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APPENDICES

Appendix 1: Rabies Vaccine and Rabies Immunoglobulin [24]

Rabies Vaccine

The vaccines those available in Thailand right now are

1. Cell culture rabies vaccine

1.1 Human diploid cell rabies vaccine (HDCV): this vaccine is obtained from the culture of the fixed rabies virus, Pitman Moore's strain, in human diploid cells. Inactivate the virus with beta-propiolactone 0.025% with the viral titer of $\geq 10^7$ MLD $_{50}$/ml (minimum lethal dose in mice) and the antigenic value of $\geq$ 2.5 IU/ml. This kind of vaccine is produced by the Pasteur Merieux Connaught, France. It is a dry vaccine with sterile water for infection. After solute in the sterile water, we will get the 1 ml of clear pink vaccine.

1.2 Purified chick embryo cell rabies vaccine (PCEC): this kind of vaccine is obtained from the culture of the fixed rabies virus, Flury LEP-C25's strain, in the primary chick embryo fibroblast cells. Inactivate the virus with the beta-propiolactone 0.025% with the viral titer of $\geq 10^7$ TCID $_{50}$/ml (Tissue Culture infectious dose) and the antigenic value of $\geq$ 2.5 IU/ml. This kind of vaccine is produced by Chiron Behring GMbH, Germany. It is a dry vaccine with sterile water for injection. After solute in the sterile water, we will get 1 ml clear colorless vaccine.

1.3 Purified vero cell rabies vaccine (PVRV): this kind of vaccine is obtained from the culture of the fixed rabies virus, PM WI 30-1503-3M's strain, in vero cells. Inactivate the virus with the beta-propiolactone 0.025% with the viral titer of $\geq 10^{7.5}$ MLD $_{50}$/ml (minimum lethal dose in mice) and the antigenic value of $\geq$ 2.5 IU/ml. This kind of vaccine is produced by pateur Merieux Connaught, France. It is a dry vaccine with solution of 0.4% sodium chloride for infection. After solute in this preparing solution, we will get 0.5 ml clear colorless vaccine.

2. Purified duck embryo cell rabies vaccine (PDEV)

This kind of vaccine is obtained from the culture of the fixed rabies virus, PM's strain, in embryonated duck eggs. Inactivate the virus with the beta-propiolactone 0.025% with the viral titer of $\geq 10^{7.5}$ MLD $_{50}$/ml (minimum lethal dose in mice) and the antigenic value of $\geq$ 2.5 IU/ml. This kind of vaccine is produced by Berna Swiss Serum and Vaccine Institute, Switzerland. It is a dry vaccine with sterile

water for injection. After solute in this solution, we will get 1 ml turbid solution vaccine because of the Thiomersal as preservative.

Rabies Immunoglobulin, RIG

Category

Immunizing agent. There are 2 types of immunoglobulin, HRIG and ERIG.

1. Human Immunoglobulin (HRIG) is a gamma globulin obtained from the plasma of hyperimmunized human donors. This kind of RIG is imported from Germany (Centeon) and Switzerland (Berna Swiss Serum and Vaccine Institute). National Blood Bank, TRCS is the main supplier in Thailand right now. Complication of HRIG is rare because it originated form human plasma. Dose of injection is 20 units per kilogram.

2. Equine Immunoglobulin (ERIG) is a gamma globulin obtained from plasma of hyperimmunized horse. This kind of RIG is totally imported from France (Pasteur merieux Connaught) and Switzerland (Berna Swiss Serum and Vaccine Institute). Purified of nowadays ERIG lowers the rate of allergy known as "serum sickness" to 1-6%. However, most of the complications are minor and occurs 7-10 days after infection. The serious complication such as anaphylaxis shock is rare. Dose of injection is 40 units per kilogram.

Indication

Rabies immunoglobulin is indicated for post-exposure immunizations against rabies infection in person who have not been previously immunize against rabies vaccine. Rabies immunoglobulin is used in conjugated with rabies vaccine.

Mechanism and Action

Following intramuscular administration, rabies immunoglobulin provides immediate passive antibodies for a short period of time, this protects the patient until the patient can produce active antibody from the rabies vaccine.

Protective Effect

When the post-exposure prophylaxis regimen has included local wound treatment, passive immunization, and active immunization 100% effectiveness has been shown. However, rabies has occasionally developed in persons when key

elements of the rabies post-exposure prophylaxis regimen were omitted or incorrectly administered.

Time to Protective Effect

An adequate titer of passive antibody is present 24 hours after injection.

Duration of Protective Effect

Short. Rabies immunoglobulin has a half-life of approximately 21 days.

Precaution

Pregnancy, breast-feeding, pediatrics, and geriatrics

Side Effect: severe systemic adverse effects to rabies immunoglobulin are rare. There are some reports of angioedema, nephrotic edema, and anaphylaxis.

Dosage Information

ERIG dosage of use is 40 units per Kg. HRIG dosage of use is 20 units per Kg.

