(Draft)

120 DAYS AFTER TSUNAMI

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EXPERIENCES & LESSONS LEARN OF THAILAND

Health Technical Office,
The Bureau of Policy and Strategy
Office of the Permanent Secretary,
The Ministry of Public Health, Thailand

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and

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Preface

This report was prepared by reviewing documents from various organizations both public and private agencies in Thailand that publicized after the occurrence of Tsunami Disaster. We also reviewed some documents from abroad and retrieved some data from many websites.

Besides, some data were collected from in-depth interviewing with many local personnel experienced in Tsunami Disaster, e.g.; Provincial Chief Medical Officers, Directors and Deputy Directors of General Hospitals and Community Hospitals, Heads of Nursing Division, Heads of Emergency Room, Heads of Operation Room, surgeons, District Health Officers, staff of Public Charity Foundation, staff of the Thai Red Cross Society and non governmental organizations, village health volunteers, and some people who affected with this disaster.

The Ministry of Public Health organized a technical conference on Tsunami Disaster in Phuket Province during February 23rd – 24th, 2005. This conference aimed at setting up a forum for experts and health care personnel to share their experiences and opinions on Tsunami Disaster. More than 300 participants from various organizations attended this conference. They were health personnel from MOPH, universities, professional societies, Royal Thai Police Bureau, the Thai Red Cross Society and private organizations. Evidence-based data and information from the conference had been presented in this report too.

However, as of the April 20th, data were still updated but not significantly different from this report. We hope that this report would be much useful to readers. We are pleased to receive further information and suggestions for the completeness of this report.

Health Technical Office ,
The Bureau of Policy and Strategy
Office of the Permanent Secretary, the Ministry of Public Health, THAILAND

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Contents

List of Table

List of Figures

Knowledge Translation from Tsunami Disaster

Introduction

Thailand is situated in the Southeast Asia Continent, 100 degrees east of longitude and nine degrees south of latitude. It lays down from north to south like a conventionally hand-made ladle or an ancient axe, covers an area of approximately 512,997 square kilometers. The northern part of Thailand is bordered by Myanmar and the Lao People's Democratic Republic. The eastern part is bordered by the Lao People's Democratic Republic and the Kingdom of Cambodia. The Khong River separates the northern part and the eastern part of Thailand from the Lao People's Democratic Republic. The western part of Thailand is bordered by Myanmar. The southernmost part of Thailand is in 3 three provinces; Yala, Puttani and Narathivat, bordered to Malaysia. The population of Thailand is approximately 64 million.

Thailand is surrounded with 2 earth shells; Indian Ocean Shell and Pacific Ocean Shell. According to the location, Thailand is safe enough for earthquake. In the past, the first record of earthquake was in B.E. 1558 (1015) that devastated Yonok Nakorn. After Seismograph had been used, Thailand had been recorded the wave with magnitude of 6.5 Richter at Pua District, Nan Province in B.E. 2478 (1935). Although earthquake occurred many times but they were not so serious except in September 11th, B.E 2537 (1994), with the magnitude of 5.1 Richter that devastated some parts of Pan Hospital. The earthquake with more than 7 Richter in magnitude often occurs outside Thailand, mostly in China, Myanmar, Andaman Sea and Northern Sumatra Archipelago. {In B.E. 2545 (2002) and B.E. 2546(2003)}.

Besides natural disasters from earthquakes, development of technology also causes major disasters that induced deaths and injuries, e.g.; the explosion of a gas truck that killed nearly 100 people in B.E. 2533 (1990), 188 deaths and around 500 injured from the fire of Kador doll factory in B.E. 2535, and 90 deaths from the fire at Royal Jomtien Resort Hotel.

In Thailand, the responsible agency that encounters with disaster is the Department of Disaster Prevention and Mitigation, Ministry of Interior. According to the Prime Minister's Office Directive related to National Disaster Prevention B.E. 2538, modified and added (2nd edition) B.E. 2543, there is a committee entitled "National Disaster Prevention Committee" chaired by the Prime Minister or Deputy Prime Minister. This committee is composed of the permanent secretary and high rank officials from various ministries and staff from many private organizations. When disaster or mass casualty occurs, the Officer of Civil Defense will collaborate with all agencies in the locality. Besides, there are also supportive agencies, e.g., Civil Disaster Prevention Volunteers, some foundations such as Ruam Katanyoo Foundation, Po Tek Tueng Foundation, private organizations such as Suppanimitr, mass media, for example; Jor Sor 100, Ruam Duay Chuay Kun, will help informing to the public. In addition, the Office of Secretary General of Civil Defense has arranged the National Civil Defense Plan B.E. 2545 which is the master plan for all stakeholders to use as a guideline to develop their own operating plans, providing equipment to support the operation units at local level, training and monitoring operation units to operate according to the policy and plan by setting up steps of operation when encounter with the event. Local authorities have to stop and mitigate the disaster rapidly. For directing, the provincial governor has the authority in the responsible area. If it is over his capacity, the provincial governor could ask for help from nearby provinces or from Civil Defense Center of the Kingdom. The assistance agencies are the agencies that have no direct impact from the event and have the capacity to assist the impacted Civil Defense Center such as the nearby Civil Defense Center, ministries, state enterprises and private agencies, etc. The master plan also defines the communication system both receiving and informing message among various agencies. In addition, the master plan also sets up civil defense activities upon public harms, e.g.; disaster from flood, windstorm, earthquake, building collapse, forest fire, chemicals and harmful materials, etc. In this plan, there are details of warning system, mobilization of manpower and equipment to mitigate the

impact on life and property after the occurrence of disaster, acceleration to rehabilitate the devastated area to normal situation rapidly.

However, this catastrophe “Tsunami Disaster” hit wide range of areas and occurred suddenly. All communication channels and routes were cut off, all aids could not be accessed due to the obstruction of communication route from mud and ruined-objects. So there was no information on the magnitude and certain areas of disaster. These were the obstacles for all aids. Mobilization of all aids could not be collaborated, so every team was very confused. For a huge catastrophe, coordination among Thai agencies was not well prepared because the lack of experiences and drills. An example from group discussion in the topic of “Aids, Private Sector and Community Dimensions: Lesson learnt and Recommendations” reflected the problems that message was delayed 4-5 hours after the disaster occurred and television stations that broadcasted disaster news were the ones who collaborated with Narenthorn Centre, Royal Thai Navy and provincial governors, etc. Late aids might cause more deaths. All information should be useful for problem solving in the future.

Lessons learnt from the operating of prevention public harm in the past shown that there have had collaborations among various agencies, e.g.; MOPH has implemented the policy on “Prevention and Control of Emergency Disaster and Public Harm” by announcing the campaign “ Don’t Drive if Drink”, promoting law enforcement of wearing helmet and safety belt while driving vehicles. For curative, MOPH has developed EMS (Emergency Medical Service) that provided 24 hours injury surveillance and communication system in the area of Bangkok Metropolis and in 75 provinces. For example, Narenthorn Centre in Region 8 is responsible for the area of Songkhla, Trang, Satul and Pattalung Province and Narenthorn Centre in Region 19 is responsible for Phuket, Phungnga and Krabi Province.

Resulting from Tsunami Disaster on December 26th 2004, MOPH agencies have shown the preparedness in immediate problem solving though there were many problems and obstacles mentioned above. From analysis, it was found that MOPH structure was well prepared and strong enough to cope with such disaster. The affected local agencies could effectively managed and the medical and health personnel have had potentials to encounter with unexpected situation effectively before other concerned agencies reached the site. In addition, local private agencies were also well cooperated. After acute situation had gone, supports from military agencies included arrangement of air freight by the Royal Thai Air Force both manpower, equipment and foods had reached people in the affected area, Royal Thai Army, Royal Thai Navy had provided large machines for lifting away ruined remains and manpower in searching for lost victims and deaths rapidly. This turmoil situation was relieved in a short time that made Thailand be praised by many countries about the effective management under her own resource without any aids from foreign countries.

Results of the technical conference in "Medical and Health Supports for problem solving and rehabilitation caused by Tsunami Disaster" held on February 23rd – 24th, 2005 at Phuket Province arranged by MOPH were recommendations, operation and problem solving methods the concerned agencies of MOPH had reflected and also information from private agencies, foundations included volunteers that had to synthesize, analyze in order to plan for encountering further disasters. Thus the surveillance and preparedness for further disasters should be foreseen to decrease loss and impact on health status of the people.

Operations for Problem-Solving in Localities

Coping with the Disaster in Localities

Health administrators (provincial chief medical officers and general hospital directors) in all six Tsunami-affected provinces were primarily informed of the disaster a just before 10 A.M.(local time) on Sunday,26 December 2004, i.e. two hours after the earthquake of Sumatra island. The information they received was similar, i.e. several people drowned near the coasts or there was an irregular flash flood, irregularly high waves attacking the coasts about 20-30 minutes before being informed and there were several deaths and injuries.

The administrators responded in a similar manner, i.e. phoning several information sources to confirm that the disaster had occurred. They then immediately reported to the provincial governor and some reported to ministerial administrators in Bangkok. At about the same time there were breaking news reports on television about huge waves or Tsunami attacking the Andaman coasts of Thailand, resulting in a large number of deaths and injuries and property damages. Telephone systems were down and as a result no telephone communication can be made. As the incident occurred on Sunday, several administrators went up-country, the reporting and directives were interrupted occasionally. However, the health radio communication system was used instead.

