The burden of CE and AE in Europe

28TH WORLD CONGRESS OF ECHINOCOCCOSIS AND 2ND PERUVIAN CONGRESS OF ECHINOCOCCOSIS

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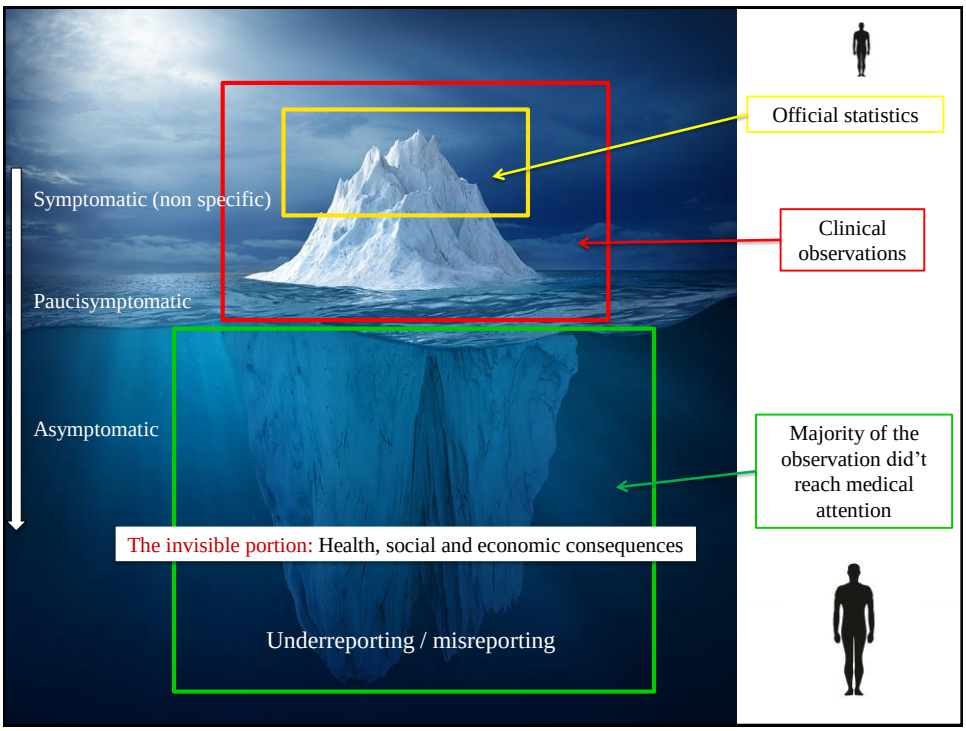
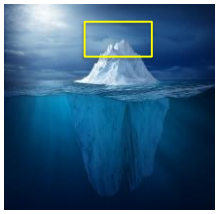
- European Union Reference Laboratory for Parasites (EURLP),

Department of Infectious Diseases, ISTITUTO SUPERIORE DI SANITÀ (Rome, Italy)



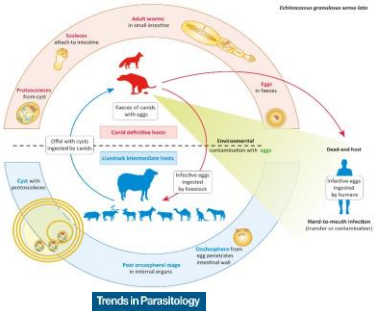
OFFICIAL BURDEN in EUROPE

"EU report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks (2017)"
EFSA Journal 2018;16(12):5500



CASE DEFINITION in Europe = ECHINOCOCCOSIS

Echinococcus granulosus sensu lato
CYSTIC ECHINOCOCCOSIS



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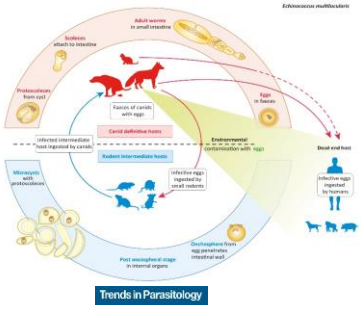
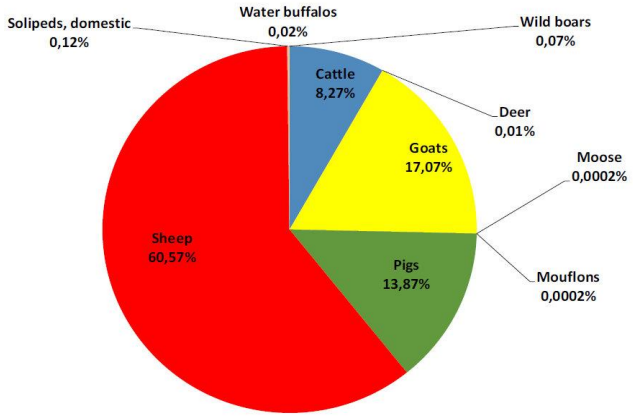
Echinococcus multilocularis
ALVEOLAR ECHINOCOCCOSIS

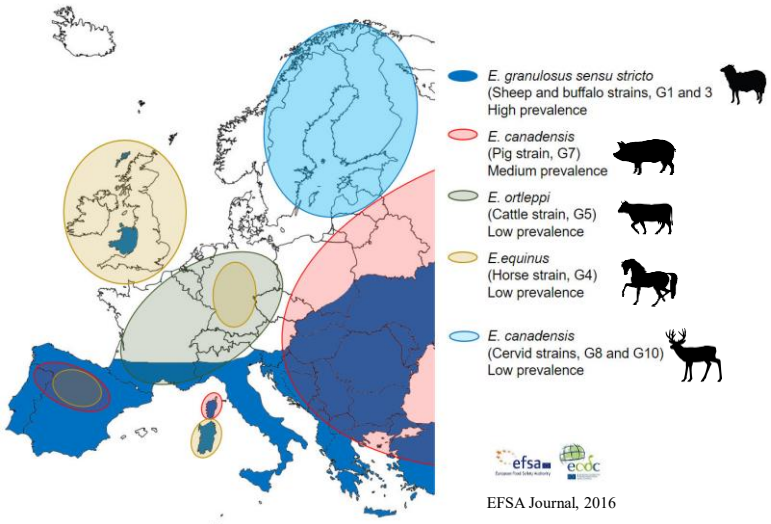


"EU report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks (2017)"
EFSA Journal 2018;16(12):5500

Prevalence in ANIMALS of *E. granulosus s.l.*, UE (2013-17), N=939,719



Echinococcus granulosus genotype/species in Europa



EFSA Journal, 2016

Bulgaria, France, Greece, Hungary, Italy, Portugal, Romania, Serbia, Spain

"EU report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks (2017)"
EFSA Journal 2018;16(12):5500

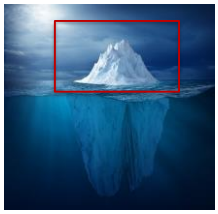
- 827 confirmed cases of HUMAN *"echinococcosis"* (0,19/100.000).

