Transmission of *Opisthorchis viverrini*, *Schistosoma mekongi* and other helminth infections in two communities of Khong Islands, Southern Lao PDR

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Background and Problems

- **Opisthorchiasis in Lao PDR** → ***Opisthorchis viverrini***
- Endemic nationwide
- High prevalence observed in **Central and Southern part of Laos**
- High intensity in **ADULTS**
- *Public health important for* **Cholangiocarcinoma (CCA)**

***O. v* positive with Hepatomegaly patient found in the community, Southern Laos (2009)**

Background and Problems (cont…)

- **Schistosomiasis in Lao PDR → *Schistosoma mekongi***
  - Only in **Khong and Mounlapamok district (endemic areas)**
  - *Public health important for* **Liver cirrhosis**

Severe cases of Schistosomiasis were found in both adults and children (2007-2010)

Endemic areas in Khong district

What we did in this study…

Both *O. viverrini* and *S. mekongi* infection

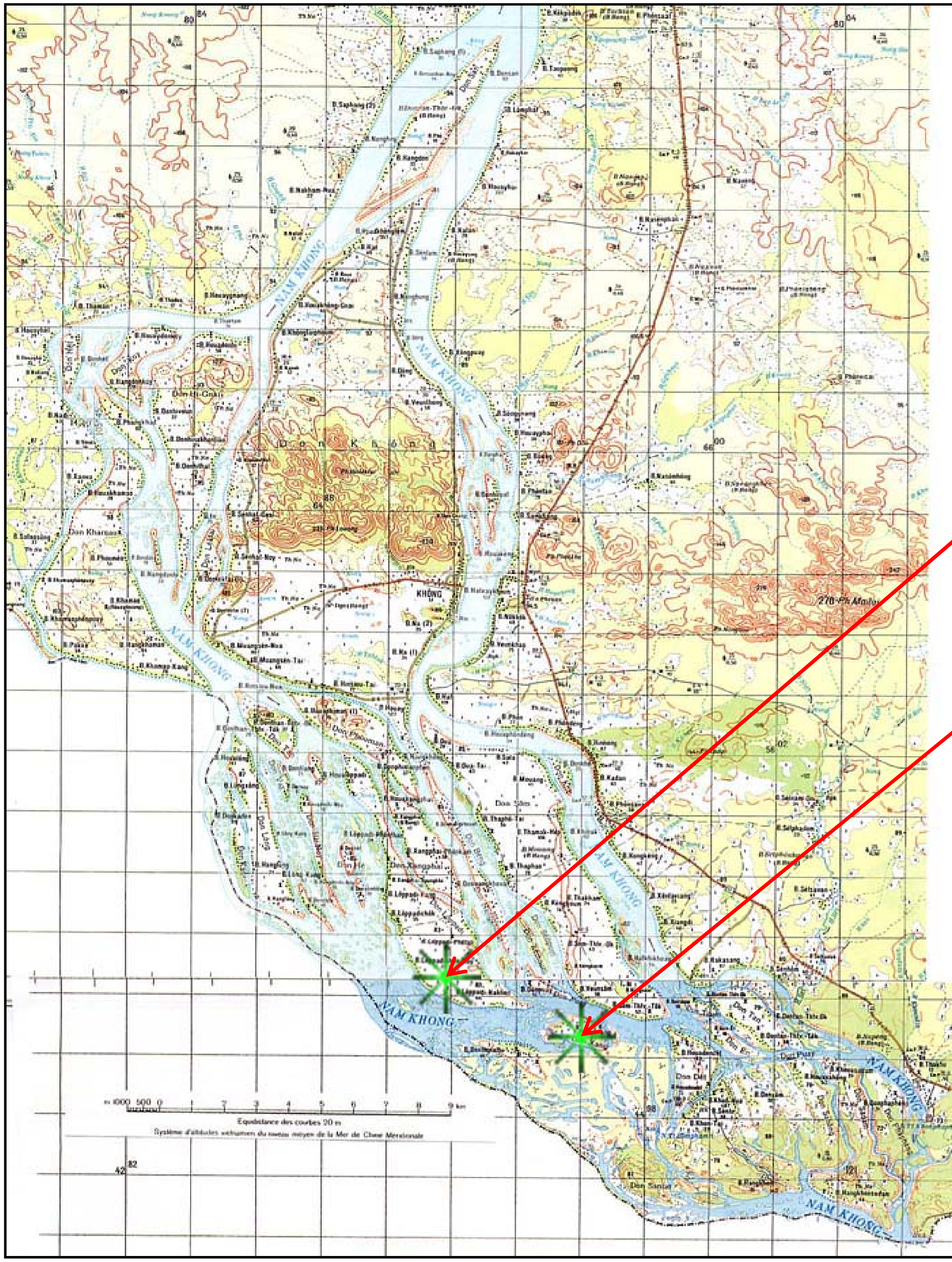
The simultaneously study on human and animal hosts of *O. viverrini* and *S. mekongi* in Lao PDR.

