

Public Health Emergency Response to Tsunami 2004: I. Effective Resource Management of Incident Command System for the Triad Interplay

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Abstract

Incident command system (ICS) is an on-scene structural and functional organization of management-level positions applicable to small as well as large and complex emergencies. In the aftermath of devastating tsunami as public health emergency on Dec 26, 2004, the Office of Disease Prevention and Control (ODPC) 11 Nakhon Si Thammarat had pivotal role and responsibilities as a coordinating body of the "Disease Control Department Operation Center - DCDOC Phang-nga" that was an incident command post collocated with the incident base of the Department of Disease Control (DDC). Its wide experience to prepare for and respond to emergencies in Southern Thailand has been shown for management and operation challenges for ICS responsible for controlling personnel, facilities, equipment and communications. Key elements required for the organization to effectively and efficiently function were incident action plan and integrated communications and in doing so the ODPC 11 handled psychosocial effects of tsunami and managed environmental resources to ensure public health emergency response, not only for immediate response but also short-term and long-term responses. This critical review based on lessons learnt from resource management for the DCDOC Phang-nga focuses on three sections (i.e., planning, logistics and finance/administration) of the ICS towards comprehensive resource management and integrated communications of the triad (i.e., interplays of ODPC 11, DCDOC Phang-nga and DDC). Such a synthesized functional model of the DCDOC Phang-nga will provide rational basis for next critical steps of their business plan to meet ultimate goals of emergency management for the future disasters.

Key words: incident command system, incident command post, incident base, Office of Disease Prevention and Control, Disease Control Department Operation Center, public health emergency response, comprehensive resource management, integrated communications, triad interplay

Introduction

The major devastating tsunamis, chronologically catastrophic disaster in Thailand, swept out the Andaman coast of Southern Thailand on December 26, 2004^(1,2). It affected approximately many thousands of people in coastal areas of six affected provinces (including Phang-nga, Krabi, Phuket, Ranong, Trang and Satun)⁽²⁾. Many of whom were affected by sudden impact of tsunamis (Table 1) were victims of “Butterfly effects”, which caused a chain of events resulted from massive destruction of human security in agriculture, fishery and tourism industries and psychosocial effects of affected communities. As consequences, the royal Thai government (RTG) by the Prime Minister developed on-scene national incident management system (NIMS)⁽³⁾ that had scalable response for emergency management for all the six devastated provinces. Immediately after declaration of the stage of emergency, an on-scene cabinet resolution in response to tsunami was authorized by the Minister of Interior as a single incident commander. The cabinet resolution had key role and responsibilities for command, control and direction to the responders of the devastated provinces. To respond promptly to search, rescue and relief operations, the NIMS was

designed for involving multiple agencies. A coordinating and collating organization of “Southern Disaster Victim Relief Collaboration Center (SDVRCC)” in Phuket⁽²⁾, as structurally and functionally known as Multiple Agency Coordination Center (MACC), was a central command and control facility responsible for strategizing all the operations to meet overall goals and achieved missions. Based on strategic and tactical decisions of individual agencies, the center used multi-agency coordination under unified command to guide their operations and to coordinate activities between multiple agencies. It had key actions to provide assistance, mechanisms and necessities to all the affected provinces. The committees were established to coordinate relief efforts that covered 7 major relief activities: (i) search and rescue operation, (ii) corpses’ searching, forensic autopsy and corpses’ identification, (iii) assistance and facilitation of tourists’ repatriation, (iv) rehabilitation and reconstruction of roads, (v) restoration of telecommunication and electricity systems, (vi) donation and dissemination of relief aid, and (vii) containment of the potential epidemics. The coordination by which incident action plan and integrated communications are essential for the responders allowed agencies at

Table 1 Areas and population affected with devastating tsunami in Southern Thailand.

| | Devastated area | | | Affected population | |
|--------------|-----------------|--------------|------------|---------------------|---------------|
| | District | Sub-district | Village | Household | Person |
| Phang-nga | 6 | 18 | 68 | 4,394 | 19,509 |
| Krabi | 5 | 22 | 112 | 2,759 | 15,812 |
| Phuket | 3 | 14 | 58 | 2,613 | 13,065 |
| Ranong | 3 | 10 | 47 | 1,509 | 5,942 |
| Trang | 4 | 13 | 51 | 660 | 1,302 |
| Satun | 4 | 17 | 70 | 82 | 2,920 |
| Total | 25 | 95 | 407 | 12,017 | 58,550 |

Adapted from: Department of Disaster Prevention and Mitigation, Ministry of Interior, Thailand. Data valid until March 21, 2005.

the local, national and international levels to effectively and efficiently coordinate their efforts on tsunami management. According to this, the Prime Minister officially publicized a newly established Regional Office for the Office for the Coordination of Humanitarian Affairs (OCHA) on 28 January 2005⁽⁴⁾.

Tsunami impacts on health (Table 2) are typically characterized by great instability and high mortality, morbidity and injury⁽⁵⁾, as they jeopardize local health capacities in public health emergency response* (PHER)^(6,7). The rational basis for the PHER (i.e., immediate, short-term and long-term responses) is typified by health effects of tsunami, which can last a long time. Immediate health concerns are scalable upon emergency* complexes including sanitation of clean drinking water, food and temporary shelter and medical care for injuries. Surge of seawater leading to floods and mud deposition in coastal areas that water supply sources (i.e., water reservoirs, shallow wells and tankers) are available can pose health risks* such as contaminated water and food supplies. Damaged houses or loss of shelter can cause vulnerabilities* of envi-

ronmental hazards* such as exposure to insect, heat, dust, spoilage of food and spill of insecticides. The majority of deaths associated with tsunamis are related to drownings and severe traumas. Persons with traumatic injuries such as fractured bones or broken limbs, head injuries, internal organ injuries and infected wounds are washed into debris (houses and trees). Strong suction of the debris in large populated area can further cause injuries and undermine healthcare services and facilities. Medical care is critical in outreach areas where basic health services cannot function. Immediate response to a regular basis for the PHER lasts one month. The short-term response (i.e., a period of stabilization) which lasts up to three to four months aims at reducing morbidity and mortality. Prevention and control of averting disasters caused by potentially emerging agents such as pathogens, toxins and chemicals are the most important public health efforts in response to secondary effects. The contaminated water and food supplies, as well as lack of temporary shelters and inadequate out-relief medical care, can further cause a secondary effect of illnesses or adverse events among vulnerable groups staying in the af-