Country	National coverage[a]	Data format[a]	2017 Total cases	2017 Confirmed cases & rates		2016 Confirmed cases & rates		2015 Confirmed cases & rates		2014 Confirmed cases & rates	
				Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Austria	Y	C	50	50	0.57	26	0.30	8	0.09	14	0.17
Belgium	Y	A	12	12	0.11	17	0.15	9	0.08	15	–
Bulgaria	Y	A	218	218	3.07	269	3.76	313	4.35	302	4.17
Croatia	Y	C	15	15	0.36	9	0.21	7	0.17	20	0.47
Cyprus	Y	C	0	0	0.00	0	0.00	2	0.24	0	0.00
Czech Republic	Y	C	1	1	0.01	4	0.04	3	0.03	6	0.06
Denmark[b]	–	–	–	–	–	–	–	–	–	–	–
Estonia	Y	C	1	1	0.08	0	0.00	0	0.00	1	0.08
Finland[c]	Y	C	5	5	0.09	4	0.07	2	0.04	0	0.00
France	Y	C	48	48	0.07	38	0.06	48	0.07	32	0.05
Germany	Y	C	123	123	0.15	177	0.22	157	0.19	131	0.16
Greece	Y	C	15	15	0.14	18	0.17	13	0.12	13	0.12
Hungary	Y	C	14	14	0.14	5	0.05	2	0.02	2	0.02
Ireland[c]	Y	C	0	0	0.00	2	0.00	0	0.00	0	0.00
Italy[b]	–	–	–	–	–	–	–	–	–	–	–
Latvia	Y	C	6	6	0.31	11	0.56	10	0.50	13	0.65
Lithuania	Y	C	53	53	1.86	26	0.90	33	1.13	22	0.75
Luxembourg	Y	C	2	2	0.34	0	0.00	0	0.00	0	0.00
Malta[c]	Y	C	0	0	0.00	1	0.23	0	0.00	0	0.00
Netherlands	Y	A	38	38	0.22	33	0.19	64	0.00	30	0.18
Poland	Y	C	75	75	0.20	64	0.17	47	0.12	48	0.13
Portugal	Y	C	2	2	0.02	2	0.02	4	0.04	4	0.04
Romania	Y	C	14	14	0.07	13	0.07	18	0.09	31	0.16
Slovakia	Y	C	7	7	0.13	4	0.07	5	0.09	8	0.15
Slovenia	Y	C	7	7	0.34	3	0.15	7	0.34	5	0.24
Spain	Y	C	83	83	0.18	87	0.19	83	0.18	77	0.17
Sweden	Y	C	34	34	0.34	27	0.27	26	0.27	21	0.22
United Kingdom[c]	Y	C	4	4	0.01	0	0.00	26	0.04	25	0.04
EU Total	–	–	**827**	**827**	**0.19**	**840**	**0.22**	**887**	**0.20**	**820**	**0.19**
Iceland	Y	C	0	0	0.00	0	0.00	0	0.00	0	0.00
Norway	Y	C	5	5	0.10	3	0.06	2	0.04	0	0.00

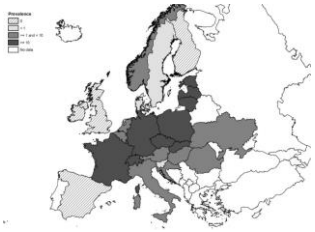
CLINICAL and EPIDEMIOLOGICAL OBSERVATIONS in EUROPE

PubMed.gov

(from scientific literature)

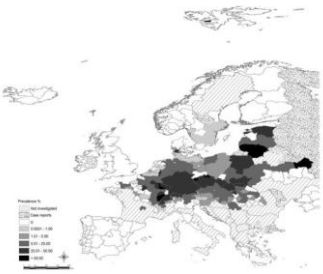


Prevalence of *Echinococcus multilocularis* in red and Arctic foxes in Europe

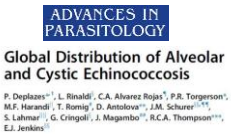


National

NUTS 1



Regional



Human alveolar echinococcosis in Europe?

Historical map of the discovery of the first cases of AE

"The estimated number of new [human] AE cases in Western and Central Europe […] is in the range of 170-200 per year"

"EU report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks"
EFSA Journal 2018;16(12):5500

HUMAN *"echinococcosis"*

Country	2017					2016		2015		2014	
	National coverage[a]	Data format[a]	Total cases	Confirmed cases & rates		Confirmed cases & rates		Confirmed cases & rates		Confirmed cases & rates	
				Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
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Denmark[b]	–	–	–	–	–	–	–	–	–	–	–
Estonia	Y	C	1	1	0.08	0	0.00	0	0.00	1	0.08
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Ireland[c]	Y	C	0	0	0.00	2	0.00	0	0.00	0	0.00
Italy[b]	–	–	–	–	–	–	–	–	–	–	–
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EU Total	–	–	**827**	**827**	**0.19**	**840**	**0.22**	**887**	**0.20**	**820**	**0.19**
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Norway	Y	C	5	5	0.10	3	0.06	2	0.04	0	0.00

ITALY
(2001-2014)

- 21,050 **HDRs** (to 12,619 CE patients)
- 901 human CE cases/year (min-max = 480-1,583)

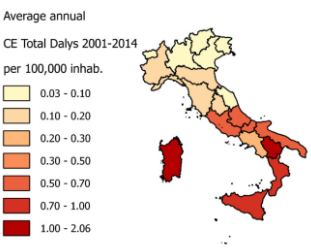
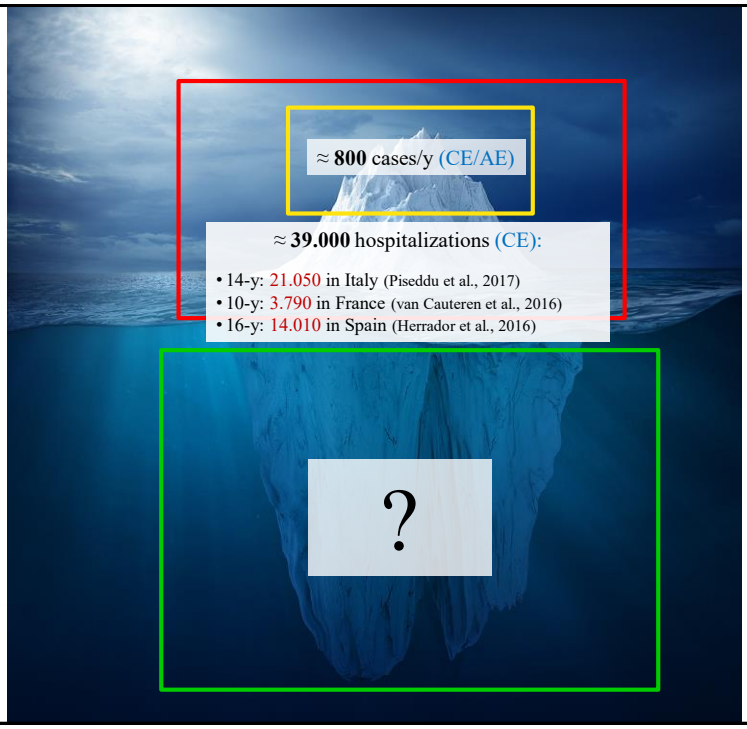


Fig 7. Choropleth map of average annual CE DALYs per 10^5 inhabitants by NUTS 2.

PLOS NEGLECTED TROPICAL DISEASES

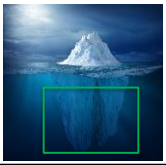
RESEARCH ARTICLE

The disease burden of human cystic echinococcosis based on HDRs from 2001 to 2014 in Italy



HIDDEN BURDEN in EUROPE

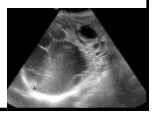
Cross-sectional study



Prevalence of abdominal cystic echinococcosis in rural Bulgaria, Romania, and Turkey: a cross-sectional, ultrasound-based, population study from the HERACLES project

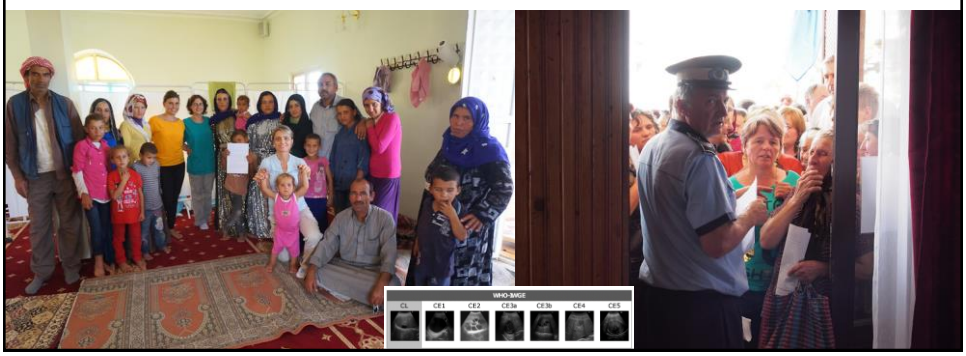
Francesca Tamarozzi*, Okan Akhan*, Carmen Michaela Cretu*, Kamenna Vutova*, Dewim Akinci, Rossitza Chipeva, Turkmen Ciftci, Corina Manuela Constantin, Massimo Fabiani, Branimir Golemanov, Denisa Janta, Patricia Mihailescu, Marin Muhtarov, Serra Orsten, Marius Petrutescu, Patrizio Pezzotti, Alexandru Cosmin Popa, Loredana Gabriela Popa, Mircea Ioan Popa, Valeri Velev, Mar Siles-Lucas, Enrico Brunetti, Adriano Casulli

