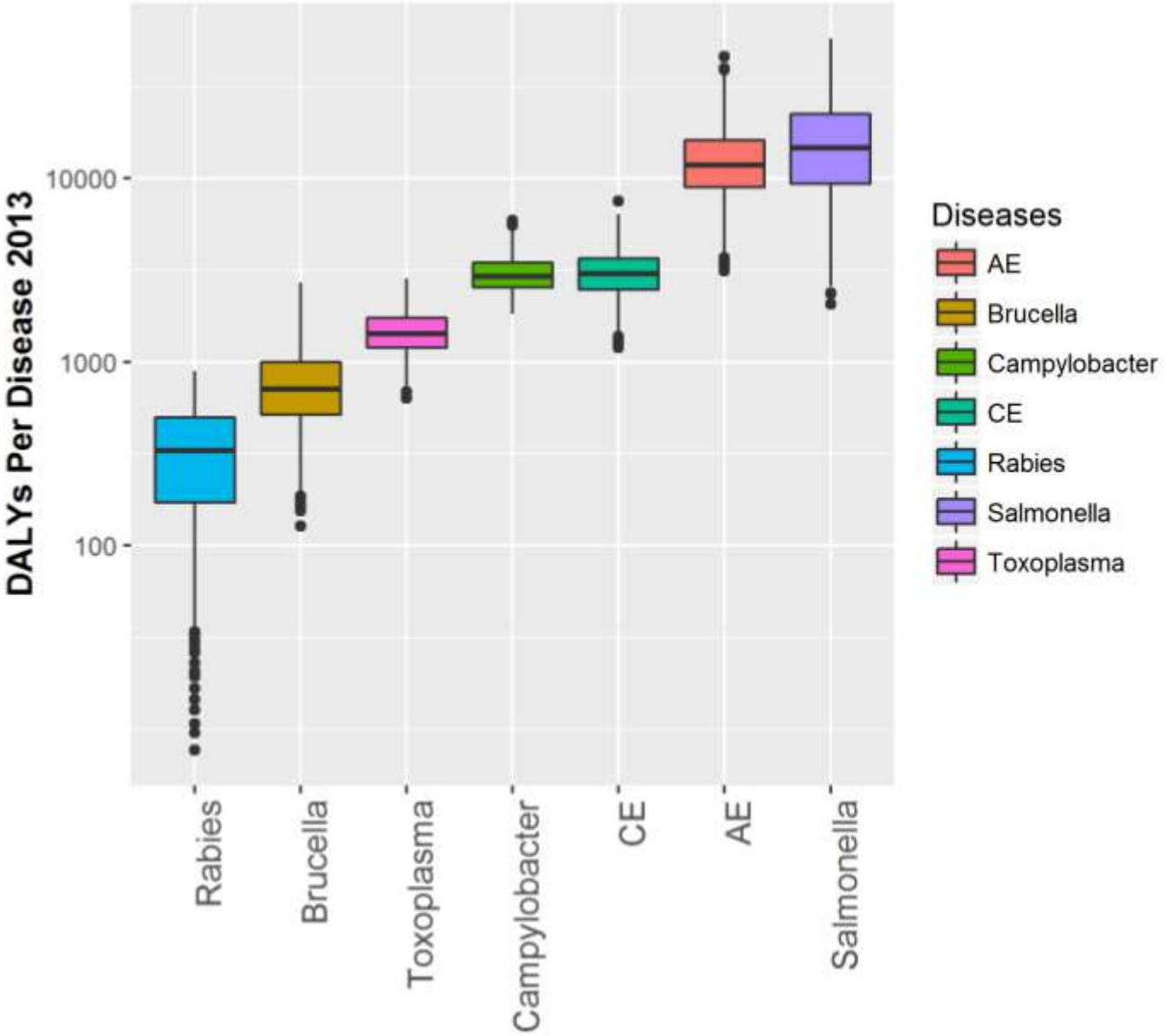
# Burden of Cystic Echinococcosis Kyrgyzstan

- 1000-2000 surgical cases
- $1000 or more per case – treatment costs
- >>$1,000,000 per year
- 3000 DALYs per year
- Including non treatment seeking, loss of employment etc
- $2,000,000 per annum



# Burden of Zoonoses

## Kyrgystan 2013



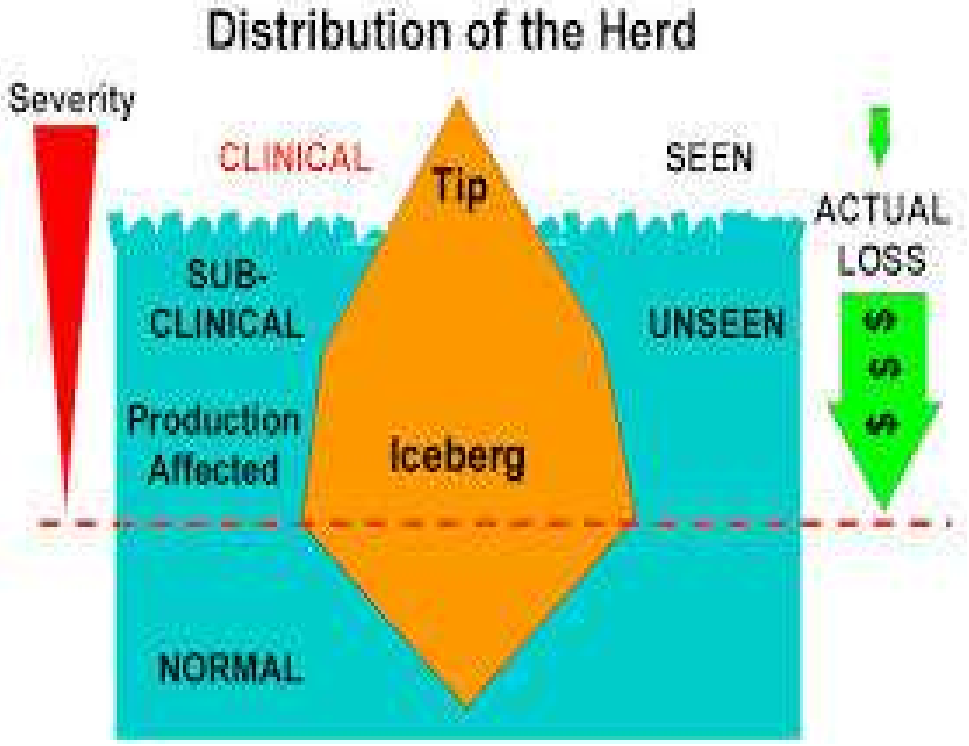
# Echinococcosis Kyrgyzstan

## Disease in context

| | |
|---|---|
| Brucellosis | 2500 new cases / year |
| CE | 1200 new cases / year |
| AE | 200 new cases/year |
| Rabies | 1-10 cases/year |
| | |
| Tuberculosis | 6000 new cases/ year |
| HIV positive | 700 new cases/ year |