Appendix 2: Indication for rabies vaccine and rabies immunoglobulin [24]

1. Pre-exposure immunization

Inject the 1 ml or 0.5 ml of vaccine (depend on type of vaccine) intramuscularly, IM, or 0.1 ml of vaccine intradermally, ID, at deltoid on day 0, 7, 21 or 28. The date of injection may be postponed 1-2 days.

This immunization protocol is used for the high-risk personnel such as rabies laboratory researcher. This kind of people should be checked for the rabies antibody every 6 months and boost 1 dose of vaccine whenever the titer is lower than 0.5 IU per ml. And for the other related personnel such as veterinary or pet keeper, should be checked for the rabies antibody annually and boost 1 dose of vaccine whenever the titer is lower than 0.5 IU per ml. In case of the over immunization, the patient may be suffered from the hypersensitivity especially for the HDCV. Thus, the pre-exposure immunization should be given to risk group only.

2. Post-exposure immunization

2.1 rabies immunoglobulin

ERIG: inject 40 IU per kg

HRIG: inject 20 IU per kg

The patient should be injected with the rabies immunoglobulin on the first day of exposure to the rabies. If the patient receives the vaccine after 7 days, there will be antibody from the rabies vaccine, so that there is no need for RIG after 7 days.

In case of ERIG use, the patient should be test for hypersensitivity against ERIG. Dilute ERIG 1:10 and inject 0.02 ml with tuberculin syringe intradermally at volar side of arm with normal saline to compare the result. Wait for the result about 15-20 minutes. If there is a wheal bigger than 6 mm or flare compare with another arm, the test will be reported as "positive".

With the positive test for hypersensitivity, the patient should be injected with HRIG instead. But if the HRIG is not available, the ERIG should be given carefully and under the supervision of doctor and even in case of test is negative. However, the symptom of ERIG allergy is only rash, urticaria or arthalgia.

From the study in animal, we found that the rabies will multiply itself firstly at the bite site before entering the neuromuscular junction. Thus, the RIG injection around the wound will inhibit and neutralize the rabies virus at wound site. Before

injection with RIG, the wound should be cleaned as much as possible. The RIG should be injected by insert the needle underneath the wound and avoid multiple injection.

If the wound is at or near the eyeball, HRIG should be dropped into the eye. And if the RIG is left over after injection, the left over part will be injected intramuscularly away from the vaccination site.

There is no need to use RIG than recommendation because it will suppress the antibody formation. And in case of the RIG is not enough for injection, RIG should be mixed with normal saline to get the enough solution of RIG.

2.2 rabies vaccine

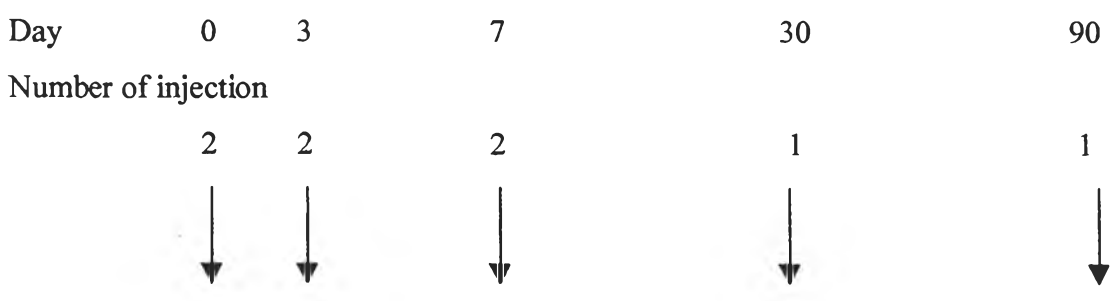
2.2.1 intramuscular injection, IM

Inject 1 ml or 0.5 ml (depend on type of vaccine) of vaccine intramuscularly at deltoid or the anterolateral aspect of thigh in the children. Do not inject at the buttock because of the low efficacy of the drug at this site.

2.2.2 intradermal injection, ID

2.2.2.1 protocol 2-2-2-0-1-1

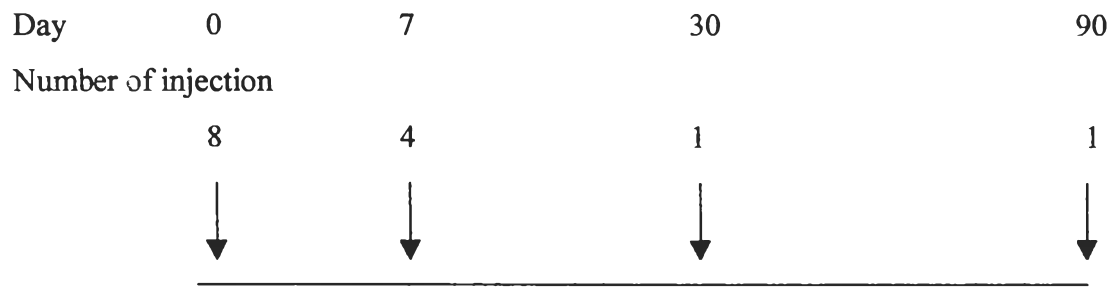
Inject 0.1 ml of the vaccine intradermally at both right and left arm on day 1, 3, 7 and at one upper arm on day 30 and 90.