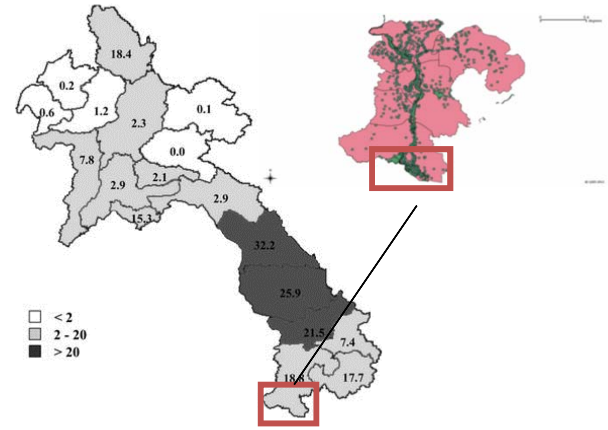
Because……

- Lacking data of **first intermediate** hosts for ***O. viverrini*** (*Bithynia* snail)
- Lacking data of **second intermediate** host for ***O. viverrini*** (*Cyprinoid* fish)
- Lacking data of **animal reservoir** hosts for ***O. viverrini*** (Dog, cat)

- Lacking data of **first intermediate** hosts for ***S. mekongi*** (*Neotricula aperta* snail)
- Lacking data of **animal reservoir** hosts for ***S. mekongi*** (Dog, pig, water buffalo)

Study area and population





- ❑ **Cross-sectional study, two communities in Khong district**
  - o First community (**Don Khone**)

    →260 households → 1,560 people
  - o Second community (**Don Som**)

    →378 households → 2,344 people
- ❑ **Data on infection status:**
  - o Human
  - o Animal reservoirs
  - o Intermediate hosts
- ❑ **Risk behaviors:**
  - o At individual level

Population and methods

❖ Human population:

- ✓ Two islands were randomly selected from 10 known endemic areas of *O. v* and *S. m*... 30 households were randomly selected/community
- ✓ Targeted 1,000 study subjects
- ✓ Selected household → all members aged > 2 years were enrolled
- ✓ Each study subject → 1 stool sample → 2KK (Kato-Katz) slides/each, questionnaires

Population and methods (cont…)

❖ Animal reservoirs for *O.v* and *S.m*:

- ✓ Dogs, cats, pigs, buffaloes in study villages
- ✓ → stool samples (10 % formalin preserved) → Formalin-Ether Concentration Technique

Enema inducing method for dog and cat

Fresh dropping of pigs and buffaloes were collected

Population and methods (cont…)

- **Snail and fish intermediate hosts:**
  - For ***O. viverrini*** → collecting *Bithynia* snails from natural pond, stream, swampy areas → shedding technique, pepsin digestion technique were used to detect *O. viverrini* cercariae and metacercariae from snail and fish, respectively.

Snail and fish collecting in the same reservoirs FOR *O. viverrini* (Scooping)

Population and methods (cont…)

- **Snail intermediates:**
  - For ***S. mekongi*** → collecting *N. aperta* snails from Mekong River **(Hand-picking)** → shedding technique was used to detect *S. mekongi* cercariae

Results

Study population

- **Human population**
- **Animal reservoir hosts**
- **Intermediate hosts**

➢ **Human survey:**

- **994 completed data records (questionnaire + 1 stool with two KK slides reading)**