# Animal Disease Costs

- The hidden costs
- Reduction in meat production
- Reduction in lamb production
- 5-10%
- $5.5 million per annum



# Economic costs
# Can you afford not to control?

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- $2 million plus human illness
- $5,5 million animal health
- 2%-4% human mortality in treated cases
  - 20-40 fatalities
- ? Mortality in untreated cases

# Cystic Echinococcosis Kyrgyzstan
# Sheep – pre control

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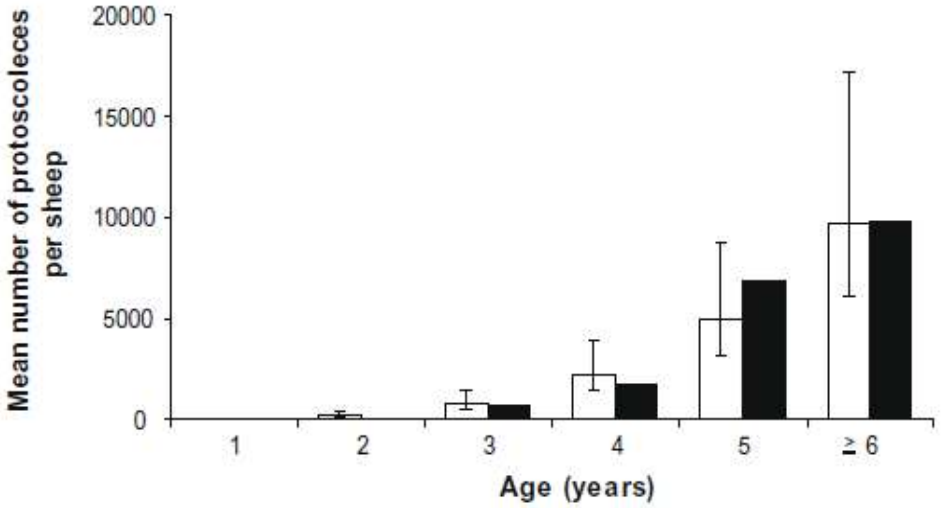
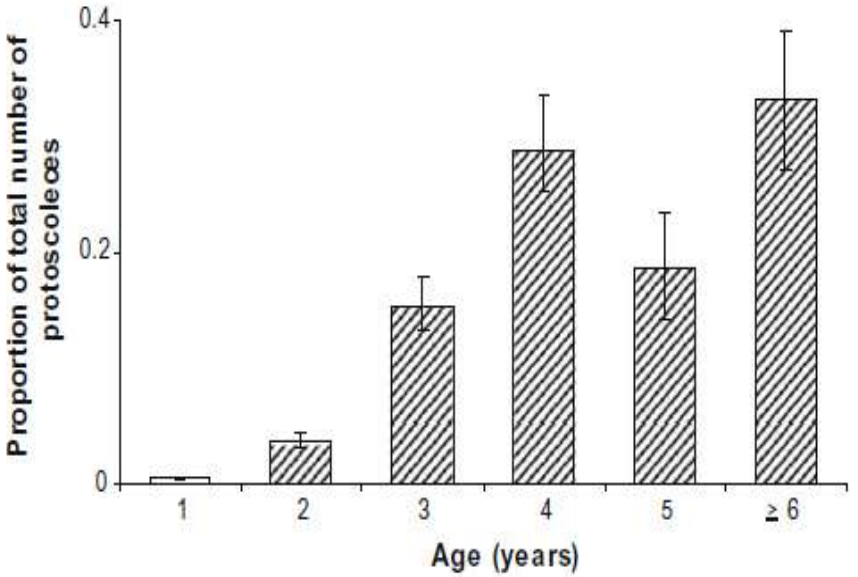
**Table 1**
The prevalence and abundance of hydatid cysts and abundance of protoscoleces stratified according to age for sheep

| Age (years) | Number sheep | Number infected | % Sheep infected (exact binomial confidence intervals) |
|---|---|---|---|
| 1 | 205 | 92 | 44.9 (37.9–52.0) |
| 2 | 264 | 140 | 53.0 (46.8–59.2) |
| 3 | 280 | 165 | 58.9 (52.9–64.8) |
| 4 | 188 | 155 | 82.5 (76.2–87.6) |
| 5 | 95 | 93 | 97.9 (92.6–99.7) |
| ⩾6 | 49 | 49 | 100 (92.8–100) |
| Mean across all age groups | 1081 | 694 | 64.2 (61.3–67.1) |



# Echinococcosis Kyrgyzstan Dogs-pre control

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| | Arecoline purgation | PCR | | True prevalence | | |
|---|---|---|---|---|---|---|
| | Sensitivity for intestinal stages | Sensitivity for eggs in faeces | Specificity | Total | Restrained dogs: hunting type, non-hunting type | Free-roaming dogs: hunting type, non-hunting type |
| *Echinococcus granulosus* | 38% (27–50%) | 78% (57–87%) | 93% (88–96%) | 19% (15–25%) | | |
| *Echinococcus multilocularis* | 21% (11–34%) | 50% (29–72%) | 100% (97–100%) | 18% (12–30%) | 11% (6–29%) | 26% (17–44%) |
| | | | | | 30% (14–56%), 9.4% (5–19%) | 44% (25–69%), 24% (16–42%) |

# Control of Echinococcosis
# Tools available

- Treatment of dogs – praziquantel
- Control of dogs
- Control of animal slaughter
- Vaccination of sheep
- Education

# Control of Echinococcosis
# Dogs



# Control of Echinococcosis Integrated Control



- Treat dogs
- Vaccinate sheep
- Control of slaughter
- Control old sheep
- Education

# Control of Echinococcosis Dogs

- Praziquantel
- 100% effective against Echinococcus spp
- Dogs become reinfected after treatment
- Repeat treatments
- Frequency depends on how quickly they become reinfected
- Recommend x 4 per year
- Coincide with slaughter of animals
  - Autumn