This protocol is for PVRV, and it would be possible to use PCEC and HDCV only in case that the antigenic value of vaccine is higher than 0.7 IU per 0.1 ml.

2.2.2.2 protocol 8-0-4-0-1-1

This protocol is applied to the HDCV and PCEC vaccine. Only day 0, inject 0.1 ml of vaccine to both site of upper arms, lateral aspect of thighs, scapulas and lateral aspect of abdomen (8 points). Day 7 inject 0.1 ml of vaccine at both upper arms and lateral aspect of thighs (4 points). Day 30 and 90 inject 0.1 ml of vaccine to one side of upper arm.



Intradermal injection

The aim of intradermal injection is to lower the cost of immunization. Multiple site of injection can activate the antibody in the short time. If we use PCEC and HDCV, the vaccine should have the high antigenic value at least 0.7 IU per 0.1 ml so that the efficacy will be as equal as intramuscular injection. But this kind of protocol should be provided in the places where are well-equipped, well-trained personnel and the high number enough of patient.

The intradermal injection is also appropriate for the multiple exposures, usually more than 2 post-exposure patients.

In case of RIG is not available, the HDCV or PCEC with protocol 8-0-4-0-1-1 should be given. And especially in case that the patient is bitten at face or head and in the low weight children, this protocol should be prescribed conjunct with the RIG. If the patient is on chloroquine or other malaria prophylaxis, the doctor should prescribe only intramuscular injection and conjunct with RIG.

Prophylaxis in the patient with the history of previous vaccination

The patient, who is vaccinated with the rabies vaccine at least on day 0, 3, 7 or antibody titer is more than 0.5 IU per ml should be

1. If expose to rabies within 6 month after last injection, the patient will be given only 1 dose vaccine IM or ID on the first day

2. If expose to rabies more than 6 months, the patient will be given 2 doses of vaccine on day 0 and 3.

In this type of patient, there is no need to given the patient with RIG because the antibody against rabies will be activated rapidly.

Notification of rabies vaccine and RIG

1. The incubation period of rabies is usually 1-3 months and 95% are within 1 year. Thus, the patient should be vaccinated with rabies vaccine even in case of coming late.
2. The dose of rabies vaccine for children and adult is the same.
3. Pregnancy women and young children can be prescribed with rabies vaccine.
4. The timetable for injection can be postpone for 1-2 days.
5. The cell culture vaccine and the embryonated vaccine can be used interchangeably.
6. The immunodeficiency patient should be given with RIG for every case and only with the intramuscular injection.

Antibody from rabies vaccine and rabies immunoglobulin

Vaccine: rabies vaccine will activate the active antibody against rabies at about day 7, then the level of antibody will be over 0.5 IU per ml on day 14, and at peak on day 30. The antibody will sustain in the body and will last for 1 year.

RIG: this passive antibody can be detected immediately after injection and its half-life is usually 3 weeks.

Appendix 3: Laboratory Diagnosis [1]

3.1 Postmortem Diagnosis of Rabies in Animals and Humans Antigen Detection

The fluorescent antibody (FA) technique is a rapid and sensitive method for diagnosing rabies infection in animals and humans. The test is based upon microscopic examination, under ultraviolet light, of impressions, smears or frozen sections of tissue after treatment with anti-rabies serum or globulin conjugated with fluorescein isothiocyanate.

Bilateral impressions (or smears) of tissue samples from the hippocampus (Ammon's horns) and brain stem are recommended for increased sensitivity of the test; some laboratories also stain samples of cerebellar tissue.

An enzyme-linked immunosorbent assay (ELISA) called rapid rabies enzyme immunodiagnosis (RREID) was developed for the diagnosis of rabies, based upon the detection of rabies virus nucleocapsid antigen in brain tissue. Since the antigen can be visualized with the naked eye, the test can be carried out (with the aid of a special kit) under field conditions.

RREID is a rapid technique, which can be especially useful for epidemiological surveys. The test may be used to examine partially decomposed tissue specimens for evidence of rabies infection, but it cannot be used with specimens that have been fixed in formalin. It should be noted, in addition, that the FA test might yield positive results when the RREID is negative.

Virus Isolation in Vitro

Virus isolation may be necessary for confirming the results of antigen detection tests and for further characterizing the isolate.

Murine neuroblastoma (NA C1300) cells are more susceptible to rabies field virus infection than any other cell lines tested. Virus isolation in cell culture (with neuroblastoma cells) is at least as efficient as mouse inoculation for demonstrating small amounts of rabies virus. It also reduces the time required for diagnosis form 10-15 days to 2 days, eliminates the need for experimental animals, and is considerably less expensive to perform. This technique is not feasible in every laboratory, however, and intracerebral mouse inoculation is still a useful test I the laboratory diagnosis of rabies. Suckling mice (less than 3 days old) are more susceptible to rabies than

weanling or adult mice and should be used whenever possible. The observation period may be shortened by FA examination of brains of inoculated mice killed 3-4 day (or more) after inoculation.

