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THE RISK STATUS OF RABIES INFECTION IN DOG BUTCHERS AND EFFECTIVENESS OF INTERVENTION METHOD IN SOME DISTRICTS OF HA NOI, 2016-2018

SUMMARY OF DOCTOR OF PHILOSOPHY THESIS IN EPIDEMIOLOGY

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INTRODUCTION

Rabies is an acute viral encephalitis disease caused by the rabies virus, which is mainly transmitted from animals to animals or from animals to humans through a bite, scratch, or lick from an animal infected with the rabies virus.

In Vietnam, a total of 497 human deaths due to rabies were reported by the National Rabies Program in the period of 2008-2013, of which 475 deaths (95.6%) were caused by dog bites and 22 (4.4%) were results of exposure during the slaughter of dogs. Of the victims who died from exposure to rabies virus during the slaughtering process, 50% were professional dog butchers and 50% were non-professional butchers. Every year in Vietnam, there are about 5 million dogs slaughtered for food, and Nguyen et al. have reported that approximately 2% of dogs in dog slaughterhouses are infected with rabies. This suggests that those working in dog slaughterhouses are at increased risk of rabies compared to the rest of the population. Despite this, there is little information on the incidence of rabies among professional dog butchers, on the measures they take to mitigate their risk of exposure and subsequent infection, or on the possibility of the acquired antibodies to rabies virus as a result of their constant exposure. Therefore, we conducted a research " *the risk status of rabies infection in dog butchers and effectiveness of intervention method in some districts of Hanoi, 2016-2018"* with the following objectives:

1. To describe the status of the risk and factors related to rabies infection in dog butchers in some districts of Hanoi, 2016.

2. To evaluate the effectiveness of communication intervention to reduce the risks of rabies in dog butchers in some districts of Hanoi, 2017-2018.

Contribution of the thesis

The study was to determine the evidences of the risks of rabies infection in professional dog slaughterers and rabies transmission among animals via dog trading, slaughtering and meat consumption, and some related factors in Hanoi,

Vietnam. Specially, the study reported the valued data on serology and virology of rabies in butchers and dogs at slaughterhouses, which have not been established previously. additionally, appreciate communication interventions have shown positive effects in changing knowledge, behavior and practices on rabies prevention of professional dog butchers.

The thesis topic has practical significance for the fields of Epidemiology, Preventive Medicine, and Public Health in the prevention of rabies in Hanoi in particular and the country in general. The research topic also gave good lessons for other localities with homologous characteristics to learn when implementation of the similar research or intervention.

Scientific and practical significance of the thesis

1. *Scientific significance*

The study identified the risk of rabies transmission in dog population in Hanoi through the dog trading, slaughtering and meat consumption activities with the evidences that 0.8% dogs in slaughterhouses infected with rabies virus, and that the protective neutralizing antibodies against rabies virus was only found in 0% and 19.17% dogs at large and small slaughterhouses, respectively.

The study also showed that the professional dog butchers in Hanoi were definitely at high risk of rabies because 84.7% professional dog butchers have not vaccinated with rabies vaccine, and only 8, 6% dog butchers had sufficient neutralizing antibodies against rabies. Particularly, 7.8% unvaccinated dog butchers had neutralizing antibodies, which probably was a result of multiple exposures to rabies virus during butchering process. This result adds to the previously published evidences that natural neutralizing antibodies against rabies occur in humans exposed to variants of rabies virus from bat and dog reservoirs.

Effectiveness of communication interventions changed knowledge and practices of professional dog butchers on rabies control and prevention. Therefore,

it is necessary to maintain these communication interventions to reduce the risks of rabies virus infection for this occupational group.

2. *Practical significance*

It is highly recommended that the rabies prevention activities in Hanoi in particular and in Vietnam in general need to emphasize the prevention of rabies spread via dog trading, slaughtering and meat consumption activities. In addition, there is a need for communication, vaccination and training on safety butchering practices for the dog slaughters to minimize the transmission of rabies from dogs to this professional group.

The research results suggested that dog trading, slaughtering and dog meat consumption should be particularly considered for control and prevention activities of the rabies endemic countries, where dog meat is the custom.

The structure of the thesis

The main body of the thesis is presented with 123 pages (excluding appendices, tables of contents, abbreviations), and is divided into 6 parts, including: Introduction 3 pages; Chapter 1 - Overview: 36 pages; Chapter 2 - Research methodology: 17 pages; Chapter 3 – Research results: 31 pages; Chapter 4 – Discussion: 31 pages; Conclusion: 02 pages; Recommendation: 02 page and list of related publications: 01 page. The thesis includes 26 tables, 11 pictures. The references contain 129 documents (31 Vietnamese, 98 English). The appendix includes a structured questionnaire.

CHAPTER I: OVERVIEW

1.1. Overview of rabies

Rabies is an acute viral encephalitis disease caused by the rabies virus, which is mainly transmitted from animals to animals or from animals to humans through a bite, scratch, or lick from an animal infected with the rabies virus. Dogs are the main source of human rabies deaths, contributing up to 93%-98% of human rabies. There have been a few cases reported due to the exposure during dog slaughter.