Table 2 Tsunami impacts on health

| | Deaths | | | | Injuries | | | | Missing | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|--------------|--------------|------------|----------|--------------|
| | Thais | Foreigners | N/A | Total | Thais | Foreigners | N/A | Total | Thais | Foreigners | N/A | Total |
| Phang-nga | 1,266 | 1,633 | 1,325 | 4,224 | 4,344 | 1,253 | 0 | 5,597 | 1,428 | 305 | 0 | 1,733 |
| Krabi | 357 | 203 | 161 | 721 | 808 | 568 | 0 | 1,376 | 329 | 240 | 0 | 569 |
| Phuket | 151 | 111 | 17 | 279 | 591 | 520 | 0 | 1,111 | 256 | 364 | 0 | 620 |
| Ranong | 156 | 4 | 0 | 160 | 215 | 31 | 0 | 246 | 9 | 0 | 0 | 9 |
| Trang | 3 | 2 | 0 | 5 | 92 | 20 | 0 | 112 | 1 | 0 | 0 | 1 |
| Satun | 6 | 0 | 0 | 6 | 15 | 0 | 0 | 15 | 0 | 0 | 0 | 0 |
| Total | 1,939 | 1,953 | 1,503 | 5,395 | 6,065 | 2,392 | 0 | 8,457 | 2,023 | 909 | 0 | 2,932 |

Adapted from: Department of Disaster Prevention and Mitigation, Ministry of Interior, Thailand.

N/A - numbers of corpses, injuries or missing persons were not identified with ethnic groups. Data valid until March 21, 2005.

affected areas. Also, people most at risk working or residing in resettlement areas can be exposed to infectious bites of vectors due to behavioral risk and environmental modification. These worsening secondary effects are risk to major disease outbreaks or severe epidemics. Long-term response required for recovering human security normally starts after tsunami impacts are subsided. Greater needs for reconstruction of affected communities are dependent on political will, finance, logistics and community participation. Long-lasting effects of tsunami can result in surveillance and monitoring of potentially emerging problems such as foodborne/waterborne diseases, vectorborne diseases, vaccine-preventable diseases, respiratory diseases, bites of venomous animals, and imbalanced diet. Basic health services at periphery, as well as water system, housing and employment, need to be restored to normal. Also, there must be needs for affected communities to heal mentally and socially. The effective PHER plan (PHERP) for making strategic decisions needs for the responders of the affected provinces to design and implement appropriate measures relevant to crisis* or disaster*.

According to an international law known as International Health Regulations (IHRs)⁽⁸⁾ aligned by the WHO Secretariat of Public Health Emergencies of International Concerns (PHEICs), the Ministry of Public Health (MoPH) and umbrellas as national health agencies has a committed mission in preparedness systems development and emergency response* at national, regional and international levels. As a result of immediate tsunami impacts, the MoPH as unified command of the SDVRCC (Fig. 1) coordinated incident action plan and integrated communications between the umbrella sectors. Based on board practice in public health, health operations of tsunami management governed health protection and disease prevention,

health service delivery, health policy and coordination. The processes of tsunami management and mechanisms (i.e., managerial, financial and technical) were driven through interplay of the Public Health Ministry Operation Center (MPHOC) and Public-Private Partnership (PPP). The MPHOC was structurally and functionally known as Emergency Operations Center (EOC) at ministerial level. The partners included governmental organizations (e.g., Provincial Public Health Offices - PPHO - and other national health agencies), nongovernmental organizations, local community organizations (e.g., civil society groups and Subdistrict Administration Organization - SAO) and academic institutions. They had key roles and responsibilities in supporting strategic and tactical decisions of the responders of the affected provinces. The on-scene organization should be better organized and more effective with multi-agency assistance. The health sectors belonging to the PPHO in affected provinces had the accountability, flexibility and speed of the PHER's phases along with crisis situations on health in the affected regions such as medical care for massive casualties, surveillance and monitoring of emerging problems, prevention and control of severe epidemics and mental health services. The principal challenge to reduce potential risks of tsunami impacts provides the rational basis for the PHERP for identifying priority needs and soliciting assistance from the national and international communities, which are of great significance.

The Department of Disease Control (DDC), MoPH, established an on-scene emergency operation center - Disease Control Department Operation Center (DCDOC) (Fig. 1). It functioned as the on-scene Incident Command System (ICS) that established a central command and control facility to support all the operations take in the tsunami-affected areas. The DCDOC developed in Phang-nga

Table 3 *Terms that are related to emergency.

| | |
|-----------------------------|---|
| Crisis | An event or series of events and its aftermath representing a critical threat to the health, safety, security or well-being of a community or society, usually over a wide area. Armed conflicts, epidemics, famine, natural disasters, environmental emergencies and other major harmful events may involve or lead to a humanitarian crisis. |
| Disaster | Any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services, or disruption of the functioning of a community or society on a scale sufficient to warrant and extraordinary response from outside the affected community or society to tackle using its own resources. A disaster results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk. |
| Emergency | A sudden occurrence requiring immediate response action to large numbers of populations that need urgent humanitarian relief. Emergencies (or humanitarian emergencies) are all the incident situations caused by conflict or natural disasters, epidemics, technological catastrophes and man-made disasters. Public health emergency is an occurrence that poses a high probability of any health risks in a large number of the affected population. Any of the following public health emergencies (bioterrorism, natural disaster, chemical or accidental release, nuclear attack or accident, or newly emerging-remerging agents/biological toxins) is expected to cause harms. |
| Emergency management | Management activities by which all individuals, groups and communities manage hazards or emergencies to avoid risks, or to reduce the impact of the disasters resulting from the hazards or emergencies. Activities at each level affect the other levels that involve continuous processes of preparing, supporting and recovering the communities when natural or man-made disasters occur. |
| Emergency | Processes of resource mobilization in urgency of the essential services in the disaster areas, in accordance with the appropriate triage of the affected community or society. |
| Hazard response | A potential or actual force, physical condition or agent that has the potential to cause health risks (illness or any adverse event, injury, death) to exposed people and their environment, which are typified by route of exposure and frequency, contact time, toxicity or pathogenicity of hazardous substances. It can cause significant damage to livelihood, property, economic activities, or environment. |
| Risk | The probability of harmful consequences or expected outcomes to health (deaths, illnesses, injuries, disabilities, or other adverse events), or well-beings (disruption of livelihood, property, economic activities, or environment damaged) resulting from interactions between humanitarian emergencies and vulnerabilities. |
| Vulnerabilities | The predictable conditions determined by biological, physical, social, economic and environmental factors or processes, which inverse the susceptibility of a community to the impact of hazards, emergencies, crises, or disasters. |

(as described below) used coordinating body of “Crisis Special Operation Teams - CSOT”. The CSOT comprised three specialized teams: Surveillance and Rapid Response Team (SRRT), Emergency and Mitigation Operation Team (EMOT) and Technical Supporting Team (TST). The better organization of the DCDOC Phang-nga, which was supervised by the Office of Disease Prevention and Control (ODPC) 11 Nakhon Si Thammarat, had key role and responsibilities to handle tsunami impacts in the province where the most severe damages, dead tolls and injuries were pictured. Three sections (i.e.,

planning, logistics and finance/administration) of the ICS were focused in this paper. Based on lessons learnt from the effective resource management of the ICS, comprehensive resource management and integrated communications of the triad (i.e., interplays of ODPC 11, DCDOC Phang-nga and DDC) were analyzed. The synthesized functional model of the DCDOC Phang-nga will provide rational basis for next critical steps of their business plan to meet ultimate goals of emergency management* for the future disasters.