# Control of Echinococcosis Dogs

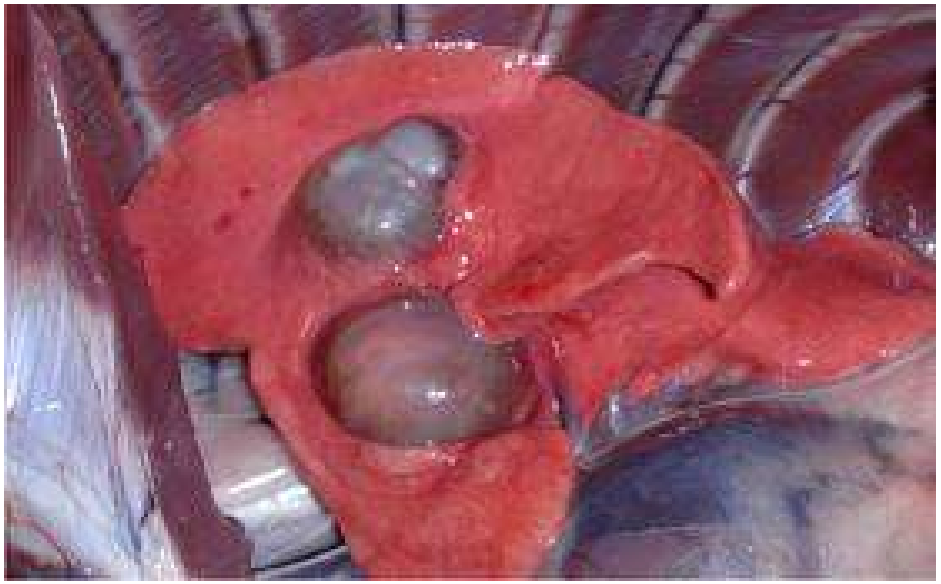
- 700,000 – 1 million dogs in Kyrgyzstan
- 4 million pills per year!
- Treat at least 70% of dogs
- Recommend licensing dogs
  - “Dog tax”
  - In some countries this pays for the programme
- Cull stray or unwanted dogs

# Control of Echinococcosis
# Control of Animal Slaughter

- All sheep should be slaughtered in a proscribed place
- Veterinary supervision of slaughter
- Condemn and destroy infected offal
- Particular care of old sheep!

# Control of Echinococcosis
# Control of Animal Slaughter

- Problems
- Lack of slaughter facilities
- Costs
- Culture



# Control of Echinococcosis Vaccination of Sheep

- EG95 vaccine
- 99% protection in sheep
- Available in China
- No cysts in sheep
- No *Echinococcus* in dogs
- No hydatid disease in humans

# Control of Echinococcosis Vaccination of Sheep



- EG95 vaccine
- Needs to be licensed in Central Asian Countries
  - Eurasian union
- May also benefit the health of the sheep
  - “Sub clinical” disease
  - Improves productivity
- May be combined with other vaccination programmes
  - Brucellosis
  - Clostridial diseases

# Control of Echinococcosis Education

# Control of Echinococcosis



- Needs a sustained and prolonged control effort
- Decades not years
- Commitment from Government
- Legislation to enforce
- In Kyrgyz Republic
- $2 million- $3 million
- Prevents $8 million- $10 million losses

# Control of Echinococcosis



- In Kyrgyz Republic
- $2 million- $3 million per annum investment
- Prevents $8 million- $10 million losses
- Reduce from 800-1000 cases per year to 100 or less
- <$20 per DALY averted
- Highly cost effective

# Control of Echinococcosis



- In Kyrgyz Republic
- We have the tools
- It should be cost effective
- Programmes are underway

# Control of Echinococcosis



- Registration of dogs
  - Dog passport
  - Ear tattoos
- Dogs treated x 4 per year
  - Village and district vets are provided with praziquantel
  - Supervise treatment
  - Passport signed
- Destruction of stray dogs
- Surveillance of dogs
- Surveillance in livestock / abbatoirs
- Education programme
- Human surveillance
  - Notifiable disease

# Dog Treatments Kyrgyzstan

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**Dehelmintization of dogs and cats 2017**

| Name of rayon | Наименование регионов | План за 2017 год/Plan for 2017 | | | Фактически обработанных за 2017 год/Have been treated 2017 | | |
|---|---|---|---|---|---|---|---|
| | | собаки/dogs | кошки/cats | всего/total | собаки/dogs | кошки/cats | всего/total |
| **Batken oblast** | | | | | | | |
| Batken | Баткенский | 14,000 | | 14,000 | 14,321 | **0** | 14,321 |
| Kadamzhai | Кадамжайский | 25,000 | | 25,000 | 27,687 | 0 | 27,687 |
| Leilek | Лейлекский | 22,000 | | 22,000 | 19,356 | 31 | 19,387 |
| **TOTAL** | **Итого по области:** | **61,000** | **0** | **61,000** | **61,364** | **31** | **61,395** |
| **Osh oblast** | | | | | | | |
| Alai | Алайский | 19,964 | | 19,964 | 16,442 | 0 | 16,442 |
| Aravan | Араванский | 25,000 | | 25,000 | 23,987 | 0 | 23,987 |
| Chon-Alai | Чон-Алайский | 4,652 | | 4,652 | 4,565 | 20 | 4,585 |
| Kara-Kuldzha | Кара-Кульджинский | 30,000 | | 30,000 | 27,936 | 249 | 28,185 |
| Kara-Suu | Кара-Суйский | 72,000 | | 72,000 | 52,231 | 11,592 | 63,823 |
| Nookat | Ноокатский | 18,000 | 20,000 | 38,000 | 18,169 | 4,993 | 23,162 |
| Uzgen | Узгенский | 78,400 | | 78,400 | 76,485 | 0 | 76,485 |
| **TOTAL** | **Итого по области:** | **248,016** | **20,000** | **268,016** | **219,815** | **16,854** | **236,669** |

# Human Surveillance

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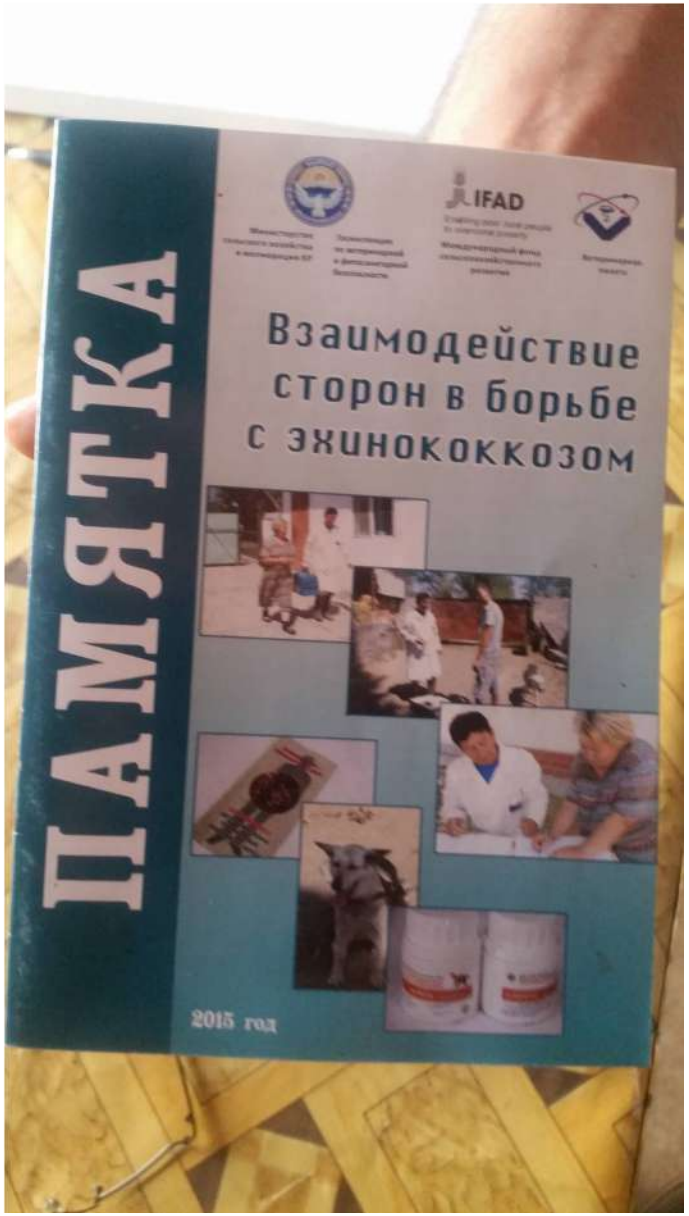
Table 1. The total numbers of cases and the annual incidence of CE and AE per 100,000 reported by district in Osh Oblast in 2013 (CIs, 95% confidence intervals).