1.2. Status of rabies risk due to dog slaughter

Recently, various studies have reported the presence of rabies infected dogs at slaughterhouses, such as in China (2.3%), Peru (31%) and Nigeria (5%). Human rabies cases also were reported through dog trading, butchering and meat consumption, including the Philippines, China, Thailand, Vietnamese and some African countries.

In Nigeria, 8 out of 9 human deaths due to rabies were reported by dog trading and butchering in the period of July to August, 2012.

In China, an epidemiology survey of human rabies deaths in 2009 showed that 3 among 64 human deaths were results of butchering and processing dog meat.

Dog slaughter was reported as a risk of rabies transmission in the Philippines in January 2008 that 30 people had to get rabies vaccine after eating an infected rabies dog. A retrospective study from January 1987 to June 2006 of all rabies patients at San Lazaro Hospital, Manila in 2011 was conducted. The results showed that 25 out of 1,839 confirmed human rabies cases were results of exposure to rabies virus during butchering dogs.

In Vietnam, a total of 497 human deaths due to rabies were reported by the National Rabies Program in the period of 2008-2013, of which 475 deaths (95.6%) were caused by dog bites, and 22 (4.4%) as a result of exposure during the slaughter of dogs.

1.3. Methods for control and prevention of rabies

Inter-sectoral collaboration for rabies control and prevention

Enhancement of interdisciplinary coordination, with the participation of Governmental, non-governmental organizations, and communities are in placed in strategies of rabies control and prevention of Southeast Asian countries, in which Vietnam is the leader country for control and elimination of rabies in the region.

In Vietnam, the Ministry of Health and the Ministry of Agriculture and Rural Development have co-chaired many workshops to develop a national plan to control and move towards rabies elimination in the 2016-2020 period.

Intervention methods for rabies control in animals

Interventions to reduce wildlife populations include hunting, trapping, poisoning and fumigation. However, immunization of the wild hosts is more effective than the reduction of animal densities, which was proven in rabies prevention programs of North American and European countries.

Rabies in domestic cats and dogs is controllable if the vaccination coverage of domestic animals (dogs and cats) is reached and maintained to more than 70% of populations. These vaccinations effectiveness have been proven in some countries, such as North America, Western Europe, Japan and South America.

Intervention methods for rabies control in humans

The principle methods for control and prevention of rabies in humans are communication to the targeted audiences on knowledge, best practices of rabies control and prevention, vaccination for high-risk subjects, and post-exposure prophylaxis for exposure people with rabies serum and rabies vaccine.

1.4. Communication interventions to change the behavior in control and prevention of rabies

In the Philippines, in 2012, a communication program for rabies control and prevention was integrated in the curriculum for teaching pupils in schools. The results showed that the number of registered dogs, as well as the number of people vaccinated with rabies vaccine after being bitten by a dog increased.

In India, in 2016, a model for communication on rabies control and prevention was implemented by using local representatives as communicators. The direct household visits and small group discussions (30 people per group) were used for educating the knowledge and practices of rabies prevention at communities. Concurrently, free mass vaccination of dogs was carried out at the region. As results, the knowledge and best practices of rabies prevention, including

first aid of dog bites and wounds treatment have improved, leading to a reduction of rabies infected dogs and human rabies cases.

In Vietnam, there have not been reported any intervention models for rabies education, information and communication (EIC) to the specific target group. The national program for rabies control and prevention mainly focuses on public communication campaigns.

CHAPTER2. STUDY SUBJECTS AND RESEARCH METHODS

2.1. Study subjects

❖ Dog butchers

Dog butchers meet the following criteria: working at dog slaughterhouses in Hanoi city, having period of employment ≥ 30 days, participating one of the process of dog slaughter, voluntarily participating in the research, no acute illness at the time of joining the study.

Exclusion criteria: Women who are pregnant or planning to become pregnant during the study; being suffered from an acute disease.

❖ Dogs at slaughterhouses in Hanoi

2.2. Location, time and research design

Research location:

The communication intervention was implemented at 7 districts of Hanoi including: Hoang Mai, Nam Tu Liem, Ha Dong, Son Tay, Quoc Oai, Thach That and Hoai Duc District.

The study was conducted at 92 dog slaughterhouses in 6 districts of Hanoi including: Hoang Mai District, Nam Tu Liem District. Ha Đong District, Son Tay District, Quoc Oai District, and Hoai Duc District.

Research duration:

a cross-sectional survey was implemented from January 2016 to December 2017 communication intervention and evaluation of intervention method was conducted from January 2017 to December 2018.

Research design:

Objective 1: Cross-sectional survey.

Objective 2: Self-control intervention research method, with comparison before and after the intervention.

2.3. Sample size and sampling methods

2.3.1. Sample size

- *The sample size for survey of knowledge and practices of dog butchers*

$$n = \frac{z^2_{1-\alpha/2} \, p\,(1-p)}{d^2}$$

+ α = 0.05, corresponding to 95% confidence.

+ d: expected at 5% of acceptable error.