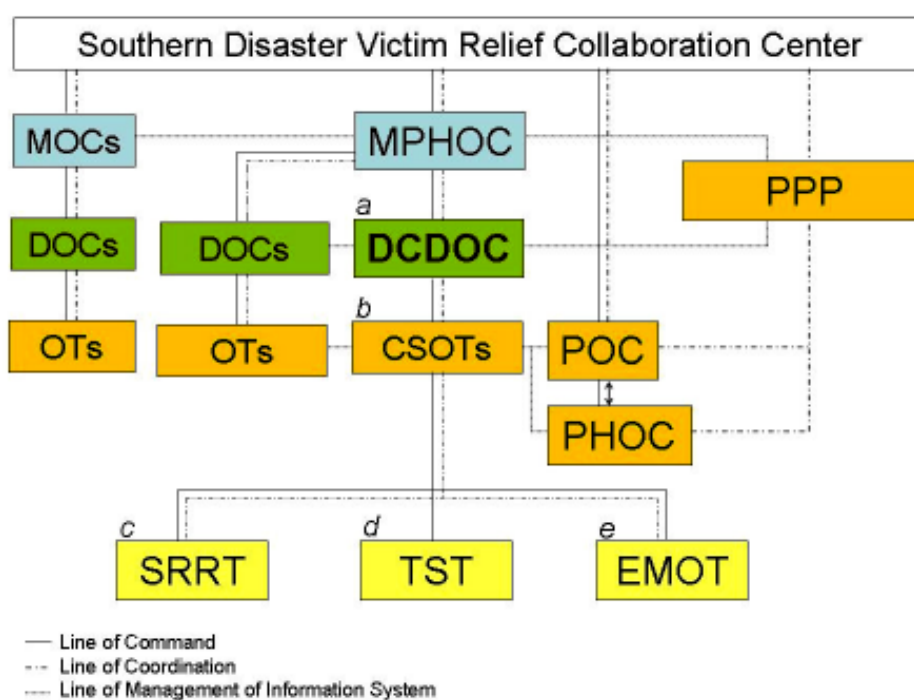


Figure 1 Organization chart of the incident command system of tsunami management at levels of national (white), ministerial (blue), departmental (green), provincial (yellow), and operational (pale yellow). The Disease Control Department Operation Center^a had area of responsibilities in public health emergency response that strategic and tactical decisions (i.e., command, control, direction and inspection) were followed by a chain of command. The Crisis Special Operation Teams^b functioned as core tsunami management team of the DCDOC, which comprised 3 specialized teams: ^cSurveillance and Rapid Response Team, ^dTechnical Supporting Team and ^eEmergency and Mitigation Operation Team.

(Abbreviations: MOCs - Ministry Operation Centers, MPHOC - Public Health Ministry Operation Center, DOCs - Department Operation Centers, CSOT - Crisis Special Operation Team, POC - Province Operation Center, PHOC - Public Health Office Operation Center, and PPP - Public-Private Partnership).

Development of field-level incident management operations by DCDOC Phang-nga

In the United States, the NIMS is used to coordinate emergency preparedness and incident management among various agencies, i.e., both governmental and nongovernmental. The NIMS is based on three key organizational systems: ICS, MAC and Public Information Systems, which all are standard for command and management. After a national incident is declared, the NIMS provides a set of standard organizational structures. Available resources of agencies capable of discipline-specific areas are summoned up for the management and operations (i.e., processes, procedures and systems) at all jurisdictional levels to address emergency. The incident management team (ITM) will provide the command and control infrastructure (i.e., facilities and resources) to manage emergency compositions that are logical, fiscal, planning, operational, safety and community issues. The ITM is typified by the scale of the emergency: five types of the ITMs in the United States are bottom-up designed type 5 local village and township level to type 1 national and state level. The ICS is one of the subsystems of the ITM, which is an on-scene structural and functional organization of management-level positions applicable to small as well as large and complex incidents. After an incident occurs, it is designed to be used or applied by various functional agencies and jurisdictions to organize field-level incident management operations. Its life-cycle lasts until the deployment for management and operations no longer exists.

Provisionalness of the NIMS by the RTG was declared to respond to tsunami in 2004, as it was not provisionally legislated during crisis for the national emergency response plan, along with the Disaster Prevention and Mitigation Bill. The SDVRC in Phuket, as the MACC that used uni-

fied command, developed emergency management for the ITM type 1 alike and the NIMS did not called in management, operations and services that the regional sectors of the Departments could provide. However, the NIMS required incident management organizations at the ministerial level to ensure that effective interoperable incident management and operation challenges across agencies and jurisdictions were achieved. The MAC was adopted by the SDVRC, which in turn was not a part of an on-scene ICS and was not involved in developing strategic and tactical decisions. The organization had the coordination of assisting agency resources and support to emergency operations, which were established upon priority needs between incident commanders (ICs) in accordance with unified command. Meanwhile, the incident management activities of the DCDOC as an incident base were involved in establishing priorities between ICs in concert with the MPHOC (Fig. 1). The DCDOC at the incident where was located in a central control facility was designed for Emergency Operations Center (EOC) in Nonthaburi. The physical location at which primary logistics functions and information are coordinated and administered to support all the field-level incident management operations. Its on-scene incident management-level organization used the ICS (i.e., combination of facilities, equipment, personnel, procedures and communications operating within its organizational structure). The Deputy Director of the DDC was assigned for IC responsible for the development of strategic and tactical decisions for command and management (i.e., the ordering and the release of resource mobilization). The DCDOC was a part of an on-scene ICS that was designed for jurisdiction of the DDC that legal responsibilities in PHER were established in management by objectives (Fig. 2). The chain of command (a series of management positions in order of