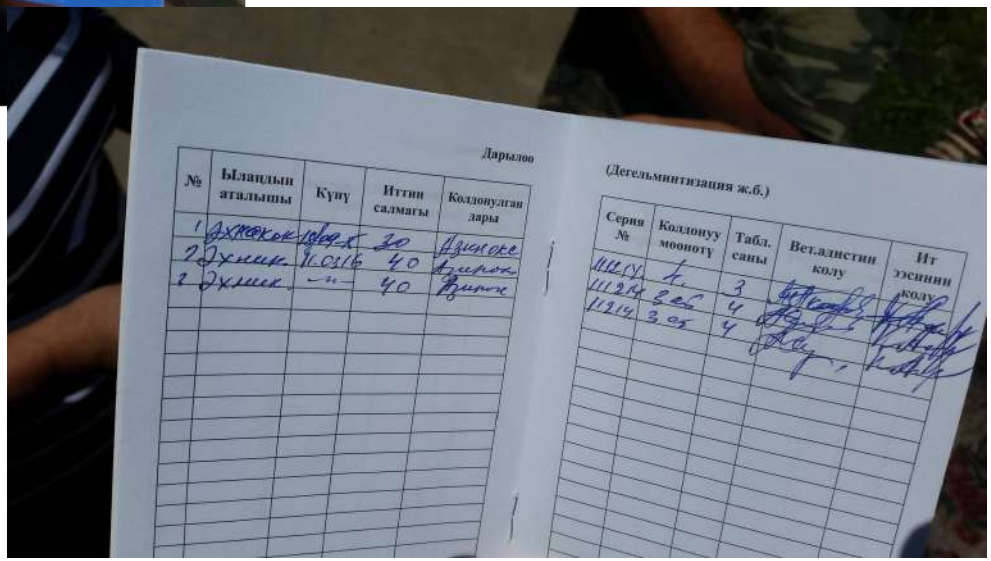
| District | CE | Incidence (CIs) | AE | Incidence |
|---|---|---|---|---|
| Aravan | 0 | 0 (0–3.6) | 0 | 0 (0–3.6) |
| Uzgen | 34 | 17 (11.5–23.7) | 0 | 0 (0–1.8) |
| Kara-Kulija | 9 | 10 (4.7–19.5) | 3 | 3.4 (0.7–10.0) |
| Nookat | 36 | 17 (11.4–22.1) | 2 | 0.9 (0.1–3.1) |
| Kara-Suu | 65 | 20 (15.3–25.2) | 5 | 1.6 (0.5–3.5) |
| Alay | 11 | 15 (7.6–27.3) | 42 | 58 (42–79) |
| Chon-Alay | 0 | 0 (0–15.8) | 8 | 34 (14–66) |
| Total | 155 | 16 (13.2–18.1) | 60 | 6.0 (4.5–7.7) |

# Animal Surveillance

- Dogs
  - Coproscopy data
- Sheep
  - Abattoir data


ПАМЯТКА
IFAD
Взаимодействие сторон в борьбе с эхинококкозом
2015 год


ИТТИ КАТТОО
ЕТЕРИНАРДЫК КҮБӨЛҮГҮ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№
Ылаңдын атальшы
Күнү
Иттин салмагы
Колдонулган дары
(Дегельминтизация ж.б.)
Серия №
Колдонуу мөөнөтү
Табл. саны
Вет.адистин колу
Ит эсинин колу

# Control of Echinococcosis



- Registration of dogs
  - Many dogs remain unregistered
  - Dog population uncertain
- Dogs treated x 4 per year
  - If dogs are registered, treatment regime is not adhered to
  - Veterinary services problem
  - Vets give out tablets rather than treating the dogs
- Destruction of stray dogs
  - No auditing if this takes place
- Surveillance of dogs
  - 10-20% of dogs remain taeniid egg positive despite “treatment”
  - Poor data collection
- Surveillance in livestock / abattoir
  - Poor data collection, few abattoirs
- Education programme
- Human surveillance
  - Very efficient system

# Control of Echinococcosis



- Registration of dogs
  - Improved system required
- Dogs treated x 4 per year
  - Vet teams to treat entire district or villages at set times
- Destruction of stray dogs
  - Rabies outbreaks results in complete clearance of dogs from district
  - It is possible
- Surveillance in livestock / abattoir
  - More abattoir facilities
  - Ban home slaughter
- Dog surveillance
  - Simple coproscopy – taeniid egg prevalence
- Introduce vaccination of sheep

# OIE PVS EVALUATION FOLLOW-UP

# REPORT OF THE

# VETERINARY SERVICES OF

# KYRGYZ REPUBLIC

# February 1st – 12th, 2016

- systematic tattoo and passport for all dogs, useless for current phase of diseases control;
- deworming of dogs 4 times a year with the intention to cover the parasitic cycle is unrealistic;