+ p = 0.74 (the proportion of people with correct knowledge of rabies prevention was reported by Bui Van Uy, 2016). Therefore, the minimum sample size for assessment of knowledge of rabies prevention in dog slaughterers is 296.

+ p = 0.51 (the proportion of people with correct practices was reported by Bui Van Uy, 2016). Therefore, the minimum sample size for assessment of practices on rabies prevention in dog slaughterers is 385.

- *Sample size for determination of antibody against rabies virus professional dog butchers*

$$n = \frac{z^2_{1-\alpha/2} \, p\,(1-p)}{(p.\varepsilon)^2}$$

+ p = 0.11 (the percentage of people seropositive with rabies antibodies that was reported by Garba et al., 2015).

+ α value = 0.05 corresponding to 95% confidence.

+ ε Relative deviation between sample parameter and population parameter is expected at 0.3.

The minimum sample size for determination of antibody against rabies virus professional dog butchers is 385. The largest sample size for surveys of KP and

rabies antibodies in dog butchers is 385. In fact, we have conducted research with 406 subjects meeting the criteria.

- *Samples for determination of dogs positive with rabies antibodies and dogs infected with rabies in the slaughterhouses*

  We collected 2,376 pairs of brain and serum samples from dogs of 92 slaughterhouses. In which, 1500 pairs of brain-serum samples were taken from 08 large slaughterhouses and 876 were taken from 84 small slaughterhouses.

- *The sample size for intervention study and evaluation of intervention effectiveness.*

$$n_1 = n_2 = \frac{\left\{ Z_{(1-\alpha/2)} \sqrt{2\overline{P}(1-\overline{P})} + Z_{(1-\beta)} \sqrt{p_1(1-p_1) + p_2(1-p_2)} \right\}^2}{(p_1 - p_2)^2}$$

n: sample size

$z(1 - \alpha/2) = 1.96$.

$z(1 - \beta) : 90\%$.

+ p1 = 0.57 (the proportion of butchers with correct practices on rabies control and prevention was reported by Anh et al., 2015)

+ p2 = 0.70 (the estimated rate of butchers with correct practices on rabies control and prevention will be reached after intervention).

$\overline{P} = (p1 + p2)/2$

RR = p2/ p1= 1.2

It shows that 287 people are needed for this study. In fact, the study interviewed 406 subjects at pre – intervention, EIC intervened to all 406 subjects, and interviewed 292 subjects at post-intervention.

2.3.2. Sampling method

Sampling dog butchers for KP interview

A total of 650 (100%) dog butchers in the 7 studied districts was listed. Then a random selection was applied to select 406 dog butchers. Researchers asked for the agreement of 406 selected to participate into the study. In the event that there were not enough participants in the study, we continued to draw random from the list until the number of participants was sufficient.

Sampling dogs in slaughterhouses for antibody and rabies virus detections:

Sample collection: A total of 1,500 dog samples were collected from the large slaughterhouses. The process was taken weekly on every Tuesday and Thursday, with 3-5 pairs of dog samples collected per each slaughterhouse. The remaining 876 pairs of dog samples were collected from small slaughterhouses, taken place once every 2-3 months with only one dog sample collected per each slaughterhouse. The samples were collected without any background on the dogs' origin information and rabies vaccination history. Each dog had two collected samples, including serum and brain samples.

Sampling dog butchers for evaluation of intervention effectiveness

- Intervention of 100% dog slaughterers in 7 studied districts.

- After the intervention, randomized selection of 287 dog butchers out of 406 participants who have been intervened to evaluate the effectiveness of the intervention.

2.4. Data analysis:

Epidata 3.1 and Stata16 software were used for data entry and analysis.

Mega 4.0.2, BioEdit 7.2.5 and laser gene 7.0 were applied to analyze genetic characteristics of the virus. Neighbor joining method was used for construction of phylogenetic tree of rabies virus.

Antibody titrates were calculated by using the Reed & Muench formula.

2.5. Tools and methods for data collection

- Knowledge and practices of dog butchers on rabies control and prevention were obtained by direct interview, using structured questionnaire and check list.

- Direct immunofluorescence technique (FAT) and RT - PCR were used for determination rabies infected dogs.

- Rapid Fluorescence Focus Inhibition Test (RFFIT) was applied to determine the neutralizing antibodies against rabies in human serum.

2.6. Research ethics

The study was reviewed and approved by the Ethics Council of the National Institute of Hygiene and Epidemiology (Decision # IRB-VN01057-1 / 2017).

CHAPTER 3. RESEARCH RESULTS

3.1. The risks and factors related to rabies infection in dog butchers in several districts of Ha Noi, 2016

3.1.1. Status of neutralizing antibodies and rabies virus infection in dogs at some slaughterhouses in Hanoi city from 2016 to 2017

Table 3.1 Status of neutralizing antibodies and rabies virus infection in dogs

	Slaughterhouses (n)	**Nabs positive (Number)**	**Nabs negative (Number)**	**rate % positive**
1	*Large slaughterhouses (08)*			
	Serum samples	0	1,500	0
	Brain samples	0	1,500	0
2	*Small slaughterhouses (84)*			
	Serum samples	231	645	26,4*
	Brain samples	7	869	0,8

A total of `2,376 pairs of blood and brain samples were collected from dogs at 92 slaughterhouses (8 large and 84 small slaughterhouses) in 6 districts of Hanoi. We have identified that no dog brain samples were infected with rabies virus and no blood samples were positive for antibodies against rabies in 1,500 dog collected at big slaughterhouses. Meanwhile, 7/876 (0.8%) of dog brain samples from small

slaughterhouses were positive for rabies virus and 26.4% had neutralizing antibodies against rabies virus.