At the provincial level, the governors or acting governors called on urgent meetings of all provincial-level chief officers to assess the situation and assign responsibilities in coping with disaster. An information center was established in each of the put up provinces to receive notifications of losses and damages, and to report and assess the situation. Rescue units were dispatched to assist the victims at the sites. In coordination with Red Cross units and charity foundations/agencies, provincial authorities erected tents as temporary shelters for the victims and provided them with

clothes, medicines for preliminary treatment, as well as first aid-kits. Most importantly, all general hospitals were directed to be prepared to provide medical services to patents and injured people.

Medical Services

Actually, all hospitals under the Ministry of Public Health located in the affected areas have had a mass casualty Management Plan for over 30 years. Revisions and rehearsals of the plan have been undertaken periodically during the past 5 – 10 years. Each hospital has experiences in managing mass casualties particularly during festivals, when there are a lot of travelers, such as New Year and other holidays, when people travelling back to their home times as sightseeing. They regularly have emergency service drills 2 – 4 times a year. At the Phuket Vajira Hospital, a general provincial hospital of MOPH, has got the Golden Dream Plan and Krabi provincial hospital, with an experience in handling hill-slide victims three months ago, leave got personnel with extensive experience in helping the victims, especially during the period close to the New Year holiday with a lot of travelers going back to visit their relatives, home towns, and sightseeing. All the hospitals have rehearsed their own public disaster or mass casualty relief efforts.

Therefore, as soon as the disaster was confirmed, all the hospital implemented their mass casualty management plans immediately; no need to wait for any instructions from their superior. This is because the plans have specified the operational frame-work for their hospital and within their respective areas of responsibility.

It should be recorded that Phuket province is where the Andaman Narenthorn Center (ANC) was located. The center, covering Phuket, Phang-nga and Krabi provinces, whenever there is a public disaster, the emergency services plan will be launched and the ANC in Phuket will inform and coordinate with the Narenthorn EMS center and its network member hospitals (Siriraj, Bangkok – Phuket), and

Mission – Phuket hospitals) as well as local clarity foundations in providing emergency medical services. It is a sub-writ of the Narenthorn Emergency Medical Services (EMS) Center of the Thai MOPH, located in Nonthaburi province. In implementing the mass casual, relief plan, all its network members will function automatically according to their designated areas and responsibilities, special rapid response teams (SSRT) or emergency management system or advance life support (EMS or ALS) teams will be immediately dispatched to provide first aid and basic life support (BLS) services at the scene. Such services will help save lives of the victims and minimize the severity of injury or prevent disabilities that may result from injury.

In the Tsunami disaster in Phuket, after assessing the situation, the Phuket hospital director sent out three EMS terms to the field and assigned the fourth EMS team to serve as a first aid triage in service area 1 (green area). Besides, a team of doctors and nurses was sent to help Patong Community Hospital, a 60-bed district hospital, located near the beach with a large number of injured victims, the team provided medical care and screened patients for surgeries at Vajira Phuket Hospital. In Krabi province, another 60 sports were formed and dispatched to provide emergency medical services to over 4,000 injury cases and some 351 cases were screened and then sent for further care at hospitals.

Within a hospital, in addition to setting up a service area 1 (green area), a service area 2 (Yellow area) was established do wound suturing/dressing, investigation, and observation services, a service area 3 (red area) was also set up to help with life resuscitation and sending to an operative room or intensive care unit. And the last area that was set up at the back of the hospital, a little bit out of sight, is the blue area for keeping dead bodies of those who died before reaching the hospital or in the hospital awaiting autopsy and/ or disaster victim identification process.

Similarly, in Takuapa and Phang-nga Hospital of Phang-nga province, Krabi and Patong community Hospitals of Krabi province, and Suksamran Hospital of Krabi province, each announced its own emergency services plan and assigned various duties to its staff based on staff categories and experiences and limitation, For instance, a patient with a minor wound, after having had wound dressing with no severe injury signs/symptoms, normal vital signs, being conscious, would be allowed to go back home ; the care for such a patient would be provided by a pediatrician or an obstetrician/gynecologist. But for a seriously injured case with a broke bone requiring urgent resuscitation, medical treatment would be provided by a surgeon, traumatic surgeon, orthopedist or neurosurgeon.

In general, in a medium sized (250-350 bed), hospital, the emergency medical services plan will be implemented whenever there are 20 injured cases or more. This might be flexible depending on the hospital size and number and experiences of staff.

During the implementation of the emergency medical service plan, in each hospital whose director serves as the plan director, and he/she may assign a deputy hospital director to function as the plan director, service centers/units would be established on follows: information center providing information to other agencies and the public under the supervisions of a deputy director; logistics unit providing medical supplies/equipment as well as food and drinking water for patients, relatives and staff; emergency care unit chief, nursing director, emergency chief nurse, operations room chief or ICU chief may be assigned to set up a mental health team and an autopsy team.

Services Network for Neighboring and Remote Areas

Under the MOPH, the service network members include general and community hospitals located in all provinces and districts; support services are also provided as needed in different localities so as to cover all the affected population and

areas, depending on the existing transport and communication systems in each locality. Thus, in Phang-nga province, two general hospitals (Phang-nga and Takuapa) were assigned to cover the entire province. In term of service potential, MOPH has assigned tertiary care facilities or regional hospitals in all regions of the country, each serving its neighboring 4 – 6 provinces. Thus, for the six Tsunami-affected provinces, other tertiary care level hospitals located about 2 – 4 hours by car have asked by phone whether additional support is needed from them. Such hospitals are: Surat Thani Hospital, Maharaj Nakhon Si Thammarat Hospital. Hat Yai Hospital, and Prince of Songkla University Hospital. They all have doctors of all specialties and plenty of medical personnel as well as supplies/equipment that could be used at the front-line facilities.

In the beginning, most of the hospitals in the affected areas thought that the problems were not beyond their capacity to cope with. But after 4 – 6 hours has passed by, they had to ask for assistance from the other 3 regional hospitals as well as the Prince of Sonkhla University Hospital. In addition, other regional/general hospitals in non-affected provinces, such as Chumphon Hospital, Trang Hospital (with a small number of victims), Yala Regional Hospital. Songkla Hospital, and several other general hospitals, even large community hospitals such as Thungsong Hospital, sent mobile medical teams with ambulances and medical supplies/equipment to help the hospitals in the affected areas. Some took turn providing medical and surgical services and took patients from Takuapa, Vajira Phuket, Krabi, Phang-nga and Ranong Hospitals to their own hospitals for further surgical and medical care; totally 284 cases were taken out for such care in Maharaj Nakhon Si Thammarat, Thungsong, Surat Thani and Hat Yai Hospitals (see details in table 2).

As Indicated above that a number of hospitals in nearly non-affected provinces rapidly sent their mobile medical teams to help the victims on the night of 26 December 2004, medical teams were also sent to the south from the central level such as a team from Bhumiphol Hospital of the Royal Thai Air Force which reached Phuket on the 26 December evening, a turn from Prince of Songkla University reaching Takuapa Hospital in the same evening, a team from Siriraj Medical School/Hospital reaching Phuket late that night (Note: Phuket airport located near the beach was temporarily closed down for about 6 hours after the Tsunami hit the area). The next day's morning, mobile medical teams arrived from hospitals under the Department of Medical Services and other regional/general hospitals under the MOPH's Office of the Permanent Secretary such as Ratchaburi, Nakhon Pathom, Pathum Thani, Khon Kaen Hospitals, Udon Thani, Ranong, Lerdsin and Chonpratharn Hospitals. Tens of other medical units also arrived from Huachiew Hospital (under a clarity foundation), regional universities and Ramathibet Hospitals. With such assistance from other areas, local hospitals decided to distribute such mobile medical units to several locations where the people were directly hit by the giant waves.

Number and Characteristics of Injuries and Deaths;

The Tsunamis or giant waves striking the western Thai coastline resulted from the earthquake of a magnitude on the Richter scale that occurred under the Indian Ocean, one of the strongest quakes ever recorded in the world. The velocity of the Under-current waves was not confirmed as no records have ever been made in the Indian Ocean, but it was estimated to range from 500 – 1,000 kilometers per hour. Some time with the same magnitude of quake, the wave velocity might be more than 750 kph; with the wave length of over 200 km, when reaching the shore, the wave would be as high as 10 – 30 meters, the momentum of millions of ton of water mass of over 700 Kph, the striking forces and damages were incalculably enormous within a short period of time.

Within the first six hours after the wave-striking occurred, there were not so many injury victims coming to the hospitals; most of them were affected by drowning, injured from being hit by debris, buildings or boats.

At Vajira Phuket, Takuapa, and Krabi Hospital, there were not so many injury cases during the first two hours of the disaster; later on the numbers of injury cases and deaths arriving at the hospitals increased rapidly as more and more of such cases and dead bodies were transported from the Tsunami affected areas. Since then, the situation had to be assessed every hour and places had to be prepared to care for non-serious cases during convalescent periods and some were referred to other hospitals outside the affected areas or even community hospitals and health centers of their own domiciles. As a result, more beds could be mode available for seriously injured cases. Some spaces or buildings, such as meeting rooms or hallways, were transformed into inpatient wards or temporary shelters for injured victims who had been treated and waiting for being relocated or taken home by relatives.