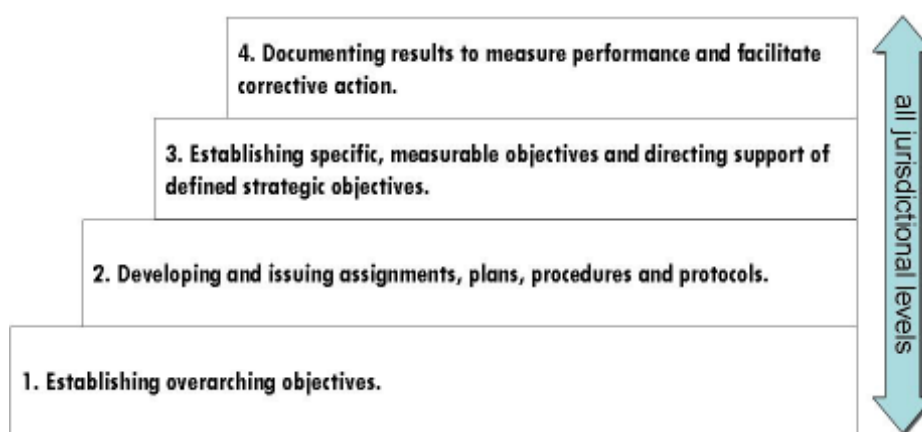
authority) and command staff (not for the SDVRCC) of the DCDOC were involved in developing DCDOC Phang-nga as an Incident Command Post (ICP) in the affected province, where the scale of emergency impacted 6 districts (covering 18 sub-districts) (Table 1 and Fig. 3). The ICP was not better organized within 72 hours unless initial response and action of the ODPC 11 were autonomously performed on corporate responsibilities in PHER to immediate health concerns. Initial action included actions taken by available resources committed to tsunami that were the first to arrive the incident sites within a day. The strike team (i.e., a specified combination of experienced personnel with common communications and a leader) of the ODPC 11 moved from its on-the-simulated incident base to 4 out of 6 affected provinces to establish health crisis situations and their priority needs by rapid assessment. This strategic decision was not developed in regular fiscal health plan that health operations and services in vertical public health pro-

grams are usually implemented and evaluated in order to meet achieved goals⁽⁹⁾. The ODPC 11 under supervision of the director (Fig. 4) assisted development of the DCDOC Phang-nga at the tsunami site where command post was further collocated with the DCDOC incident base of the DDC and other incident facilities. The ODPC 11 had the responsibility for the coordination of assisting the DCDOC Phang-nga's resources and operationally supporting its working environment to achieve during operations.

Comprehensive resource management

Resource management is a system for identifying available resources at all jurisdictional levels. Efficient incident management requires such a system to ensure that all-emergency management can use resources timely and unobstructedly accessible for handling incidents. Resource mobilization protocols used by the ODPC 11 (Fig. 4) were effectively and efficiently applied for management of

Management by objectives approach :



A four-step process for achieving the incident goals

Figure 2 Management by objectives approach, which includes various incident management functional activities at all jurisdictional levels.

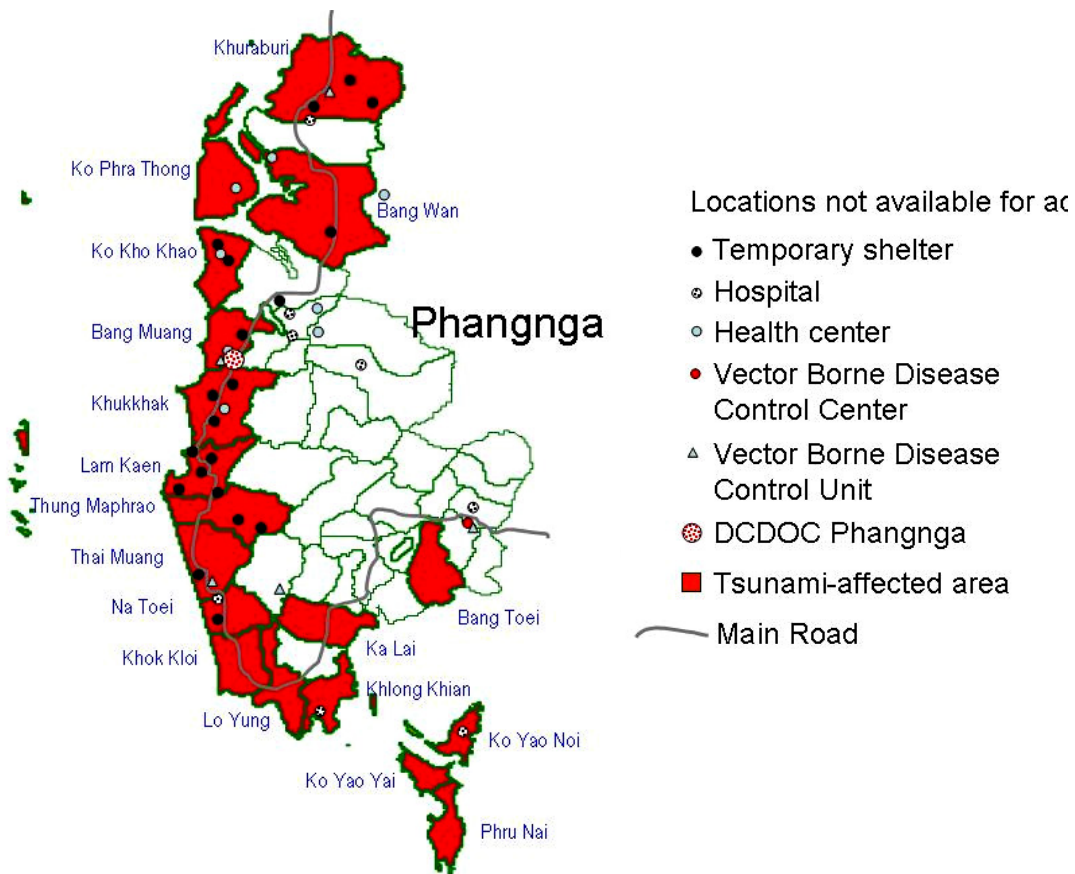


Figure 3 Field location of the DCDOC Phang-nga, as an Incident Command Post (ICP), approximately 700 km south of the DCDOC incident base where on-scene incident command structure and functions were performed. The primary strategic and tactical levels of on-scene management and operation challenges by the CSOT were collocated with the DCDOC incident base. A turnover of the CSOT supervisor(s) (i.e., Directors of the ODPCs) and the ICP’s resources was critical for its life cycle during operations. The ICP normally identified by a green rotating or flashing light is located outside of the epicenter of the present and potentially hazard zone but close enough to the incident to maintain command and management. The DCDOC Phang-nga was initially established during the strike team of the ODPC 11 sought for base locations of response operations. Criteria for establishment of the ICP included: (i) demographic and geographical information of the affected zones, (ii) maintenance of assigned resources in support of all response operations by groups or teams with discipline-specific function areas, and (iii) availability of control facility such as transportation and communications.