3.1.2. Status of neutralizing antibodies against rabies in butchers working at dog slaughterhouses in studied area

3.1.2.1 Demographics of butchers working at slaughterhouses of dogs in Vietnam

Table 3.4. Demographics of butchers working at slaughterhouses of dogs in Vietnam (n=406)

		Number of butchers (%)		
		Male	Female	Total
SEX		215 (53)	191 (47)	406 (100)
AGE	18-34	94 (23,2)	75 (18,4)	169 (41.6)
	35-44	60 (14,8)	64 (15,7)	124 (30.5)
	≥45	61 (15,0)	52 (12,8)	113 (27.8)
Educational background				
Primary school		31 (7,6)	32 (7,9)	63 (15,5)
Secondary school		123 (30,3)	98 (24,1)	221 (54,4)
High school		52 (12,8)	48 (11,8)	100 (24,6)
College/University		9 (2,2)	13 (3,2)	22 (5,4)

A total of 406 participants were interviewed from 92 dog slaughterhouses in 6 among 30 districts of Hanoi, using a structured questionnaire and tested for antibody neutralizing antibodies against rabies virus. The results showed that overall respondents were aged $18 - 74$ years (mean $= 37.39 \pm 12.26$), and that 53% (215/406) of respondents were males. Altogether, 221 (54.4%) respondents had secondary education, 100 (24.6%) had graduated from high school, 63 (15. 5%) from primary school and 22 (5.4%) had college degrees.

3.1.2.2. Neutralizing Antibodies against rabies virus in dog slaughterers and vaccinated

Table 3.9. Neutralizing Antibodies against rabies virus in dog slaughterers (n=406)

Level of Nabs	Vaccinated group n (%)		Unvaccinated group n (%)	Total n (%)
	Cell culture vaccine	Fuenzalida		
Negative (Nabs =0)	0	0	344 (84.7)	344 (84.7)
Positive	26 (6,4)	7 (1,7)	29 (7,2)	62 (15,3)
Insufficient protection (0< Nabs <0.5IU/ml)	0 (0)	6 (1.5)	21 (5.2)	27 (6.7)
Sufficient protection (Nabs≥ 0,5IU/ml)	26 (6.4)	1 (0.2)	8 (2.0)	35 (8.6)
Total n (%)	26 (6.4)	7 (1.7)	373 (91.9)	406 (100)

Among the 406 serum samples obtained from individual study participants, 91.9% (373/406) were serum negative and 62 serum samples (15.3%) were serum positive. Of those that were serum positive, 35 (56.4%) had sufficient protective antibody (≥0.5 IU / ml) and 27 (43.5%) had neutralizing antibodies (Nabs) that were insufficient for protection additionally, 12.9% (8/62) of those that were serum positive had not been vaccinated against rabies.

Table 3.10. Characteristics and level of neutralizing antibody in positive antibody group (n = 62)

Characteristics	Vaccinated group		Unvaccinated group	Total n (%)
	Cell culture vaccine	Fuenzalida		
Level of neutralizing antibodies				
Insufficient protection n (GMT)	0	6 (0.32)	21 (0.17)	27 (6.7)
Sufficient protection n (GMT)	26 (3.07)	1(0.66)	8 (0.66)	35 (8.6)
Total n (GMT)	26 (3.07)	7 (0.35)	29 (0.25)	62 (15.3)

Characteristics	Vaccinated group		Unvacci nated group	Total n (%)
	Cell culture vaccine	Fuenzali da		
Duration (months) of vaccination to the time study (min-max)	3 – 120	125 - 150	-	-
Number of shots (min-max)	2 – 5	4 – 7	-	-
Duration (years) of working as professional dog butcher (min-max)	2 – 30	4 - 27	5 – 35	-

GMT: geometric mean titer

Antibodies against rabies virus were found in 26 (3,07) professional dog butchers who have been Cell culture vaccinated with rabies virus and 7 (0,35) person, who have been Fuenzalida vaccine. Only 26 (3.07) and 9 (0.66) of professional dog slaughterers had Nab at sufficient protection level. There were 29 (0,25) of professional dog slaughterers unvaccinated.