- Biggest cross-sectional study research-based (ultrasound population surveys)
- Aims to estimate: prevalence, cyst stage distribution, number of infected individuals
- First "*original research*" ever published by "THE LANCET Infectious Diseases" on echinococcosis

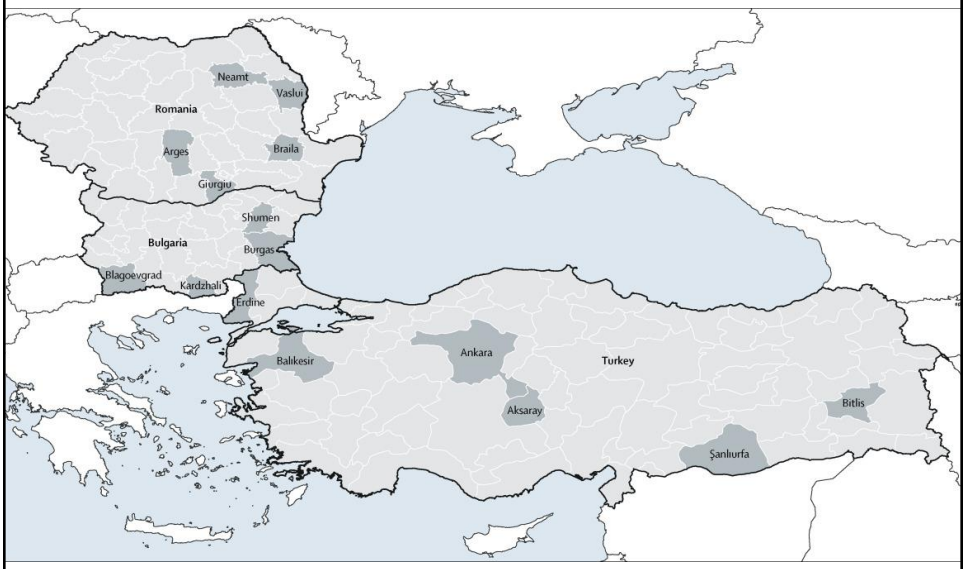


AREA, SAMPLE SELECTION and CASE DEFINITION

- Districts selected with mid-range average annual hospital incidence of CE;
- US by convenience sampling;
- Consensus protocol & case definition/cyst staging (WHO-IWGE);
- US lesions assessed by 2 sonographers during screening;
- Re-evaluation by a core team.



STUDY AREA and SAMPLE



Abdominal US screenings on **24,693** people in a total of **50** villages and **15** districts/provinces of Bulgaria, Romania, and Turkey.

Demographic characteristics of the

study sample *vs* reference population

	Sample			Reference rural population, 2015		
	Women	Men	Total	Women	Men	Total
Bulgaria						
<20 years	927 (16·1%)	830 (29·0%)	1757 (20·4%)	165 258 (17·1%)	176 246 (18·4%)	341 504 (17·7%)
20–29 years	372 (6·5%)	190 (6·6%)	562 (6·5%)	92 267 (9·5%)	107 974 (11·3%)	200 241 (10·4%)
30–39 years	794 (13·8%)	301 (10·5%)	1095 (12·7%)	103 034 (10·6%)	122 412 (12·8%)	225 446 (11·7%)
40–49 years	1033 (18·0%)	334 (11·7%)	1367 (15·9%)	114 312 (11·8%)	133 987 (14·0%)	248 299 (12·9%)
50–59 years	1224 (21·3%)	484 (16·9%)	1708 (19·9%)	123 387 (12·7%)	137 727 (14·4%)	261 114 (13·6%)
≥60 years	1392 (24·2%)	721 (25·2%)	2113 (24·6%)	370 513 (38·2%)	279 485 (29·2%)	649 998 (33·7%)
Total	5742 (100%)	2860 (100%)	8602 (100%)	968 771 (100%)	957 831 (100%)	1 926 602 (100%)
Romania						
<20 years	993 (19·4%)	693 (29·7%)	1686 (22·6%)	1 033 095 (22·6%)	1 094 626 (23·9%)	2 127 721 (23·3%)
20–29 years	398 (7·8%)	110 (4·7%)	508 (6·8%)	493 721 (10·8%)	584 333 (12·8%)	1 078 054 (11·8%)
30–39 years	656 (12·8%)	188 (8·1%)	844 (11·3%)	582 748 (12·8%)	645 339 (14·1%)	1 228 087 (13·4%)
40–49 years	844 (16·5%)	312 (13·4%)	1156 (15·5%)	599 120 (13·1%)	720 247 (15·8%)	1 319 367 (14·4%)
50–59 years	666 (13·0%)	315 (13·5%)	981 (13·1%)	490 349 (10·7%)	536 800 (11·7%)	1 027 149 (11·2%)
≥60 years	1569 (30·6%)	717 (30·7%)	2286 (30·6%)	1 366 271 (29·9%)	989 383 (21·6%)	2 355 654 (25·8%)
Total	5126 (100%)	2335 (100%)	7461 (100%)	4 565 304 (100%)	4 570 728 (100%)	9 136 032 (100%)
Turkey						
<20 years	1291 (26·9%)	1252 (32·8%)	2543 (29·5%)	3 038 126 (34·0%)	3 202 763 (35·7%)	6 240 889 (34·9%)
20–29 years	485 (10·1%)	322 (8·4%)	807 (9·4%)	1 178 004 (13·2%)	1 258 652 (14·0%)	2 436 656 (13·6%)
30–39 years	755 (15·7%)	534 (14·0%)	1289 (15·0%)	1 115 901 (12·5%)	1 168 183 (13·0%)	2 284 084 (12·8%)
40–49 years	758 (15·8%)	547 (14·3%)	1305 (15·1%)	1 036 607 (11·6%)	1 068 705 (11·9%)	2 105 312 (11·8%)
50–59 years	694 (14·5%)	514 (13·5%)	1208 (14·0%)	970 540 (10·9%)	946 874 (10·6%)	1 917 414 (10·7%)
≥60 years	816 (17·0%)	650 (17·0%)	1466 (17·0%)	1 584 716 (17·8%)	1 317 160 (14·7%)	2 901 876 (16·2%)
Total	4799 (100%)	3819 (100%)	8618 (100%)	8 923 894 (100%)	8 962 337 (100%)	17 886 231 (100%)

Table 1: Screened populations and reference rural populations, by sex and age group

Establishment of a prospective case retrieval system

Adjusted % of abdominal CE at national level

The crude % of CE infection was adjusted with direct standardisation by sex and age group by the 2015 country's rural population

	Cystic echinococcosis by imaging
Bulgaria	
Abdominal cystic echinococcosis detected/ participants screened	31/8602
Crude prevalence	0·36% (0·26–0·50)
Standardised prevalence	
Reference Bulgarian rural population, 2015	0·41% (0·29–0·58)
Reference European population, 2013	0·39% (0·28–0·56)
Romania	
Abdominal cystic echinococcosis detected/ participants screened	35/7461
Crude prevalence	0·47% (0·28–0·79)
Standardised prevalence	
Reference Romanian rural population, 2015	0·41% (0·26–0·65)
Reference European population, 2013	0·42% (0·27–0·67)
Turkey	
Abdominal cystic echinococcosis detected/ participants screened	53/8618
Crude prevalence	0·61% (0·20–1·89)
Standardised prevalence	
Reference Turkish rural population, 2015	0·59% (0·19–1·85)
Reference European population, 2013	0·67% (0·21–2·13)

Conservative estimate of number of individuals* that may be affected with (abdominal) CE (in the rural population)