Regarding medical supplies and equipment, in addition to being taken out from the hospitals central supply units, some were received from other network member hospitals.

In summary, the number of injuries, deaths and missing due to the Tsunami disaster by province are as follows:

Table 1 Numbers of deaths and missing persons as of 17 January 2005 (National Center for Civic Disaster Prevention)

No.	Province	Deaths	Missing
1	Phang-nga	4,198	1,865
2	Krabi	693	715
3	Phuket	260	646
4	Ranong	161	11
5	Trang	5	1
6	Satun	5	-
Total	**-**	**5,323**	**3,238**

Table 2 Numbers of patients treated at hospitals in the Tsunami-affected provinces as of 17 January 2005

No.	Province	Injury cases			Cases admitted			Surgical cases	Referred cases	Inpatients remaining on 17 Jan.
		Thais	Foreigners	Total	Wards	In ICU	Total			
1	Phang-nga	3,230	1,285	4,515	681	157	838	652	367	60
2	Krabi	971	791	1,762	364	6	370	139	47	8
3	Phuket	924	931	1,855	349	28	377	318	83	42
4	Ranong	253	18	271	48	2	50	19	18	2
5	Trang	122	14	136	40	2	42	4	3	2
6	Satun	31	2	33	18	-	18	2	1	-
	Total	**5,531**	**3,041**	**8,572**	**1,500**	**195**	**1,695**	**1,134**	**519**	**14**

Table 3 Results of mobile medical/health services, 27 December 2004 – January 2005

No.	Province	No. of times of mobile services	No. of service recipients
1	Phang-nga	38	5,864
2	Krabi	12	1,080
3	Phuket	25	2,980
4	Ranong	6	803
5	Trang	4	164
6	Satun	2	226
Total		**87**	**11,117**

Source: Coordinating Center for Southern Disaster Relief operations, MOPH.

Illness Characteristics of the Patients Treated at Hospitals

Most of the patients had wounds all over the body or on parts of the body. The top five types of illness were open wound and laceration of soft tissues down to the muscles on the arms, legs, chest, abdomen, and back; drowning, mostly dying before reaching the hospital, and pneumonia, mostly resulting from choking of water, mud and sand and almost all being infected; bone fractures of arms, legs, ribs, wrists and angles at one or more location.

Lacerated wounds mostly had foreign bodies including impacted soil and sand, in some cases such foreign bodies were found in the tissue one-foot from the wound opening. Some cases had complications with infectious as a result of the severe impact of the foreign bodies. The surgical procedures or debridements performed to take out impacted tissues so as to let the wound heal itself, which was difficult and almost impossible. Besides, there were pneumonitis from aspiration of water and dirt during the event. Infections were found differently in each hospital, for example in Vachira Phuket Hospital; culture and sensitivity test mostly found Proteus,

Klebsiella and Pseudomonas, those bacteria were sensitive to antibiotics, e.g.; Amikin, Augmentin and Gentamicin, etc

Roles of Private Sector and NGO's and Foreign Aids

Actually health personnel and health agencies in Thai government sector work closely with private sector and NGO that work in the same field, e.g.; Thai Red Cross Society and its branches in every province conduct activities together with government hospital in blood donation, blood provision, distress mitigation or launch mobile team to provide service for the people in remoted area, or in case of disaster, e.g.; fire, traffics mass casualty, aid volunteers from charity agencies and disaster mitigation agencies, e.g.; Por Tek Tueng Foundation and its local network (may be named differently, e.g.; in Krabi Province was Pracha Santisuk Foundation) or disasters mitigation and prevention volunteer unit of some local authorities, and also the Business women and Professional Association of Thailand, Phuket branch, etc.

These agencies would assist in accordance with their missions or skills, e.g.; arrangement of temporary shelter with clothes, bedding, temporary bathroom and toilet, arrangement of kitchen and provision of foods and water for large group of people, preparing packed foods and water for mobile team. Some agencies would ask for donation both in cash and in kinds, e.g.; clothes, dried foods and distribute to the site. Some agencies conducted more special mission, e.g.; Red Cross, arranging first aid treatment mobile team or asking for blood donation and blood provision or prepared supplies used in hospitals. Pracha Santisuk Foundation in Krabi Provinces or other foundation and their network in other provinces would conduct special roles, that were; helping victims and collecting bodies at the sites, transferring bodies and procurement of coffin, etc. For this disaster, the continual activities that had to conduct, e.g.; Phuket Red Cross Society allocated donated money to purchase more coffins or purchased wood for making special size of coffins in order to fit large foreign dead bodies or Thai or Asian dead bodies that were swollen and not be able to fit in normal size coffin, every province had to procure clothes or plastic bags with zipper for packing dead bodies waiting for verification of personal identity, etc.

Besides those charity agencies and foundations, there were also many private agencies contributed in helping victims and mitigating impact on victims both Thai and foreigners, e.g.; the owner and executives of Krabi Meritine Hotel, Krabi Province had open hotel's rooms and other parts of hotel used as temporary shelter for wounded mostly foreigners who were treated from hospitals and still had no lodging, no relatives and be unable to travel back home from wounded physical condition that need dressing or continual treatment or because of losing their relatives or friends or losing personal document, e.g.; passport, I.D. card, included money, property, clothes and personal belongings. Krabi Meritime Hotel allowed victims used as temporary shelter without charging and more ever provided clothes, foods, bags, socks and shoes and other necessities included money in some cases. The hotel also let many embassies to use as temporary offices in issuing documents and facilitating their people to travel back home or transfer to Bangkok for continual treatment, etc. This hotel also provided clothes to use for patients in Krabi Hospital, provision of interpreters for communicating with personnel of the hospital or other agencies or other Thai people. The same as in Phuket, Pearl Phuket Hotel and Pearl Village Hotel at Nai Yang beach, had also open the hotels for foreign victims who were wounded, losing their cousins, losing their money, property included travel documents as temporary shelter. Pearl Village Hotel was also modified as temporary office for Sweetish Embassy in issuing diplomatic documents and facilitating to travel back home or transfer to Bangkok for continual treatment. Moreover, there were many people and private business firms cooperated in helping the victims as much as they could do, for examples; C.P. Co. Ltd sent frozen chicken through freezer containers 15 tons for foundations, volunteers or workers to cook as foods, Toyota Pearl Co. Ltd in Phuket helped transferring people with 15 new pick-up vehicles and donated necessities distributed to the sites. Many individuals up to hundreds voluntarily drove their own cars to help transferring victims or aid workers to the sites. Thai Airways, Bangkok Airway, Nok Air, Thai Air Asia and Thai Orient Air all facilitated arranging flights for medical teams included all fields of volunteers together with necessities donated by people and various agencies to the affected provinces included transferal

of patients and foreigners from Phuket to Bangkok. Air Flight Division from Royal Thai Police Psureau, Royal Thai Navy, Royal Thai Air Force and Royal Thai Army all together launched war ship, helicopter carrier and airplane to search for victims along the islands, in the sea and the bays which had been devastated in order to transfer the wounded or victims back to town to the hospitals or transfer a large number of patients to whom had been preliminary treatment to nearby regional hospitals, e.g.; Hat Yai Hospital or transfer to hospitals in Bangkok.

Assistance from private sector both individuals and private agencies, some were ended in a short period, some were still doing continuously until the present time and some had to support some groups of victims further for a long time, e.g.; victims center of Phuket Red Cross society which was able to bear 300 victims but there were about 1,000 victims asking for help in the first few days, Phuket Red Cross Society had to spread out to Satree Phuket School, community halls. In first week after disaster, Phuket Red Cross Society had to provide packed food up to 5,000-6,000 sets/day because besides victims, had to provide for volunteers or personnel from various agencies that asked for packed-foods in order to conduct searching for victims and bodies in various places, too. Red Cross Center had provided services for 2 weeks until clients were decreasing and then moved to provincial hall and closed up itself a month later.

The same as aid center of Pracha Santisuk Foundation at Krabi Province, besides mobilizing volunteers from many southern provinces more than 1,000 volunteers/day, it had to distribute volunteers to conduct help in every affected area; Krabi, Phangnge, Phuket and along islands, bays and capes. The foundation had to provide packed-foods more tan 5,000/sets/day in the first few days and had to set up free kitchen at the foundation and provided food to support soldiers, volunteers form several Vocational Education Institutes who conducted help by building replace houses, repairing buildings and fishing boats which were used for earning of victims

in various places; Kao Luk, Ban Nam Khaem, Lenta Island, Pratong Island, P.P. Island, Nang Guft, Nopparat Thara Beach or Ban Kloing Pak Bang, etc. There were still many continual aid projects such as Paen Pung Pa Yam Yak Foundation, Thai Red Cross Society together with International Red Cross Society, the Businesswoman and Professional Association of Thailand, etc.

It should be recorded that after 1st first day of disaster, there were several aids from Red Cross Society of many countries such as Finland, Hong Kong, France, China, Japan, etc; China, Japan, etc; these countries had sent mobile teams to conduct helping or visit or situation assessment at the site first in order to provide aids later, even though Quarter Red Moon Council from Saudi Arabia also sent to number of big size foreign dead bodies. Japanese Red Cross Society not only sent mobile mitigation team but also provided helicopters with equipment for searching victims along the islands. Besides Red Cross teams, there also had Rescue Team from other agencies of various countries had been sent for rescue too by gradually reaching the devastated area since the 3rd day after disaster. Later on, after Thai official (by Dr. Supachai Kumarattanapruek, deputy permanent secretary of MOPH.) decided to move treated patients from Ta Kua Pa Hospital, Phuket and Krabi Hospital to other hospitals, there were some governmental agencies from some countries such as; German, France and England had sent airplanes that had potential as airplane hospital to refer foreign patients and victims back to their home countries many flights.