3.1.2.3. Relationship of antibody status and the risk experience of butchers working at slaughterhouses of dogs in Vietnam (n = 373)

Table 3.12. Odds ratio between Nabs and the risk experience of butchers working at slaughterhouses of dogs in Vietnam (n = 373)

Hazardous risks	Number of butchers		OR	95% CI	p
	Nabs positive	Nabs negative			
Number of dogs slaughtered daily					
< 5 dogs	17	212	0.88	0.38-2.04	0.77
≥ 5 dogs	12	132			
Butchering sick dogs					
Yes	5	48	1.61	0.54-4.76	0.39
No	24	296			
Butchering dead dogs					
Yes	7	39	2.16	0.75-6.21	0.14

No	22	305			
Bitten by dogs					
Yes	0	39	-	-	
No	29	305			
Wound by knife					
Yes	10	89	0.67	0.27-1.63	0.38
No	19	255			
Period of employment					
< 5 years	5	164	**6.16**	2.20-17.25	**0.001**
≥ 5 years	24	180			
Use of gloves					
Never	23	317	1.18	0.41-3.42	0.75
Regularly	6	27			

Results of the analysis showed that there was a relationship of antibody status in those who did not receive rabies vaccination with Period of employment (p<0,05; OR=6,16). Antibody was not a relationship in people who had the following activities such as killing deadly dogs, killing more than 5 dogs daily, injury by dog bites or knives cut and no gloves usage during butchering.

3.1.3. Knowledge and practices on rabies control and prevention of professional dog butchers

Table 3.14. Personal characteristics and knowledge on rabies of dog butchers

Characteristics		Knowledge on rabies (n=406)		
		Low n (%)	Enough n (%)	High n (%)
Sex	Male	172 (42,4)	43 (10,5)	0
	Female	170 (41,9)	**21 (5,2)**	0
p		*0,10*		
Age (year)	18 – 34	126 (31,0)	43 (10,6)	0
	≥35	**216 (53,2)**	21 (5,2)	0
	< High school	**254 (62,7)**	30 (7,4)	0

		Low	Enough	High
Highest level of education	≥ High school	88 (21,6)	34 (8,3)	0
p			0,00	
Working experience	< 5 year	168 (41,4)	**20 (4,9)**	0
	≥ 5 year	174 (42,9)	44 (10,8)	0
p			0,00	
Total		**342 (84,3)**	**64 (15,7)**	0

The rate of professional dog butchers that had low knowledge in age group ≥35 is 216 people (53,2%), who have low knowledge at high school is 254 people (62,7%) and dog butchering with working experience below 5 years is 41,4%. People, who had achieved knowledge score was 15.7%.

Table 3.16. Personal characteristics and practice on rabies of dog butchers

characteristics		practice on rabies		
		Low	Enough	High
		n (%)	n (%)	n (%)
Sex	Male	211 (51,9)	4 (1)	0
	Female	191 (47,1)	0	0
Age (year)	18 – 34	167 (41,1)	2 (0,5)	0
	≥35	**235 (57,9)**	2 (0,5)	0
Highest level of education	< High school	**284 (69,9)**	0	0
	≥ High school	118 (29,1)	**4 (1)**	0
Working experience	< 5 year	186 (45,8)	2	0
	≥ 5 year	**216 (53,2)**	2	0
	Total	**402 (99)**	**4 (1)**	0

The results showed that the percentage of dog butchers had practice at level of "enough" is 1%, Who have practice at low level of high school is 284 people (69,9%), who is age of from 35 years old 57,9% and working experience had practice at low level is 53,2%.

3.1.4. Some factors related to knowledge practice on rabies and prevention of professional dog butchers

Table 3.17. Some factors related to knowledge on rabies control and prevention of professional dog butchers

Characteristics		Number	OR	CL 95%	p
Sex	Male	215	1,47	0,23-1,46	0,11
	Female	191			
Highest level of education	< High school	284	**2,46**	1,17-5,18	0,00
	≥ High school	122			
Age (years)	18 – 34	169	1,41	0,66-3,01	0,55
	≥35	237			
Working experience(year)	<5 năm	194	1,57	0,72-3,41	0,58
	≥ 5 năm	212			

People with high school education had a 2.46-fold increase in knowledge on rabies prevention ($p < 0.05$, OR = 2.46) compared to those with a lower education.

Table 3.18. Some factors related to practice on rabies control and prevention of professional dog butchers

Characteristics		Number	OR CI 95%		p
Sex	Male	215	0,53	0,47-0,60	0,35
	Female	191			

Highest level of education	< High school	284	0,34	0,28-0,41	0,34
	≥ High school	122			
Age (years)	18 – 34	169	0,73	0,05-11,76	0,31
	≥35	237			
Working experience (year)	<5 Years	194			0,63
	≥ 5 Years	212	0,70	0,04-11,32	
Knowledge	Low	342			0,00
	High	64	**6,70**	5,31-8,46	

People with high knowledge had a 6,70-fold increase in knowledge on rabies prevention (p <0.05, OR = 6,70) compared to those with a lower knowledge

3.2. Effectiveness of communication intervention to reduce the risk of rabies in dog butchers in several districts of Ha Noi, 2017-2018. (n=292)

3.2.1. The rate of knowledge on rabies control and prevention of professional dog butcher post- intervention

Table 3.24. The rate of knowledge on rabies control and prevention of professional dog butcher post- intervention

Degree knowledge	Intervention group (n=292)			
	Pre- intervention n (%)	Post- intervention n (%)	efficiency (%)	p-value
Low	256 (87,7)	106 (36,3)	58,6	0,00
Enough	36 (12,3)	186 (63,7)	80,64	0,00
High	0	138 (47,3)	-	-

