Special Reviews

The National Blood Program, 1969-1998

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Introduction

Blood program in Thailand is run by the Thai Red Cross Society, with a close collaboration from the Ministry of Public Health. It is an integrated application of concept, policy and strategy. The successful outcome of the blood program depends heavily on a sound structure at the very beginning, i.e. government authorization and regular annual government budgeting, although partially. Good support is also from the Thai Red Cross Headquarter. The successful outcome also depends on the participation of local community, vigorous campaign for blood donation. Leadership to encourage public participation is required.

The Concept

To run a successful blood program in Thailand we start with the following basic concepts:

1. Blood program is essential for national health care; it needs financial support from the government.

2. Blood is a pharmaceutical product; it must be as safe as possible.

3. Blood is a gift of life; it needs donation, not to buy and not to sell.

4. Blood is a community resource; it needs sharing and effective management.

This concept is regularly advocated to the public (blood donors), the hospitals (users), as well as to the government authority (financial supporter).

Level of Blood Program Development

WHO has classified development of a transfusion service into 6 levels as follows:

Level 1 (Inadequate). Whole blood collection, ABO typing, no component separation, no screening for transmissible infectious agents

Level 2 (Basic adequate). Whole blood and red cells preparation, ABO typing, screening for syphilis, HBsAg, HIV, and other infectious markers as determined by the national blood policy.

Level 3 (Basic full-range). Whole blood and component separation (<30% of units collected) into 4 basic products (packed red cell, platelet concentrate, cryoprecipitate, and fresh frozen plasma), antibody screening and reagent preparation; in addition to Level 2 activities.

Level 4 (Highly productive). Whole blood and

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component separation (30-100% of units collected) into 4 basic products; others as in level 3.

Level 5 (Advanced). Level 4 activities plus frozen RBC, washed RBC, apheresis and special products.

Level 6 (Sophisticated). Level 5 activities plus plasma fractionation and basic research.

We follow WHO's development guidelines as our strategic plan. Every provincial transfusion center must attain the level 3.

A Brief History

Blood transfusion service in Thailand was initiated by the Thai Red Cross Society in January 1952 as a small section in the Science Division (Queen Saovapa Memorial Institute). The setup was in response to the recommendation of the International Red Cross (XVII International Red Cross Conference, Stockholm, 1948, Resolution No. XVII).

In this connection, the Rangsit Royal Family donated the money to build "Rangsitanusorn Building" as an operating office. Their Majesties, the King and Queen, declared the building open on 12 November 1953.

H.R.H. Prince Jumpotpong Baripat, Executive Vice President of the Thai Red Cross at that time, was the first person who donated blood on 6 April 1953, the Chakri Memorial Day. At the very beginning, blood was collected at the Center from only 56 donors per day. Few years later (1955), blood collection was expanded to perform outside the Center. The St. Andrew's Association of Bangkok had donated a car for this purpose.

The blood transfusion service then became under royal patronage, Her Majesty the Queen, President of the Thai Red Cross Society. In 1956, it was the first time that Her Majesty the Queen graciously presented royal gifts to the regular donors as token for their good spirit.

In order to promote the blood program, the Committee for Recruitment and Promotion of Voluntary Blood Donor of the Thai Red Cross was established in 1961. Major General Siri Siriyothin, senator of the Parliament, led the Committee in rigorous public campaign for blood donation with such devotion that the blood program has been on a solid ground ever since.

In 1963, the French government became interested in supporting the blood program of the Southeast Asian region. After visiting Thailand Prof. Jean Bernard, offered Thai government in training and equipment equivalent to 10 million bahts to set up the National Blood Centre.

With Cabinet approval to accept the French offer in 14 December 1965, the National Blood Centre was planned. Construction of the building was initiated at the budget of 6.1 million bahts and was officially opened on 13 October 1969. The building has been in use till the present day.

In 1977, a second building was constructed at the government budget of 14 million bahts through the Ministry of Public Health. This 4,000 square meters four-story building was opened in 1979 to accommodate the compo-

nent preparation, plasma lyophilization, plasma fractionation.