Intermediate host survey

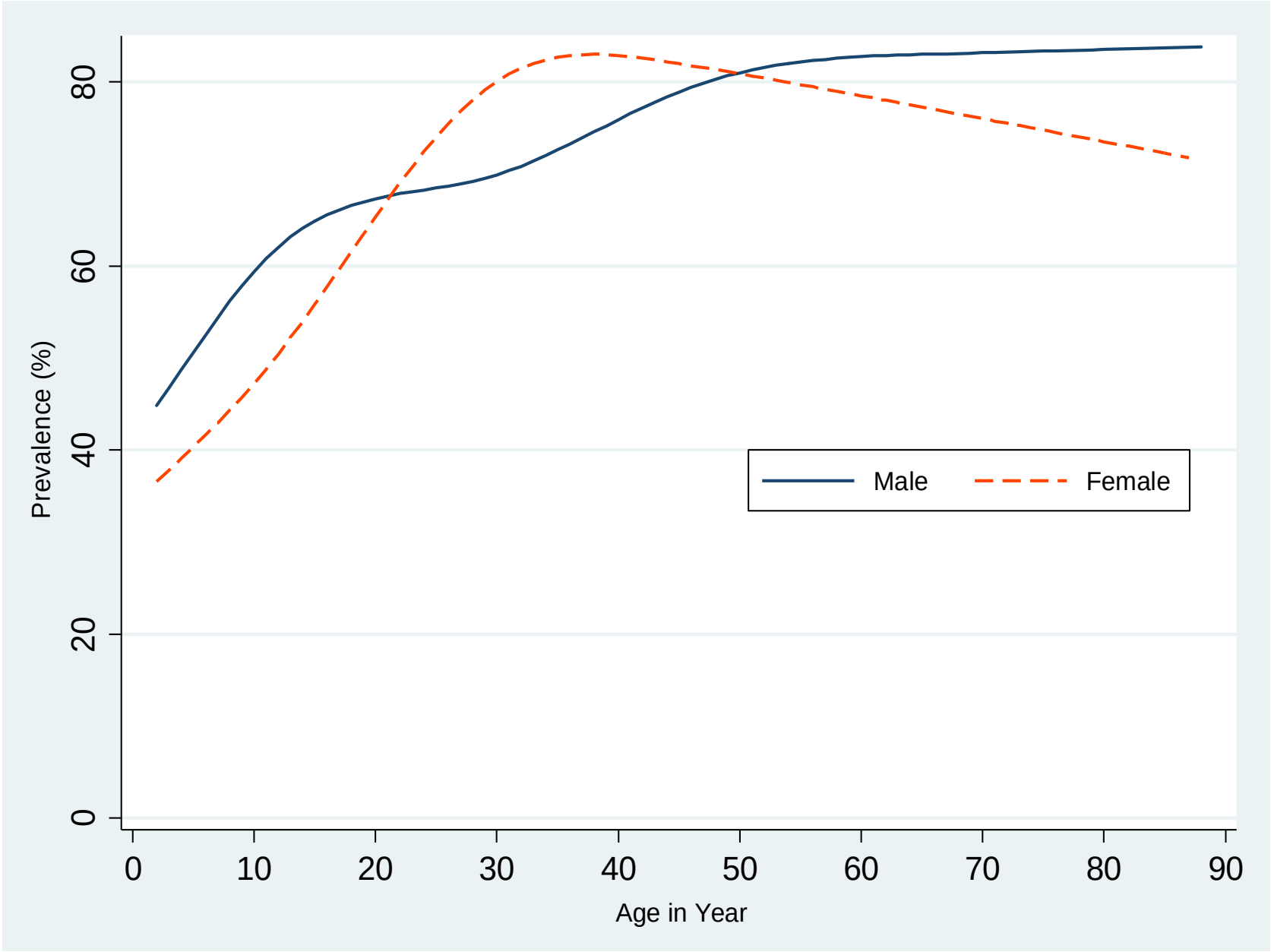
- **29,583 *N. aperta* snails**
- **3,102 *Bithynia* snails**
- **628 *Cyprinoid* fish**