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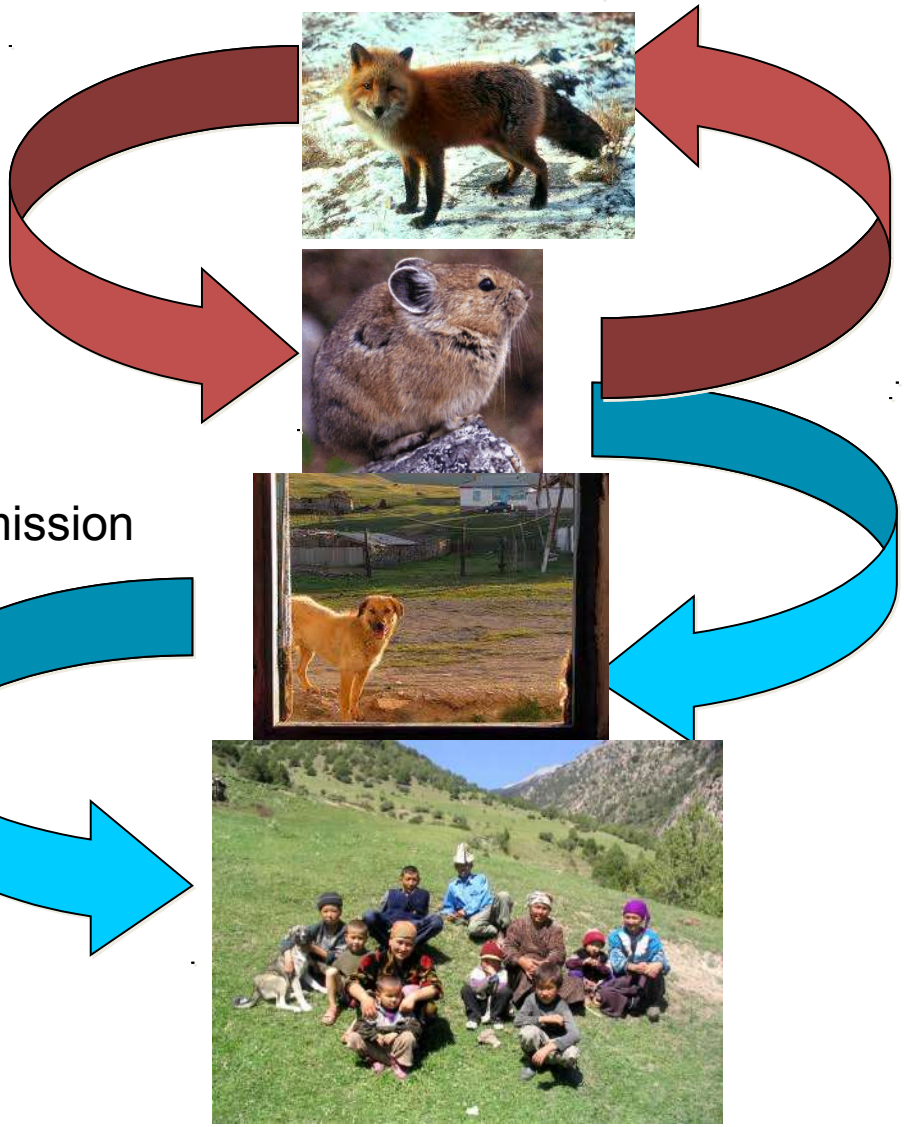
# Control of Alveolar Echinococcosis



