

Development of a Comprehensive Model of Disaster Management in Korea Based on the Result of Response to Sampung Building Collapse(1995), - Disaster Law, and 98 Disaster Preparedness Plan of Seoul City -

In Sook Lee*

I. Introduction

To construct a system in a certain area is easier than complement and enrich it. EMS system isn't exception of that rule. In some advanced country, they suggest that EMS system should be integrated to overall health care system and be developed based on community as an agenda toward 21C. The community based EMS system is which lays more stress on prevention, education, and accessibility of community people for life-saving chain in the view of health promotion. Because the phenomena of development show a transition trend, developing countries establish their EMS systems more rapidly than that of the developed country. But they are prone to follow their erroneous step especially in the areas, where they need knowledge, skill and change of perception or behavior because there are stressed to be developed in the establishment of hardware of the system. In Korea, they began to establish a basic frame of EMS system since 1991 when the provision of EMS had been enacted and the 129 emergency phone line and ambulance system had been activated. But the mechanism of coping with disaster or

mass casualty incident (MCI) spins vicious circle around. EMS system doesn't train the professional rescue personnel, and doesn't prepare for the community response even if they depend on community resources and volunteers in case of MCI. At the time of Sampung collapse, they didn't have any support systems such as trained EMS personnel, communication system, community response plan, hospital plan, scene response plan, and Disaster Law. After the event, they had made the Disaster Law and regulated to make response plan at the level of administration (nation and city or province (county)) every year. But it usually has been made based on civil defense model, that is, it can not maintain the chain of life saving, community mobilization and preparedness.

Disasters, natural or man-made, are the unbalancing status between human life and environment, which can hardly be predicted.

In Korea, they have had large scale man-made and natural disasters recently; such as the derailment accident at Gupo(1993), the capsizing of a ferry in the West Sea(1995), the crash of an Asiana aircraft at Mokpo(1993), the Seong-Su bridge collapse in Seoul(1994), the gas explosion of Subway at Daegu(1995) and of

* College of Nursing, Seoul National University

the residential area at Ahun-dong(1995), collapse of Sampung department store(1995), and the flood at Chulwon and Yeoncheon(1996). These series of man-made disasters had aroused the public attention widely about the preparedness plan of disaster. But because they had not developed the elements of EMS system for disaster step by step, the medical response plan, which was suggested by some professions, was prone to be as a desk plan. Therefore, they couldn't activate the response plan and didn't perform the efficient rescue, scene triage and transportation, and the efficient hospital and community's response.

This study's purpose is to suggest the model of disaster response based on community in the view of medical and public health in developing country. Specific objectives are as follows.

Review the data of response to Sampung building collapse, the present disaster plan in Seoul City, and Disaster Law Review the article-related, and the U.S.A.'s disaster response plan at state and national level.

Suggest the operational model in Korea.

II. Study method

Study process is divided into three phases: the secondary data collection and review, analysis, and suggestions for future direction.

1. Evaluate the response to the building collapse in public health and medical aspect, and the plan of disaster preparedness of Seoul at 1998. The related data of Sampung event was gathered from daily newspaper, published official reports and academic research papers. As the data of disaster response after Sampung collapse, Disaster Law and 98 Seoul Plan of Disaster preparedness were analyzed. And the United States Federal, States and local plan were also reviewed.

2. Through reviewing process, defined the problems and explored the point of modifying strategies of disaster preparedness.
3. Suggest the future direction of disaster preparedness plan in Korea.

III. Results

1. Disaster response process to Sampung Building collapse

At 5:57 PM, the 29th June, 1995, Sampung building, which was the 2nd mammoth department store in Seoul and had 5 stories on the ground and 4 stories under the ground, had collapsed with dust and thundering sound because of the erroneous design of building construction, the unbelievable constructing process in terms of accuracy and completeness according to the original blue print, and the excessive enlargement of building after getting a building permit. The 1,439 casualties (502 dead and 937 injured) and enormous loss of properties had caused from this calamity.

- 1) prepared phase

In the law of emergency medicine (March 1995), the chief of community (by each City/province, and district) should make a plan of disaster coping by type and scale. And it specify that disaster plan should include the strategies of establishment and mobilization of emergency personnel, equipment, and facilities, mutual aid and training and drill for disaster coping. But the plan is not formulated based on system of function (May 1995); therefore, it could not be activated according to plan as described. According to this plan when Sampung collapse was occurred, main officer would have discussed with chief of Civil defense bureau and have mobilized headquarters of disaster coping in

Seoul City. And at the scene of medical care, the personnel of military, police, civil servants, civil defense military force, and 119 rescuer and community people would have done act of emergent rescue (Seoul city, 1995). Like above, disaster plan had not played the role of scene management at the time of event. They had enacted the Disaster Management Law for man-made disaster a month later after the Sampung collapse.

Even though community people have participated in rescue at scene, but they had no experience of training and drill for rescue. And the representatives of community people have not participated in making the preparedness plan for disaster; they had no idea how to cope with disaster. There were sporadic education programs in the voluntary agencies of community, but these schedules usually have not announced to community people.

Hospitals had a committee for disaster coping, which was in name but not in reality, but they have never experienced activate in of the disaster plan and drill. At Sampung collapse, scene triage, stabilization, transportation, and hospital response were not coordinated at all in view of appropriate disaster response.

2) response and mitigation phase

(1) response and alert

The first witness had reported the collapsing of building to the fire office (17:57). The officer confirmed the situation at the scene and reported the fact to the disaster information center in Seoul City office through telephone (17:57). The chief of fire office reported the situation to the related authorities, Mayor and president through hot-line telephone (18:00). Seoul City announced the disaster, called all public officers and organized the headquarters to cope with disaster by transforming from the center of disaster prevention in Seoul City

office. At the scene, Seoul City, Sucho district office, Sucho fire office and police office installed each headquarter at separated places without any networking systems (18:30).