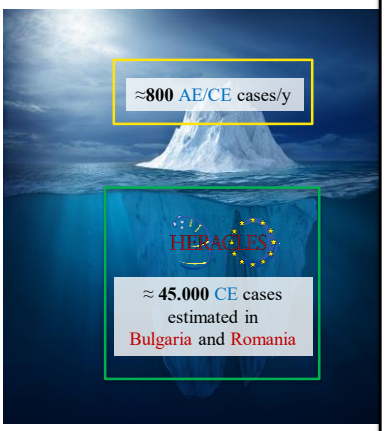
	BULGARIA	ROMANIA	TURKEY
	7,872 (5,520 - 11,220)	**37,229** (23,405 - 59,166)	**106,237** (33,829 - 330,751)
Active cysts	3,374 (1,398 - 8,129) [42,9%]	15,004 (8,432 - 26,683) [40,3%]	34,798 (17,505 - 69,109) [32,8%]
Inactive cysts	4,498 (2,395 - 8,439)	22,225 (11,180 - 44,132)	71,439 (15,941 - 316,737)

* estimated by multiplying the adjusted prevalence by the 2015 rural population;

"EU report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks"

efsa European Food Safety Authority

ecdc



Country	2016 National coverage[a]	2016 Data format[a]	2016 Total cases	2016 Confirmed cases & rates: Cases	2016 Confirmed cases & rates: Rate	2015 Confirmed cases & rates: Cases	2015 Confirmed cases & rates: Rate	2014 Confirmed cases & rates: Cases	2014 Confirmed cases & rates: Rate
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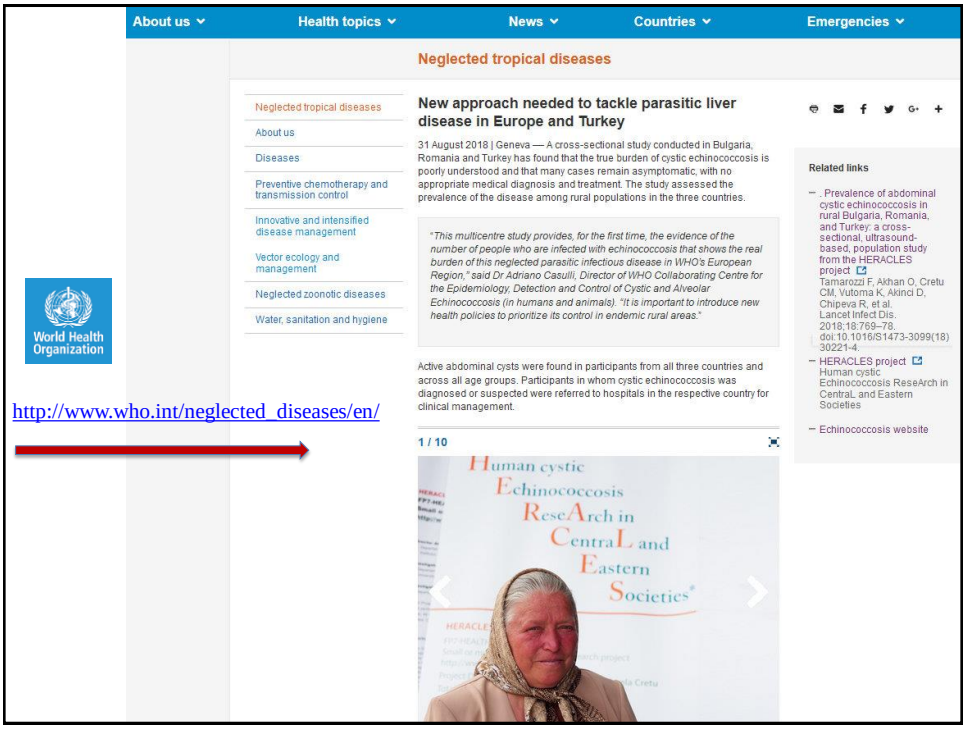
Czech Republic	Y	C	4	4	0.04	3	0.03	6	0.06
mark[b]	–	–	–	–	–	–	–	–	–
ia	Y	C	0	0	0.00	0	0.00	1	0.08
[c]	Y	C	4	4	0.07	2	0.04	0	0.00
	Y	C	38	38	0.06	48	0.07	32	0.05
	Y	C	109	109	0.13	156	0.19	131	0.16
	Y	C	18	18	0.17	13	0.12	13	0.12
	Y	C	5	5	0.05	2	0.02	2	0.02
		C	2	2	0.00	0	0.00	0	0.00
	–	–	–	–	–	–	–	–	–
		C	11	11	0.56	10	0.50	13	0.65
		C	26	26	0.90	33	1.13	22	0.75
			0	0	0.00	0	0.00	0	0.00
			1	1	0.23	0	0.00	0	0.00
			33	33	0.19	64	0.38	30	0.18
				64	0.17	47	0.12	48	0.13
				2	0.02	4	0.04	4	0.04
				13	0.07	18	0.09	31	0.16
				4	0.07	5	0.09	8	0.15
					0.15	7	0.34	5	0.24
					0.19	83	0.18	77	0.17
					27	26	0.27	21	0.22
						26	0.04	25	0.04
						883	0.20	820	0.19

Underestimation:

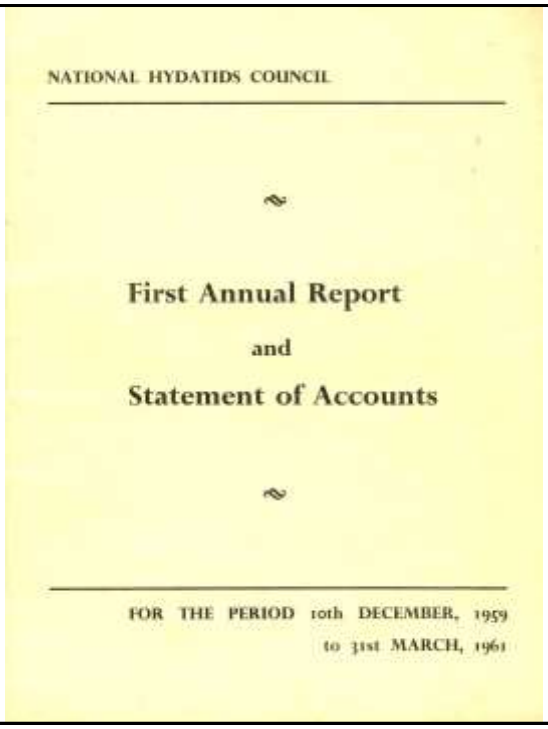
- Romania **700** folds
- Bulgaria **10** folds



http://www.who.int/neglected_diseases/en/

Situation of Cystic Echinococcosis around the world

- David Heath (New Zealand)
- National Control Program of Cystic Echinococcosis in New Zealand.
- Cystic Echinococcosis in Australia
- Cystic Echinococcosis in China