In the first decade of operation (1969-78), the mission was to set up provincial blood centers in each of the 72 province throughout the country and to encourage general unpaid donation. This was achieved by conversion of previously unorganized, hospital based paid donor system, into a centrally coordinated and unpaid donation system. It took more than 15 years of effort to successfully establish unpaid donation at every center. By the end of the first decade, the National Blood Centre was able to prepare 4 basic blood components, namely packed red cells, platelet concentrates, cryoprecipitates and fresh frozen plasma.

In the second decade (1979-88), campaign for unpaid voluntary blood donation continued. Blood grouping reagents were developed. Pilot scale of plasma fractionation was also initiated.

In the third decade, with the intrusion of HIV/AIDS, the emphasis was on the safety of blood products. Nine regional centers were planned. Specialized products were prepared to accommodate the advance of medical care. The National Blood Centre of Thailand is now at level 5, approaching level 6 of WHO classification.

The Blood Program Policy

Policy on national blood program was reiterated and approved by the Ministry of Public Health in 1989. They are as follows:

1. The National Blood Centre, Thai Red Cross Society is responsible for national blood program with government support.

2. Blood collection should come from voluntary non-paid basis and self-sufficiency should be aimed at provincial level.

3. Before dispatched for use, every unit of blood must be tested according to the set standard to maximize the safety of blood.

4. Appropriate use of blood must be encouraged

5. User (clinicians) and provider (blood centers) must be mutually co-operative to maximize blood collection and minimize wastage.

The policy was updated in 1993; the following points were added:

6. The government as well as private organizations should be encouraged to participate in blood donation campaign.

7. Pre- and post-donation counseling for HIV as well as other transmissible diseases should be carried out in every blood center.

8. Quality assurance program must be established in every blood center.

9. Staff training and continuing education must be provided in every blood center

Each provincial blood center is responsible for the supply of blood and blood component in her province while the National Blood Centre is responsible for Bangkok. The National Blood Centre also provides essential blood components as a back up service to other provinces, when needed. The provincial blood centers run the blood program under the auspices of the Provincial Red Cross Chapters, which work closely with the provincial hospitals of the Ministry of

Public Health

Basic Activities in Blood Program

Essentially, basic activities in blood program are as follows:

1. Donor recruitment
2. Blood collection
3. Laboratory screening
4. Component preparation
5. Storage and distribution

The National Blood Centre, has a comprehensive blood program where all activities including donor recruitment, blood collection, blood screening and blood storage and distribution, are performed at the Centre. At provincial blood center, however, donor recruitment are performed by staff of the Red Cross while blood collection, blood screening and blood storage are performed by hospital staff. However, the plan for establishment of 9 regional blood center is underway to standardize the quality of blood screening.

Donor Recruitment Program

The Goal

The goal of blood collection in each province, is 20,000 units per million population per year, or 15 units per hospital bed per year, whichever is higher. Thus, the goal for the whole country of Thailand is between 1.2 million units and 1.5 million units per year. For Bangkok, the target of blood collection is 360,000 units per year (24,000 hospital beds).

The Mechanisms

Campaign for blood donation is done through several mechanisms:

1. *Committee for Recruitment and Promotion of Voluntary Blood Donors.* Since 1961, this committee has been the major task force to encourage public for blood donations. HRH Princess Maha Chakri Sirindhorn, the executive vice president of the Thai Red Cross Society, appoints a 24-person honorary committee, each serving a 2-year term. Members of the Committee are representatives from various professions such as bankers, journalists, physicians, educators, military officers, high ranking government officials, etc. The members of the committee elect their chairman and meet once a month. They work closely with staff of the National Blood Centre in three main aspects:

1.1 To create public awareness of voluntary blood donation

1.2 To organize public activities that increases blood donation as well as scientific conference

1.3 To raise fund to support activities

One-hundred-time Donor Club and Rh-negative Donor Club are organized under this Committee. There are now 300 members in the One-hundred-time Donor Club and 1,000 members in the Rh-negative Donor Club.