In other sides, Seoul City and Seocho fire office surveyed and estimated the number of remaining beds, capacity of ER and morgue service of hospitals at the scene district on that time (19:30). They worked separately, so these activities were duplicated and caused confusion when they dispatch the casualties.

The ground was hollowed out about 20-30M under the ground (it was as deep as ground 3rd floor) and was filled with bent iron frames and blocks of concrete which interrupted the rescue and extrication. The scene was an utter confusion because several thousands of residents around area and passengers were driven toward casualties. Several tens of fellow soldiers of navy made efforts to control the scene, but it was not effective. The residents attend the activities of rescue. They tied the bleeding point of patients using pieces of cloths and transferred the patients to the hospitals near the scene by taxi or passengers' private car. After 2 hours from the accident, the number of person attended the activity of rescue was 3,840 in all. And after 4 hours, it mounted up to 7,122. Even the public rescue team constructed and intervened the scene, they didn't obey the direction of headquarter. There was no controlling system of volunteers who acted the rescue.

The Mayor commanded the various activities at the scene but couldn't control them effectively. At 0:30AM, the 30th June, he convened the meeting of directors of each headquarter, recommended the director of fire office as the chief of the collaborated rescue team in order to control the scene systematically.

The authority of Seoul City office had

organized headquarters at scene within one hour after the accident, but they didn't have a law about disaster management and scenario by situation. Because they had a desk plan by civil defense model, but it couldn't be operated to rescue and command at scene systematically. It didn't contain the specific role or job specification of each department or official. Although all personnel in charge of safety and EMS (EMT, fire fighter, police, and soldier) had assembled at the scene but they could not controlled traffics around the scene for several hours after accident. Besides, over one hundred cars that were going out of the scene obstructed the way to the scene of ambulances.

Korea had a plan for disaster in 1995, but it was very ambiguous in its extent of job and role by personnel's function. They had reactivated the organic structure, but they couldn't manage the command system systematically. Even though many facilities convened the scene, they weren't coordinated and cooperative. First of all they failed to control the traffic around the scene and to prevent the lay person from entering into the scene. And the mechanisms of mutual aid were premature and didn't have experience to work cooperatively at real situation. Table III-1 presents the chronological event at initial phase.

(2) Continuous assessment

At initial phase, because the result of reassessment wasn't consistent, each rescuer got and gave the sporadic information. Then they had trouble with the difficulties of confirming the number and the name lists of casualties and didn't operate the scene command. This was the basic problem in the process of scene command. In addition, because each authority was not unified into one communication system, sharing information was not possible. Each headquarter located physically distance area in the scene and had separate channel in cordless communication line and separate reporting system. Therefore, they couldn't exchange and distribute information rapidly among the related facilities, and reporting data wasn't accurate. Above all they had low capabilities of analyzing situation through data fusion system which analyze and summarize the opinion of the profession of different area.

Over six thousands people attended rescue but they didn't have any sign to be identified as rescuer. While the rescue proceeded at basement, the activities of taking steel beams and blocks of concrete away also went on over the ground. Headquarter of rescue didn't obtain the blue print of building and they proceeded

Table III-1 chronological events at initial phase (I)

Date	Main events
	(17:57) Report of the collapsing by passenger and witness to fire office
	(18:00) Mobilize the headquarter of disaster management in Seoul City
	(18:30) Install the headquarters(City office, District office, Fire/Police/Military office) at scene
	(18:50) Start to command by Mayor at scene
	(19:25) Start to control the traffic near the scene by District Office
June 29	(19:35) Meeting the chief of each headquarter; determine the redistribution of ambulance and rescue equipment
	(20:05) Perform the briefing to the public by Mayor
	(20:30) Define the charged department for patients dispatching
	(20:40) Start the supply activity by KRC
	Rescue: 687 (dead 20, injured 667)

Source : Seoul City, Description of Sampung collapse, 1996 June

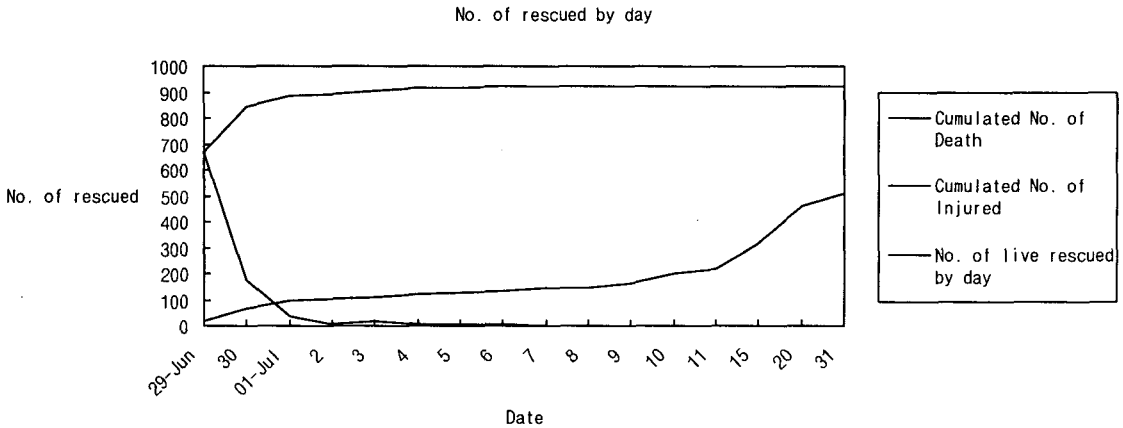


Figure III-1 Number of rescued by day

the activity by rule of thumb over one day. It was very dangerous for rescuers. They didn't have any plans of recess for rescuers, so several rescuers dropped down for exhaustion and overwork.