ICP’s resources for the DCDOC Phang-nga. The resource mobilization (i.e., process and procedures for activating, assembling and transporting all resources that are assigned to respond to or support an incident) has usually been used in the rational basis for emergency operations after disease outbreaks occur in area of stratifications. Resources include public health personnel (i.e., front-line staff,

technical/senior level staff and director) and major items of equipment, supplies and facilities available or potentially available for assignment to emergency operations and for stand-by services. They are described by kind and type. Technical Support Section and General Management Section are responsible for operational support or supervisory capacities at the incident. Flow chart of logistics, plan-

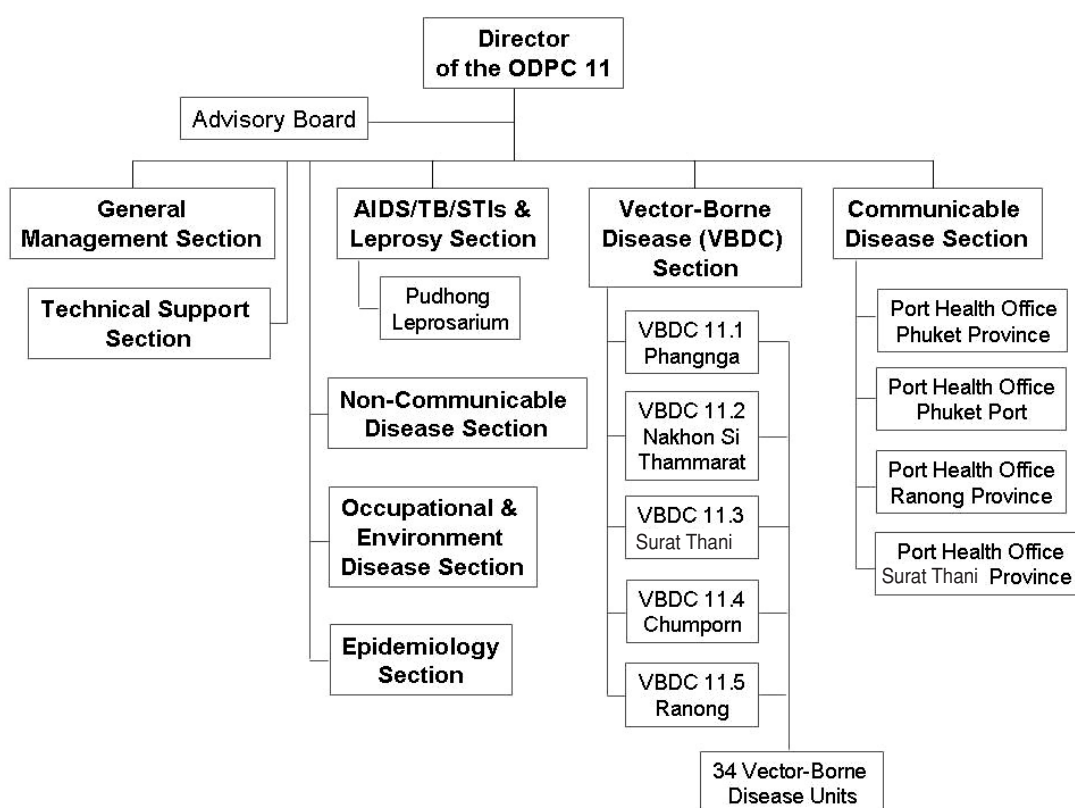


Figure 4 Organization chart of the ODPC 11 Nakhon Si Thammarat.

ning and finance/administration that interoperable sections developed resource mobilization protocols along incident objectives is described below (Fig. 5).

Efficient resource management is essential for the ICS that meets the measurable incident strategy and objectives along Incident Action Plan (IAP). The verbal or written IAP prepared before or during an operational period provides all incident supervisory personnel with direction for actions to be implemented and, in practice, effective communications with overall incident objectives in the context of both operational and support activities. The consolidated IAP insures that single resources (personnel directed to a field assignment) can perform interoperable assignments with the same goals and hence reducing freelancing and enhancing coordi-

nated response. The tactics are required to implement the selected strategy, the selection and assignment of resources to accomplish incident strategy and objectives. In principle, comprehensive resource management is a key management challenge that all allocated resources (i.e., personnel and assets) need to cope with the incident. Resource management includes the five-step processes for: categorizing, ordering, dispatching, tracking and recovering resources. All allocated resources can be moved quickly to support the preparation and response to the incident and they are required for check-in and turnover to maintain on-scene management functions and operations at the ICP or other incident bases.

To respond promptly to tsunami, the management and support section (Fig. 5) provided the pro-

cesses and procedures for comprehensive resource management, along the POC/PHOC or other incident management facilities at the incident where the needs were requested. This self-organization of the ODPC 11 established appropriately primary strategic and tactical directions that allowed assembling rapid response team(s) as part of assigned resources of the DCDOC Phang-nga. Nontactical and tactical resources were directed under the supervision of the Director of ODPC 11. The resource mobilization protocol for tactical resources (rapid response team) included six-step processes: (i) assembling crew member of rapid response team(s) of all the

sections that were assigned to respond to tsunami, (ii) documenting and issuing management-level positions and assignments of the ODPC 11 as assisting agency at the incident, (iii) preparing and dispatching resources (i.e., personnel, medical supplies, chemicals, equipments and vehicles) that were assigned to the DCDOC Phang-nga, checked in and available for a mission assignment, (iv) coordinating POC/PHOC/DCDOC Phang-nga in support of assigned works and identifying tactical direction, and (v) documenting results to measure performances. Check-in and turnover of the single resources with tasks on field assignments were sched-