Wildlife cycle

Domestic Transmission

Zoonotic Transmission

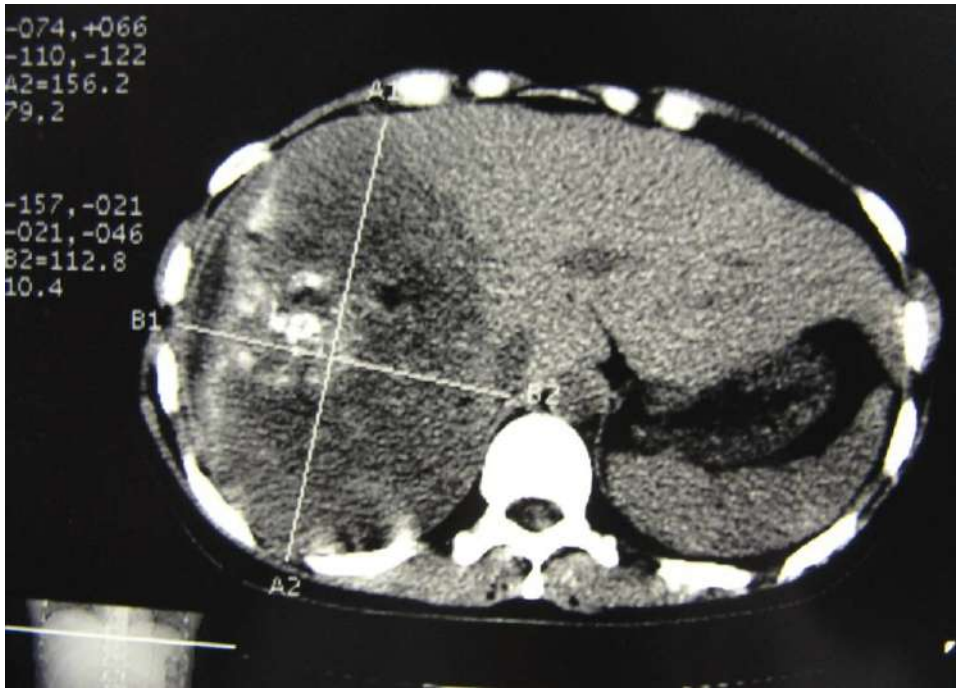
# Transmission AE - Kyrgyzstan

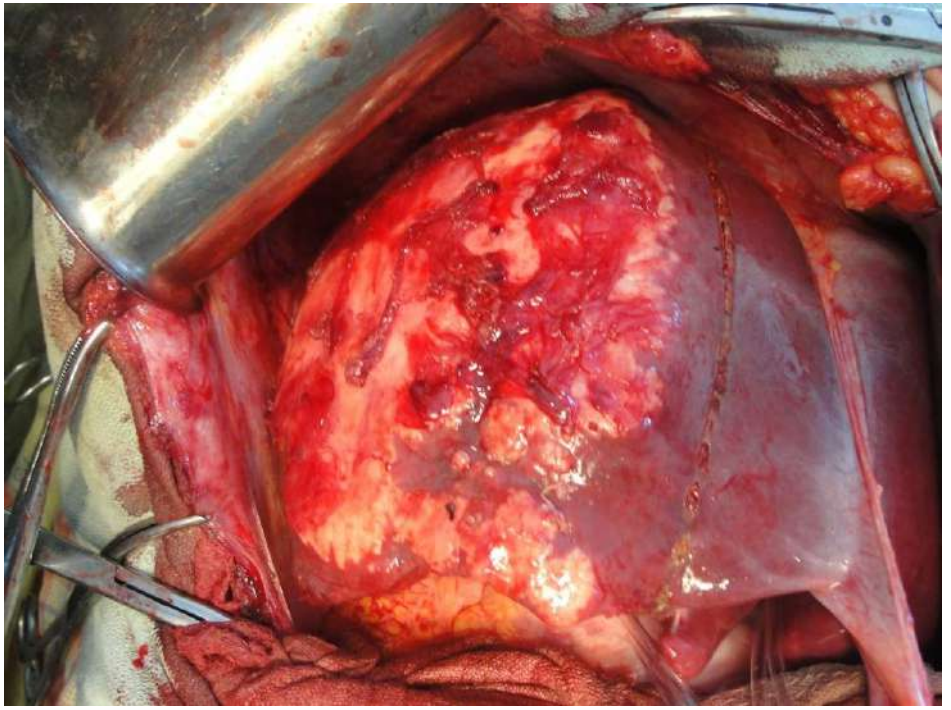
Foxes 65%

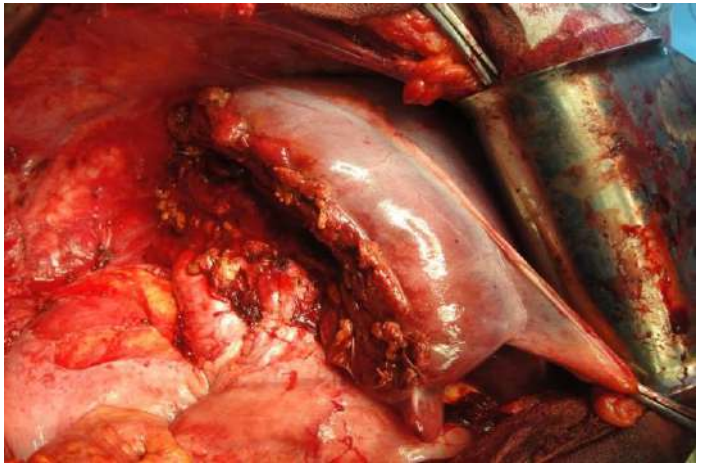
Dogs 19%

250 cases per year

# Альвеококкоз



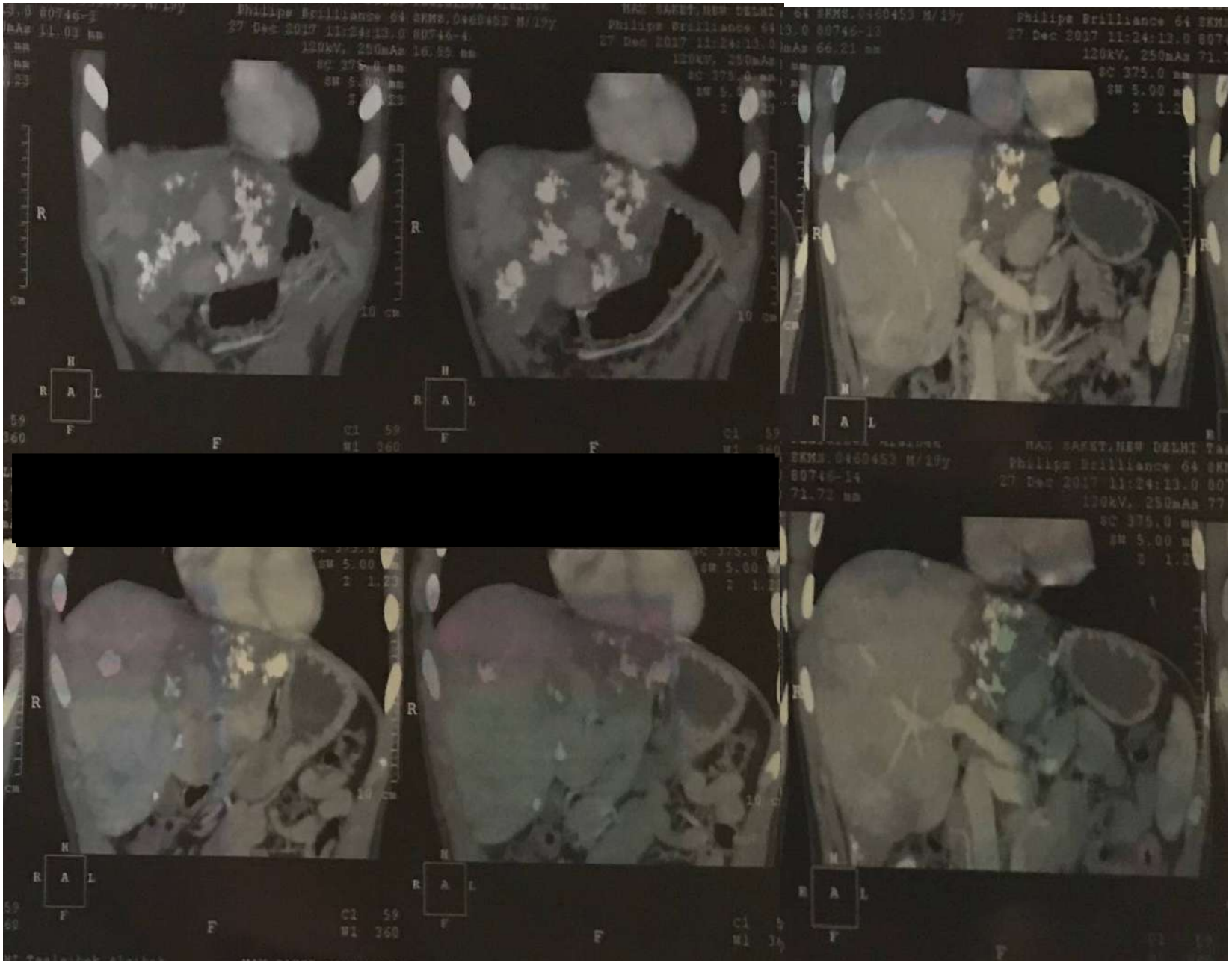





# Male patient 19 yrs old

- Presents to local hospital
- Initial complaints: pain in the right kidney area
- Imaging reveled extensive AE involvement of both liver lobes, no jaundice, no liver failure
- Considered inoperable
- Referred for living donor liver transplantation in India

# Male patient 19 yrs old



# Recipient

# Donor

# Female patient 24 yrs old

Present to First City Hospital, Bishkek in 2014.

Initial complains: fatigue, weight loss and anemia

# Female patient 24 yrs old


- On long term albendazole since 2014
- Normal liver values, clinical asymptomatic,
- Fully recovered

Picture taken with permission from the patient

# Control of Alveolar Echinococcosis

- Treat dogs
- Fox treatment – baits
- Has had some effect in Europe
- Difficult
- Dogs continuously reinfected from wild life

Universität Zürich

# Echinococcosis Control Kyrgyzstan

- Major weakness in veterinary sector
- Poor motivation
- Poorly trained
- Surveillance and treatment of dogs is poorly executed
- No abattoirs
- Medical surveillance is competent

# Large-scale Vaccination of EG95 Vaccine Significantly Interfered with the Dog-sheep/goat Transmission Chain of Hydatidosis

**Ran, Zhiguang PhD/Prof**
**Chongqing Auleon Biologicals Co., Ltd, China**
**Oct 30, 2019; Lima, Peru**



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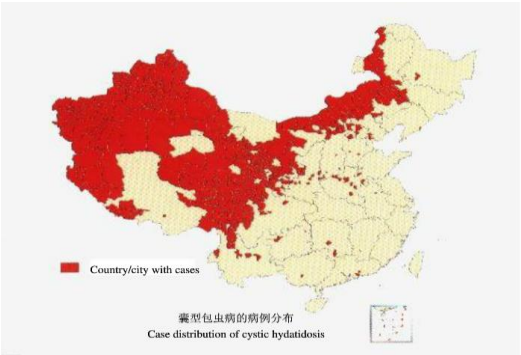
## Hydatidosis is one of most serious zoonosis in China