2. *Public relation and donor recruitment section of the National Blood Centre.* Staff in this section has the following responsibilities

2.1 To serve as secretarial body to the Committee for Recruitment and Promotion of Voluntary Blood Donors.

2.2 To prepare educational materials such posters, pamphlets, videotapes, cassette tapes

for public

2.3 To set up exhibitions in school, factories, companies, etc. to motivate prospective donors to donate blood.

2.4 To arrange mobile team to collect blood

3. *Volunteers.* We have a small group of university graduates who volunteer to do field work. They communicate with prospective blood donors in school, military barracks, governmental offices, companies, factories, temples, etc., give information about blood donation and confirm appointments with mobile blood collection team. The volunteers were given a two-week course and are paid for meals and transportation. There are about 800 participated organizations handled by our volunteers.

4. *Mobile Collection Team.* Nine mobile teams are attached to the National Blood Centre. The team goes out to various work places according to schedules arranged by staff of the donor recruitment section for blood collection. There is 3 different sizes of blood mobile buses. Big bus is more convenient and more comfortable for personnel as well as for donors. They are air-conditioned and they can accommodate 4-6 donors at one time. These big buses are, however, expensive. Medium size buses are more efficient. Personnel and equipments such as portable beds are put together on the same bus for transportation. Up to 24 beds can be accommodated at one time. Small vans are more suitable in remote area where road access and communication route is compromised. However, two vans are needed, one for personnel, the other for equipments.

5. *Liaison.* A cooperative and supportive liaison in each organization is one of the keys to success in our donor recruitment program. It is necessary to identify such persons. Usually, they are our regular blood donors who volunteer to help us. One of the best liaisons we have is a Buddhist monk. With his support, we able to collect about 2,000 units in each 3-days session every three months. Buddhist monk in Thailand has influence upon public and when he takes a lead, people will undoubtedly cooperate. Liaisons from various organizations are invited to participate in annual conference in donor recruitment every year to share, with each other, informations and experiences.

The Strategies

Buddhist religion and Royal institute have great influence on the Thai culture. Religiously, Thai people would like to give and to help each other. And once they have given help, they would also like to do it again if they are appropriately recognized. Merit pins, as a token of recognition, are given to donors who donate blood for the first time and subsequently at 7, 16, 24, 36, 48, 60, 72, 96 and 108 times. Royal Ceremony for merit pins presented to the donors is performed annually. Those who complete 36 donations are eligible to attend. Culturally, Thai people love to express their loyalty and gratitude towards the Royal Family, especially the King and the Queen. Any activities dedicated to the Royal Family are integrated

into the theme of the campaign.

Our strategies in donor recruitment program include campaign towards general public as well as towards target group.

1. *Campaign towards general public.* Activities related to blood donors and blood donations are announced through variety of mass media, in the forms of news and spot announcement which include television, radio, newspapers, Web site in the Internet: (http: www.thai blood.org).

We also issue a monthly newsletter, 'the blood service newsletter' to disseminate information to our donors. Exhibition is displayed at shopping center with videotapes and slide-tapes presentation.

We organize blood donation in special events relating to the Royal Family, such as Birthday anniversary of His Majesty the King, Her Majesty the Queen, and HRH Princess Maha Chakri Sirindhorn.

2. *Campaign towards target groups.* The target groups are prospective donors in schools, factories, military barracks, companies, governmental offices, temples, etc. Volunteers play an important role, giving short lectures and display exhibitions on the same day or few days before schedule for blood donation. It is an opportunistic approach, taking opportunity whichever is available and convenient to donors. At school, short lectures, 10-15 minutes, are given in the morning just before the beginning of the classes, when all students get together to perform religious rite and sing the National Anthem. At companies and factories, lectures are given in the canteen during lunch hour. The objective is to motivate prospective donors, old and new, to give blood. Arrangement for the activities is done through our liaisons.