3.2 Intra Vitam Diagnosis of Rabies in Humans

The choice of techniques for *intra vitam* diagnosis varies greatly according to the stage of the disease; antigen detection is generally sensitive during the first few days, while virus-neutralizing antibodies in cerebrospinal fluid and serum usually tend to appear after 7-10 days of illness.

Viral antigen may be detected by FA in corneal impressions or skin biopsies from patients with rabies; however, FA-positive specimens are more common during the final stages of the disease. Skin biopsies are usually taken from the nuchal area of the neck, with hair follicles containing peripheral nerves. Corneal impressions (*never* scrapings) are taken from patients with encephalitis by lightly touching the central part of the cornea with a microscope slide.

The quality of the sample-both corneal impressions and skin biopsies-is paramount; they should be refrigerated immediately after collection and until the test is carried out.

Rabies virus may be isolated in cell culture from certain body tissues and fluids, especially saliva and cerebrospinal fluid.

Saliva samples should be maintained frozen after collection; the contents of the swab should be expressed in the collection medium, the swab removed and the specimen sent frozen for further examination. Biopsy material and cerebrospinal fluid should be frozen after removal.

Antibody Titration

Neutralizing antibodies in the serum or cerebrospinal fluid of non-vaccinated patients may be measured either by the mouse serum neutralization test (MNT) or by the rapid fluorescent focus inhibition test (RFFIT). The Committee recommended that, where possible, the MNT be replaced by the RFFIT, since the latter test is more rapid and at least as sensitive as the MNT.

An enzyme-linked immunosorbent assay (ELISA) using purified rabies glycoprotein has been used to determine virus-neutralizing antibody levels in the serum of several species, including humans. The test can be carried out (with the aid

of a special kit) in the field and provides results within a few hours. It also appears to be quite reproducible. Nevertheless, the sensitivity of the test is limited; the measurement may include a variety of antibodies in addition to virus-neutralizing antibodies.

Appendix 4
Computation of decreasing rate of death during 1981-2002

year	Deaths(Dn)	Population	per million.(Yn)	Yn - Yn-1	(Yn - Yn-1)/ Yn-1	Dn- Dn-1	(Dn- Dn-1)/ Dn-1	A *	B +
1981	339	47,488,000	7.14						
1982	300	48,490,000	6.19	-0.952	-0.133	-39	-0.115	-0.115	-0.115
1983	288	49,459,000	5.82	-0.364	-0.059	-12	-0.040	-0.040	-0.040
1984	228	50,396,000	4.52	-1.299	-0.223	-60	-0.208	-0.208	-0.208
1985	205	51,681,000	3.97	-0.558	-0.123	-23	-0.101	-0.101	-0.101
1986	219	52,646,700	4.16	0.193	0.049	14	0.068		
1987	139	53,605,100	2.59	-1.567	-0.377	-80	-0.365	-0.365	-0.365
1988	219	54,534,000	4.02	1.423	0.549	80	0.576		
1989	212	55,537,648	3.82	-0.199	-0.049	-7	-0.032	-0.032	
1990	185	56,296,817	3.29	-0.531	-0.139	-27	-0.127	-0.127	-0.127
1991	171	56,661,966	3.02	-0.268	-0.082	-14	-0.076	-0.076	-0.076
1992	113	57,788,900	1.96	-1.063	-0.352	-58	-0.339	-0.339	-0.339
1993	93	58,336,100	1.59	-0.361	-0.185	-20	-0.177	-0.177	-0.177
1994	78	59,095,400	1.32	-0.274	-0.172	-15	-0.161	-0.161	-0.161
1995	74	59,460,400	1.24	-0.075	-0.057	-4	-0.051	-0.051	
1996	77	60,116,182	1.28	0.036	0.029	3	0.041		
1997	58	60,816,227	0.95	-0.327	-0.255	-19	-0.247	-0.247	-0.247
1998	57	61,466,178	0.93	-0.026	-0.028	-1	-0.017	-0.017	
1999	68	61,661,701	1.10	0.175	0.189	11	0.193		
2000	50	61,878,746	0.81	-0.295	-0.267	-18	-0.265	-0.265	-0.265
2001	37	62,310,000	0.59	-0.214	-0.265	-13	-0.260	-0.260	-0.260
2002	31	63,060,000	0.49	-0.102	-0.172	-6	-0.162	-0.162	-0.162
		total		-6.647	-2.123	-308	-1.867	-2.744	-2.644
		average/year		-0.317	-0.101	-15	-0.089	-0.161	-0.189

Note: * A = Not included the year that has more deaths than the year before.
+ B = Not included the year that has more deaths than the year before and the year that lower number of death reducing compares to the year before.
Negative sign means decrease amount.
Source: Division of Epidemiology, MOPH