Management on Environmental Health, Disease Surveillance and Control

Sanitation and Environmental Health

When first coping with Tsunami disaster, the first interest and reaction was immediately taking care of victims who needed to be cured, surgery, physical and mental rehabilitation. However, local health agencies did not look after management of environmental health, sanitation, and communicable disease surveillance and

control which later on would be health problems. Thus health teams of every province had mobiled out to survey and preliminarily assessed the situation. Moreover, local technical agencies of technical department which were, Regional Health Centrer (region 11 and 12) of Health Department located in Nakorn Si Thammarat and Songkhla Province, the same as Regional Diseases Control of Diseases Control Department and Psychiatry Center at Suratdhani Province (Saun Saran Rom Hospital) and Songkhla Psychiatry Hospital of Mental Health Department all reached the devastated areas and provided technical advice included managing on concerned problems.

In part of Health Department, besides experienced technical support from Regional Health Center, Health Department also set up Special Operation Center in order to manage support for problem solving by sending high rank Officials and senior technicians to manage in each affected province by assessing situation and planning to control the problems. Preliminarily classified affected area by local problems into 3 categories, those were;

1. Area around migration center

Since there were many victims whose houses were destroyed by tidal wave had no shelter, in addition with a number of both Thai and foreign tourists who lose their relatives and friends were waiting for the news of searching for victims. Those people were arranged to live in migration centers or temporary shelter centers which were urgently set up, e.g.; on January 31st, 2005, Phangnga Province had 20 migration centers, 6 in Krabi, 2 in Ranong and 1 migration center in Phuket (These data were dynamic, same centers might have informal temporary shelters or there were few victims and migrated to live in a more convenient site, these centers then closed themselves or dissolved to join with the nearly centers

2. Area for autopsy and collecting bodies

Only the first day evening, there were more than 5,000 bodies transferred to Vachira Phuket; Ta Kua Pa, Phamgnga, Krabi Hospitals and local community hospitals such as Pa Tong Hospital, Suk Samran Hospital induced the

problem of places to collect and autopsy, refrigerators for preserving bodies included physicians were insufficient. As one day passed by, the problem of foul smell from bodies arose meanwhile injured victims were sent to the hospitals more and more until the hospitals were too crowded then all the bodies discovered afterwards were transferred to collect waiting for autopsy at another places, e.g.; Phangnga Province had arranged an area to Beng Muang Temple, Krabi Province at Pracha Santisuk Foundation and Phuket Province at Ta Chut Chai Cemetery, these area were urgently arranged that were not technically correct and risk to occur environmental health problems, e.g.; foul smell, flies, lacked of clean water and sanitary latrine and the most crucial matter was waste water from autopsy and refuse and excreta from bodies.

3. Devastated area

Fishermen villages, shop houses, hotels, resorts and government buildings and all properties in these devastated area were destroyed in a ruinous condition becoming pieces of woods, bricks and garbage dump dispersed over the area Refuses and water retention became rotten induced environmental sanitation problems and be risk to occur outbreaks.

The teams assessed the condition and planned to improve environmental sanitation condition that would be risk to health and planned to develop, monitor the condition until these area were safe from communicable diseases and health-threatening condition. The problems were assessed periodically, as follows;

1. First 48 hours after occurrence

- Sites bodies found and area for body collection were inadequate and problem of foul smell, inadequacy of refrigerator for keeping bodies
- Area around migration center had problems of clean water for consumption, sanitary latrine, garbage's and flies. Water and foods were not problem

since a large number of bottle packed water were denoted and packed foods prepared by private sector, foundations, Red Cross and supported by people is general

- Devastated area, problems mostly were garbage from destructive materials and rotten organic matter, public utilities were destroyed especially tap water, electricity, waste and garbage eradication included retention of waste water

2. 48 hour to 1 week after occurrence

- Area for body collection has the problem of severe foul smell, more infected garbage, flies, excreta and waste water from autopsy.

- Migration center area still had the problem of sanitary latrine, cleanness of area around, quality of water for consumption was below standard, more garbage and lacked of rapid eradication system induced the following problem, non-hygienic of cooking places.

- Devastated area had more problem of contamination of water sources.

3. Rehabilitation phase, 1 week after till now

- Area for body collection still had the same problems especially infected garages and waste water from autopsy but the problem of foul smell was improved due to the use of bacteria that helped digestion of organic matter and the use of deodorant.

- Area around migration center, 5 weeks after disaster, some centers started to cope with scarcity of drinking water because of shortage of donated bottle-packed water, other remained problems were problems of garbage eradication, treatment of waste water form temporary shelter and food sanitation.

- Contamination of water source in devoted area was still the crucial health problem. The method to solve this problem was done by local health personnel, special operation team and Health Department team, the problem was prioritized and operated, e.g.; cleaning of water pit with chlorination, arrangement of mobile water-supply system, eradication of flies and vector insects, provision of health education to victims and concerned people in the topic of general sanitation, food sanitation included supported technical knowledge to local authorities, provision of black bags, garbage

containers and set up garbage collection and eradication system, built diffused pit for temporary waste water treatment, water and food quality surveillance by sampling food and water from various sources and installed septic anaerobic fetter onsite treatment plant in body collection area at Phuket and Krabi Province, also collaborated with Office of FDA to private sector asking for support to install water filtration system for long term use in migration center.

Disease Surveillance and Disease Control

Thailand has long experience in disease surveillance and disease control especially for infectious diseases. Thailand has been on the front line among developing country for the eradication of crucial communicable diseases in the past, e.g.; small pox, plague and polis, etc. In the pat 10 years, Thailand has experienced in control epidemics, e.g.; acute hemorrhagic, fever, leptospirosis or even HIV/AIDS. Last two years, Thailand also had experienced in learning how to control severs acute respiratory superdome (SARS) and Avian Influenza, which are emerging diseases. From these experiences, Thailand has built up new generation of health personnel with good experiences in investigation, disease surveillance and disease control distributed all over the country. Regarding Tsunami Disaster in 6 Andaman provinces, SRRT of each province was well prepared to conduct operation immediately by visiting affected area to assess the situation and then set up disease surveillance system, Diseases Control Department by Office of Epidemiology and Regional Diseases Control Center in localities had sent out support team to provide technical and advice or manage operation at the site included follow outcome of operation periodically.

Management of Offensive Surveillance System

As mentioned that each province in Thailand has the experience in disease surveillance continuously and arranged health manpower as Express Mobile Team to operate disease surveillance and investigation which is added into normal function. But in case of this Tsunami Disaster might state that in first 72 hours the mission still belonged to local and regional agencies but after carefully assessed the

situation and well planned as the first 72 hours passing by, the SRRT from Department of Diseases Control that were well oriented had been sent out to work with the provinces in operation offensive surveillance system which was sure that technical data equipment, formation of report for patent data collection and daily report were well prepared, collaborated with Department of Medical Science and local Regional Medical Science Center to ask for medical science personnel and equipment for preserving samples and sent to laboratories for investigation of bacteria both aerobic and anaerobic bacteria included viral study, too.

Preliminarily the diseases that had to do offensive surveillance in these 6 affected provinces were categorized into 5 groups 22 diseases, those were; 1 group of diarrhea diseases, 2 group of respiratory tract diseases, 3 group of fever, 4 group of meningitis, 5 Miscellaneous group, e.g.; wound infection, injury and jaundice, etc and had added more diseases that had to do surveillance in devastated area as shown in Table 1: Number of eases found in local diseases surveillance quoted from Weekly Report of Epidemiological Surveillance 2005, 36th year, 3rd edition.