Students are welcomed to visit the National Blood to see our activities, which help them understand the blood program.

The result of donor recruitment is shown in

Table 1 Donor Characteristics, 1998

Total donor=228,091	
Sex: Male	58.2%
Female	41.8%
Age: <21	15.7%
21-30	44.3%
31-40	25.2%
41-50	11.6%
51-60	3.0%
>60	0.1%

Table 2 Frequency of Donation, NBC, 1998

Total donation	395,241
Total donors	228,091
Frequency of donation	
Once a year	60.0%
More than once	40.0%
New donors (80,262)	35.2%
Repeat donors (147,829)	64.8%
General Unpaid	96.6%
Replacement	3.4%

table 1-3

Blood Safety

After the intrusion of HIV in 1981, safety of

Table 3 Blood group, 1998

Group A	21.68%
O	37.77%
B	33.09%
AB	7.47%

blood became an important issue. Safety measures implemented at the National Blood Centre are safe blood donation, laboratory screening for transmissible diseases and viral inactivation, wherever possible.

Safe blood donation

Safe blood begins with safe donor. Unpaid voluntary donor is considered to be safe donor. Nevertheless, selection of donors among this group is also required to assure further blood safety. To secure safe blood, we promote more donations from:

1. Unpaid general donation (rather than replacement)
2. Regular donors (rather than first time)
3. Female donors

The three groups of donors as mentioned above have much lower prevalence of infectious disease markers. Replacement donation could become a concealed paid donation under certain circumstance. They could be paid by the third party who requests blood for his/her family or friend. Although regular donors may contract infection through his/her daily lifestyle, it is evident that the prevalence of infectious disease markers is much lower than the first time donors. The prevalence of HIV infection among female was also much lower than male counterpart.

In addition, we deferred donation from:

1. Donors with risk behaviors, such as drug addicts, prison inmates, homosexuals, commercial sex workers and his/her partners, known positive for HBV, HCV, HIV, malaria, syphilis, are excluded from donating blood.

In Thailand, the HIV prevalence among drug addicts is about 30% and drug addiction is also common in the prison. The HIV prevalence among commercial sex workers is about 15% comparing to 1% among the general population.

2. Donors during infectious window, 22 days of the last (unsafe) sexual contact. Infectious window for HIV decreases from 52 days in 1985, to 22 days in 1990, and to 16 days in 1996. We ask donor to postpone his donation to beyond the window period or till the next (3-month) schedule. In the past we use 3 months as quarantine window period, but most donors forgot and ignored. The figure "22 days" is therefore chosen, to make the donor seriously aware of the window period.

Laboratory Screening for Transmissible Diseases. Emphasis on the safety of blood against infection has always been the main interest of the National Blood Centre. Routine screening for transmissible diseases is done on every unit of donated blood, which includes syphilis, hepatitis B, hepatitis C and HIV. For other diseases, such as malaria, we rely on medical history of blood donors since no laboratory screening for malaria is available yet. With an em-

phasis on HIV, HIV antigen as well as anti-HIV screening is performed at the National Blood Centre.

Result of blood screening at the National Blood Centre is shown in table 4

Screening for syphilis began since the conception of the blood program. VDRL was used as screening method until 1995, when it was replaced by Treponema Pallidum Haemagglutination (TPHA) test.

In the past 9 years, VDRL prevalence among donated blood is decreasing as shown in figure 1.

Screening for hepatitis B surface antigen (HBsAg) began since 1971, using reverse passive haemagglutination method. The reagent was prepared in-house. It was replaced by ELISA method in 1995, when we began to use Prism automated system. Other hepatitis B markers, such as anti-HBc, anti-HBs, are not performed because the prevalence of hepatitis B infection in Thailand is very high. Anti-HBc positive rate in general population is as high as 60%.

The prevalence of HBsAg among donated blood is also decreasing, as shown in figure. 2.

Screening for hepatitis C antibody began since 1990 when the test was commercially available. The test is now in its third generation, which has nearly 99% sensitivity. It is however, only 60% specific when compared with PCR.