Appendix 5
Computation of changing rate of postexposure treatment during 1991-2001

year	case(Pn)	population	per million (Yn)	Yn - Yn-1	(Yn - Yn-1)/ Yn-1	Pn- Pn-1	(Pn- Pn-1)/ Pn-1
1991	93,641	56,661,966	1,652.63				
1992	116,222	57,788,900	2,011.15	359	0.217	22,581	0.241
1993	133,963	58,336,100	2,296.40	285	0.142	17,741	0.153
1994	148,142	59,095,400	2,506.83	210	0.092	14,179	0.106
1995	153,483	59,460,400	2,581.26	74	0.030	5,341	0.036
1996	176,118	60,116,182	2,929.63	348	0.135	22,635	0.147
1997	207,808	60,816,227	3,416.98	487	0.166	31,690	0.180
1998	234,394	61,466,178	3,813.38	396	0.116	26,586	0.128
1999	239,698	61,661,701	3,887.31	74	0.019	5,304	0.023
2000	340,394	61,878,746	5,500.98	1,614	0.415	100,696	0.420
2001	351,141	62,310,000	5,635.39	134	0.024	10,747	0.032
			total	3,983	1.356	257,500	1.465
			average/year	398.28	0.136	25,750	0.147

Appendix 6
Computation of changing rate of dog vaccination and dog population during 1991-2002

year	dog vaccination (Vn)	dog population (P1)	%coverage (Vn /P1 = Cn)	Cn -Cn-1	(Cn - Cn-1)/ Cn-1	Vn- Vn-1	(Vn- Vn-1)/ Vn-1	A*
1991	1,590,449	8,431,830	18.86					
1992	1,174,982	8,599,538	13.66	- 5.199	-0.276	- 415,467	-0.261	
1993	2,128,153	8,680,967	24.52	10.852	0.794	953,171	0.811	0.811
1994	3,106,210	7,020,535	44.24	19.729	0.805	978,057	0.460	0.460
1995	4,001,555	6,732,070	59.44	15.196	0.343	895,345	0.288	0.288
1996	3,614,445	5,899,073	61.27	1.831	0.031	- 387,110	-0.097	
1997	4,219,034	5,969,409	70.68	9.406	0.154	604,589	0.167	0.167
1998	3,301,120	5,024,709	65.70	- 4.980	-0.070	- 917,914	-0.218	
1999	4,604,008	5,883,712	78.25	12.552	0.191	1,302,888	0.395	0.395
2000	4,277,939	5,987,195	71.45	- 6.799	-0.087	- 326,069	-0.071	
2001	4,579,079	5,953,249	76.92	5.466	0.076	301,140	0.070	0.181
2002	3,848,134	6,298,644	61.09	- 15.823	-0.206	- 730,945	-0.160	
		total		42.232	1.756	2,257,685	1.385	2.302
		average/year		3.84	0.160	205,244	0.126	0.384

Note: Dog population (P1) is derived from DLD record.
* A = Not included the year that has lower amount of dog vaccination than the year before.
Negative sign means decrease amount.

Appendix 7
Computation of changing rate of specimens submission during 1991 - 2002

year	Specimen(Sn)	Positive test	%Positive test	(Sn- Sn-1)	(Sn- Sn-1)/ Sn-1
1991	12,149	5,263	43.32		
1992	10,489	4,643	44.27	-1660	-0.137
1993	9,576	4,263	44.52	-913	-0.087
1994	8,113	3,781	46.60	-1463	-0.153
1995	6,254	2,937	46.96	-1859	-0.229
1996	4,414	1,858	42.09	-1840	-0.294
1997	3,369	1,115	33.10	-1045	-0.237
1998	4,508	1,314	29.15	1139	0.338
1999	4,350	1,208	27.77	-158	-0.035
2000	4,024	1,164	28.93	-326	-0.075
2001	3,329	954	28.66	-695	-0.173
2002	2,961	726	24.52	-368	-0.111
total				-9188	-1.192
average/year				-835	-0.108

Note: Specimens are animal heads.
Negative sign means decrease amount.

Appendix 8
Estimation of dog population : human population in three ratio during 1991-2002