Table 4 Number of patients and surveillance in 4 affected provinces Phuket, Phang-Nga, Krabi and Ranong (from 26 December 2004 to 25 January 2005)

Group of Disease	Diseases	Phuket		Phang-Nga		Krabi		Ranong		Total	
		Illness	Dead	Illness	Dead	Illness	Dead	Illness	Dead	Illness	Dead
Diarrheal	1. Acute Diarrhea	1,449	0	680	1	246	0	136	0	2,511	1
Diseases	2. Cholera	0	0	0	0	0	0	0	0	0	0
	3. Dysentery	1	0	0	0	0	0	4	0	5	0
	4. Food poisoning	15	0	26	0	4	0	8	0	53	0
Respiratory	5. Flu	19	0	10	0	6	0	3	0	38	0
Diseases	6. Pneumonia	64	0	87	1	65	1	6	0	222	2
	7. Measles	0	0	2	0	0	0	0	0	2	0
	8. Typhoid fever	4	0	1	0	3	0	1	0	9	0
	9. Malaria	6	0	26	0	15	0	0	0	47	0
	10. DHF	96	0	19	0	36	0	1	0	152	0
	11. PUO	37	0	13	0	95	0	32	0	177	0
Neurological	12. Menin-meningitis	0	0	0	0	0	0	0	0	0	0
Jaundice	13. Hepatitis	2	0	0	0	2	0	0	0	4	0
Other	14. Viral conjunctivitis	34	0	7	0	12	0	5	0	58	0
	15. Animal	6	0	3	0	9	0	3	0	21	0
	16. Injury	1	0	0	0	0	0	0	0	1	0
	17. Wound infection	81	0	213	0	62	0	33	0	389	0
	18. Unknown death	0	0	1	1	0	0	0	0	1	1
	19. Other important disease	3	0	27	0	1	0	0	0	31	0
	20. Sepsis/Cellulitis	10	1	7	0	0	0	0	0	17	1
	21. Fever with rash	0	0	0	0	0	0	0	0	0	0
	22. Chicken pox	0	0	20	0	6	0	1	0	27	0
	23. ENT	0	0	42	0	0	0	0	0	42	0
	24. Mumps	0	0	15	0	1	0	0	0	16	0
Total		1,828	1	1,199	3	563	1	233	0	3,823	5

Note : Phuket - Collected data from all health care facilities

Phang-Nga - Collected data from hospital & health center in 4 districts i.e. Takua-Tong, Takua Pa, Kura Buri ; phang-nga hospital and rescue area 14 units

Krabi - Collected data from NungKhong, Lanta, Krabi Hoapital and first-aid unit at PP Island

Ranong - Colleted data on patients in affected area Muang District, Hadsaidam Island Kapur District M.2, 4, MuangKlong Tambon, Subsamran M.1, 2, 7 Kampuan Tambon

After preliminary situation assessment with local personnel, the sites for surveillance had been assigned

- 77 health centers
- 22 government hospitals
- 4 private hospitals
- 2 centers of temporary shelter for victims
- Death Identification Center

Data collection from contained all crucial variables; name, surname, gender, age, address, diagnosis and condition of patent in order to analyze as a whole in each disease, gender; male and female, child-adult, Thai foreigner etc and then analysis and compiling were done in order to report and made use for diseases control. Report would be collected from every surveillance unit at district level and reported to provincial level and information centre in MOPH for analysis. However daily reports would be analyzed by local epidemiologist of each team in order to find out cases who were sick from these diseases or group of suspected diseases that might occur outbreak or might be health problem which would be useful for close observation to the solution and rapid diseases control. Besides the appointed surveillance site also adapted to the situation with the fact that migration and shelter site would be increased or decreased or combined together in some area or increase new surveillance site, e.g.; among many islands, number of victims were increasing, etc. When the system had been set completely, reports were clearer and demonstrated interesting change in 4 major diseases that had to conduct surveillance, those were; (as shown in Table 4)

1. Acute diarrhea, after disaster occurrence 1 week, the number of diarrheas cases were up to 126 cases/day and decreased down to 100 cases/day or incident rate was 2,950/100,000 population which was 1.7 time of normal incident rate in the same period of last year (IR = 1,758/100,000)

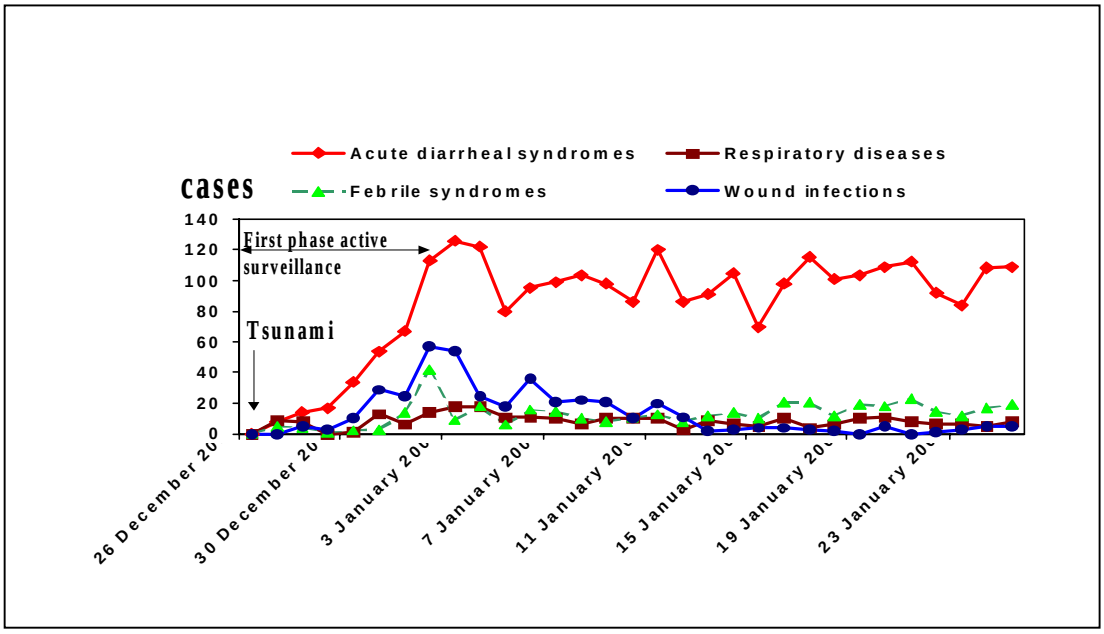
2. Infected would and fever group, also found more cases 1 week after disaster occurrence and reduced to normal level, most of the wounds were multiple

infections, which were Proteus sp; Klebsiella sp; Pseudomonas sp; Staphylococcus aurous sp. and Escherichia coli

3. Respiratory tract diseases, from surveillance report found no abnormal increment of the diseases

From offensive diseases surveillance for 1 month form December 26th, 2004 to January 25th, 2005 had conducted disease investigation from incidence 7 times found that there were diarrheas and food poisoning cases, led to improvement of food sanitation, health education and diseases control in order to prevent outbreak effectively and without death. Other 2 incidences were the investigation of malaria which was existing 2-3 cases and investigation of acute hemorrhagic fever that found more cases but however there was no any significant relationship between increasing number of cases with disaster occurrence (Figure 1: demonstrated number of cases form 4 major diseases quoted from weekly Report, Epidemiological surveillance, 2005,36th year, 3re edition).

Figure 1: Number of 4 active diseases surveillance in 4 affected province.



Source: Weekly Epidemiological Surveillance Report 2003 Vol.36 No.3

Mental Support to Victims

The same as responding to the event of physical team, operation team from Mental Health Crisis Centre (MCC) from local psychological hospitals, those were; Suan Saranrom Hospital, Suratdhani Province and Songkhla Nakarin Psychological Hospital of MOPH had reached the devastated area on the first day after disaster occurrence and provided services to the victims both physical primary medical care and mental health problem assessment included primary treatment with medicine, counseling and psychological support to victims who lost their relatives, friends and properties, listened to what they complained. And since December 29th, 2004, after mobilizing psychologists, psychological nurses, pharmacists and other personnel form psychological hospital network of Mental Health Department both in central and provincial administration included experts in mental health and psychology from many universities, were ready and had assessed the situation included emergency operations planed, the Mental Health Mobile Team had been set up and mobiled into the affected area of 6 provinces and provided services to the victims everyday continuously for 1 month. The target groups of these teams were :

1. Injured victims
2. Relatives
3. Victims who lost their houses and properties
4. Local workers

Services provided included mental status assessment, physical and mental therapy; counseling and referring sever patients to appropriate hospitals. During one month of providing mobile services, collection of technical data was done simultaneously, e.g.; interviewing patients both behavior and emotion by observation using stress test and depression test questionnaire which was an instrument the Mental Health Department had developed before included questionnaire of general physical conditions, too.

Regarding result of operation conducted by mental health mobile team for one month since December 26th, 2004 to January 30th , 2005, there were 10,456 patients as shown in Table 5

Table 5 Summary Report of Mental Health Service for Tsunami V
The Mental Health Center (MHC) for Thai Tsunami Disaster
(Commutative Reports on December 26, 2004 – March 24, 2005)

Province	**No. of Service (case)**	**Services (time)**		
		Psychiatric Drug	**Counseling**	**Medical Treatment**
Phang-Nga	5,077	1,363	5,283	1,391
Krabi	1,978	344	1,295	605
Phuket	1,491	273	1,068	198
Ranong	977	72	871	159
Satul	704	273	226	458
Trang	229	-	272	156
Total	10,456	2,325	9,015	2,967

There were 5,345 interviewees, 34.5%, 19.4%, 19.1%, 27% were from Phang-nga, Puhket, Krabi and other provinces respectively. Sex ratio was male to female 1:1.4, 34.9% and 280% were in age group 20 – 40 years, 41 – 59 years, the rest were children and old age respectively.