Prevalence of anti-HCV also showed a downward trend as shown in figure 3.

Screening for anti-HIV began in September 1987, only after a case of transfusion associated HIV was evident. ELISA method with combined HIV-1/HIV-2 assay was currently used for initial screening. Non-reactive units are taken on blood inventory for distribution. Initial reactive samples are also re-tested in duplicate with a second ELISA and/or another agglutination

Table 4 Transmissible Disease Markers, NBC, 1998

	HBsAg (%)	HCV (%)	TPHA (%)	Anti-HIV (%)
All donation (n=395,241)	1.27	0.39	0.14	0.18
All donors (n=228,091)	2.08	0.62	0.23	0.29
New donors: All	4.76	1.17	0.29	0.51
Among Male	6.09	1.73	0.37	0.72
Among Female	3.22	0.52	0.20	0.26
Repeat donors: All	0.63	0.32	0.20	0.17
Among Male	0.78	0.38	0.24	0.21
Among Female	0.38	0.23	0.14	0.09

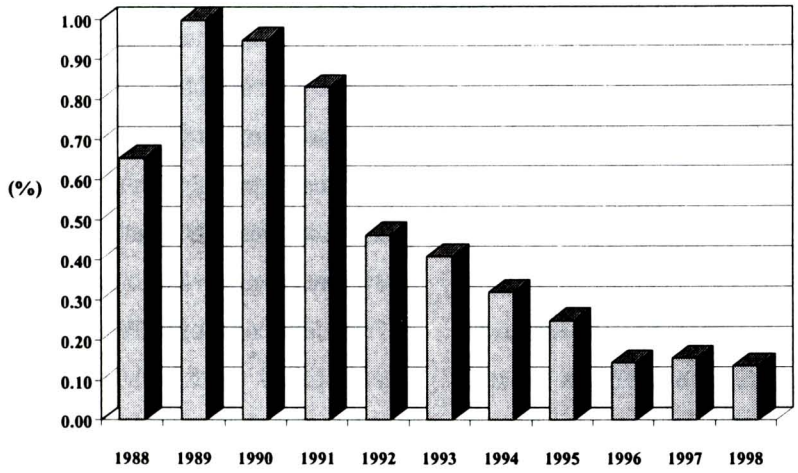

Fig. 1 VDRL positive disease markers

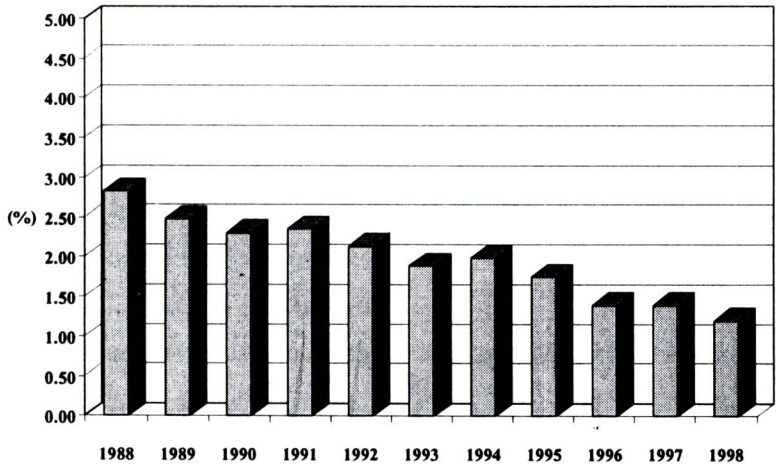

Fig. 2 HBsAg positive disease markers

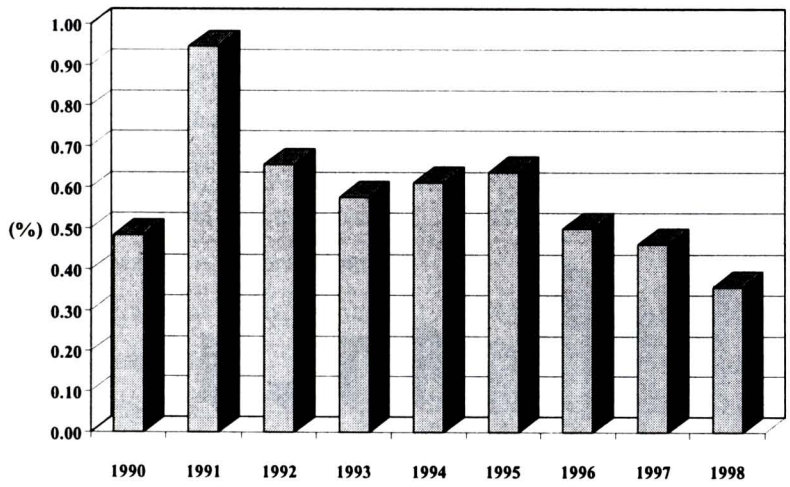

Fig. 3 HCV positive disease markers

method, and confirmed with Western Blot if indicated. Donors with confirmed positive results are notified with consent (optional), and are advised not to donate blood.

Prevalence of anti-HIV increased rapidly during early period of HIV infection. It reached the peak in 1992 and then declined as shown in figure 4. Prevalence of anti-HIV in donated blood in 1998 is 0.14%

Screening for HIV antigen began in 1991 after having discovered 2 cases of hemophiliacs who received multiple units of screened cryoprecipitates developed AIDS. Abbot HIV-Ag1 monoclonal and Ortho HIV Ag assay ELISA are currently used for initial screening. If reactive, they are re-tested in duplicate with the same reagents, but with neutralization. Confirmation of positive result required more than 50% neutralization as compared to control.

Prevalence of Anti-HIV among donated blood in the past 7 years is shown in figure 4

Prevalence of anti-HIV negative, HIVAg positive (window) in 1991, when the incidence of HIV infection reached its peak, was 5.6 per 100,000. It was declined to 1.2 per 100,000 in 1996 shown in figure 5