Effectiveness of communication post- intervention the percentage of the study subjects had knowledge at level of "enough" increased from 12.4 % to 63.7% (efficiency of 80,64 %; p <0.05) and high knowledge was 47.3%

3.2.2. The rate of practice on rabies control and prevention of professional dog butcher post- intervention
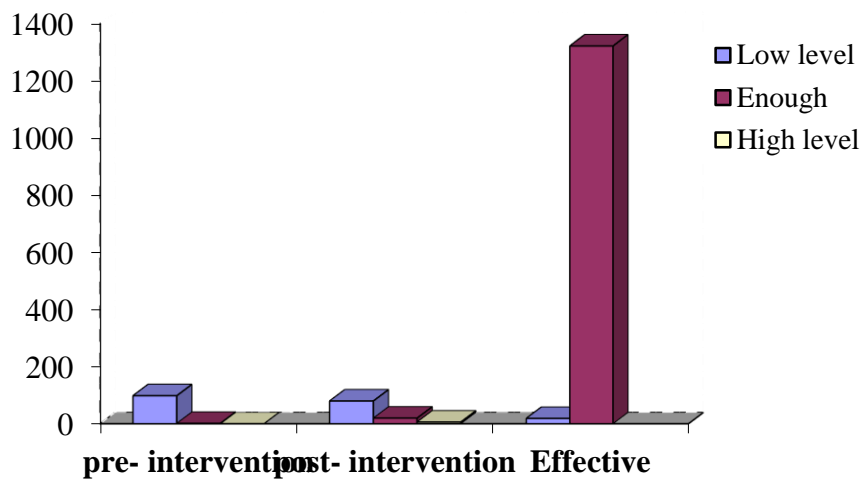
Plot 3.2. The rate of practice on rabies control and prevention of professional dog butcher post- intervention

The results showed that the percentage of the study subjects had practice at using of gloves increased from 2.1 % to 76.0 % (efficiency of 97,23; p<0,05). Who have been injured by dog bites was reduced 37%, pre- exposure to rabies vaccination was 13%.

3.2.3. The rate of exposure prophylaxis to rabies control of professional dog butcher post- intervention
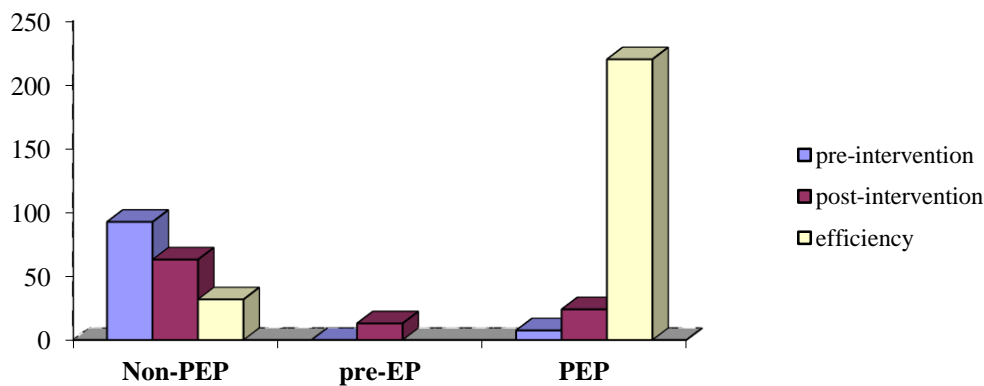
Plot 3.3. The rate of exposure prophylaxis to rabies control of professional dog butcher post- intervention

After 2 years of intervention, the percentage of the professional dog butchers administered pre-exposure prophylaxis rabies vaccine was 13% compared to the pre-intervention of 0%. Who have been injured by dog bites was reduced 37%.

CHAPTER 4. DISCUSSION

4.1. Status of the risk and factors related to rabies infection in dog butchers in several districts of Ha Noi, 2016.

4.1.1 Neutralization of antibodies and rabies virus infection in dogs at slaughterhouses

Among 1,500 pairs of dog brain and serum samples collected at large slaughterhouses where dozens to hundred dogs are slaughtered daily, none of the samples was detected to be positive for neutralizing antibody or rabies virus. Investigations on the origin of the slaughterhouse dogs have been conducted within the neighbors and workers of the slaughterhouses, as well as the license plates of dog-shipping trucks. These investigations revealed that these slaughterhouses concentrate a large number of dogs illegally imported from Thailand or possibly from Myanmar and Laos to Vietnam through Cau Treo border gate. Neither these dogs were detected with anti-rabies antibodies nor their brain samples got infected with rabies virus, which was possibly because they were industrially raised and imported from neighborhood countries via Thanh Hoa. Because industrial breeder dogs are not vaccinated against rabies and rarely in contact with other rabid animals, they do not have antibodies to rabies virus or infection. However, cross-border entries animals in general and dogs in particular need to be strictly regulated to minimize the risks of zoonotic diseases, including rabies.