The total duration of management of disaster

was 33days: from June 29th to July 31st. They rescued the live injured till the 15th July, especially for initial 4 days, almost all lived casualties were rescued. The last three persons rescued on the 9th, the 11th and the 15th July (Figure III-1).

Table III-1 chronological events at initial phase (II)

June 30	(0:30)Delegate the command role about the specific rescue work to the chief of Fire Office (0:55) Start to supply the rescue equipment by private sectors (14:00)Input the mining worker for rescue Rescue: 910 (dead 66, injured 844)
July 1	(13:00) install the information center for missing person Rescue: 978 (dead 96, injured 882)
2	Assess the safety of the remained parts of building Input the searching equipment(SLOT) from U.S. Army Redistribute the patients who wanted according to the distance access Start to discuss the compensation for the casualty Rescue: 995 (dead 105, injured 890)
3	Rescue: 1013 (dead 107, injured 555, return to home 351)
5	Command to prevent another safety accident of rescuer Rescue: 1044 (dead 126, injured 565, return to home 353)
9	Rescue one live casualty Rescue: 1086 (dead 164, injured 538, return to home 384)
10	Input the detecting the sound equipment(STOLS) from U.S. Army Reside the medical personnel for scene rescue Rescue: 1127 (dead 203, injured 529, return to home 395)
11	Rescue one live casualty Rescue: 1146 (dead 221, injured 523, return to home 402)
15	Rescue one live casualty Rescue: 1248 (dead 316, injured 423, return to home 509)
31	Withdraw the scene headquarter Rescue: 1439 (confirmed dead 471, recognized dead 31 injured 937)

Source : Seoul City, Description of Samsung collapse, 1996 June

Because that building was department store, we can assume that there was the same number of consumers at each floor. But many live casualties were found at 1st or underground 1st level, where was the near area from the door. The building collapsed to the ground 3rd floor. Because the caved in ground 3rd floor could make seclude, some live casualties were found at there (Table III-2). In Oklahoma City booming, the medical examiner's office was unable to clearly distinguish deaths caused by primary blast effects from deaths caused by building collapse. However, the large RR of 16 for persons in the collapsed area Vs those in the uncollapsed area leads us to regard the collapse as a major risk factor. The increased risk for persons in the collapsed region on the upper floors as compared to lower floors further substantiates this theory(Mallonee, 1996).

The concept of volunteer participation was not established in Korea, so they couldn't be controlled systematically, protected from risky scene, and didn't comply with the commander's command.

Table III-2 casualties' location at accident (393 among casualties admitted; surveyed data)

Location	No. of surveyed	Percent
5 th	19	4.8
4 th	37	9.4
3 rd	23	5.8
2 nd	54	13.7
1 st	83	21.1
Underground 1 st	83	21.1
2 nd	22	5.6
3 rd	68	17.3
4 th : not collapsed	-	-
Near the building	4	1.0
Total	393	100.0

Source: Kim Sekung (1995): Review of The Event of Sampung Collapsing in medical side, Modified

(3) community response

Community that had disaster usually doesn't show a systematic voluntary activity. At that time, not only government didn't designate the charged organization for community response but also the ability of community coping wasn't drilled through education. Even though several thousands people joined the rescue work, because they weren't educated in CPR, first aid and rescue, they pulled out the injured casualties without pre-assessment and carried casualties to the car without stabilizing or immobilizing procedure.

When disaster occurred in Korea, the range of the volunteers' activities was too unclear to perform rescue systematically. Control of the activities of volunteers' was not performed systematically. Even though they were exposed to the risky scene and they worked hardly. But they didn't comply with the commander's command when trained rescuers took over their job.

(4) flexible resource allocation

At first, there were lack of the equipment and personnel to rescue. After a while these reports were announced by broadcasts' networks, then they were aggregated from various sources. But because circumstances were beyond headquarters' control, they couldn't distribute these resources to proper places on time Eventually the aggregated equipment cut the pathway of ambulances and made them difficult to access to the scene. The using of rescue equipment wasn't operated efficiently. They didn't have reallocation plan by type & scale of accident and the information of needed equipment wasn't distributed rapidly. Finally because of shortage of the basic rescue equipment (welding machine, cutting machine, pressure lifter etc.), there was the difficulty in rescue.

(5) EMS response

Korea didn't have EMS response plan at scene. Even if they had a plan, it has not been activated and it was only a paper plan. They couldn't establish the liaison between different levels even though the plan each level's has a same structure, role and responsibility, and activating process.

Finally they didn't activate the medical command system, and didn't allocate the emergency medical team at the scene. Because there was no field medical treatment clinic, no triage and first aid treatment could be performed. They didn't activate the referring system and communication system among hospitals, ambulances and headquarter. Patients were concentrated to the hospital near the scene. They couldn't do emergency care, activities of admission and casualty confirming and care of existing patient.

While transporting, patients were not cared according to medical direction because the appropriate personnel, equipment and communication system was not settled up in ambulance. To transport 1,380 casualties, 1,283 ambulances were aggregated to the scene(Table III-3).

Even though only 12.9% of casualties were urgent or emergent, almost all casualties including dead bodies were transported to the 3rd level hospital near the scene in a moment (table III-4). Emergency rooms were changed into the secondary disaster scene. Hospitals' Medical treatments were delayed and they couldn't do appropriate care. First of all they focused on the patient triage and transferring to other hospitals.