Mental condition and behavior found most in children age 1 – 5 year was; stuck with adult and night phobia, children age 6 – 11 year needed more parents' interest and had no concentration, children age 12 – 14 years needed more interest from their parents and teachers: and learning problem, age 15 – 19 years had problem of

sleeping, moody, more doubtful than adult, as for adult and old age had the problem of sleeping, confusing on more doubtful than usual (Table 6)

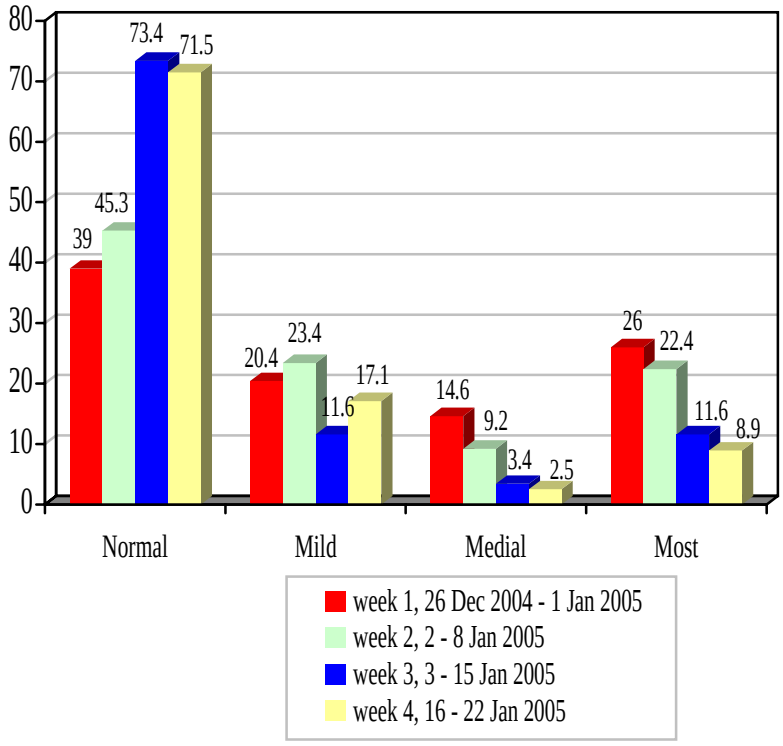
Table 6 The condition of mental health in the affected people each age group (26 December 2004 – 26 January 2005)

Age group	Mental health status
1 – 5 year old	1. More attached to adults 2. Fear of darkness 3. Difficulty with eating and sleeping
6 – 11 year old	1. Seek more attention from parents 2. Difficulty to concentrate 3. Reduction of studying
12 – 14 year old	1. Seek more attention from parents/teachers 2. Frequent frustration 3. Having physical symptoms without reasons
15 – 19 year old	1. Difficulty with sleeping 2. Frustration 3. Difficulty to concentrate and having depression
20 – 59 year old	1. Difficulty with sleeping 2. Paranoid 3. Frustration
60 year old and over	1. Difficulty with sleeping 2. Paranoid 3. Frustration

Source : Department of Mental Health, MOPH, Thailand

By using P.11 to test health status of 807 affected people, it revealed depress was fond 26.0 % in the first week after the event. The number declined to 22.4%, 11.6 and 8.9% in the second week, third week and forth week respectively.(see Figure 2)

Figure 2: Stress of affected people from Tsunami Disaster



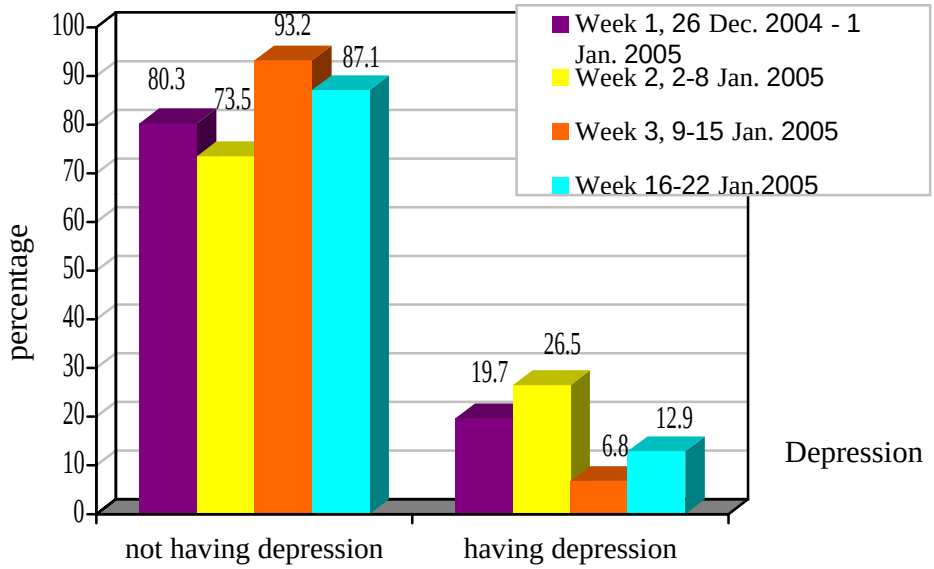
Note : 1. Start using stress evaluation form (30 Dec. 2004X

2. Week 1, 2, 3 & 4 n = 123, 415, 146 and 123 persons respectively

Source : Department of Mental Health, MOPH Thailand

The Department of Mental Health also used Depress Evaluate Form in 807 affected people. The study revealed that depress was found 19.7 % in the first week and increases to 26.5 in the second week. The number declined to 6.8 in the third week and it turned to 12.9 in the forth week.

Figure 3 Depression of affected persons from Tsunami distributed by week



Note : 1. Start using depression evaluation form (30 Dec. 2004X

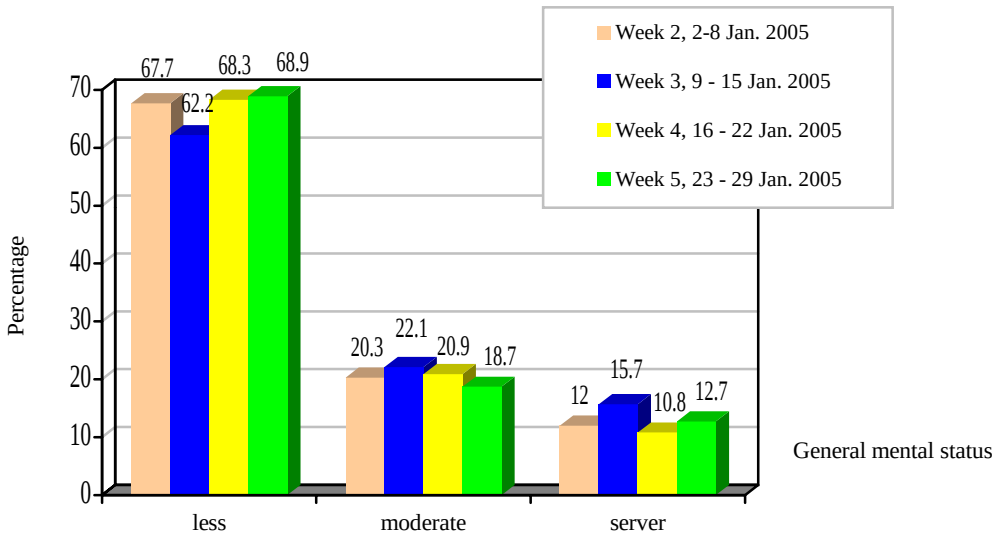
2. Week 1, 2, 3 & 4 n = 66, 456, 161 and 124 persons respectively

Source : Department of Mental Health, MOPH Thailand

As for long term support for victims who had psychiatric problems, from workshop meeting among experts from both inside and outside the country, workers from both government and private total 150 participants, held at Department of Mental Health on January 7th , 2005 classified risk groups who had to be supported into 5 major groups, those were;

1. Victims who lost their families' lives, properties and earning equipment.
2. Foreign survivors and returned back to than home countries.
3. Children, adolescence and fisherman children who copped with the event and be able to escape promptly but were mentally impacted and group of orphan
4. All professional aid workers.
5. Employees who worked in these devastated area and had to be unemployed, lack of income and support from government

Figure 4 General mental status of affected person from Tsunami affected area distributed by week



Note : 1. Start using general mental health status (GHQ 12) evaluation form (7 Jan. 2005)

2. Week 2, 3, 4 & 5 n = 384, 1,032, 628 and 937 persons respectively
3. Most of data came from affected persons in Phang-Nga, Krabi, Ranong & Phuket

Mental Health Rehabilitation for Target Group, Children and Families

Technical Institutes of Mental Health Department that work in the field of children and adolescence had brain stormed to arrange special operational plan in order to rehabilitate mental health of children and families who encountered with the disaster started from January 5th, 2005 only 2 weeks after the disaster by collaborating for coordination from Ministry of Education, Ministry of interior, Ministry of Social and Human Resource Development, NGOs and mass media to arrange various rehabilitation activities for target group by conducting training in order to provide knowledge and practical guideline for teacher in 60 schools of Phuket Province, 30 school of Ranong Province and 50 schools of Phangnga Province. Those schools were severely damaged both children and their families who were mentally and emotionally impacted. After training, those schoolteachers understood and knew the appropriate method to support those children and families and the children had been well rehabilitates

In addition, Village Health Volunteer group (VHV) who were the crucial health personnel and strong institute to run primary health care project the MOPH had created and had been working strongly for more than 20 years. These VHVs were scattered in every village all over the country, they had been continuously trained for working with health personnel in mental health. There were 3 major contents of training, as follows:

- Mental impact from disaster
- Screening of people with mental health problem and
- Practice in primary support included understanding mental health service system and referral system

Besides this, Department of Mental Health also cooperated with UNICEF and Health Department conducted continuous support and rehabilitation for impacted children project emphasized on children 4 target groups, as follows:

1. Orphan whose parents were dead and orphans whose parents were lost, the latter group might be mentally impacted more than first group

2. Children who encountered the disaster directly, this group after had the problem of being scared, dared not to go near water or beach

3. Children who did not encountered the disaster directly but families were impacted by losing their homes and properties.