Animal reservoir survey

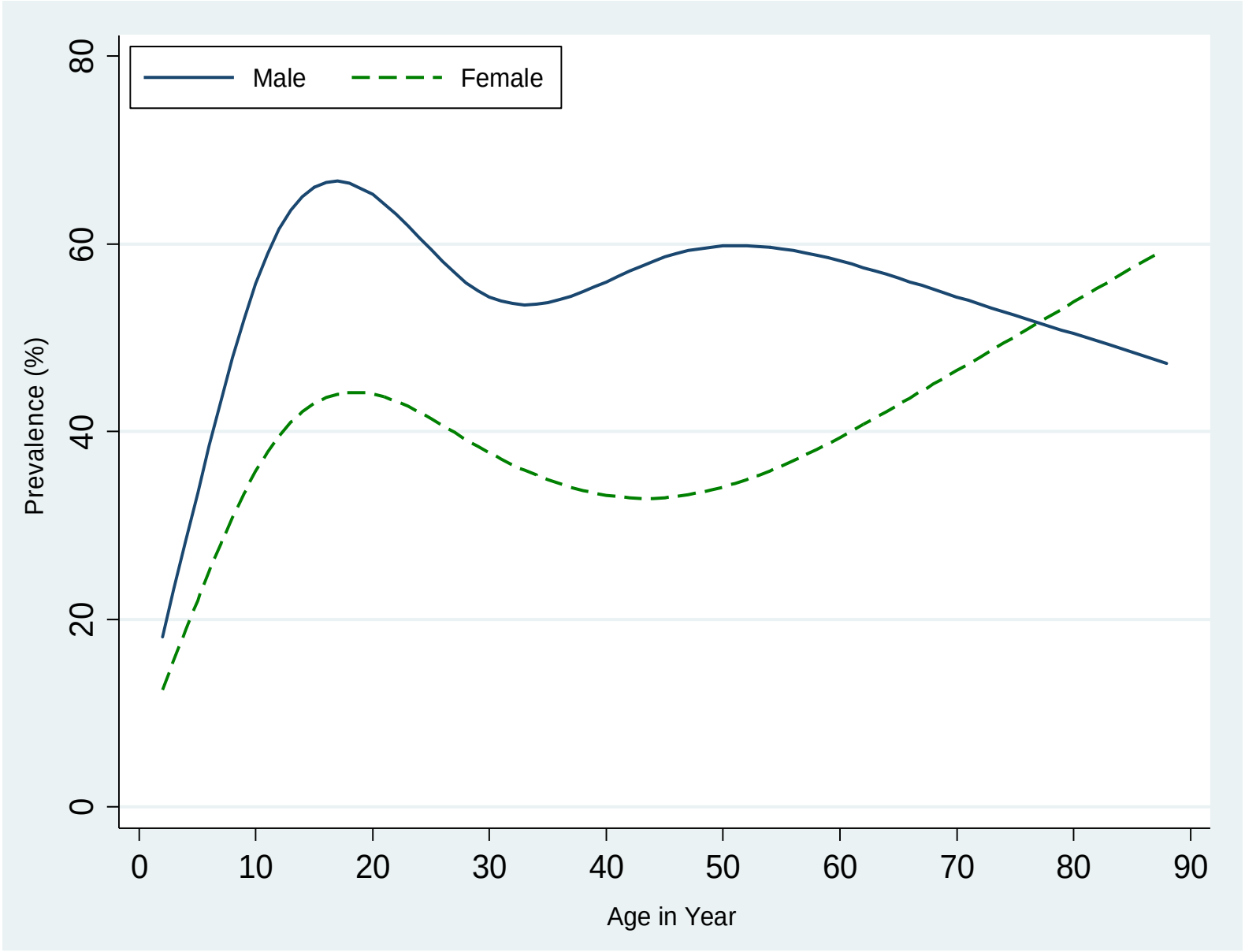
- **105 pigs**
- **94 water buffaloes**
- **68 dogs**
- **64 cats**

Socio-demographic characteristics of study participants from two study islands (N=994)					
Characteristics	Overall n (%)	Study area		x^2	P-value
		Done Khon, n (%)	Done Som, n (%)		
Age (years)					
Mean (range)	29.8 (2-88)	30.0 (2-87)	29.6 (2-88)		
Sex					
Male	479 (48.2)	212 (44.6)	267 (51.5)		
Female	515 (51.8)	263 (55.4)	252 (48.6)	4.6	0.032
Latrine available					
No	556 (55.9)	239 (50.3)	317 (61.1)		
Yes	438 (44.1)	236 (49.7)	202 (38.9)	11.7	0.001
Opened defecation this year					
No	484 (48.7)	256 (53.9)	228 (43.9)		
Yes	510 (51.3)	219 (46.1)	291 (56.1)	9.9	0.002