89.0% of the admitted patients were mild injury in ISS below 8, and only 2.2% were in ISS above 25(Table III-5). The chronological main facts are the same as the following table III-1(II). In case of Oklahoma, the rescue and recovery effort spanned a total of 16 days from

right after the blast. 61% of bodies were identified less than 1 day following recovery, 24% were identified within 24 to 48 hours following recovery, and 15% were identified 72 or more hours following recovery(Mallonee, 1996).

Almost all hospitals didn't have disaster plan and have never activated it. Only one hospital organized the hospital headquarters, reinforced the medical personnel to emergency room, and reorganized the charged job.

Because the patients were massed at that moment, medical record of patients couldn't be kept precisely, especially in minor injured cases, and it caused the difficulty of getting reimbursement from insurance company.

The morgue service had a difficulty because of blocked information about the capacity of hospital morgue service and lack of the sag of corpse.

Table III-3 Number of ambulances mobilized by agencies

Agencies	No. of ambulances mobilized	No. of casualties transported
119 Public EMT	1,077	1,261
129 Private rescuer team	84	70
Public health center	25	25
Private hospitals	29	29
Police	4	-
Military	48	-
Others	16	16
Total	1,283	1,380

Source: Kim Sekung(1995): Review of The Event of Sampung Collapsing in medical side

Table III-4 Distribution of casualties by triage

Classification	Number	Percent(%)
Urgent	72	5.1
Emergent	109	7.8
Non-emergent	296	21.2
Discharge after minor treatment	464	33.2
Death	458	32.7
Total	1399	100.0

Source: Kim Sekung(1995): Review of The Event of Sampung Collapsing in medical side, Modified

Table III-5 Distribution of casualties by ISS

ISS	Number	Percent(%)
0 - 8	398	89.0
9 - 15	39	8.8
16 - 24	5	1.1
25 and over	5	1.1
Total	447	100.0

Source: Kim Sekung(1995): Review of The Event of Sampung Collapsing in medical side

(3) rehabilitation phase

After Sampung collapse they had recovered the scene physically and compensated for casualties. They couldn't apply the mental crisis (post-traumatic) intervention and prepare the prevention program based on the feedback of previous evaluation. Kim(1995) surveyed post-traumatic stress through SCL-90 (Symptom checklist) directly after the incident, and reported that patients felt anxiety, depression, hostility, somatization, and phobia. But he didn't apply debriefing.

2. Change of disaster management system after the event

1) Structure

(1) Disaster Management Law

At the time of Sampung collapse, Korea had to cope with disaster based on Civil Defense Law. Because flood and storm are occurred frequently, they had a sub-law to measure the damage from storm & flood under the Civil Defense Law. But there was not legal base to measure the man-made disaster. While measuring Sampung collapse, the related authorities were criticized for the ineffective coping strategy and lack of legal basis. They enacted the law at July 18, 1995, immediately after the accident and revised at August 30, 1997. In Disaster Management Law, they reinforced the items about scene response, community participation, Emergency medical response, information sharing, and training and

education for disaster coping.

(2) Organizational structure

According to urgency and severity of the damages of disaster, disasters are usually classified into three levels from the 1st to the 3rd. In the 1st class, which is a large-scale disaster and needs the support from nation, the national central headquarters (Central committee of disaster measure), Seoul city or each province headquarter and district headquarter should be settled. The Prime Minister as a chief should manage the central committee of disaster coping. In case of the 2nd class disaster, Seoul City or district affected disaster has to have a main charge of operation as headquarter and have coordinated liaisons with national central headquarter. If the 3rd class disaster were occurred, the charged department in district office would be designated as a main sector for managing of disaster by district head.

To cope with disaster, Korea has the system, which is operated separately by Ministry of Home Affair, Ministry of Health and Welfare, Bureau of police office and Military. Bureau of Fire office is under Ministry of Home Affair. To cope with disaster, they have usually applied the Civil Defense Model which has been managed by Military. Seoul City has a Center of comprehensive information services, which is transformed into the Headquarter and charged to manage the situation, to incorporate the scene commander and to gather and distribute the information when disaster occurs. Annex Figure1 shows the liaison structure of reporting in disaster event.

Before Disaster Management Law was enacted, if disaster occurred, the national central headquarter would be constructed by the Prime minister Instruction No. 280. Because the Sampung event was building collapse, The Ministry of Construction and Transportation was

the principal axis of the construction of the Central Headquarters of disaster management and Seoul City also constructed City Headquarter within one hour. In spite of establishment of those headquarters, the main charged department in Seoul City Office didn't decide how to activate the disaster plan because they had never activated it according to the plan. And they had never experienced to cooperate with other related authorities when they cope with disaster, either. Therefore, they couldn't operate the disaster plan for rescue and the command system effectively. Finally Seoul City Mayor convened the meeting of directors of each headquarter, and recommended the Director of Seoul City Fire Office to play a role as the chief of the collaborated rescue team in order to control and perform the management systematically at the scene (Seoul city, 1996). A system of headquarter at the scene, which

includes in Seoul City Plan (1998) which is made abide by Disaster Management Law(Figure III-2). Even the chief of headquarter is Mayor, the commander at scene is the director of fire office and this system has eight acting units.