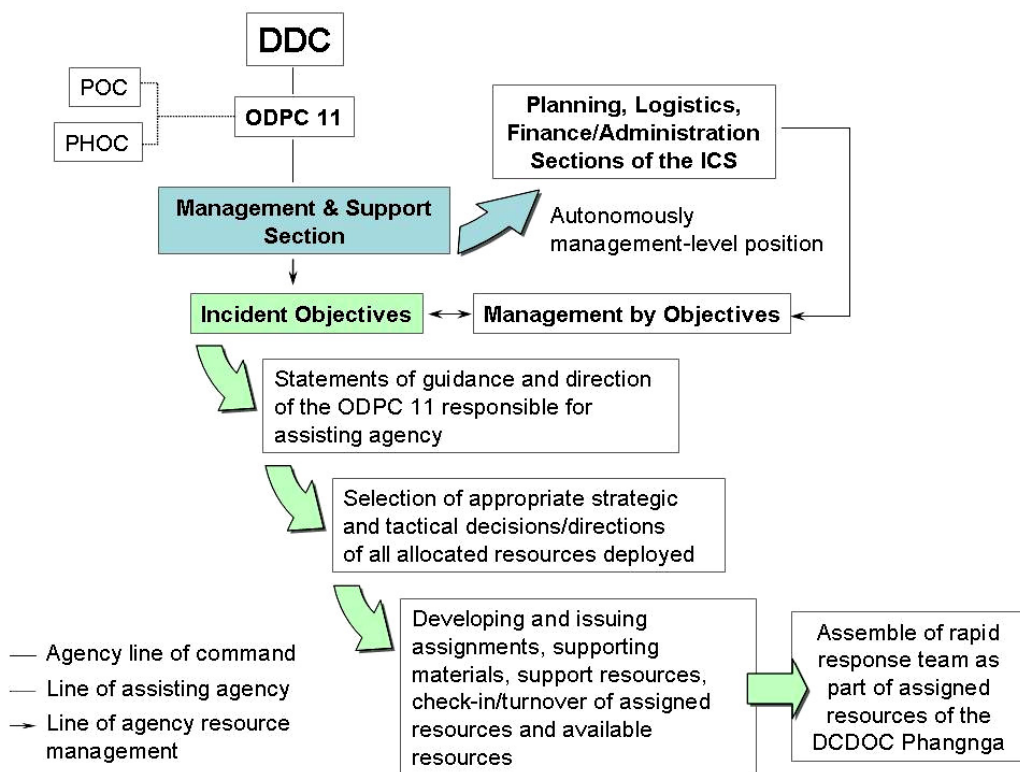


Figure 5 Establishment of incident objectives and management by objectives for incident action plan. The management and support section of the ODPC 11 through communication with the strike team identifying an “anomaly” developed further rapid situational assessment of the anomaly and related details. This incident response (the first stage of response) was achieved by activating the ODPC 11’s emergency operations plan. The section was autonomously assigned of management-level position for planning, logistics, finance/administration of the ICS, which was coordinated with support branch of the DDC. The Director of the ODPC 11 was the supervisor of the support resources. The Chief of Technical Support Section was the secretariat.

uled, along a time frame essential for maintenance of all actions taken during response operations. Man-working hours per day and compensation of overtime hours were the most important operational issues for direct line assignments. Budget infrastructure and fiscal decisions required to all field assignments were efficient enough to procure a set of planning, programming and execution of response operations for the triad interplay. In principle, recording operational capability and process optimization, as well as assessment tools, can provide efficient performance-based management that incident objectives are synchronized with the overall goals and missions. The triad did not execute their performance management system (PMS)⁽¹⁰⁾, public health performance standards, or competencies for public health emergency response. If effectively and efficiently applicable, on-scene incident management and operation challenges can minimize weakness of emergency response operations. On the other hand, a management approach that encompasses compliance-based environment of performance entities for on-scene incident management is applied to the PMS.

The resource mobilization protocol for nontactical resources (i.e., support resources and supporting material) included five-step processes: (i) meeting rapid response team(s) to summarize understandable health crisis situations of the tsunami-affected provinces, (ii) analyzing severity and extent of situations in the affected provinces and needs, (iii) predicting vulnerabilities of tsunami impacts on health that needs to be tracked to prevent and control potentially averting disaster(s), (iv) preparing and categorizing resources (i.e., primarily medical supplies, field-work supplies, chemicals and equipment) in the warehouse by their status (available resources that were categorized by kind and type), and (v) ordering and dispatching allocated

resources that were working on a mission assignment or were requested by POC/PHOC and other incident management facilities in the affected provinces. Again, the management and support section established in order of authority by the director became on-scene incident management organization responsible for planning, logistics, finance/administration sections of the ICS. Support resources, as well as supporting materials (e.g., data sheet, forms, map, traffic plan, communications plan, medical emergency plan, sanitation plan, vector control plan, health education media and plan, and immunization plan), were complementary to the tactics that were deploying and directing resources on secondary effects of tsunami to carry out incident strategy and objectives. The process for categorizing resources for assignments or support of tasks assigned to the POC/PHOC/DCDOC Phang-nga was documented during the immediate response along changeable situations of the 4 affected provinces (Table 4).

Allocated resources were directed to Phang-nga most at risk of secondary effects. Ordering resources was simultaneously processed by fast track ordering and reimbursement for resources was performed on the establishment of budgets and other fiscal decisions, policy development and tactical reasons of setting priorities. The centralized budget management for direct line assignments at the incident was the most important financial issue for all management-level positions of the ICS to response operations. The flexibility of ordering and release of resources was efficient enough to maintain assigned and available resources along actions taken during immediate response (Table 4). Dispatching resources was orderly processed by documenting a series of itemizing allocated resources along the tracking procedures (i.e., dating, numbering, locating, transporting and receiving). But it was unclear

that processes for tracking and recovering resources were appropriately demobilized and recorded for specific purpose of assignments and operational optimization. Retrieval for supply database as well as personal performances was not systemized. Quantity of items classified by their type and kind was not estimated to suffice directed tactics or resources allocated to the realistic situations of the affected provinces, along the period of tsunami impacts or response operations.

Integrated communications

A common communications plan is essential for all the responders to communicate with one another and with the incident base effectively during response operations. Effective communications across interoperable assignments are operated along incident management facility equipped with communication equipment, procedures and systems. An exercise of voice and data communications system for all management-level positions for direct line assignments and jurisdictions along incident action plan must perform prior to an incident. The incident communications center is the organization responsible for the communications unit and the message center. Development of an integrated voice and data communications systems (equipment, systems and protocols) is a real need for the responders. Effective communication plan with easily understandable and common terminology (i.e., clear text) and chain of command must be operated in the preparedness phase since assigned personnel of the jurisdictions come into contact with each other as working group or team. The clear text describes the format and phrasing of all incident communications. Effective use of clear text is essential for team building and communications, both internally and with other organizations assigned to emergency response.

The ODPC 11 rehearsed common communications plan for small-scale emergency response but networking communications between the ODPC 11 and DDC at the incident was not yet coordinated. On Dec 26, immediate response to the tsunami sudden impacts in the four affected provinces before the incident action plan being started were interpersonal and intersectoral communications between the umbrella sectors of the ODPC 11 (Fig. 4). Tsunami collapsed community infrastructures that telecommunications (i.e., calling and faxing) were not efficient enough to coordinate incident management facilities in the affected provinces. Networks for incident communications by the ODPC 11 were simultaneously linked with other regional sectors of the DDC such as the ODPC 12 Songkhla and ODPC 4 Ratchaburi. The internal and external communications by cell phones was rather effectively and efficiently coordinated to transfer information. The use of cell phones was an information channel for communications, regardless of formal dialogues, sending of e-mail messages or short message service (SMS) messages and transfer of command. Even the procedures and processes for developing information for incident communication were not yet coordinated through the integrated communication of the triad, its wide experience in common communications plan for response to the disease outbreaks provides enough management of internal information. Incident communications center was not operated within the triad. The hardware systems that transferred information were set by the ODPC 11, as well as the DCDOC Phang-nga, at the incident. Initial development of hardware systems of the ICP's operations was operated with support of available communication resources by the ODPC 11. The installation of computers connected with intranet or internet was not a key function that supported integrated communications for strategic and

Table 4 Support resources that incident management facilities were allocated by the ODPC 11 during immediate response to tsunami 2004.