The test results of 876 pairs of brain and serum dog samples collected in small slaughterhouses show that there were 231 serum samples (26.4%) positive with neutralizing antibodies, and that the percentage of dogs that were able to be protected against rabies with titer above 0.5IU/ml only reached 19.17%. At the same time, we also found 7 brain samples (0.8%) infected with rabies virus by both

FAT and RT-PCR techniques. The results of this study show that there has not been strict compliance with Decree 05/2007/ND-CP of the Government on the management and vaccination of dogs. Trading and slaughtering dogs without quarantine increase the risks of transmitting and circulating rabies in dogs and cats. Moreover, the evidence of rabies dogs in slaughterhouses from previous and current studies shows that there is a high risk of rabies transmission from one locality to another due to dog trading and slaughtering. Dog slaughterers are also at high risks of rabies, especially those in Hanoi where there are many slaughterhouses.

4.1.2. Neutralizing antibodies and rabies virus infection in dog butcher

In this study, there were 373/406 (91.9%) professional dog butchers who did not vaccinated against rabies. The reason of professional dog butchers did not take pre exposure prophylaxis (pre-EP) may be the fear of side effects of rabies vaccine. In the past decades. Regarding to rabies neutralizing antibody titers of professional dog butchers, most of them (91.9%) were negative for neutralizing antibody against rabies. Only 35/406 (8.6%) were positive for rabies neutralizing antibodies, among those, 8.6% showed protective antibody titers (≥ 0.5IU / ml). In Vietnam, rabies is circulating national wide with approximately 100 human rabies cases recorded annually. Dog meat consumption is regular habit of almost families and regions of the country. However, dogs are supplied for most slaughterhouses without veterinary control, the supply of dogs for slaughterhouses is from the regions of the country or may be illegally imported from abroad such as Laos, Thailand, China ... In addition, 2% of rabies infected dogs were also found in slaughterhouses according to research of Nguyen et al. Every year, Vietnam consumes about 5 million dogs and if the rate of rabies infection is 2%, there may be thousands of rabid dogs being put into slaughterhouses. With only 8.6% of professional dog butchers was at protective antibody level against rabies from the findings of this study, dog slaughter is definitely an occupational group at high risk

of rabies in Vietnam. In fact, a number of human rabies cases has been recorded due to dog slaughter. Therefore, to control human rabies, the Government should take measures to strictly manage the transportation and consumption of dogs; veterinary control at slaughtering and markets; implementing communication interventions to improve people's understanding of rabies, prevention measures, vaccination against rabies for professional dog butchers as well as need to study anti-rabies antibodies of other risk occupational groups such as veterinarians, pet care, pet owners ... for appropriate interventions.

Concerning geometric mean titer (GMT) of antibodies against rabies virus of the study group, the GMT of the group vaccinated with cell culture rabies vaccine was higher (3.07 IU/ml) than that of the Fuenzalida rabies vaccination group (0.35IU/ml). 26/26 (100%) of people vaccinated with cell culture rabies vaccine had Nab titer at protection level (> 0.5IU / ml). The longest persistence duration of Nab was 10 years with antibody titer of 1.38IU/ml. The minimum and maximum number of injections

Analysis of risk factors related to the presence of rabies neutralizing antibodies in the non-vaccinated group, we found that there were one risk factors such as period of employment (p<0,05; OR=6,16).

4.1.3. Knowledge, practice about rabies control and prevention of dog butchers in Hanoi

A descriptive cross sectional study was carried out on 406 professional dog butchers at the 7 districts of Hanoi in 2016 in order to understand their knowledge (K), practices (P)on rabies control and prevention and related factors. The achieved practice was defined when score reaches from 24-32 points and their answers to two obligatory questions were correct. The results showed that the rate of professional dog butchers that had achieved knowledge score and practices score was 15.7% and 1%, respectively. No one reached "high" score on both knowledge and practice. People with high school education had a 2.46-fold

increase in knowledge on rabies prevention (p <0.05, OR = 2.46) compared to those with a lower education.

4.2. Evaluating effectiveness of communication intervention to reduce the risk of rabies in dog butchers in several districts of Ha Noi, 2017-2018

Direct communication combined with indirect communication has increased the comprehensiveness of communication activities. Communication activities include individual counseling, group counseling, group propaganda in villages and residential areas, combined with other activities of the Women's Union and of the CPC and CHS, direct group communication content. small (30 people), presenting a video clip of people who are suffering from rabies due to rabies effectively improving KAP related to rabies, giving a deep impression to research subjects, probably because directly observed the symptoms of animal rabies attacks in people with rabies, thereby changing awareness, practice slaughtering dogs in court.

In this study, the effectiveness of improving the practice of washing wounds with soap and disinfectants, after intervention, 108 were injured when operating dogs, of which 104 were (28.0%; p <0.05) applied proper first aid measures and 96 people had medical advice. The effectiveness of intervention significantly increased in subjects using personal protection when participating in dog slaughter increased from 2.1% to 76% after the intervention (p <0.05), the rate of use The increase in protection was due to the fact that the study subjects were using medical gloves and plastic gloves, which are easier to manipulate than they used previously to use thick sanitary gloves that were difficult to manipulate. In order to maintain the effectiveness of interventions to improve the use of protective equipment in the next dog slaughter, it is recommended that slaughter owners are fully equipped with gloves and boots for participants to slaughter dogs.