RHMS (relief and health/medical services) for disaster is divided into the initial actions and continuing actions. Each action is continuing process but Seoul City Plan doesn't describe the operational process as a function. In organizational structure, 119 fire-fighter, EMT and 129 private rescue team (named Korean Emergency Rescue Association) will be charged of relief, rescue and transportation, Tertiary emergency medical centers and primary emergency medical centers will begin to treat injured casualties. In public sector, public health center and City hospital are the primary agencies which cope with disaster and in private sector, Red Cross is charged of rescue, volunteer

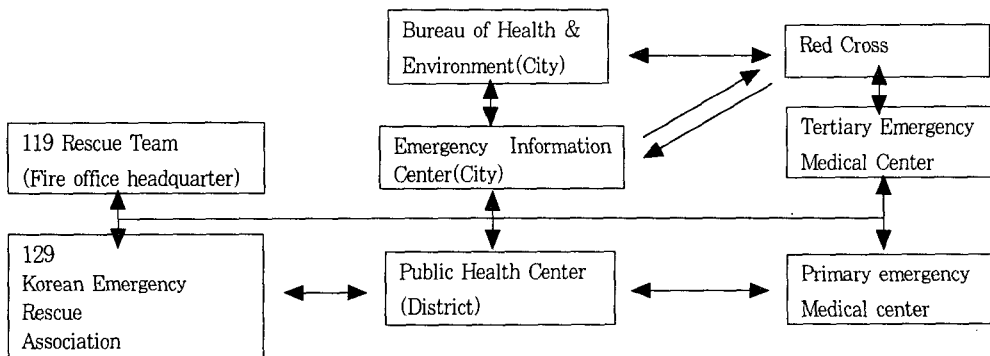


Figure III-2 Liaison System for disaster coping in Seoul
Source: Seoul City, Civil Defense plan, 1998

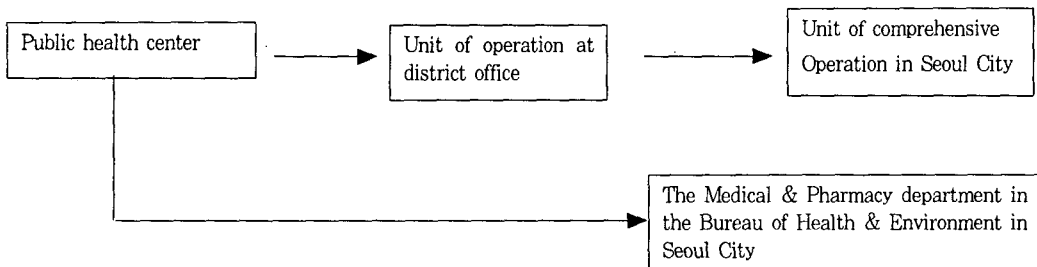


Figure III-3 Health/Medical Service System in Disaster
Source: Seoul City, Civil Defense plan, 1998

services and cordless communication.

As the part of primary coordinating, Bureau Health and Environment will control and coordinate the whole process of disaster coping.

At local level, public health center has a main role in the area of health/medical service in disaster. All process of disaster coping should be reported to the district office and the city office. But this organizational structure revealed the difficulty of performing of medical response at scene because public health center doesn't have the liaison with emergency medical hospital, the charged office of rescue and life saving.

(3) Preparedness Plan

Sampung collapsed, Korea made three plans of disaster management. The Civil Defense Plan includes the contents of Disaster Management Plan for man-made disaster and the prevention plan of damage for natural disaster. If the contents of plan were overlapped or a little bit different, in the cases of man-made disasters, disaster management plan would be predominant in application to situation. But there is no rationale to make the duplicated plans like that.

When reviewing the 98 Seoul disaster plan, it has directions like this: settlement of the system holding a person in charge responsible for disaster management; supplement of the coping capability by the scale & type of disaster; promote the prevention program of disaster; establish the system for restoration & coping with disaster; promote the movement rising of perception of safety.

Each department in Seoul City has a charged function, which is specified in the organizational structure for disaster management. But these functions are mainly consisted of the preparation and supply of EMS system's elements. Comparing the Casualty Disaster Management Plan, Korean plan represents the ambiguous and

immature figure in the process elements for emergency response at scene. It doesn't specify the function of alert/notification, EMS incident command, need assessment, casualty triage and stabilization, casualty collection, field medical care, transportation with life-support, medical/surgical care, stress debriefing, and evaluation.

A. community plan

Korean Red Cross has health education program for community lay person all around year. The most of contents are general health care such as modifying life style. Emergency care covers the 8% of the total time of education. And there is issue about the preparedness of disaster(table III-6).

Because Korea doesn't have regular health education course in elementary, middle and high school, to be taught of the life saving technique and first aid is not available. Only the member students of the RCY (Red Cross for Young) have a chance to learn the CPR and First Aid. And also teachers are not always prepared these techniques.

Recently public health center held various health education programs to distribute the knowledge of behavior change and healthy life style for health promotion. Public health nurses should plan and perform the health education for community people one or two times every month by her/his job description. But they don't have any idea and skills in emergency care of prehospital setting and disaster preparedness.

B. hospital plan

In spite 129 hospitals involved in treatment at Sampung collapse, there was no hospital which has drilled disaster coping with the liaison to the Fire office within district. If casualties were transported to 3rd level emergency medical center without first aid treatment, hospital s capability of treatment is

Table III-6 Health education to lay person at Seoul Branch of Korean Red Cross
(Jan.1 '98 - Dec. 31 '98)

Contents	No. of hold the program/year (times)	Total number of attendants (persons)	No. of attendants by character		
			Student(middle high school)	Teacher	Residence in community
First aid	141	4,003	2,433	35	1,535
CPR	59	1,209	349	-	860
Rescue at sea	28	755	458	-	297
Basic care for chronic patient	132	3,412	-	-	3,412
Elderly care	106	2,641	-	-	2,641
General health education	2,3095	67,180	56,120	-	11,060

Source: Korean Red Cross, unpublished, 1998

5 to 7 persons per hour in severe cases in Korea(Kim, 1995). But in case of MCI(Mass Casualty Incident) or CCD(Catastrophic Casualty Disaster) hospitals' coping capability are lessened than usual time because casualties are concentrated at 3rd hospital for a moment without triage. But at present there is no plan for coping with disaster in almost all hospitals. Even if each hospital has a plan, it isn't drilled with other hospitals and related agencies within catchment area at regular interval. Hospital disaster committee is only a name, it doesn't include the personnel of related authority and representative of community people.