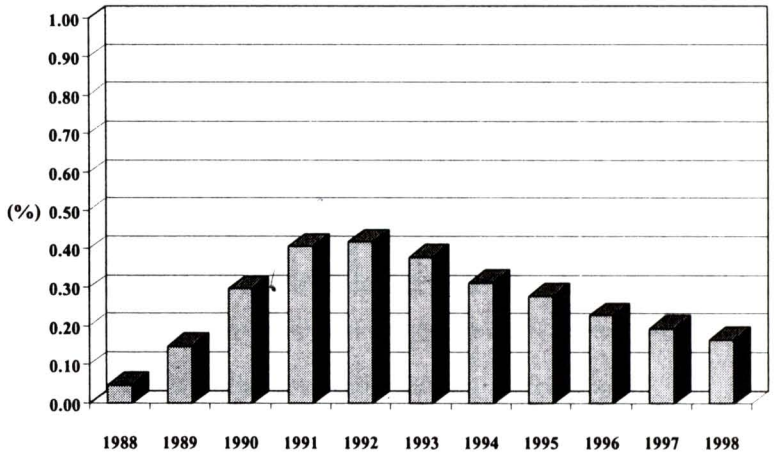

Fig. 4 Anti-HIV positive disease markers

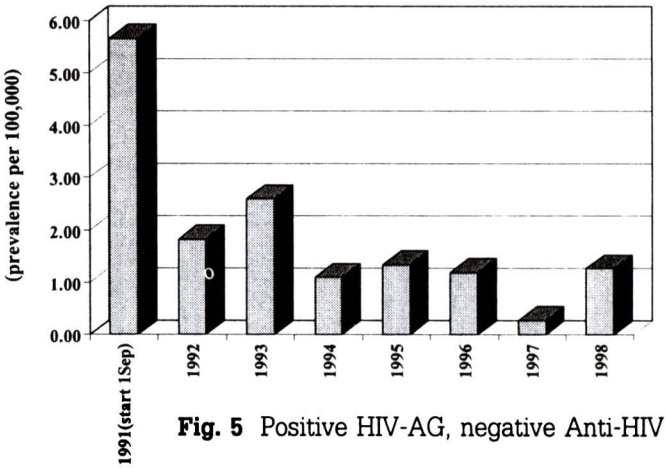

Fig. 5 Positive HIV-AG, negative Anti-HIV

Blood Collection and Component Preparation

Whole blood was collected in glass bottle containing ACD solution until this year, when it was replaced by plastic bag. Bottle is cheaper than blood bag. Although imported, glass bottle costs about $1 and can be re-used 4 times whereas plastic single bag costs more (about $1.5) but can be used only once. Glass bottle, however, is not suitable for component separation. Presently, more plastic double- and triple-bags are used for separation of blood components.

Whole blood collection from first time donor is 350 ml. Donor who weighs less than 50 kilogram also gives 350 ml per donation. Both are collected in double-bags, which are separated into red cells and plasma. Donor who weighs 50 kilograms or more gives 450 ml per donation. It is collected in triple-bag, which is separated into red cells, fresh frozen plasma and platelet, or red cells, plasma and cryoprecipitates.

We initiated component preparation in 1978. More components are prepared every year. In 1998, 57 % of total unit collected are separated into 4 basic blood components, i.e. red blood cell concentrates, fresh frozen plasma, cryoprecipitates and platelet concentrates. Currently, pooled leukocyte-poor platelets were prepared using the Optipress machine. Current products and services performed at the National Blood centre are shown in Table 5.

Table 5 Performance at NBC, 1998

Whole blood collection	395,241 units
Component separation (57%)	206,810 units
Packed red cells	206,810 units
Plasma fractionation	8,900 L
Plasmapheresis	2,358 L
Platelet, random donors	63,554 units
Platelet, leuko-poor (5 units/bag)	9,264 bags
Plateletapheresis (5units/bag)	3,371 bags
Cryoprecipitates (80 iu)	73,493 bags
Dried pooled cryo (250 iu)	2,813 bottles
Albumin (20%, 50 ml)	19,924 bottles
HBIG (200 iu/ml, 2 ml)	6,036 vials
HRIG (150 iu/ml, 5 ml)	2,992 vials
Anti-sera (monoclonal, 10 ml)	110,652 bottles
Coombs' serum	34,206 bottles
Blood bag production (single)	461,520 bags