Prevalence of *S. mekongi, O. viverrini*, soil-transmitted helminth and other intestinal helminth infections among study participants from two islands (Done Khon and Done Som) of Khong district (n=994)					
Parasites	**Positive, n (%) (n=994)**	**Done Khon, n (%) (n=475)**	**Done Som, n (%) (n=519)**	**x^2**	**P-value**
Trematodes					
Opisthorchis viverrini	**603 (60.7)**	202 (42.5)	401 **(77.3)**	125.4	<0.001
Schistosoma mekongi	**221 (22.2)**	112 **(23.6)**	109 (21.0)	0.9	0.329
Soil-transmitted helminth					
Hookworm	**438 (44.1)**	196 (41.3)	242 (46.6)	2.9	0.090
Trichuris trichiura	**41 (4.1)**	21 (4.4)	20 (3.9)	0.2	0.653
Ascaris lumbricoides	**6 (0.6)**	6 (1.3)	0	6.6	0.010
Cestodes					
Taenia spp.	1 (0.1)	1 (0.2)	0	1.1	0.296
Multiparasitism					
No infection	202 (20.3)	127 (26.7)	75 (14.5)		
Single species	379 (38.1)	197 (41.5)	182 (35.1)		
Multiple species	413 (40.5)	151 (31.8)	261 (40.5)	43.9	<0.001



The figures represent the **smoothed age distribution** of **male (solid line) and female (dotted line)** study participants for an infection with ***Opisthorchis viverrini***



The figures represent the **smoothed age distribution** of **male (solid line) and female (dotted line)** study participants for an infection with ***Schistosoma mekongi***

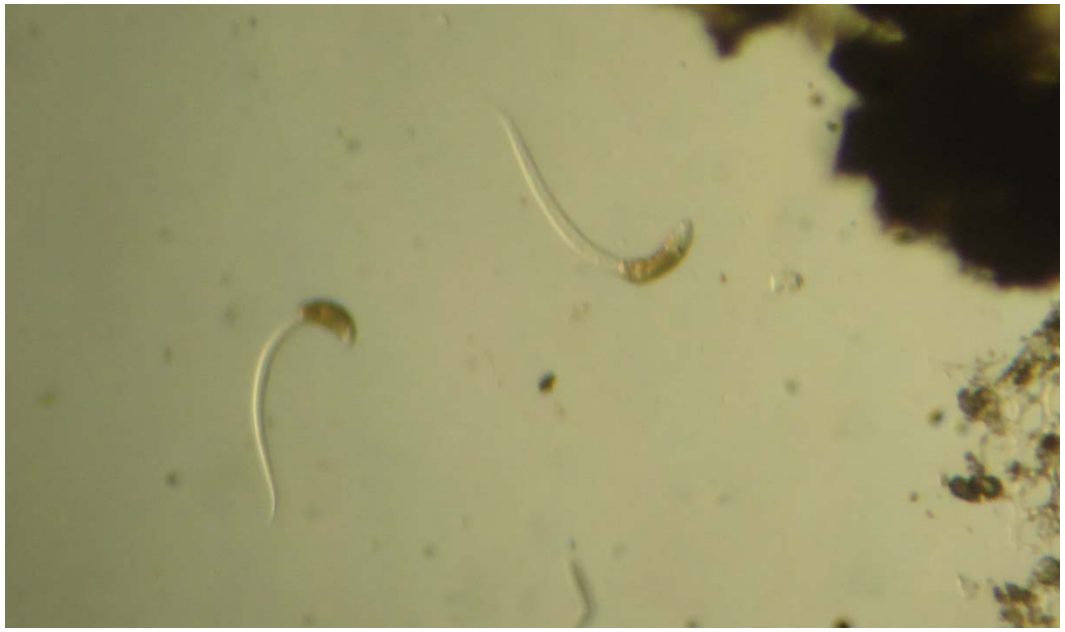
Infection intensity of *O. viverrini*, *S. mekongi* and soil-transmitted helminths among study participants from two islands of Khong district (n=994)

Infections	Light			Moderate			Heavy		
	Overall	Done Khon	Done Som	Overall	Done Khon	Done Som	Overall	Done Khon	Done Som
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
O. viverrini	409 (67.8)	174 (86.1)	235 (58.6)	169 (28.0)	27 (13.4)	142 (35.4)	**25 (4.2)**	**1 (0.5)**	**24 (6.0)**
S. mekongi	187 (84.6)	100 (89.3)	87 (79.8)	26 (11.8)	10 (8.9)	16 (14.7)	**8 (3.6)**	**2 (1.8)**	**6 (5.5)**
Hookworm	420 (95.9)	191 (97.5)	229 (94.6)	10 (2.3)	2 (1.0)	8 (3.3)	**8 (1.8)**	**3 (1.5)**	**5 (2.1)**
A. lumbricoides	5 (83.3)	5 (83.3)	0	1 (16.7)	1 (16.7)	0	0	0	0
T. trichiura	41 (97.6)	22 (100.0)	19 (95.0)	1 (2.4)	0	1 (5.0)	0	0	0