2) Facilities

Korea has the three-level based service facilities. The 3rd level EMC(emergency medical center) has a role as the same as the trauma center in America. There're 93 3rd EMC in whole country, and each center covers the 479,634 community people.

In Seoul, there are 30 centers and 340,975 community people are covered per center. The numbers of the 2nd and primary centers are 46 and it covers 222,237 people per center in Seoul. If one person out of 10,000 people visited emergency room a day(Shin, 1994), among them 30% are admitted (Lee,

1998), and among admitted people 10% are ICU patients(Lee, 1999). 31 people among Seoul residence need the bed at 3rd level EMC per day. Considering the duration of stay in ER is average 4.5 hours per patient (Shin, 1994), 3rd level emergency rooms are able to cover 160 patients a day. If they were settled on the triage system or fast track system and if the emergent care area was separated from the primary care area in physical structure, these facilities would be sufficient to care for emergency patients without delay. But emergency rooms are very crowded in Korea because not only above systems are not settled in ER but also patients choose the 3rd level hospital to treat even EMT recommends other level hospitals according to their severity. And hospitals don't want to transfer patients to the other appropriate hospital, either. Many hospitals don't have specialist in emergency medicine even in 3rd level. Therefore, to maintain the 10% bed among total as reserved beds doesn't abide in 3rd level hospital.

Among the designation criteria of emergency medical center, 76.9% in 3rd EMC and 45.7% in 2nd EMC had the Committee for operation of emergency room.

Guidelines for ER's activity were prepared 79.6% and 58.6% at each level. In 90% and

over hospitals, charged doctors resided in ER for 24hours in ER; but among them only a half were specialists.

In the criteria of space, 73% of 3rd EMC and 24% of 2nd EMC were satisfied. And 62% of 3rd EMC and 8.7% of 2nd EMC were satisfied the numbers of beds. In equipment, almost all designated hospitals were fulfilled in except defibrillator and communication system. Defibrillator was kept in only 76.9% of 3rd EMC, 37% of 2nd EMC. Communication system was established in 84.6%, 39.1% of each level ER. Because Government doesn't support the settlement of communication system financially to each hospital, almost all hospital hesitate to settle it. If they settled it, it would not be kept in ER. Therefore, it is impossible to give a medical direction during transportation and to transfer information to other hospitals. 34.6% of 3rd EMC had three ambulances and 53.8% had two ambulances. In 2nd EMC, 18.3% of them didn't have ambulance(Shin, 1994).

3) Personnel

There are several types of personnel in EMS system. First responder (health care personnel

in school, industry and public health center and police, fire fighter, Taxi-Driver, Physical Fitness Center etc.), EMT, EMT-I, and trauma resuscitation team (physician, nurse, and paramedic). In case of first responder, Korea doesn't have a specific role. In education for them, even though education contents are specified in The Law of Emergency Medical Services but to participate in is not mandatory.

Only in industrial setting, the Institute for Research and Training for Industrial Safety operates the education program of first responders' training for worker. But it's not a course for certification and doesn't have refreshing course regularly.

The Law of Emergency Medical Services specifies the role, responsibility and the minimum requirement of education and qualifying examination.

Table III-7 shows the distribution of personnel by agency. Since 1995, EMT and EMT-P are produced through regular education program. EMT education program has performed as a retraining one for the existing rescuers at fire office for 6 to 7 weeks. In Korea, they don't permit to establish private ambulance company

Table III-7 Number of personnel by function (1995)

Personnel	No of personnel	Others
129 Information Center: Corporation Transportation Team	Whole country : 312 Seoul : 63	No. of ambulance Whole country : 168 Seoul : 43 Existing Member are not qualified personnel, but 129 employ EMT-P since 1996
119 Fire Office : Rescue Team	Whole country : 1558 Seoul : 516	No. of ambulance Whole country : 406 Seoul : 75 119 rescue officer educated as EMT in School of Fire Fighter since 1995
EMT(1996) : duration of education : 6-7weeks	Whole country : 880	Existing employee in Fire office
EMT-P(1996) : duration of education : 2 year	Whole country : 935	A few employed as EMT(Graduate in Technical Colleague since 1995)
Specialist in Emergency Medicine (1996)	Whole country : 51	Approved as specialist since 1996

Source: Ministry of health and Welfare, Yearbook of Health and welfare statistics, 1995

except 129 Corporation Transportation Team which began as a volunteer team for rescue and transportation about 20 years ago. Therefore, job market is very limited for Paramedic. Even though EMT-P course is a regular 2-year-college education program (producing 760 paramedics per year), a few graduates take up a job as EMT at 129 Corporation Transportation Team. If EMT has a career for 3-year fieldwork, he/she can promote to paramedic. The Emergency physician is approved as a specialist since 1996.

(1) Role and responsibility

EMT-P rescues and treats according to doctor's medical direction during transportation from scene or between hospitals. If communication system doesn't operate and patients' conditions are urgent, EMT-P has to act as a guideline within his/her job limit, which is specified by law (Table III-8). It is the same as the EMTs' job description.

(2) Education

Korea has educated EMT and EMT-P based on the Law of Emergency Medical Services since 1995.