year	Human population (H_n)	dog vaccination (V_n)	dog population (P1)	dog population (P2) = 1:6.72	dog population (P3) = 1:10	dog population (P4) = 1:15	%coverage(1) (V_n / P1 = C_{n1})	%coverage(2) (V_n / P2 = C_{n2})	%coverage(3) (V_n / P3 = C_{n3})	%coverage(4) (V_n / P4 = C_{n4})
1991	56,661,966	1,590,449	8,431,830	8,431,840	5,666,197	3,777,464	18.86	18.86	28.07	42.10
1992	57,788,900	1,174,982	8,599,538	8,599,539	5,778,890	3,852,593	13.66	13.66	20.33	30.50
1993	58,336,100	2,128,153	8,680,967	8,680,967	5,833,610	3,889,073	24.52	24.52	36.48	54.72
1994	59,095,400	3,106,210	7,020,535	8,793,958	5,909,540	3,939,693	44.24	35.32	52.56	78.84
1995	59,460,400	4,001,555	6,732,070	8,848,274	5,946,040	3,964,027	59.44	45.22	67.30	100.95
1996	60,116,182	3,614,445	5,899,073	8,945,860	6,011,618	4,007,745	61.27	40.40	60.12	90.19
1997	60,816,227	4,219,034	5,969,409	9,050,034	6,081,623	4,054,415	70.68	46.62	69.37	104.06
1998	61,466,178	3,301,120	5,024,709	9,146,753	6,146,618	4,097,745	65.70	36.09	53.71	80.56
1999	61,661,701	4,604,008	5,883,712	9,175,848	6,166,170	4,110,780	78.25	50.18	74.67	112.00
2000	61,878,746	4,277,939	5,987,195	9,208,147	6,187,875	4,125,250	71.45	46.46	69.13	103.70
2001	62,310,000	4,579,079	5,953,249	9,272,321	6,231,000	4,154,000	76.92	49.38	73.49	110.23
2002	63,060,000	3,848,134	6,298,644	9,383,929	6,306,000	4,204,000	61.09	41.01	61.02	91.54
2003	63,660,000*			9,473,214	6,366,000	4,244,000				

Note: Dog population (P1) is derived from DLD record.

Appendix 9 Operating cost of postexposure vaccination in public hospital and private hospital.

1. Public hospital

Labor cost:

Labor cost per minute of public health personnel who perform vaccine injection (baht per minute) = average monthly salary of all personnel who perform this service divided by (20.3 days per month * 7 hours per day * 60 minutes).

Public health personnel who perform this service are:

(1) doctor: average salary 30,000 baht, spend 5 minute per visit,

(2) nurse: average salary 12,000 baht, spend 10 minute per visit.

Therefore, average salary = (30,000+12,000)/2
= 42,000/2 = 21,000 baht per month
and labor cost per minute = 21,000/8526 = 2.46 baht per minute
for 15 minute = 2.46 * 15 = 36.90 baht.

This amount is for the first visit and for the rest 4 times, it is only a nurse who gives vaccine injection.
Labor cost of nurse per minute = 12,000/8526 = 1.41 baht per minute, spend 10 minute per visit = 1.41 * 10 = 14.10 baht.

Material cost:

(1) IM: consumes 5 vials of vaccine (included needle and syringe), it is 294.25 baht per vials = 294.25 * 5 = 1,471.25 baht.

Tetanus toxoid 3 doses, 35 baht per dose = 35 * 3	= 105 baht
Antibiotics and analgesics	= 22 baht
Wound dressing material	= 50 baht
ERIG 2 vial, 581.01 baht per vial = 581.01 * 2	= 1,162.02 baht
or HRIG 1,000 unit	= 7,421.52 baht.
Cost of vaccination not included RIG	= 1,648.25 baht
Included ERIG	= 2,810.27 baht
or included HRIG	= 9,069.77 baht.

There have only 5% of PEV received RIG[Ψ] then average cost of vaccination =

$$\frac{(1{,}648.25*95\%) + \{(2{,}810.27+9{,}069.77)/2 * 5\%\}}{100\%}$$

= 1,862.84 baht

In conclusion total operating cost of vaccination by IM is
= {36.9. + (14.10*4)} + 1,862.84 = 1,956.14 baht for complete course.
Therefore average cost = 1,956.14/5 = 391.23 baht per visit.
Discounting to year2000, CPI in year2002 = 104.2, CPI in year 2000 = 101.9, then price in year 2000 = $\frac{101.9}{104.2}$ * 391.23 = 382.58 baht.

[Ψ] Source: Disease control division, MOPH

(2) ID: consumes 3 vials of vaccine (included needle and syringe), it is 294.25 baht per vials = 294.25 * 3 = 882.75 baht.

Tetanus toxoid 3 doses, 35 baht per dose = 35 * 3 = 105 baht
Antibiotics and analgesics = 22 baht
Wound dressing material = 50 baht
ERIG 2 vial, 581.01 baht per vial = 581.01 * 2 = 1,162.02 baht
or HRIG 1,000 unit = 7,421.52 baht.

Cost of vaccination not included RIG = 1,059.75 baht
Included ERIG = 2,221.77 baht
or included HRIG = 8,481.27 baht.

There have only 5% of PEV received RIG then average cost of vaccination =

$$\frac{(1{,}059.75*95\%) + \{(2{,}221.77+8{,}481.27)/2 * 5\%\}}{100\%}$$

$$= 1{,}274.34 \text{ baht}$$

In conclusion total operating cost of vaccination by ID is
= {36.9. + (14.10*4)} + 1,274.34 = 1,367.64 baht for complete course.
Therefore average cost = 1,367.64/5 = 273.53 baht per visit.
Discounting to year2000, CPI in year2002 = 104.2, CPI in year 2000 = 101.9, then price in year 2000 = $\frac{101.9}{104.2} * 273.53 = 267.49$ baht.