Prevalence of *Schistosoma mekongi* and *Opisthorchis viverrini* infections in animals on Done Khon and Done Som islands

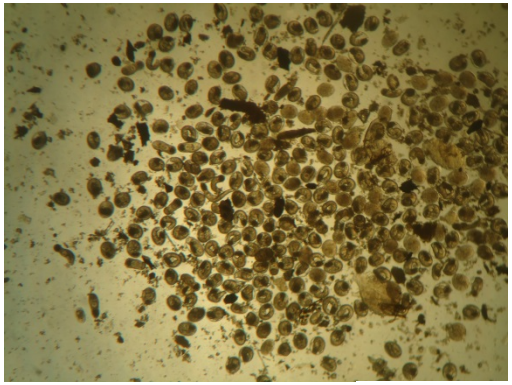
Infections	No. exam	Overall, n (%)	Done Khon, n (%)		Done Som, n (%)	
			No. exam	No. positive	No. exam	No. positive
Opisthorchis viverrini						
Dog	68	**17 (25.0)**	44	**10 (22.7)**	24	**7 (29.2)**
Cat	64	**34 (53.1)**	25	**15 (60.0)**	39	**19 (48.7)**
Pig	105	**1 (0.9)**	43	0	62	1 (1.6)
Water buffalo	94	0	32	0	62	0
Schistosoma mekongi						
Dog	68	**10 (14.7)**	44	7 (16.0)	24	3 (13.0)
Cat	64	0	25	0	39	0
Pig	105	0	43	0	62	0
Water buffalo	94	0	32	0	62	0

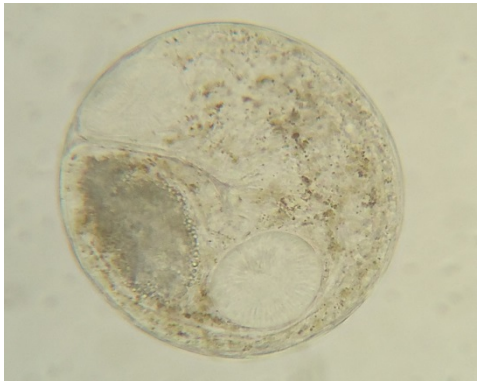
***Bithynia* snails for *O. viverrini* :**
A total of **3,102** *Bithynia* snails were collected → only 9 **(0.3%)** snails shed *O. viverrini* cercariae.



***N. aperta* snails for *S. mekongi* :**
A total of **29,583** *N. aperta* snails were collected → **only 4 (0.01%)** snails shed *S. mekongi* cercariae.

Cyprinoid fish infested by *O. viverrini* metacercariae





***O. viverrini* metacercariae**

Fish for *O. viverrini* :

21 species of **628** **fish** were collected (**622** *Cyprinoid* family & **2** other family)

→ A total of **628** fish, **169 Cyprinoid fish (11 species)** were positive **(26.9%)**

→ Only ***Cyprinoid* family** were positive,

THREE majors of fish infectded *O. v* metacercariae

- → ***Hampala dispa*** (87.1%, Lao: *Pa soud-jam*)
- → ***Cyclocheilichthys apogon*** (85.7%, Lao: *Pa dok-ngew*)
- → ***Puntius brevis*** (40.0%, Lao: *Pa khao-mon*)

Discussion and Conclusion

- *O. viverrini* and *S. mekongi* are highly prevalent on Mekong islands, southern Laos
- Dogs and cats contribute to *O. viverrini* transmission
- Dogs must be considered as reservoir hosts for *S. mekongi* and contribute the transmission
- Heavy infection was still observed within *O. viverrini, S. mekongi* and Hookworm ←-----→ MDA program should be revised
- Sustainable control approaches must address both human and animal risk factors such as:
  - Sanitation improvement
  - Health education ←----→ in **communities and schools**
  - MDA in both human and animal reservoir hosts
  - Policy of parasite control particularly helminthiasis should be revised in the country

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3. **University of Health Sciences, Vientiane, Lao PDR**
4. **Malariology, Parasitology and Entomology Station, Pakse, Champasack Province, Lao PDR**
5. **Provincial Health Office, Pakse, Champasack Province, Lao PDR**

All participants in two communities of khong islands in Khong district.

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