Education program for EMT-P is held in

2-year technical colleges, which are 11 schools in whole country. And EMT program has opened for existing fire officer as a refreshing or reeducation course for 6 to 7 weeks at School for Fire-fighter (2 places) and technical colleges (2 places).

Total duration time of education for EMT is 320 to 355 hours including practice and ambulance ridding. The contents of EMT program are specified in the law, but EMT-P program is not. If the total time of major or elective course is satisfied to the regulation of The Ministry of Education, the paramedic curriculum of technical college is not restricted or supervised by Law. Therefore, the curriculums of EMT-P are various by each school and don't meet the description of job. Korea is developing for the standardized curriculum for paramedic through research.

It is similar to the American standardized curriculum in total duration of education, but it lacks the practice time in the lab or field. Considering the proposal of EMT-P curriculum compared with the job of EMT-P, the session of theory course is not able to be covered at regular curriculum in technical college because it's too extensive and deep in medical orientation. In addition, because the most of

Table III-8 Job description of EMT-P

Items	Contents
Act 19	(Limitation of job) EMT-P should not act any emergency treatment without direct medical direction through communication network. In case of cutting off the communication with doctor, he/she can start to treat by his/her own decision. But he/she performs it within the minimum first aid treatment, which is specified by Law.
	(the minimum first aid treatment) Removal of foreign body in oral cavity Air way maintenance using medical apparatus CPR
Regulation 28	Inhalation of oxygen Applying prosthesis to extremities and vertebra Control of hemorrhage Measuring vital sign Use the special equipment for prevention of shock and maintenance of blood pressure

Source: Ministry of health and Welfare, The Law of Emergency medical services, 1995

teaching staff of technical school don't have the certification of paramedic, this curriculum proposal is possible to be a desk-using plan.

In the criteria of candidate of EMT certification exam, EMT-P's candidates are required to be the graduates of Emergency Rescue Technical College, medical personnel approved by the medical law, person who got a paramedic certification in other country or EMT-B who has career of emergency rescue for 3 years and over at least.

4) logistics and equipment

The plan of civil defense disaster coping in Seoul(1997) includes the list and amount of equipment to use such as helicopter, rescue tool from fire and water, restoration of scene and urgent drugs (14 items) and blood. In Sampung accident, medical supplies and services weren't got there and scene treatment wasn't performed. Rescue equipment was short and wasn't supplied properly. The current plan includes the organizations to supply for logistics and equipment but it doesn't describe how to get mutual aid when and what.

5) Transportation

In emergency, transportation is an essential part for life support. Shin(1994) estimated the number of ambulance and personnel of transportation in Seoul. He had assumed 1) emergent patients are 3.5% of total population per year 2) one ambulance is able to transport 10 person per day 3) 3 EMT distribute one ambulance, shift every 12 hour (or 8 hour), 10% of personnel is always participated in training. The results were that the maximum number of ambulances was 110, numbers of personnel were from 776 persons to 1,125 persons. Therefore, number of ambulances was not short (table III -9), and that of personnel was not, either. But the problems were communication system

between ambulance and hospital, and not-qualified EMS personnel. Acting personnel of transportation at the 129 and hospital are usually trained 2 weeks first aids training program which is performed in Korean Red Cross. In 119 fire rescue and transportation team, they have been trained for 320 hours since 1995.

In Sampung Accident, 1,283 ambulances were mobilized and 1,380 casualties were transported through these cars. The ambulances weren't utilized efficiently, and similar situations present at many other scenes (Shin, 1994). Converging ambulances at the same time interrupted the scene and traffic rather than transporting the patients efficiently. Current plan doesn't include the guide of the ambulance operation at disaster.

Table III-9 Number of ambulances by facilities

Area	Emergency Medical Center		119 Fire Office	129 Private Rescue Team
	3 rd EMC	2 nd EMC		
	Whole country	196	248	406
Seoul City	122		75	43

Source: Source: Ministry of health and Welfare, Yearbook of Health and welfare statistics, 1996

(6) communication and information system

Table III-10 shows a communication system at Sampung Collapse. Seoul had 14 circuits of wire system but they couldn't operate them because of excessive calling at the same time. At that time Seoul didn't have cordless system. But other those systems also couldn't communicate each other, because they had different frequency of networking. Korea has no communication system between the hospitals and ambulance to hospitals. They can't give a direct medical direction during transportation.

Table III-10 Status of possession of communication system by facilities at Sampung Collapsing

Method	Seoul City	Fire Office	Police Office	Military	comparison
Wire System	14 Circuit	5 Circuit (General :3 Hot-line : 2)	5 Circuit (General :1 Hot-line : 4)	14 Circuit (General :3 Hot-line : 11)	Can communicate each other but it can't work at event because of excessive calling at the same time
FM Networking	-	-	-	P-77 : 1 network	No Common frequency : can communicate with in each organization
Cordless Network System	-	SA-H55 :1network	MPA: 1network PCS: 2network	GLS3420 1network Sub 6 network	
Hand phone	14	-	-	-	

Source: Source: Kim Sekung(1995): Review of The Event of Sampung Collapsing in medical side, Modified

7) transferring between facilities

In Korea, even the situation is emergent, patients usually choose the hospital to go. In Sampung Accident, they had not been triaged; therefore, non-emergent and delayed cases were concentrated to the 3rd level hospital near the scene(table III-11). As soon as they arrived in hospital the patients are triaged and got first aid treatment and transferred to other hospitals. Except this catastrophic casualties incidents people don't change from 1st visiting hospital to the lower level one, and personnel who provide health care shouldn't usually regulate this phenomena.