Specialized Products/Service

In recent years, there are needs for specialized products and services to accommodate the advanced medical care in private sectors, such as bone marrow transplant, chemotherapy of leukemia and cancer. The National Blood Centre has provided additional specialized products to the hospitals, such as frozen red cells, leukocyte filtered red cells, single donor platelet (apheresis), gamma irradiated products (e.g. red cells, platelets), peripheral stem cell collection and freezing for autologous transplant, HLA typing, platelet serology, leukemia phenotyping etc.

Lyophilization of fresh plasma was initiated in early 1980 to accommodate the home treatment program for Thai hemophiliacs. In 1996 lyophilized cryo-precipitates were prepared to replace lyophilized fresh plasma.

A pilot scale plasma fractionation was initiated in early 1980. The products are albumin, hepatitis-B hyper-immune globulin (HBIG) and rabies hyper-immune globulin (HRIG). The fractionation capacity is 10,000 liters per year.

Plastic blood bag production was initiated in 1996. This is to replace the production of glass bottles that have been produced since the very beginning. The production capacity is 500,000 bags per year.

Fibrin glue is prepared and distributed for use throughout the country since 1997.

A contracted fractionation with Korean Green Cross was initiated in 1998 to produce IVIG and albumin was initiated in 1998 to supply good and economical plasma products to the hospitals.

International Activities

The National Blood Centre has participated in many international activities. They are as follows:

2. Sending staff oversea for training. Many countries have provided training for our staffs, mostly a period of 1-3 months. They are France, Australia, Denmark, New Zealand, Belgium, the Netherlands, UK, Austria and Japan. We have been sending our staff, 2 persons each year, to be trained at the Japanese Red Cross Central Blood Center for the past 20 years. Sending staff oversea for training are of great help to our national blood program. For the development of new activities and products.