| Items | Total | Quantity | | | | | |
|---------------------------------|---------|------------------------|---------------------|--------------------|---------------------|--------------------|------------------|
| | | Phang-nga ^b | Phuket ^c | Krabi ^d | Ranong ^e | NSTOC ^f | RRT ^g |
| Medical supplies | | | | | | | |
| 1. Survival drug kit | 11,590 | 5,790 | 800 | 3,300 | 1,200 | 400 | - |
| 2. ORS powder | 9,600 | 2,400 | 2,400 | 2,400 | 2,400 | - | - |
| 3. Tetracycline | 8,000 | 2,000 | 2,000 | 2,000 | 2,000 | - | - |
| 4. Doxycycline | 100,000 | 50,000 | 50,000 | - | - | - | - |
| 5. Norfloxacin | 7,000 | 2,000 | 2,000 | 2,000 | 1,000 | - | - |
| 6. Povidone iodine | 8,704 | 5,824 | - | 2,880 | - | - | - |
| 7. Lysol solution | 120 | 30 | 30 | 30 | 30 | - | - |
| 8. Choline powder | 714 | 360 | 180 | 174 | - | - | - |
| 9. Formalin solution | 400 | - | 400 | - | - | - | - |
| 10. Alcohol gel | 9,600 | 2,400 | 2,400 | 2,400 | 2,400 | - | - |
| 11. Disposable syringe | 100 | - | 100 | - | - | - | - |
| 12. Disposable needle | 100 | - | 100 | - | - | - | - |
| 13. Disposable mask | 2,300 | 500 | 500 | 500 | 500 | 100 | 200 |
| 14. Mask N95 | 740 | 500 | 240 | - | - | - | - |
| 15. Glove S, M, L | 45,000 | 13,000 | 10,000 | 11,000 | 11,000 | - | - |
| 16. Disposable PPE ^a | 6,600 | 2,600 | 1,000 | 2,000 | 1,000 | - | - |
| 17. TTV | 33,000 | 8,000 | 9,000 | 9,000 | 7,000 | - | - |
| 18. MV | 16,000 | 6,000 | 3,000 | 6,000 | 1,000 | - | - |
| 19. CV | 140 | 15 | 65 | 30 | 30 | - | - |
| 20. MPVV | 210 | 50 | 100 | 30 | 30 | - | - |
| 21. RVV | 40 | 10 | 10 | 10 | 10 | - | - |
| 22. Cotton wool | 8 | - | - | - | - | 4 | 4 |
| Field-work supplies | | | | | | | |
| 23. Boots | 2,096 | 460 | 1,070 | 300 | 200 | - | 66 |
| 24. Bucket | 30 | 30 | - | - | - | - | - |
| 25. Plant shower | 30 | 30 | - | - | - | - | - |
| 26. Fact sheet (D) | 7,000 | 2,000 | 2,000 | 2,000 | 1,000 | - | - |
| 27. Fact sheet (FP) | 4,400 | 1,000 | 1,000 | 1,400 | 1,000 | - | - |

Abbreviations: CV - Cobra vaccine, D - Diarrhea, FP - Food poisoning, MPVV - Malaysian pit viper vaccine, MV - Measles vaccine, NST - Nakhon Si Thammarat Operation Center, PPE - Personal protection equipment, RRT - Rapid response team, RVV - Russell's viper vaccine, TTV - Tetanus toxoid vaccine.

Kind of items: 1&16 - set, 2 - sachet, 3-5 - tablet, 6-9 - bottle, 10 - tube, 11-15 - piece, 17-21 - dose, 22 - bag, 23 - pairs, 24-25 - bucket, 26-27 - sheet.

^aIncluding gown suite, mask and head cover.

Ending date of January of dispatching resources after 27th December 2004: ^b 10th, the same ^{c,d} 7th, ^e 5th, as for SRRT^g 29th December and for NSTOC dispatched once on ^f 29th December.

Locating resources: ^b VBDC 11.1 Phang-nga, ^c PHOC Phuket, ^d PHOC Krabi, ^e VBDC 11.5 Ranong

tactic directions and otherwise they were used to document and restore information and results of response operations. The availability of a telephone and a fax machine at the DCDOC Phang-nga was the most important communication equipment that supported management of information system of the ICS of the triad.

Conclusion and Recommendations

Comprehensive resource management is a key management principle of the ICS that provides on-scene incident management activities and mechanism of controlling personnel, facilities, equipment and communications. The following recommendations address possible next steps in the development of better resource management to meet management by objectives for achieving incident goals of emergency management for the future disasters.

1. Complete an updated literature review

Worldwide, the growing number of humanitarian emergencies has resulted in an expanding need for skilled public health professionals. The application of public health principles in a domestic response differs from public health practice in an international response, but the public health competencies in emergency response (PHCER)⁽¹¹⁻¹³⁾ required for the profession are the same. Performance-based management applicable to ensure operational capability of direct line assignments of the DDC needs approachable infrastructure capability within the organization. The principles, operation concepts and assessment tools need to be designed to meet mission requirements and focus on planning, programming and execution efforts on management actions. A management approach that encompasses compliance-based environmental program management is alternatively designed. Lessons learnt from incident management activities of the triad interplay reflect developing systemization of resources

(i.e., assigned, available and out-of-service) that the triad did not design basic tasks and cross-cutting analysis of the PHCER for implementing incident management processes and response operations. Resource requirements need for operation optimization to meet incident management challenges: (i) the needs of the scale of any incidents, (ii) standard performances and operations of the public health personnel from various jurisdictional agencies, (iii) logistical and administrative support to operational staff, (iv) incident management and operation efforts in cost-effective manner. The DDC can develop research and training programs for public health core competencies and additional competencies for PHER, and can prepare a literature review of resource management system. But, with the humanitarian emergencies being increased, an updated literature review is useful in guiding the next critical steps related to the initiative program for development of resource management for regular business plan and comprehensive resource management at the incident.

2. Reduce weakness of management by objectives

Based on direct line assignments of the ICS, the emergency response to tsunami adopted by the DCDOC Phang-nga reflect the unity of command that was vital for all public health workers and permitted them to participate in the response operations and reporting to the only one supervisor. This process eliminated the potential for individuals to receive conflicting orders from a variety of supervisors. Unplanned or undesired conditions during health operations in emergency response were minimized with effective chain of command, thus increasing accountability, preventing freelancing, improving the flow of information, helping the coordination of operational efforts, and enhancing operational safety. The DCDOC Phang-nga had turn-

over of the supervisors that comprehended situations and on-scene incident management. But there was gap of the transfer of command process that did not laterally coordinate. The crew members of the DCDOC Phang-nga including experienced and inexperienced public health workers may sometimes misunderstand the ever-growing needs of the extended incident or crisis, because of communication barriers using the clear text. Also, in case of the DCDOC Phang-nga, other reasons to transfer command included situation change since tsunami emergencies moved locations or area of responsibilities, and normal turnover of public health personnel due to extended incidents. The triad interplay did not develop the transfer of command process which always includes a transfer of command briefing to be oral, written, or a combination of both to avoid conflicting codes and terminology. Therefore, weakness in incident management by objectives included: (i) unclear laterally chains of command and supervision, (ii) insufficient uses of available communications systems, and (iii) unclear development of an orderly, systematic planning process. As we learnt from the integrated communications, satellite mobile phones and other integrated data systems will be effectively available for use in both common communications plan and response operations plan. Also, there is need for the ICs to mobilize all allocated resources to the incident or disaster site more quickly and efficiently. The comprehensive resource management guide to managers or public health leader/administrator should be developed and resource mobilization protocols should depend on utilization of effective resources in the appropriate triage of the disaster site or during response operations.