- Hydatidosis or hydatid disease, also known as Echinococcosis, distributes widely in China (23 provinces, 360 counties) ;
- the North-west China (pastoral & semi-pastoral) is the hyper endemic areas of CE

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## Hydatidosis caused heavy animal husbandry loose, public health risks and economic burden to peoples in China



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### 因病致贫、因病绝户家庭情况

一户包虫病患者家庭成员名录

| 身份 | 姓名 | 性别 | 职业 | 出生年份 | 死亡年份* | 死亡时年龄 | 死因 |
|---|---|---|---|---|---|---|---|
| 母亲 | 阿地 | 女 | 牧民 | 1944 | — | — | — |
| 父亲 | 久才 | 男 | 牧民 | 1943 | 1987 | 42 | 肝包虫 |
| 大儿子 | 索昂 | 男 | 工人 | 1970 | 1995 | 25 | 肝包虫 |
| 二儿子 | 索保 | 男 | 工人 | 1975 | — | — | — |
| 三儿子 | 依穷 | 男 | 牧民 | 1979 | 1995 | 16 | 肝包虫 |
| 四儿子 | 达桑 | 男 | 牧民 | 1982 | 2004 | 22 | 泡型肝包虫 |
| 大女儿 | 康吉 | 女 | 牧民 | 1971 | 1998 | 27 | 肝包虫 |
| 二女儿 | 琼吉 | 女 | 牧民 | 1986 | 2010 | 24 | 泡型肝包虫 |
| 外孙 | 久美尖措 | 男 | 牧民 | 1992 | 2011 | 19 | 泡型肝包虫 |
| 大女婿 | 次成 | 男 | 牧民 | 1970 | 2000 | 30 | 脑包虫可能 |
| 姑姑 | 班吉 | 女 | 牧民 | 1948 | 1973 | 25 | 肝包虫 |

**The echinococcosis destroyed a family in Qinghai province, China**

- household member 11
- 5 died with cystic Echinococcosis
- 3 died from alveolar Echinococcosis
- 1 died from suspicious coenurus cerebralis

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## One source of dog management is not enough

- Since 2010, the Chinese government conducted a comprehensive control measure using praziquantel in dogs in the hyper endemic area.
  - Transmission reduced;
  - Epidemic situation remains serious in South-west China.




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## EG95 vaccine provide a new tool

- Recombinant hydatids subunit (EG95) Vaccine registered as the Class I of new veterinary drug in 2007 in China.
- Large-scale production of the vaccine was established in Chongqing Auleon Biologicals Company Lmited in 2010.

**Recombinant Hydatids Subunit Vaccine**

Approval Number：兽药生字（2015）230242040

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# EG95 vaccine provide a new tool

- **Pilot trials of the vaccine in sheep and goat herds had been complete in three provinces from 2011 to 2015, and the results were very satisfied.**

**From 2011 to 2015, 4.81 million doses have been injected， Mostly given free to farmers to promote the vaccine.**



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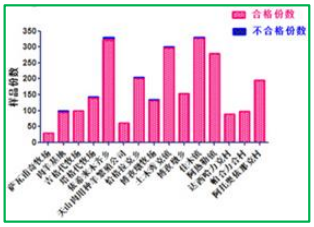
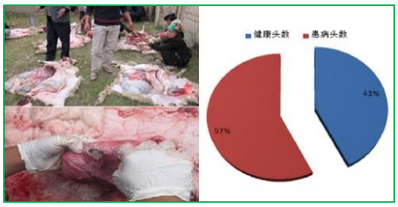
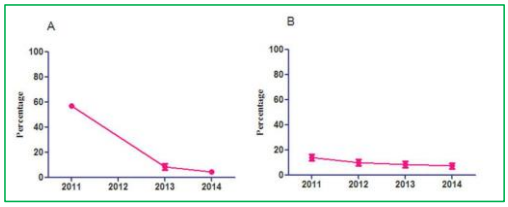
## The hydatid Vaccine demonstrated excellent clinical immune efficacy for sheep and goats




- **The antibody positive rate at 30d-post the 2nd immunization: 97.4%**




- **The Prevalence of CE in sheep declined from 57% to 4.63%**
- **The detection rate of Echinococcus eggs decreased from 10.1% to 7.4%**

**Continuously monitoring in Wensu county, Xinjiang 2011-2014**

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# EG95 vaccine provide a new tool

- **In 2016, the central government launched comprehensive compulsory vaccination of sheep and goat in 7 provinces:**
  - ✓ Sichuan
  - ✓ Tibet
  - ✓ Xinjiang
  - ✓ Gansu
  - ✓ Ningxia
  - ✓ Qinghai
  - ✓ Inner Mongolia.




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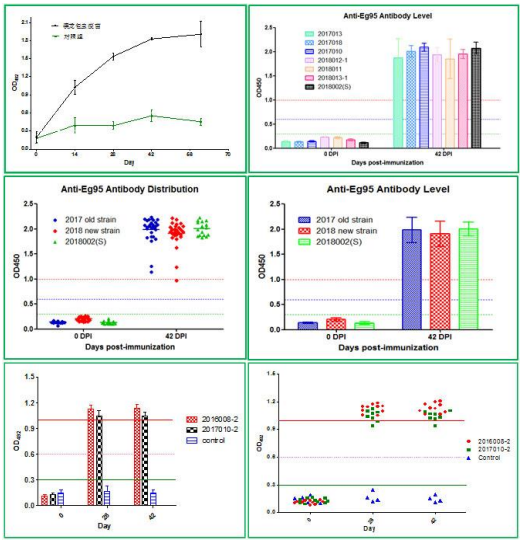


**Finished product must experienced strict inspection and test in animals, and the antibody should be evaluated.**

**Immunization programs**

- **Neck subcutaneous injection of 1 dose;**
- **Lambs born of immunized ewes： vaccinated twice at 16w- and 20w-old, respectively;**
- **Lambs born of non-immunized ewes: vaccinated twice at 8w- and 12w-old, respectively;**
- **Then boost once every 12 months.**

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### The vaccine has been widely used highly endemic area of China

Unit: million doses

| Year | Gansu | Inner Mongolia | Ningxia | Qinghai | Sichuan | Tibet | Xinjiang | Subtotal |
|---|---|---|---|---|---|---|---|---|
| 2019 | 1.985 | 9.097 | 0.8 | 10.5 | 3.759 | 9.133 | 5 | 40.274 |
| 2018 | 2.505 | 10.56 | / | 11.00 | 5.93 | 8.93 | 6.002 | 44.927 |
| 2017 | 0.001 | 11.514 | 1.4 | 10.9 | 10.553 | 7.195 | 6.202 | 47.765 |
| 2016 | 1.6625 | 11 | 0.6 | 7.008 | 8.404 | 3.221 | 9.021 | 40.9165 |
| Subtotal | 6.1535 | 42.171 | 2 | 39.408 | 28.646 | 28.479 | 26.225 | 173.8825 |