2. Private hospital

We assume that all PEV was given IM type and 5% of PEV received RIG. By interviewing cost of PEV at private hospital is as followings.

Cost of vaccination not included RIG = 3,600 baht
Included ERIG = 6,000 baht
or included HRIG = 14,100 baht.

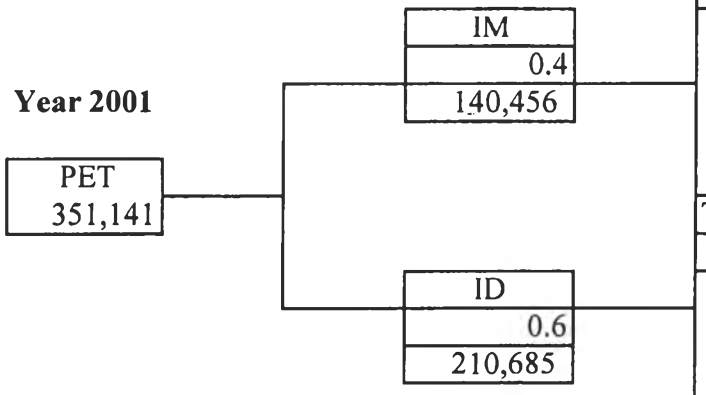
There have only 5% of PEV received RIG then average cost of vaccination =

$$\frac{(3{,}600*95\%) + \{(6{,}000+14{,}100)/2 * 5\%\}}{100\%}$$

$$= 3{,}922.50 \text{ baht}$$

Therefore average cost = 3,922.50/5 = 784.50 baht per visit.
Discounting to year2000, CPI in year2002 = 104.2, CPI in year 2000 = 101.9, then price in year 2000 = $\frac{101.9}{104.2} * 784.50 = 767.18$ baht.

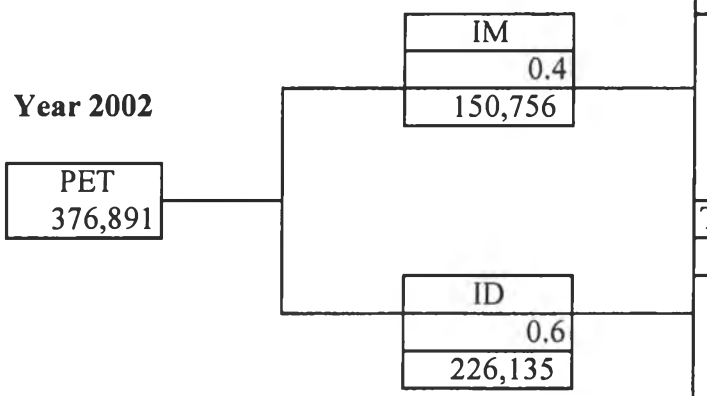
Appendix 10: Method to calculate number of visits at MOPH hospital, Year 2001- 2004



Visit(s)	%	PET (case)	Number of visits
5	12.13	17,040	85,200
4	13.02	18,281	73,123
3	30.15	42,352	127,056
2	19.85	27,876	55,752
1	24.85	34,907	34,907
Total		140,456	376,039

Visit(s)	%	PET (case)	Number of visits
5	12.13	25,560	127,800
4	13.02	27,421	109,685
3	30.15	63,528	190,584
2	19.85	41,814	83,629
1	24.85	52,361	52,361
Total		210,685	564,059

Year 2001, Number of visits = 940,098 visits

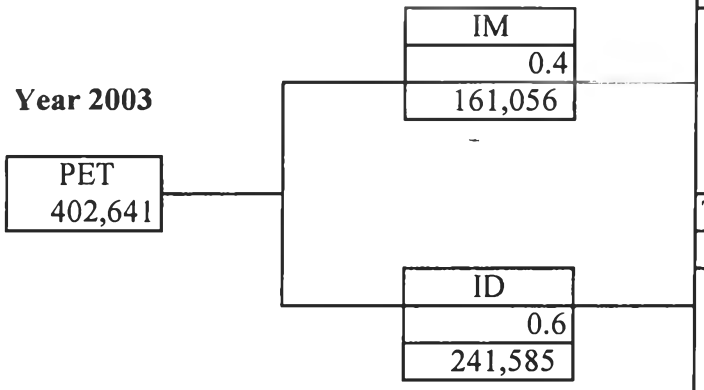


Visit(s)	%	PET (case)	Number of visits
5	12.13	18,290	91,448
4	13.02	19,621	78,486
3	30.15	45,458	136,373
2	19.85	29,920	59,841
1	24.85	37,467	37,467
Total		150,756	403,615

Visit(s)	%	PET (case)	Number of visits
5	12.13	27,434	137,172
4	13.02	29,432	117,728
3	30.15	68,187	204,560
2	19.85	44,881	89,761
1	24.85	56,201	56,201
Total		226,135	605,423