3. Design effective organization of the ICS

Composition of the ICS organization at the departmental level (Incident base) or at the field

implementation level (Incident command post) can be revised in accordance with the context of cultural competencies and board practices of public health in the public health system in Thailand because the ever-growing number of the humanitarian emergencies can happen countrywide. Lessons learnt from the DCDOC Phang-nga reflect instructive ICS of tsunami management along the NIMS: a developed system used to coordinate emergency preparedness and incident management. The incident action plan and integrated communications along the PHERP for disease outbreaks must be designed to effectively coordinate a wide variety of jurisdictional agencies. The PHERP adopted by the DDC as assisting agency must be aligned with other cooperating agencies and jurisdictional agencies along the Disaster Prevention and Mitigation Bill, B.E. 2550.

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Acronyms that are used in emergency response.

| | |
|--------|--|
| DCDOC | Disease Control Department Operation Center |
| EOC | Emergency Operations Center |
| IAP | Incident Action Plans |
| IHRs | International Health Regulations |
| IC | Incident Commander |
| ICP | Incident Command Post |
| ICS | Incident Command System |
| MACC | Multiple Agency Coordination Center |
| MPHOC | Ministry of Public Health Operation Center |
| NIMS | National Incident Management System |
| PHCER | Public Health Competencies in Emergency Response |
| PHER | Public Health Emergency Response |
| IPHERP | Public Health Emergency Response Plan |
| PMS | Performance-Management System |

บทคัดย่อ การตอบโต้ภาวะฉุกเฉินทางสาธารณสุขในกรณีภัยพิบัติคลื่นยักษ์สึนามิ 2004 : I. การบริหารจัดการทรัพยากรเชิงประสิทธิผลของระบบบัญชาการภาวะฉุกเฉินในการปฏิบัติการร่วมระหว่างไตรภาคี

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วารสารวิชาการสาธารณสุข 2551; 17:SII305-22.

ระบบบัญชาการภาวะฉุกเฉิน (ICS) เป็นลักษณะการจัดโครงสร้างหน้าที่การบริหารจัดการในภาวะฉุกเฉินของผู้ปฏิบัติการตอบโต้ภาวะฉุกเฉิน ซึ่งสามารถประยุกต์ใช้กับภาวะฉุกเฉินที่เกิดผลกระทบน้อยจนถึงระดับที่มีผลกระทบในวงกว้างและซับซ้อน จากผลกระทบที่เกิดขึ้นของภัยพิบัติคลื่นยักษ์สึนามิซึ่งเป็นภาวะฉุกเฉินทางสาธารณสุข เมื่อวันที่ 26 ธันวาคม 2547 นั้น สำนักงานป้องกันควบคุมโรค (สคร.) ที่ 11 จังหวัดนครศรีธรรมราช มีบทบาทหน้าที่ความรับผิดชอบหลักโดยเป็นหน่วยประสานงานศูนย์ปฏิบัติการกรมควบคุมโรค - สปค. จังหวัดพังงา ซึ่งเป็นฐานบัญชาการภาวะฉุกเฉินระดับสนามที่อยู่ภายใต้การควบคุมกำกับของฐานบัญชาการกรมควบคุมโรค (คร.) ประสบการณ์และความเชี่ยวชาญในการเตรียมความพร้อมและการตอบโต้ภาวะฉุกเฉินในพื้นที่ภาคใต้ของประเทศไทย ได้แสดงให้เห็นถึงสิ่งท้าทายในการบริหารจัดการและการปฏิบัติการของ ICS ซึ่งเกี่ยวข้องกับการควบคุมกำกับทรัพยากรบุคคล สถานที่ปฏิบัติการ เครื่องมือ และการสื่อสาร องค์ประกอบสำคัญๆ ของ ICS ในการดำเนินงานอย่างมีประสิทธิภาพ ประสิทธิผล คือ แผนปฏิบัติการภาวะฉุกเฉินและการสื่อสารแบบบูรณาการ สคร. 11 สามารถจัดการผลกระทบด้านสังคมจิตวิทยาของภัยพิบัติคลื่นยักษ์สึนามิ รวมถึงทรัพยากรต่างๆ ที่เป็นองค์ประกอบทางสิ่งแวดล้อมที่เอื้ออำนวยในการปฏิบัติการตอบโต้ภาวะฉุกเฉินทางสาธารณสุข ทั้งในระยะเร่งด่วน ระยะปานกลาง และระยะยาว สาเหตุสำคัญของบทสังเคราะห์นี้ ได้จากการถอดบทเรียนจากการบริหารจัดการทรัพยากรของสปค. จังหวัดพังงา โดยมุ่งเน้นฝ่ายต่างๆ ในระบบ ICS ได้แก่ ฝ่ายวางแผน ฝ่ายสนับสนุน และฝ่ายงบประมาณและการบริหาร โดยเฉพาะอย่างยิ่งด้านการบริหารจัดการทรัพยากรแบบครบวงจรและการสื่อสารแบบบูรณาการของไตรภาคี ซึ่งก็คือการปฏิบัติการร่วมระหว่างสคร. 11 สปค. จังหวัดพังงา และคร. การสังเคราะห์รูปแบบการปฏิบัติการกิจของสปค. จังหวัดพังงานี้ จะก่อให้เกิดหลักคิดพื้นฐานในเชิงวิกฤตขั้นต่อ ๆ ไปของการดำเนินงานตามแผนงานของหน่วยงาน เพื่อให้บรรลุเป้าหมายในการบริหารจัดการภาวะฉุกเฉินสำหรับภัยพิบัติที่จะเกิดขึ้นในอนาคต

คำสำคัญ: ระบบบัญชาการภาวะฉุกเฉิน, ฐานบัญชาการระดับสนาม, สำนักงานป้องกันควบคุมโรค, ศูนย์ปฏิบัติการกรมควบคุมโรค, การตอบโต้ภาวะฉุกเฉินทางสาธารณสุข, การบริหารจัดการทรัพยากรแบบครบวงจร, การสื่อสารแบบบูรณาการ, การปฏิบัติการร่วมระหว่างไตรภาคี