NATIONAL HYDATIDS COUNCIL

First Annual Report

and

Statement of Accounts

FOR THE PERIOD 10th DECEMBER, 1959
to 31st MARCH, 1961

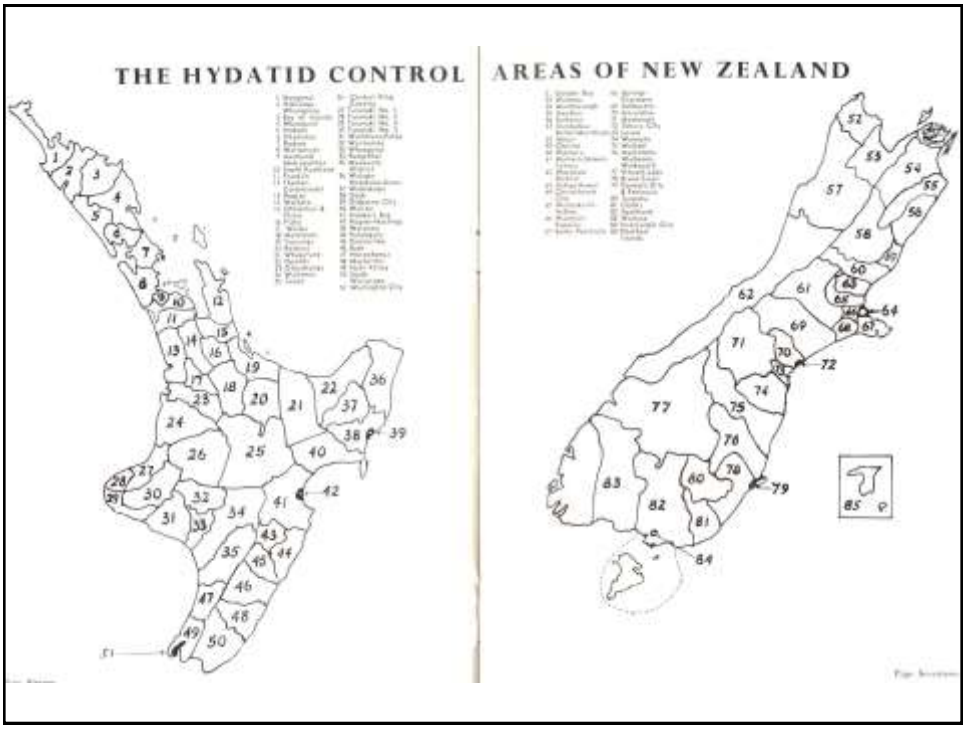
Michael A. Gemmel

1926-2003

Echinococcologist Extraordinaire

1960-1986

- Dog dosing strips set up around the country for arecoline purgation of dogs.
- Education programme started.
- 7 field officers, 240 hydatids and dog control officers.



The Hydatid Program

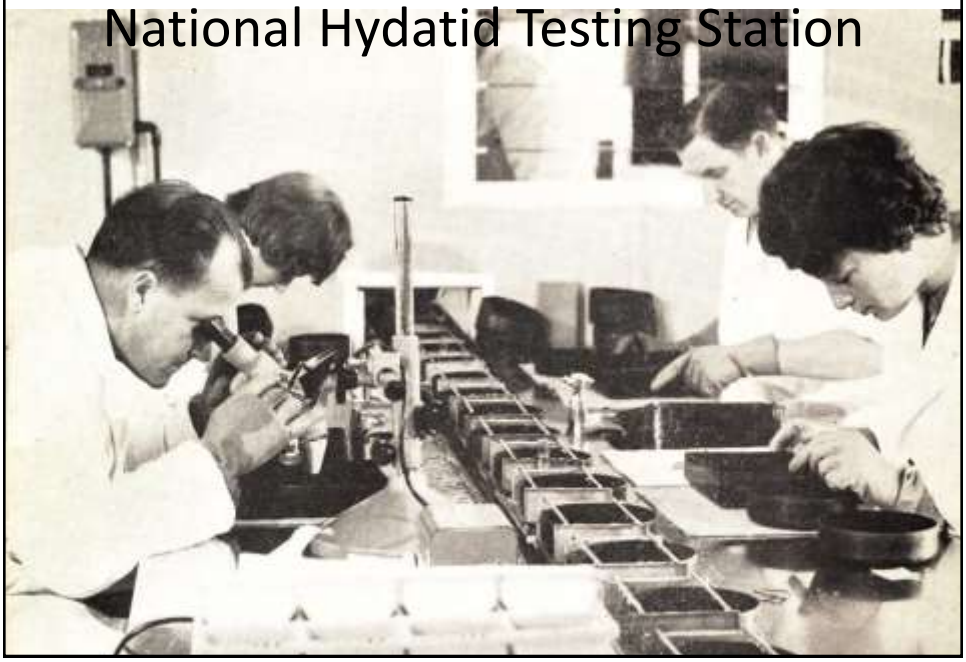
1. **Dogs do not eat livers and lungs**. Dead animals, and livers and lungs, into a hole.

2. **Arecoline purging of dogs** regularly for Dog control officers to show dog-owners and to **create data for the National Hydatid Council**.

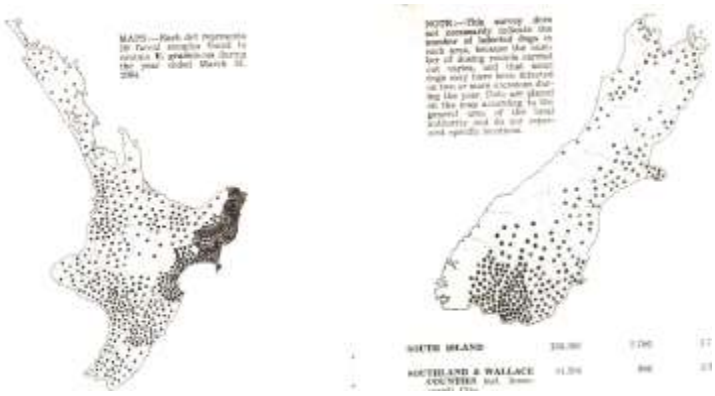
3. **Annual Reports** to all control officers