5. Under-privileged children who actually had understandard of living and had to have more under standard of living. At present time, there are around 200 children in this group

As for the mentioned mental health problems. It should be anticipated that the problems to follow, assess the situation and provide appropriate treatment in this target group at least 6 months to 2 years were Post Traumatic Stress Disorders (PTSD) or Generalized Anxiety Disorder (GAD) or Depression

Integration on Services

In the first period, mobile health treatment team, health and environmental health team, epidemiological surveillance and disease control team and mental health team had their own operation plans and independently operated in order to manage their problems and high risk factors. After the rescue period, all of health team started integration to identify the targeted area and timetable to operate together in each area.

Table 7 Summary data of orphans from Tsunami affected 6 provinces

Province	No. of Family	Orphan Father		Orphan Mother		Orphan parent		Old supported person death		Total Orphan		Total girl and boy
Ranong	92	25	39	30	29	2	2	5	2	62	72	134
Phang-Nga	246	48	38	88	91	26	24	0	0	162	153	315
Phuket	76	42	39	18	24	1	4	0	0	61	67	128
Krabi	44	16	16	13	5	2	9	1	3	32	33	65
Trang	15	7	7	5	2	0	0	1	0	13	9	22
Satul	10	2	2	1	0	3	1	1	3	7	6	13
Total	483	140	141	155	151	34	40	3	8	337	340	677

Source: Social Development and Welfare Department, 27 Jan. 2005

Procedure on Death Victim Identification

There had been many problems and troubles in death victim identification procedure because lacking of forensic medical doctors and resource person on forensic sciences. According to the data resource, we found that the number of doctors who had directly passed forensic medicine training were not over than 60 people during the period of incident and also separately worked in the medicine schools. Few of them worked at the National office of Police and Institute of Forensic Medicine, Ministry of Justice. Another reason was the characteristic of the incident that we may refer it was the most severe catastrophe in the modern era because almost 217,500 people died in this disaster (WHO: April, 2005). In case of Thailand, we found that the number of death was 5,395 people, consisting of 1,952 Thai and 1,953 foreigners. The remaining number of death (1,490 people) could not identify their nationalities. (http://hazard.disaster.go.th/overall.php.pack=report 10). All of dead bodies were in the 6 affected provinces along 700 kilometers of the Andaman Sea. Most of them were on the island and floated in the sea before finding and carrying to identify on the land. In the beginning, rescue team and volunteers from all organizations were responsible for searching the bodies in the affected areas and carried them to the nearest hospitals.

According to the situation, we found that all of hospitals could not keep the body for further identification because of lacking the death storage refrigerators and the lack of manpower.

Table 8: Tsunami Disaster Situation April 6, 2005

Area	**Dead**				**Injured**		
	Thai	**Foreigner**	**Unidentified**	**Total**	**Thai**	**Foreigner**	**Total**
Phuket	151	111	17	279	591	520	1,111
Phang-Nga	1,279	1,633	1,312	4,224	4,344	1,253	5,597
Krabi	357	203	161	721	808	568	1,376
Ranong	156	4		160	215	31	246
Trang	3	2		5	92	20	112
Satul	6	1,953		6	15		15
Total	1,952		1,490	5,395	6,065	2,392	8,457

In the following days detachment of soldiers. Police Air Division and volunteers from foundations of other province together in thousands mobilizes to search for the deaths and could discover many bodies more and more everyday. Besides bodies found at the seashore, the bodies were also found in the sea and sent from island. There were also rescue team from German (2 teams, 20-30 persons/teams), Japan (50 persons with 22 physicians and/rescue boat), a number from Taiwan together searched for the bodies led to many bodies were found. In first week Thailand also used a number of dogs to smell for the bodies, mobilized heavy machines to help and could safe many survivors and many bodies were found, too. Thus in the first few days, bodies keeping center were combined together, the bodies were collected locally at Ta Chotchai Cemetery, Phuket (later moved to Mai Kao Cemetery), at Yan Yao Temple. Bang Muang Temple and Luk Khaon Temple in Ta Kua Pa District, Phangnga Province and autopsy center at Pracha Santisak Foundation, Krabi Province.

Regarding management in autopsy and DVI, Preliminary forensic science team from Ministry of Justice together with forensic medicines physicians from some universities worked at Ta Kua Pa District, forensic medicines team from Royal Thai Police Bureau together with forensic medicine team from Chulalongkorn University as major team worked at Krabi Province. Forensic medicine team Chiangmai University, Khonkhaen University, Mahidol University, Pra Mongkudkhlo Army Medical School, Phumiphol Hospital, etc were working in shift at affects hospital and bodies keeping centers. Moreover police officers from Academic Superintendent Division Region II, Nakorn Si Thammarat came and look fingerprints pictures and samples from the bodies to investigate for DNA.

It should be recorded that on January 1st – 3rd, 2005, Dean of Dentistry Faculty, Mahidol University with 66 personnel both lecturer and student had helped identifying the deaths. Dentists from Chulalongkorn and Khonkhan University, MOPH 's hospital together with 60 dentists helped forensic science team verifying DVI in the area, too.

There were also many DVI teams from German, Austria, Hong Kong, Israel, Sweden, South Korea, Japan, etc helped working together but since Thailand was scarce of experts and amount of bodies were so large that be unable to manage on time because the bodies began to be rotted and it was very hard to verify even samples were kept from the bodies for DNA verification induced conflict of idea in autopsy standard. Some DVI teams from wealthy countries, the autopsy standard was also high, had asked for standard autopsy room and equipment which was impossible since it never happened such large disaster before even 9/1 disaster that there were only 3,000 bodies and the devastated area were confided only few square kilometers, thus there was no standard as the teams asked for. Later teams from Thailand confirmed to use FBI-USA method standard and it was accepted at last (Dr.Sawit Kunluan, former heads of DVI unit, Chicago, Illinois State, consultant of that team advised to use FBI-USA method and form). However after changing data and idea in a meeting, DVI team from 29 countries included DVI team from Thailand decided together to use the same standard,

DVI international standard and decided together to autopsy all races orderly without crossing the sequence and not to select that Thai bodies, Asian bodies or Europe or American bodies or not. All of these the data would be linked to Interpol of each country) Data confirmed that there were races of victims from Tsunami Disaster in Thailand up to 44 races)

Moreover besides sending rescue team and DVI team to Thailand for help, many countries also helped in body presentation and transfer too, that were; refrigeration containers, a number of seal body packed bags. After conducting DVI and discharged more than 2,000 bodies to their cousins, many autopsy centers were cancelled and combined together in order to provide one stop services. However, the rest of the bodies after 2 months were the most difficult to verify since they were not easily sampling for DNA verification or no history of dental x-rays or other history of health used together for investigation. On March 7th ,2005, there were 2,900 bodies remained waiting for autopsy or DVI, but with strong cooperation from every sector both inside and outside the country, it was to verify and discharge the bodies back to their cousins everyday. It was expected that within May, 2005, the bodies would be sent back to their home 80%.

Management: Lesson Learn and Development of the Mechanism on Prevention and Mitigation in the Future

Regarding to the Tsunami catastrophe, we may summarize the lesson learnt by reviewing the disaster stories from the affected person in the real situation, confusedness and response in each period of the incident as follows:

1. Knowledge of Tsunami

Most of Thai people had never heard about the word of Tsunami before its occurrence except the academics who interested in this topic. The word of Tsunami was firstly appeared on the newspaper in the beginning of year 1996 after Tsunami occurrence in Sulawesi on July 1,1996 and Jaya on February 17, 1996 in Indonesia or in Papua New Guinea on July 17, 1998. Even some academics wrote their article in the newspapers warning about the opportunity of catastrophe occurrence in Thailand because there had been the crack of the earth's crust beneath the Andaman Sea and earthquake beneath the sea along Sumatra coast but they were still only be news and article that had been discussed in the small group and short period and ignored later. In the education system in Thailand, both of primary and secondary schools had not mentioned and included about this topic in the curriculums as well. Surprisingly, Morgan sea gypsies are minority who live on the island and along the shore in Andaman Sea in Thailand gaining knowledge from their ancestors to prevent themselves about the danger of Tsunamis before the huge wave striking on the coast.

Furthermore, Thailand had still lack of surveillance and warning system of the Tsunami. It may be implied that all of countries located along Bengal Bay or the Indian Ocean had also no previous experiences and awareness about the incident. Even though Thailand has the instrument in some area to check the earthquake occurrence possibility but not for Tsunami because of specific characteristics which occurs from vertical movement at the sea floor and lead to the huge wave. (On March 28, 2005, there had been earthquake 7.8 Magnitude outside the western coast of Sumatra 3 months later the December 2004 Tsunami occurrence but it did not caused Tsunami

even with such a mass earthquake resulting in heavy casualties of over 600 deaths buried under the rubble on Nias island at its epicenter. The existing monitoring of seismic activity in Thailand was bound to fail to alert communities to the upcoming Tsunami.

2. Communication System

The Communication System in Thailand is among the most modern. Not only the nationwide telephone system but also over 16 million mobile phones, thousands of radio stations and 6 nationwide TV networks (with additional local satellite stations) were functional yet the telephone networks were inundated with the extreme overload for 6 hours during the crisis. The single side band system operated by the Ministry of Public Health was the only effective means of communication then and kept the agency abreast of the fiasco. In addition a wide network of amateur radio operators had propagated information quite rapidly.