Year 2002, Number of visits = 1,009,038 visits

Year 2003

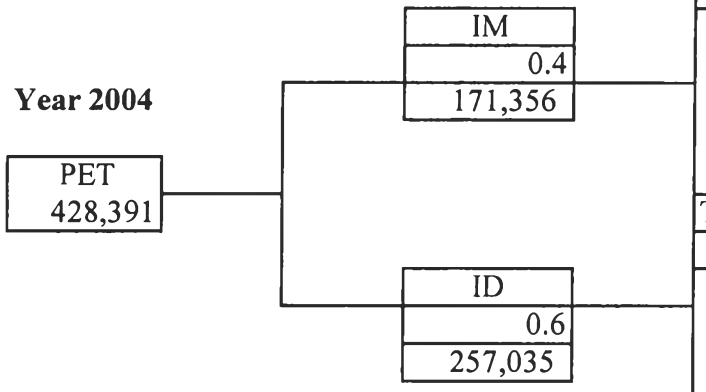


Visit(s)	%	PET (case)	Number of visits
5	12.13	19,539	97,696
4	13.02	20,962	83,848
3	30.15	48,564	145,691
2	19.85	31,965	63,929
1	24.85	40,027	40,027
Total		161,056	431,191

Visit(s)	%	PET (case)	Number of visits
5	12.13	29,309	146,544
4	13.02	31,443	125,772
3	30.15	72,845	218,536
2	19.85	47,947	95,894
1	24.85	60,040	60,040
Total		241,585	646,787

Year 2003, Number of visits = 1,077,978 visits

Year 2004



Visit(s)	%	PET (case)	Number of visits
5	12.13	20,789	103,944
4	13.02	22,303	89,210
3	30.15	51,669	155,008
2	19.85	34,009	68,018
1	24.85	42,587	42,587
Total		171,356	458,767

Visit(s)	%	PET (case)	Number of visits
5	12.13	31,183	155,916
4	13.02	33,454	133,815
3	30.15	77,504	232,512
2	19.85	51,013	102,027
1	24.85	63,880	63,880
Total		257,035	688,150

Year 2004, Number of visits = 1,146,917 visits

Appendix 11: Names and locations of rabies diagnostic laboratories in Thailand

No.	LAB	Province
1.	The Queen Saovabha Memorial Institute	Bangkok
2.	National Institute of Health	Nonthaburi
3.	Department of Livestock Development	Bangkok
4.	Siriraj Hospital	Bangkok
5.	Chiangmai Hospital	Chiangmai
6.	South Vet. Res. Center	Nakhon Si Thammarat
7.	Northeast Vet. Res. Center	Khon Kaen
8.	Med. Sci. Center, Songkhla	Songkhla
9.	Med. Sci. Center, Chiangmai	Chiangmai
10.	Praprokloa Hospital	Chanthaburi
11.	Med. Sci. Center, Khon Kaen	Khon Kaen
12.	Med. Sci. Center, Nakorn Ratchasima	Nakorn Ratchasima
13.	Med. Sci. Center, Cholburi	Cholburi
14.	North Vet. Res. Center	Lampang
15.	Ubol Hospital	Ubol Ratchatani
16.	Lampang Hospital	Lampang
17.	Med. Sci. Center, Phitsanulok	Phitsanulok
18.	Saraburi Hospital	Saraburi
19.	Udorn Hospital	Udorn Thani
20.	East Vet. Res. Center	Cholburi
21.	Livestock Regional Office 1	Ayutthaya
22.	Livestock Regional Office 2	Chachoengsao
23.	Livestock Regional Office 3	Nakorn Ratchasima
24.	Livestock Regional Office 5	Chiangmai
25.	Livestock Regional Office 6	Phitsanulok
26.	Livestock Regional Office 7	Nakorn Pathom
27.	Livestock Regional Office 8	Surat Thani
28.	Livestock Regional Office 9	Songkhla
29.	Livestock Provincial Office	Chai Nat
30.	Livestock Provincial Office	Kalasin
31.	Livestock Provincial Office	Amnat Charoen
32.	Livestock Provincial Office	Si Sa Ket
33.	Livestock Provincial Office	Buri Ram
34.	Livestock Provincial Office	Phetchabun
35.	Livestock Provincial Office	Udorn Thani
36.	Livestock Provincial Office	Chaiyaphum
37.	Livestock Provincial Office	Kamphaeng Phet
38.	Livestock Provincial Office	Sakon Nakhon

Source: Pongpanich P, Department of Livestock Development

BIOGRAPHY

Name: Sumet Ongwandee

Citizenship: Thai

Date of Birth: December 2, 1969

Single / Male

Address: 11/10 Pichai Rd. Soi 34 Pak-Priew Subdistrict, Maung District, Saraburi Province, Thailand, 18000
Mobile Phone (66)-1-287-7028

Language: Thai, English

Education Background:

Doctor of Medicine, graduated year 1994, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
Diploma in General Practice,
Mini MBA in Hospital Administration, Faculty of Public Health, Mahidol University

Employment: Director of Pai Community Hospital, Ministry of Public Health, Thailand

Professional Membership:

The Medical Council of Thailand, registration number 19977, valid since April 1994