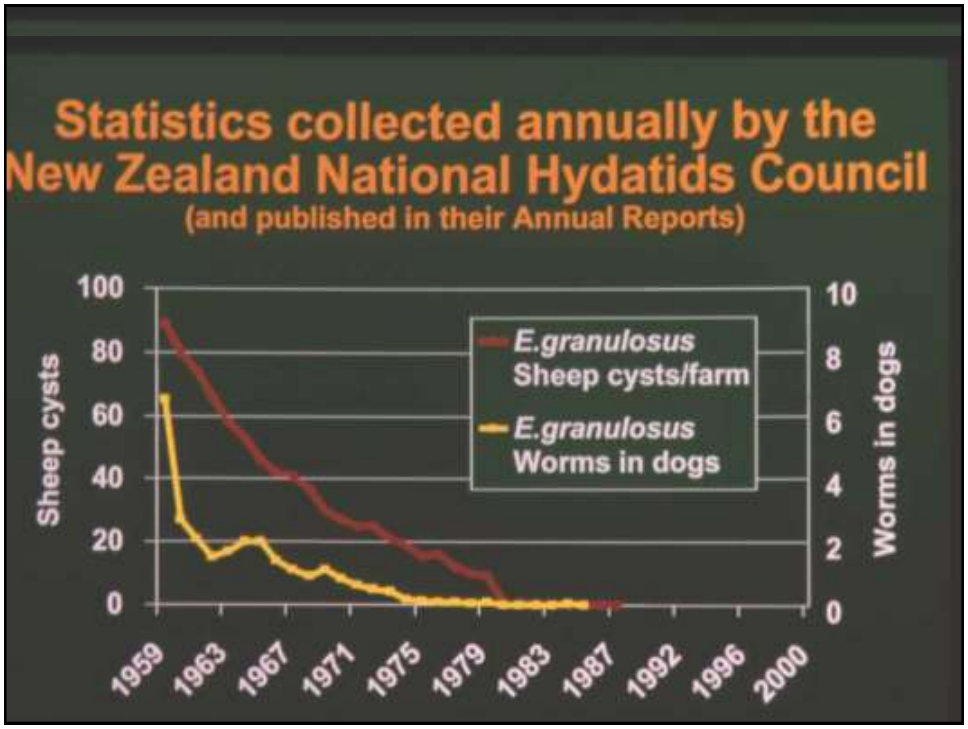
Hydatid Dosing Strip

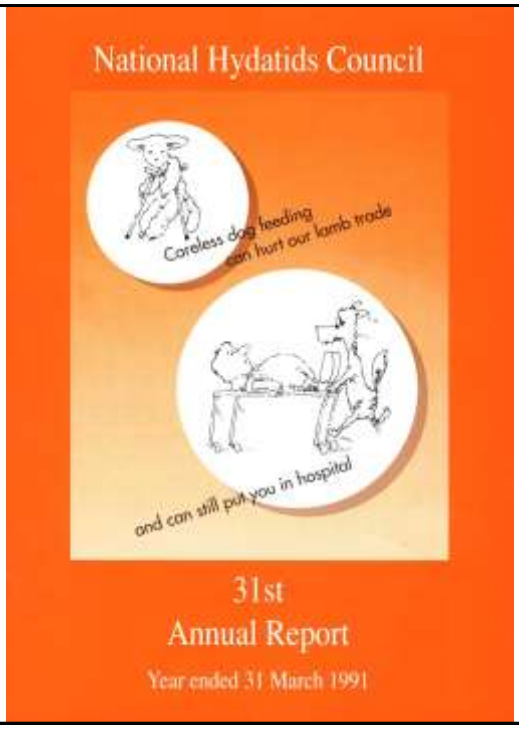
National Hydatid Testing Station

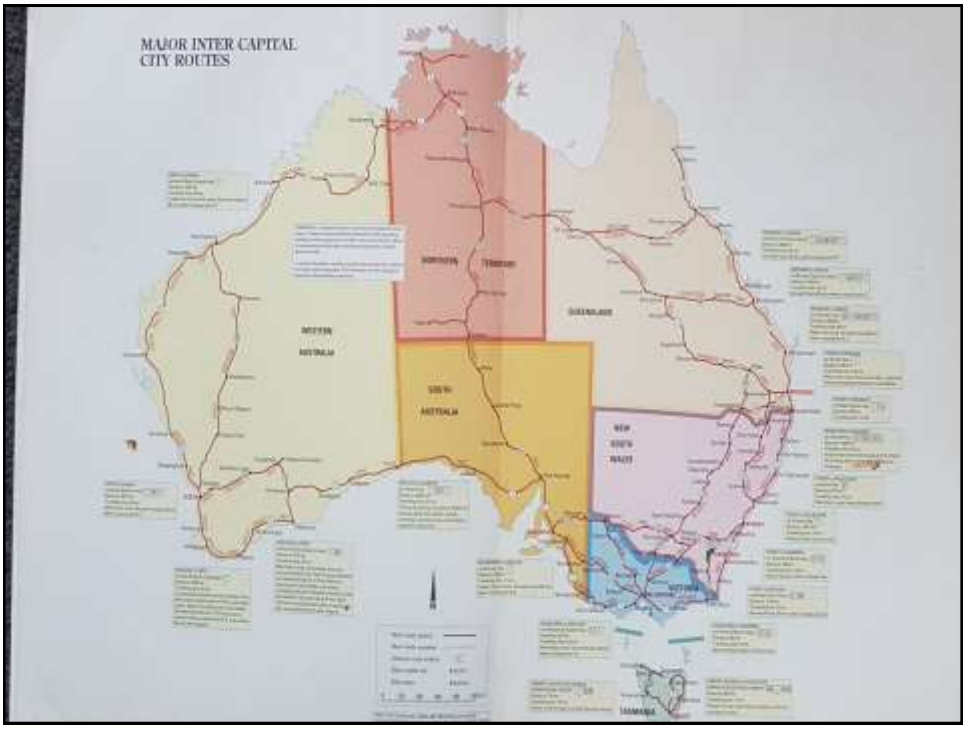


Each spot is 10 E.granulosus samples






National Hydatids Council
Careless dog feeding
can hurt our lamb trade
and can still put you in hospital
31st
Annual Report
Year ended 31 March 1991


MAJOR INTER CAPITAL
CITY ROUTES

E.Granulosus in Australia

- **Human cases:**
- 80-100 cases reported annually, more common in Aboriginal cases in rural Western Australia.
- Some young children infected.
- Reporting of cases is very poor in all States
- Recent education (from 2000-2019), and use of good anthelmintics, now find that sheep and cattle are not infected by the farmer, but some are infected when grazing near forests where wild dogs and Dingoes are infected.
- Tasmania free of hydatids from 2006, but cases in older people are still common in 2013.

E.Granulosus in Australia

- All species of marsupials can be infected, and wombats. Swamp Wallabies can be up to 65% fertile cysts in the lungs
- Wild pigs have been up to 70% fertile cysts
- Foxes have low levels of infection and small numbers of worms, but are still a problem around urban areas

E.Granulosus in Australia

Grazing Livestock cases:

Cysts regularly seen at abbatoirs in:

Queensland, NSW. Victoria, Northern Territory and Western Australia

An abbatoir in Eastern Australia showed about 50% of 8-tooth cattle showed cysts.

Macropid marsupials are the main hosts, eaten by Dingos and Wild Dogs

E.Granulosus in Australia

- **Peri-urban wild dogs**:

- Swamp wallabies are the main hosts for peri-urban wild dogs in Northern NSW and Southern Queensland.
- Peri-urban wild dogs look for edible garbage around houses.

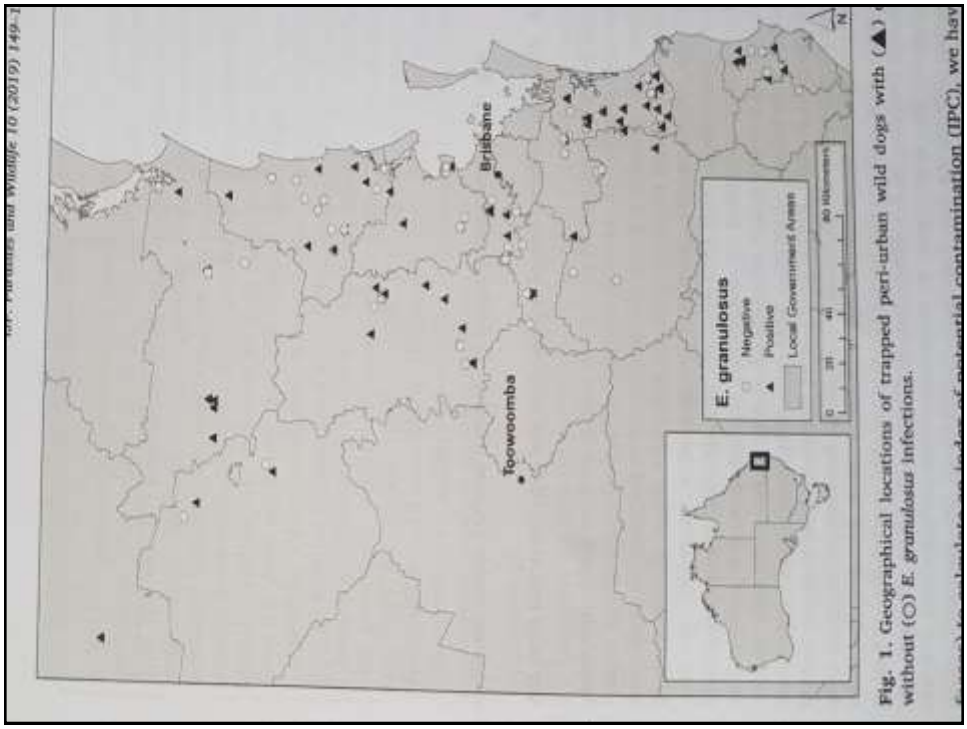
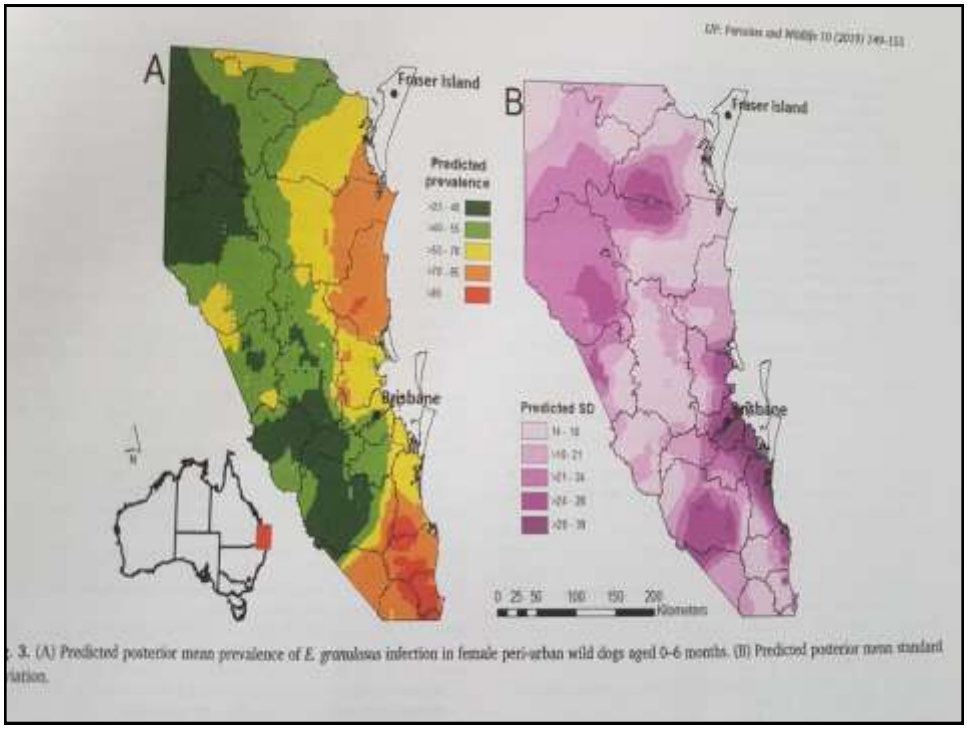


Fig. 1. Geographical locations of trapped peri-urban wild dogs with (▲) and without (○) *E. granulosus* infections.