3. Disaster Preparedness Plan and Regular Drills.

Even a national committee on disaster prevention has already been set up even -before the tsunami attention was still paid on other pre-existing major catastrophes, for example, floods, fires, chemicals or radioactive substances leakage, massive explosions, road traffic accidents, land slides. However the public health services network, unprepared for such a gigantic scale of tsunami, yet had undergone a series of planning and drills. As such, its strength and capacity had been tested for the ability of the nationwide network to fully cope. With the critical situation. The norms, spirits and patience of health teams, widely participated by the staffs of the Ministry of Public Health Universities, Ministry of Defence and public sector, proved to substantially beneficial in the effective physical and mental health service deliveries through the crisis.

A preparedness plan for a major disaster such as tsunami should be site-specific and developed with strong local participation, particularly on preventive measures.

However, any future relief effort should be collectively coordinated by provincial, regional and national public service networks.

Preventive Plan Natural disasters are often not preventable yet an effective early-warning system can make much difference by precisely forecasting the cause and the exact time of its strike.

Critical information required for planning of prevention and evacuation include:

- ***warning system:*** Sound alarm warning system and communications systems-alternatives for sounding the alarm. For tsunami, a network to effectively monitor gigantic wave movement will provide reliable database for the early warning system to fully function.
- **Population assessment**: any evacuation plan will call for an estimate of number of population along coastline with respect to times and densities.
- ***Attitude of communities:*** Altitudes of high-risk areas and designated zones, basic utilities in designated zones for evacuation. More than one area may be required.
- ***Distance from high-risk places to designated areas:*** Type and quantity of vehicles to transport evacuees. Time required for walking or being transported to the safe haven.
- ***Evacuation management:*** Evacuation Plan should be appropriated planed procedures and by responsible people in charge.
- ***Laws and regulations*** legal framework to support the crisis management should be extensively reviewed and stipulated if needed.
- ***Basic amenities*** adequate supply of food, potable water, clothes, gadgets and sanitary systems etc. should be readily available.

Plan for medical treatment and relief efforts.

The plan is more comprehensive than those designed for major accidents or emergency medical service (EMS). Taking into account various scenarios and their consequences, public and private sectors are to collectively formulate plan on required medical services and other supporting systems. With participation of various foundations, NGOs, medical laboratories, disease control centers, health promotion centers and mental health centers / hospitals, the plan is to be laid down and regional EMS centers provide secretarial service. Basic information is required in the planning process:

- Medical services at various levels. A referral system encompassing primary, secondary and tertiary cares in public, private, and university hospitals in the region should be identified, Details include number of available beds, operation rooms, intensive care units, distance / times in referring service, referral system management and distances to effected areas.
- Health manpower is to be focused on general surgeon, orthopedist, neurosurgeon, other surgeon, anesthetist or even some specialists in internal medical. (kidney failure was reported in some cases after days of being hospitalized.
- Number and type of other health workers lists of health team are to be made, comprising registered nurse, information officer, communications, technician, epidemiologist, medical science technician, psychiatrist, psychologist, social workers, sanitarians, statistician, public relations, stretcher operator, driver.
- Medical equipment and appliances, scientific equipment. Equipment and supply check list is to be developed with particular attention on emergency operation unit, resuscitator, respirator, clean cloth, vehicles, ambulance and other medical supplies.

- Drugs and medical supplies a complete inventory of drugs and medical supplies describing types, doses, quantities, number of drugs the reserve last, additional time for replenishment.
- Appliances and chemicals. Supplies required for chemical and biological investigations of specimen, cadaveric cloth, body bag, refrigerators of various sized (in case of lengthy body verification), time suppliers for additional stock.

Moreover, the regional / national plan should identify extra resources available in neighboring countries and member nations in any network in case of emergencies. The information should be periodically updated with relevant exchange, interactions, and dialogues.

4. Forensic service and body verification.

Forensic medicine is generally the weakest link in Thailand due to a limited number of well-qualified personnel. Being in a transition period of a system in dire need of development, offers a rational explanation for its great delay in identifying over 5,000 bodies, fatally affected within a few hours of the tsunami. The fiasco hit the world record as the total death toll climbed over 200,000 and devastating homelands of millions in 10 countries of 2 continents. In Thailand alone, over 10,000 Thais and foreign visitors faced drastic consequences. The strength and patience of the forensic teams and volunteers were put to the extreme test. With the international assistance, half of the workload had been done within 3 months. The nation learned about the pains of inadequacy the hard way and fully realized the urgent need of capacity building and networking in order to mobilize resources and technical assistance in time. It is worth noted the most valuable experiences of managing and co-ordinating forensic teams from 29 foreign countries

5. Environmental management, surveillance and control of diseases

The rapid surveillance and control of diseases have been the strength of the health system put to the test in the aftermath of the catastrophe. The operation was lengthy yet proved fruitful, as the affected areas were free from drastic outbreaks of communicable diseases. Nevertheless, a geographical shift of some islands and for coastlines were observed. Some beaches shrank or extended out (about 6-9 inches) yet their short-term ecological impacts could not be witnessed. There had been reports on limited damage of coral reefs in shallow sea. Such loss will be offset by better quality of seawater and beaches by which the living species be regenerated. The main public health concerns were the party disrupted sanitary system, for example, water supply solid waste disposal and wastewater treatment. Close surveillance and improvement of environment conditions habitats and communities are to be carried on.

The most crucial supporting systems are laboratory examinations, which proved to be very effective in chemical and biological investigations in the effected areas. However; laboratory services should be extended to identify microbial/chemical contamination detection hazardous wastes generated from demolitions of building should also be included in the preparedness plan.

6. Long term social/psychological impacts

The drastic diaster and the great loss of human life /their property within a short period of time involuntarily cause: have and post traumatic stress disorder (PTSD) among the victims and their close friends relatives. Those include orphans or minor victims with/without loss of their parents, friends, family members and classmates. Their PTSD symptoms are anxiety, phobia, stress, and depress at various degrees. Adults in working age group suffered not only losses of their spouse, offspring, kin/ family members but also damage of Their properties and loss of job opportunities at least temporarily. Many victims were in fishery sector and sustained the damage and particularly, losses of their professional equipment. Deprived of making a living, they would be hit harder by PTSD. The most vulnerable groups, how ever, are orphans, small children and elderly.

Those remained in the designated areas awaiting their new houses provided by public and private sectors might have felt cramped and ripped of privacy. Social consequences may be unavailable and can be observed in terms of sexual crimes, robberies, assaults, drug/alcohol abuse and violence, however even the incidents were not reported in Thailand, surveillance is still required. In this capacity, trained volunteers can be an answer and lend a helping hand to government officers. Rehabilitation programs on education system, job opportunities and utilities/sanitary systems are urgently needed and should become the best solution.

Interested issue and research question

1. Set up research team composed of representatives from various stakeholders to integrate body of knowledge from this event and set up the main responsible organization.
2. Summarize new body of knowledge in medicine such as the severity of injury, rescue, infected wound and inflammation caused by sand, prevention of infectious after surgery, and mental support
3. Collect the results of haemoculture from every organization

There should be an organization look after the ethic in research, redundancy in study. The result of study should be released to public.

New Innovation

The wound care technique by using vacuum assist closure is new innovation employ in treatment of would infection. It uses 100-200 mmHg negative pressure to stimulate the growth of granulation tissue. This technique increases the healing process and reduce the number of dressing, so surgeon can make skin graft or close wound very quickly.

Recommendations

1. Research needs and knowledge management

There should be extensive exploration on new knowledge and its management to propagate information. Related to different areas.

1. Many Target groups need to learn and be informed about tsunami and other natural disasters.
2. Relevant information and knowledge become part of school curricula and widely propagated to the public and the media.
3. Appropriate technology and development of early warning systems related to natural and man-made disasters.
4. Clinical epidemiology of injuries and diseases resulting from disasters – tsunami, earthquakes, flood, landslides and etc.
5. Epidemiology study of the tsunami.
6. Logistic supply system under different context of disasters.
7. Epidemiology and treatment of neurological diseases/ disorders for communities
8. Disease control in different affected areas and factors related to effective control of outbreaks.
9. Environmental sanitation, water supply, solid waste management, wastewater treatment and night soil disposal under different contexts.
10. New technology and innovations of medical treatment, disease control and prevention, sanitation and environmental health.
11. Risk communication system for disasters.
12. Public communication and roles of the media, NGOs during crises.

2. Management

1. Set up a National body or strengthen existing agencies to effectively and efficiently cope with various disasters.

2. Develop networks of local authorities and strengthen /empower them to efficiently and effectively operate, forming strings of networks at local, regional national and international levels.

3. Preparedness plans for disaster are to be developed aiming at appropriate interactions and multilateral co-ordinations among local, regional, national and international bodies.

4. Allocation of resources and budget to promote research and development, equipment procurement, medical reserves and supply.

5. Promote skills and human resource development specializing in areas in their need.

6. Arrange regular exercise and drills of the preparedness plan with proper adaptation at intervals.

7. Review laws, regulations, and guidelines with respect to the ever-changing contexts, environment and legal frameworks at the national and international levels.

8. Develop effective communications networks with ample alternatives.

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