2. Receiving expert consultants. We received technical expert from Montpelier, France at the very beginning (1966), led by Prof. Cazal to formulate basic operation. Later, in 1987, Prof. Cazal also came back to help set up computer program at our center. The computer program still function well till today. We also received Mr. Herrington from CSL, Australia in 1990 to evaluate our system for the expansion of plasma fractionation. This year (1998) we receive experts from IFRC/RC to conduct a 5-day training course in IFRC Quality Program to our staffs

3. Participation in the expert meeting. Director of the National Blood Centre has been invited to participate in the many Expert Meeting of the WHO, IFRC/RC. Invitation to give lectures were also came from organization in Myanmar, India, Vietnam, Philippines, China and Japan

3. Receiving oversea trainees. Trainees from Nepal, Myanmar, Laos came under the WHO sponsorship had come to our center for a short period of 1-3 months to receive training in donor recruitment, routine laboratory screening, anti-sera preparation.

4. Hosting international conferences, seminars, workshops, or symposia.

The National Blood Centre has engaged in hosting many internal conferences, seminars, workshops, or symposia. They are as follows:

In 1988 (September 27-30), Symposium on Biotechnology for Blood Derivatives, jointly organized with the French Embassy of Thailand, the League of Red Cross and Red Crescent Societies and the Thai Red Cross Society

In 1992 (July 11-18), Workshop on Informal Consultation to Evaluate the Distance Learning Materials, sponsored by WHO

In 1992 (November 17-26), Workshop on Management of Blood Transfusion Services and Optimal Use of the Resources, sponsored by the Finish Red Cross Society and jointly organized by the Finish Red Cross Society, IFRC/RC, WHO and the Thai Red Cross Society.

In 1992 (November 26-27), WHO/SEAR, WPR Inter-country Workshop on Blood Transfusion Services, sponsored by WHO/GBSI.

In 1995 (October 30-November 3), Symposium on Blood Program in the Asian Region: Securing Safe Blood, sponsored by the Japanese Red Cross Society with support from IFRC/RC and ISBT.

In 1997 (November 10-14), WHO/SEARO Inter-country Meeting on Strategies for Strengthening of Blood Transfusion Services in SEAR Countries, sponsored by SEAR.

In 1997 (November 23-27), the First Asia-Pacific Conference on Donor Recruitment and Donor Retention, organized by the National Blood Centre, Thai Red Cross Society.

In 1998 (August 24-28), WHO/SEARO Inter-country Training Workshop on Quality Assurance in Blood Transfusion Services.

In 1998 (November 9-13), the Second Red Cross and Red Crescent Symposium on Blood Program in the Asian Region: Securing Safe Blood II, jointly organized by the Japanese Red Cross Society, IFRC/RC and the Thai Red Cross Society, sponsored by the Japanese Red Cross Society.

Summary

Blood program in Thailand was started by the Cabinet's decision in 1966, designated its operation to the Thai Red Cross Society. The operation receives a close collaboration from the Ministry of Public Health. The successful outcome depends on the participation of local community, vigorous campaign for blood donation and leadership which encourage public participation.

Currently, the program consisted of one National Blood Centre (as head quarter), nine regional blood centers and 76 provincial blood centers throughout the country. The program gradually developed from a volunteer service into a professional one. Presently, the National Blood Centre is in the WHO's stage 5 of development and provincial blood centers are in stage 3. This year (1998) is the first time that blood collection reached the target of 20,000 collection per million populations.

The future goal is to install a standardized quality system of the IFRC/RC to ensure quality, first at the National Blood Centre, then the whole country.

IX CONGRESS OF THE INTERNATIONAL SOCIETY OF HEMATOLOGY, ASIAN-PACIFIC DIVISION

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- The Thai Society of Hematology
- National Blood Center, Thai Red Cross Society
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