3. (A) Predicted posterior mean prevalence of *E. granulosus* infection in female peri-urban wild dogs aged 0-6 months. (B) Predicted posterior mean standard iation.

China Echinococcosis Serological Survey 2005

- **Provinces of Western China –Av. 12% positive**
- Xinjiang 22%, Inner Mongolia 21%
- Age group 75-79 (18%) and 0-4 (7%)
- Females 14% and males 10%
- Herdsman (19%) and housewife (17%)

- Ultrasonography showed Tibet (2.8%), Sichuan(2.3%). Herdsman showed (4%)

China Baseline study in Sichuan(2006 -2009)

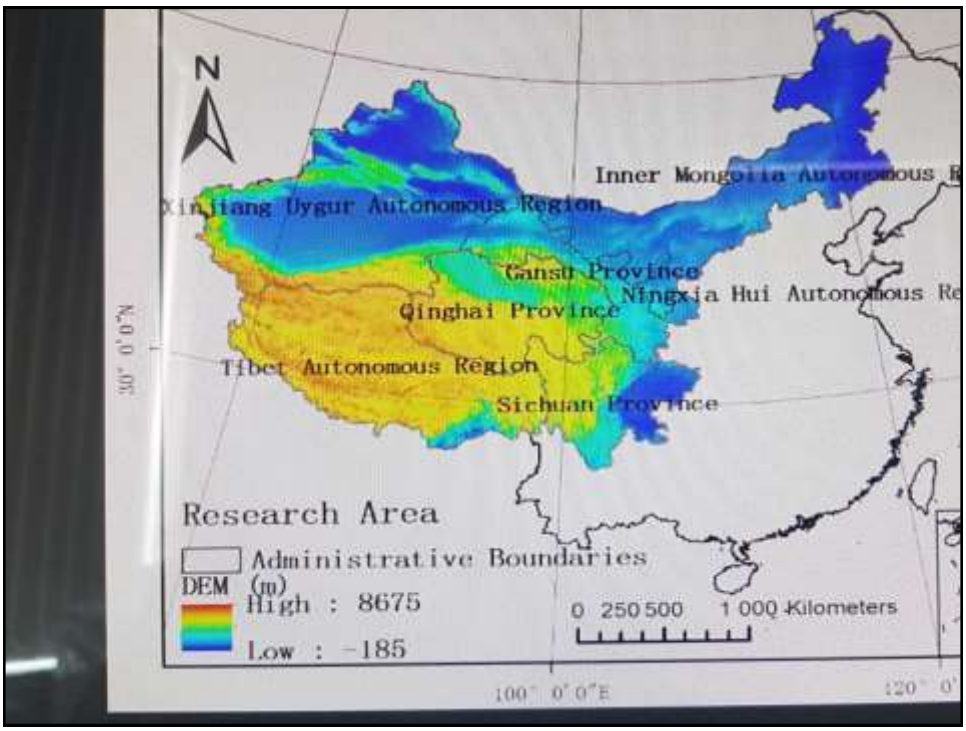
31 Counties in 2 Prefectures

- Abdominal ultrasound -**115 units** - 555,000 people screened

- **Ultrasound positive – 10,687 people had cysts**

A baseline Survey in Qinghai using ultrasound 2006-2009

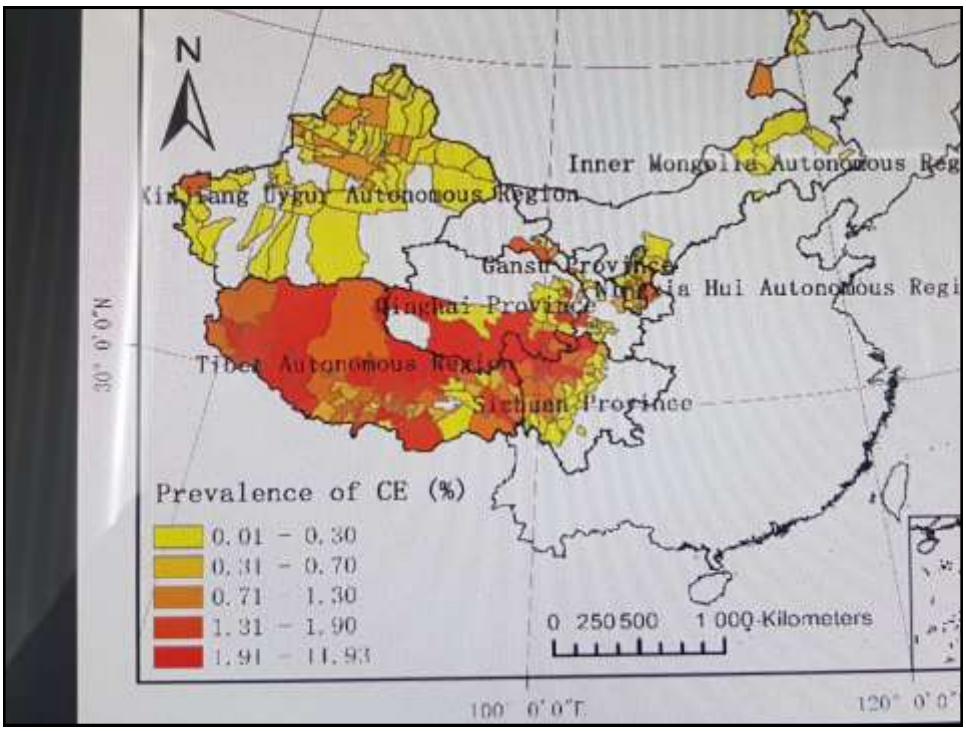
- **208,000 people have cysts**
- Tibetan herdsmen and Lamas had the highest incidence – **10%** actually infected.



The Tibetan Plateau

- General 5000 metre plateau (Summer grazing) with rivers down to 3000 metres (Winter grazing). No trees and no vegetables.
- Families have yaks and goats/sheep for grazing.

- New Zealand have been assisting with Hydatid control in Sichuan since 1996, especially demonstrating the New Zealand vaccine.