**Due to government pricing in China, the vaccine is very cheap: 2CNY (equivalent to US $0.28 ) per dose.**

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| Province | Year | Ab Pos rate (sampling) |
|---|---|---|
| Sichuan | 2016 | 89.20% |
| | 2017 | 85.60% |
| | 2018 | 87.30% |
| Qinghai | 2016 | 70.00% |
| | 2017 | 78.69% |
| | 2018 | 83.12% |
| Tibet | 2016 | / |
| | 2017 | 84.37% |
| | 2018 | 85.38% |
| Gansu | 2016 | 73.41% |
| | 2017 | 75.97% |
| | 2018 | 86.51% |
| Xinjiang | 2016 | 60.90% |
| | 2017 | 63.57% |
| | 2018 | 73.25% |
| Ningxia | 2016 | 82.07% |
| | 2017 | 85.00% |
| | 2018 | 86.74% |

**High anti EG95 antibody positive rate**

**Antibody positive rate was between 60.9% to 89.2%.**

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**Significantly decreased prevalence after 3-year large-scale immunization**

| Province | Prevalence in sheep/goat herds | | Prevalence in dogs | |
|---|---|---|---|---|
| | 2014/2015 | 2017/2018 | 2014/2015 | 2017/2018 |
| Sichuan | 5.34% | 4.03% | 25.00% | 13.80% |
| Tibet | 44.72% | 20.16% | 4.09% | 1.82% |
| Qinghai | 41.76% | 7.83% | 29.63% | 5.16% |
| Gansu | 5.76% | 4.42% | 5.16% | 2.57% |
| Xinjiang | 9.80% | 4.51% | 9.84% | 4.05% |
| Ningxia | 6.24% | 1.23% | 12.88% (coproELISA) | 2.04% (coproELISA) |
| Inner Mongolia | 1.12% | 0.83% | 3.12% | 1.04% |

**Slaughter examination & necropsy of sheep/goat: from 5.34%- 44.72% to 1.23%-20.16%;**

**Arecoline purgation of dogs: from 3.12%-29.63% to 1.04%-13.8%.**

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## Conclusion

- After three years of comprehensive immunization in South-west China, the prevalence decreased significantly in both intermediate host animals (sheep & goat) and dogs
- demonstrating excellent clinical immune efficacy of EG95 vaccine
- indicating that the vaccination has effectively interfered with the dog-sheep and dog-goat transmission chain, which provides an economical, efficient and practical tool for controlling hydatidosis.



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## Hope:

- The Chinese experience can provide a valuable information to other countries for helping control of echinococcosis;
- The vaccine will contribute to controlling of echinococcosis of the world, especially the countries along the “belt and road”.

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# Chongqing Auleon Biologicals Company Limited


重庆澳龙生物制品有限公司
Chongqing Auleon Biologicals Co., Ltd.

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- A modern Hi-tech enterprise engaged in research, development , production, marketing and service of veterinary biologicals.
- Founded in 2007 for EG95 vaccine.
- Located in the National Rongchang Hi-tech Industrial Development Zone Chongqing Municipality, China.
- 2 workshops, 7 production lines, 15 products.
- 180 employees.
- http://www.aolongbt.com


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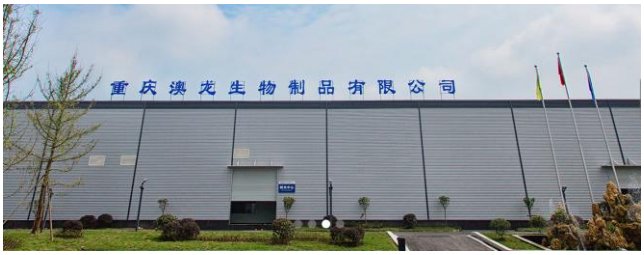
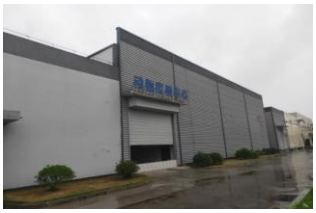
## Factory buildings





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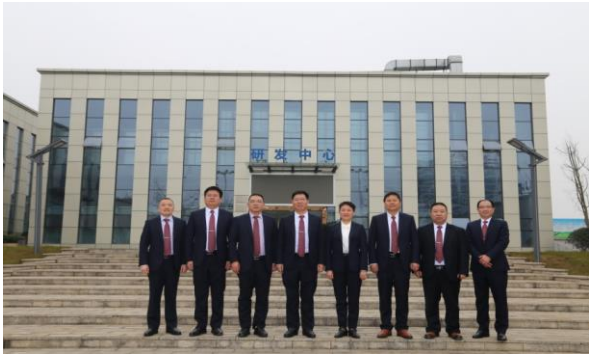
## Young and energetic management team

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## Facilities












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## Product for Ruminants

| SN | Product Name in Chinese | Product Name in English |
|---|---|---|
| 1 | 羊棘球蚴（包虫）病基因工程亚单位疫苗 | Recombinant Hydatid Subunit Vaccine |
| 2 | 布氏菌病活疫苗（A19）株 | Brucellosis vaccine (Strain A19), Live |
| 3 | 布氏菌病活疫苗（S2）株 | Brucellosis vaccine (Strain S2), Live |
| 4 | 山羊痘活疫苗（AV41）株 | Goat Pox vaccine (Strain AV41), Live |
| 5 | 小反刍兽疫-山羊痘二联活疫苗（Clone 9株+AV41株） | Peste des petits Ruminants and Goat Pox vaccine (Strain Clone 9 + Strain AV41), Live |
| 6 | 羊快疫、猝狙、羔羊痢疾、肠毒血症三联四防灭活疫苗 | Combined Ovine/Caprine Braxy, Struck, Lamb Dysentery, and Enterotoxaemia Vaccine, Inactivated |
| 7 | 牛巴氏杆菌病灭活疫苗 | Bovine Pasteurelosis Vaccine, Inactivated |
| 8 | 山羊支原体肺炎灭活疫苗（MoGH3-3株+M87-1株） | Goat Mycoplasmal Pneumonia Vaccine (Strain MoGH3-3 + Strain M87-1), Inactivated |
| 9 | 牛结节性皮肤病病毒荧光PCR检测试剂盒 | Lumpy Skin Disease Virus Real-time PCR Test Kit |
| 10 | 羊包虫病ELISA抗体检测试剂盒 | Sheep/goat hydatid EG95 antibody ELISA detection kit |
| 11 | 犬粪棘球蚴抗原ELISA检测试剂盒 | Canine Echinococcous coproantigen ELISA detection kit |
| 12 | 牛多杀性巴氏杆菌ELISA抗体检测试剂盒 | Bovine Pasteurella multocida antibody ELISA detection kit |

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