However, some practice indicators have not been significantly improved in line with the change of knowledge of the study participants, the proportion of

people who have not practiced has decreased by 18.7%, at the level of practice reached 19.9% of people, at the level of good practice before the intervention did not have any cases, after the intervention was 6.0% of people. The explanation for this change may be due to causal knowledge and practice, but it is not entirely sure, there are other factors that affect change in practices such as vaccine costs, lack of health services, and people's ease of access to health services. Our research results are higher than in community intervention studies using leaflets on rabies Wash wounds: 8.4) According to the WHO recommendations, those who are regularly exposed to the source of rabies, dog slaughterers must be vaccinated against active rabies before vaccines, no intervention before the vaccination active rabies vaccine before being bitten by dogs, after intervention, 38 people (13.0%) took the active vaccination before being bitten by dogs and cats, along with the number of people exposed to the rabies vaccination after the bite was also increased from 7.5% to 24.0% (efficacy index of 220%; $p < 0.05$).

CONCLUSION

1. *Status of the risk and factors related to rabies infection in dog butchers in several districts of Ha Noi, 2016.*

73.6% of dogs from the community sent for slaughter have not been vaccinated against rabies or vaccinated against rabies.

- The rate of rabies dogs still being slaughtered in Hanoi is 0.8%. The percentage of people slaughtering dogs exposed to rabies who have received preventive treatment is 8.1%

100% of people slaughtering dogs do not get rabies vaccination before practicing.

 - People with high school education (high school) level of knowledge about rabies prevention and control 2.46 times higher than people with education from lower secondary school ($p \leq 0.05$; OR = 2.46).

- People who work in dog slaughtering positions such as catching dogs to make secretions, making organs, taking brains with the number of daily slaughter dogs greater than 5 dogs, are at high risk of rabies exposure.

- People with good knowledge will practice about 6.7 times more than rabies prevention and control (p <0.05; OR = 6.70).

2. Evaluating effectiveness of communication intervention to reduce the risk of rabies in dog butchers in several districts of Ha Noi, 2017-2018.

The results showed that the percentage of the professional dog butchers had knowledge and practice at level of "enough" increased from 12.3% to 63.7% (efficiency of 417.8%; p<0.05) and from 1.4% to 19.9% (efficiency of 1321.3%), respectively. Knowledge and practice of the professional dog butchers reached at "good" level was 47.3% and 6.0%, respectively. After 2 years of intervention, the percentage of the professional dog butchers administered pre-exposure prophylaxis rabies vaccine was 13% compared to the pre-intervention of 0%. Thus, health education interventions by simple audiovisual means bring about high effectiveness in changing perceptions and behaviors on rabies prevention of professional dog butchers at slaughterhouses in Hanoi.

LIMITATIONS OF RESEARCH

The study conducted communication intervention on the same group of subjects comparing the effectiveness of intervention before and after without control group, the sample was not representative for the whole research subjects in Hanoi but only in a number of subjects. The district has many dog slaughterhouses, dog meat restaurants, and butcher shops.

RECOMMENDATIONS

- Communication for dog slaughterers with various communication methods at commune health stations, focusing on group counseling, group communication, and private household quality assurance advice.

- Control the status of dogs supplied to slaughterhouses, dog meat restaurants in Hanoi, especially veterinary inspection with rabies virus
- Review vaccinations for dogs to achieve a minimum rate of 70% of dogs with anti-rabies neutralizing antibodies. Active vaccination for dog slaughterers.

LIST OF PUBLISHED ARTICLES RELATED TO THE THESIS

1. Vu Hoang Anh, Nguyen Nhat Cam, Hoang Van Tan, Nguyen Thi Kieu Anh (2018), "Knowledge, practice about rabies control and prevention and factors related among professional dog butchers in Hanoi, 2015" *Journal of Preventive Medicine*, XXVIII (11), pp. 20-28

2. Vu Hoang Anh, Nguyen Nhat Cam, Hoang Van Tan, Nguyen Thi Kieu Anh (2019), "Evaluating effectiveness of communication intervention to change knowledge and behaviors on rabies prevention of professional dog butchers in several districts of Hanoi, 2017-2018", *Journal of Preventive Medicine*, XXIX (13), pp. 131-138.

3. Nguyen Tuyet Thu, Vu Hoang Anh, Ngo Chau Giang, Nguyen Vinh Đong, Nguyen Thanh Thuy, Pham Van Chung, Akira Nishizono, Nguyen Thi Kieu Anh (2019), "A COMPARATIVE STUDY OF THE RAPINA AND THE FLUORESCENCE ANTIBODY VIRUS NEUTRALIZATION (FAVN) FOR THE ESTIMATION OF ANTI-RABIES NEUTRALIZING ANTIBODY LEVELS IN DOG SERA COLLECTED IN SOME NORTHERN PROVINCES OF VIETNAM, 2015 – 2018", *Journal of Preventive Medicine*, XXIX (12), pp. 128-136.