E.g. Humans 2006 and Predictive 2018

	2006	Predictive 2018
2018		
TIBET	2-10%	1-5%
QINGHAI	2-10%	0.3-1.3%
SICHUAN	1-2%	0.3-1.3%
GANSU	0.1-5%	0.3-1.3%
XINJIANG	0.3-1%	0.01-0.3%
NINGXIA	0.1-2%	0.01-0.3%
INNERMONGOLIA	0.1-1%	0.03-1.3%

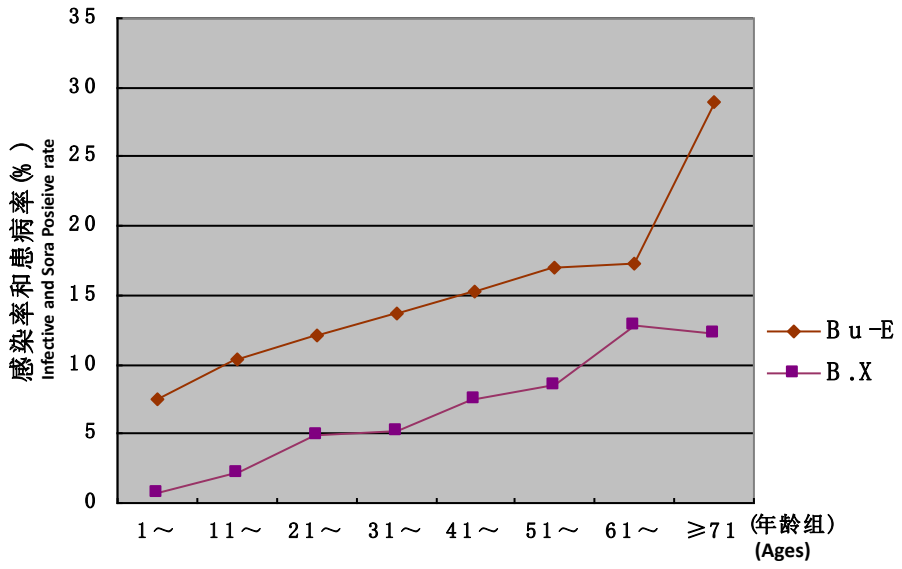


图5 青海省不同年龄组棘球蚴病流行病学调查结果

The survey results of echinococcosis in crowd by serological and B-ultrasound and X-ray examinations in different ages in Qinghai

Human Alveolar Echinococcosis

- **E.m. has been found in 115 Counties of 6 Western Provinces (Wu et al., 2018)**
- **In some hyper-endemic areas prevalence of human AE is up to 5-9%, with dogs of 5-20% (Torgerson et al., 2010).**
- **In the eastern Tibetan Plateau** within Tibetan communities, 6.3% were diagnosed by ultrasound. **Prevalence of 3.2% for CE (1-14%) and 3.1% for AE (1-9%) (Li et al., 2010)**

Field-Trial of <u>Factory Vaccine</u>

Farm,77 – a Merino fine-wool breeding farm Western Xinjiang

- **2095 lambs** were vaccinated with EG95 and more than this were in the Control group.
- Vaccinations were given when lambs were **5 and 6 months old.**
- **<u>Necropsy</u> at 24 months after the vaccination**

Beginning examination of livers and lungs

Veterinarians examine livers and lungs

Echinococcus granulosus liver cysts

Very Big Merino Farm

- RESULTS: **Vaccinated lambs – 1 cyst in 1 animal**.
- **Control lambs – 50% of lambs had cysts (1-50).**

Two infective times

- (cysts of 10-13 and2-3 mm)

Very Big Merino Farm - 2 years Later

- All dogs were supposed to get Praziquantel every 6 weeks. A man tried to find all the dogs each time.
- Two infective times of Echinococcus eggs were eaten by sheep during the 2 years (@ 9 months and18months).
- The vaccine was very effective!

Echinococcus vaccine in China

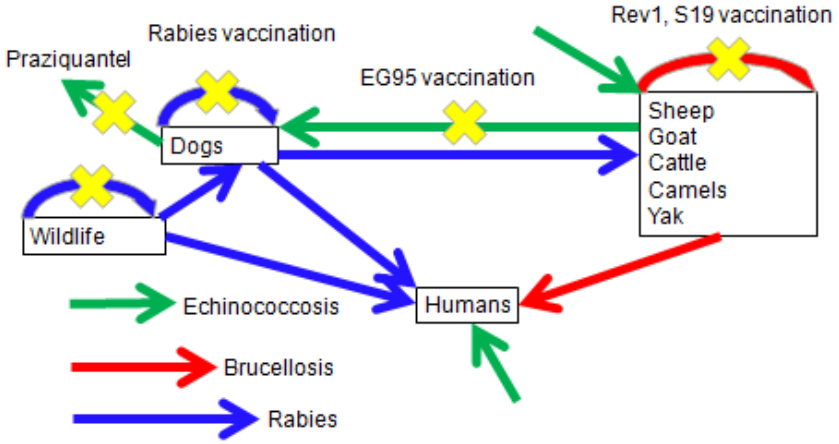
- **From 2006**, **praziquantel for dogs** is required in all Western Provinces
- **From 2016**, The Ministry of Agriculture has **vaccinated sheep and goats in endemic areas of Western China** to prevent infection with E.granulosus.
- **Each year, between 40 and 50 million doses are used.**

THE END?

Will the vaccination against CE reduce the hyperendemic areas? – see next meeting!

Swiss TPH

8. Towards an integrated control package for brucellosis, echinococcosis and rabies in Central Asia



Echinococcus in dogs

Year	Number found infected
1962-63	6336
1977-78	148
1978-79	112
1979-80	5
1980-81	1
1981-82	2
1982-83	1

Echinococcus in sheep

Year	% Sheep or Number of Farms Found Infected
1962-63	58%
1977-78	12%
1982-83	0.21%
1984	910 Farms
1987	435 Farms
1990	3 Farms
1996	1 Farm

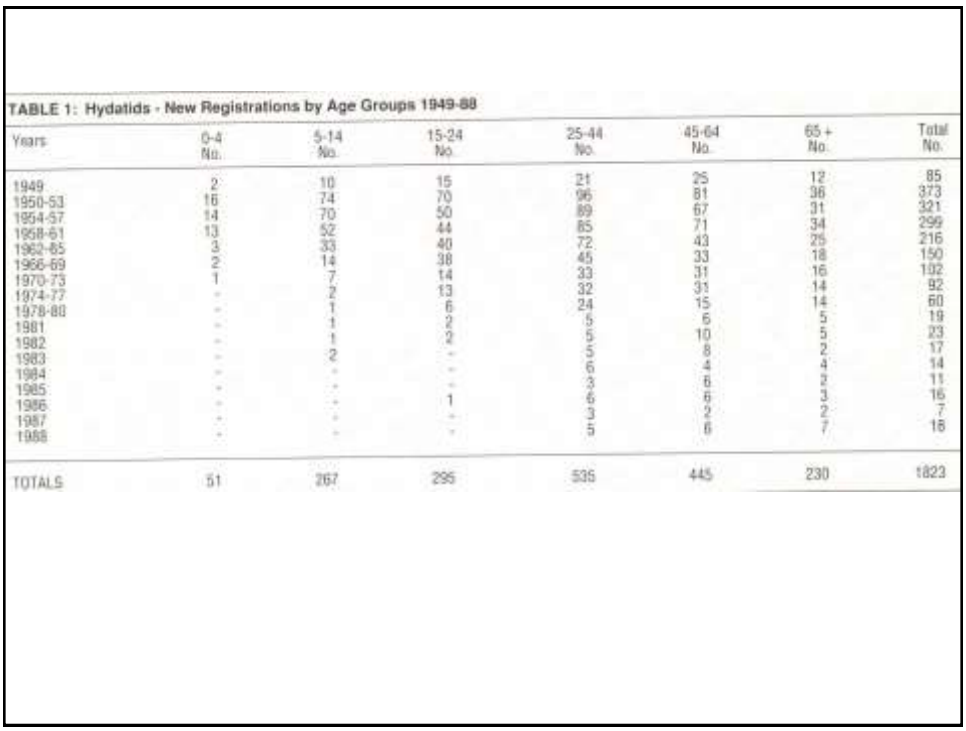


TABLE 1: Hydatids - New Registrations by Age Groups 1949-88

Years	0-4 No.	5-14 No.	15-24 No.	25-44 No.	45-64 No.	65 + No.	Total No.
1949	2	10	15	21	25	12	85
1950-53	16	74	70	96	81	36	373
1954-57	14	70	50	89	67	31	321
1958-61	13	52	44	85	71	34	299
1962-65	3	33	40	72	43	25	216
1966-69	2	14	38	45	33	18	150
1970-73	1	7	14	33	31	16	102
1974-77	-	2	13	32	31	14	92
1978-80	-	1	6	24	15	14	60
1981	-	1	2	5	6	5	19
1982	-	1	2	5	10	5	23
1983	-	2	-	5	8	2	17
1984	-	-	-	6	4	4	14
1985	-	-	-	3	6	2	11
1986	-	-	1	6	6	3	16
1987	-	-	-	3	2	2	7
1988	-	-	-	5	6	7	18
TOTALS	51	267	295	535	445	230	1823