8) Coordinated record keeping

In emergency room there are various records keeping systems, which are lack of accuracy, adequacy and comparability of records. One of

the main reasons of that fact is they don't have the standardized record format; therefore, it is impossible to exchange the information between hospitals. At Sampung event, because a lot of minor patients' records were not left, the hospital had difficulties to get reimbursement of giving care from insurance company. They don't still have transferable recording system between hospitals.

3. Comprehensive Evaluation

Korea don't complete planning system through regular evaluation.

In the evaluation of disaster preparedness, Boer(1997) made an attempt to calculate the disaster preparedness in the chain of medical care. These assessment areas were medical rescue capacity, medical transportation capacity

Table III-11 transfer facility by triage at Sampung Event

Class by Triage	No. of casualty	Hospital of 1 st arrived			Hospital of treatment continuously		
		3 rd	2 nd	1 st	3 rd	2 nd	1 st
Urgent	72	47	23	2	37	31	4
Emergent	109	72	32	5	42	60	7
Non-emergent	296	156	112	28	60	192	44
Delayed	458	244	214	-	-*	-*	-*

Source : Kim Sekung (1995): Review of The Event of Sampung Collapsing in medical side, Modified

-* : Discharged after minor wound treatment

and hospital treatment capacity. In these chain of medical care, evaluation of the aspects of preparedness of personnel and material, and coping process is performed. Although this methodology for the assessment proved to be incomplete, analyzing the disaster preparedness by using the score system can identify not only a level of preparedness score but also the weak points in the chain of medical care.

Table III-12 is the score estimation of medical disaster preparedness after Samping event. In medical rescue, doctors and nurses are not available at scene; materials are available but these aren't used for drills regular and upgrading; preparedness plan are available but these are not drilled and revised. The medical transportation has a similar capacity as the scene coping capacity. In Korea, personnel and materials in hospital treatment are satisfied to the criteria relatively, but hospitals' disaster plans are not prepared and drilled at all. Korea got the score 15.3 which is almost a third of total expected score 45. At the emergency scene response, plan of preparation and drill and revising are major weakness in Korean disaster preparedness.

According to the results of disaster coping evaluation by system model in Korea, disaster

preparedness plan doesn't consider the prevention program for public health based on the feedback of previous evaluation. After Samping event, Korea makes the Disaster Management Law, but they are not improved in preparedness plan in term of activation. Because they depend on civil defense model, and they don't weight the preparedness of community to maintain the chain of life saving.

IV. Discussion

1. Definition and conceptual model

A disaster can be defined broadly as a disruption of the human ecology that exceeds the capability of the community to function normally(Lillibridge, 1993). Definitions proposed and adopted not only reflect the professional background of the definer, but also the context of work, studies or research with which the definer is involved. By definition medical disaster occurs when an incident produces so many number of casualties that the routine methods for patient care not adequate. Therefore, the primary objective of disaster planning is to insure efficient utilization of local health resources so that they will not be

Table III-12 Gross estimation of the medical disaster preparedness Range of total: 1-15

Criteria for medical care	Medical rescue capacity		Medical transport capacity		Hospital treatment capacity	
Personnel(1-5)	Docto	1	Doctor	2	Doctor	4
	Nurse	1	Nurse	1	Nurse	4
	Paramedic	3	Paramedic	3	Paramedic	1
	Subtotal	5/3	Subtotal	6/3	Subtotal	9/3
Material(1-5)	Ventilation	3	Ventilation	3	Ventilation	4
	Circulation	3	Circulation	3	Circulation	4
	Other material	3	Other material	3	Other material	4
	Subtotal	9/3	Subtotal	9/10	Subtotal	12/3
Method (1-5)	Attack plans	3	Ambulance assistance	2	Disaster procedures	1
	Triage	3	Patient distribution	1	Triage	2
	Treatment protocols	1	Patient monitoring	1	Simplification standardization	2
	Subtotal	5/3	Subtotal	4/3	Subtotal	5/3
Total (1-15)	19/3=3.3		19/3=3.3		26/3=8.7	

overwhelmed during the initial disaster relief period when emergency medical care and first aid are needed for casualties(American hospital association, 1973). But according to size of incidents, Heide(1989) divided it three types such as medical emergency (5 to 15 casualties), major medical emergency(16 to 50 casualties), and medical disaster(more than 50 casualties). This definition is more specified three levels by PEMS (1999), there are MCI (multiple casualty incidents), MCD (mass casualty disasters), and CCD (catastrophic casualty disasters). Considering the number of casualties related with the existing resources of community which are able to use in coping, MCI can cope with the community resources while MCD or CCD can get rid through cooperation with state or federal level.

Sampung collapse was a definite CCD. Korea had a civil defense office which intervened all man-made disasters. They usually have drilled the civil defense from war disaster. But man-made disasters except war present various features according to causative agent. Therefore, the organization, which has not any specific skill for disaster coping such as rescue or life saving, doesn't command the disaster scene entirely.

Disaster preparedness aims to strength the capacity of the health system as a whole to provide essential services in case of emergencies resulting from natural and man-made disasters (Poncelet, 1996). The management of many emergency response and public safety agencies is usually patterned on the military model. This reflects the belief that the most effective emergency operations are carried out under rigid control exercised from a single commander. Indeed, such centralized intra-organizational authority structure may be entirely appropriate and effective in the dependent daily, routine operations of these organizations(Heide, 1989).

In disaster, local and regional EMS (emergency medical services) systems would respond first. The armed forces should help, at least for transport and security. The civil defense plan might be suitable for definitive care of stabilized war victim transferred in large numbers from abroad, and designed mobilize rapid support for local emergency medical services system from regional, state, and national resources. But it does not fulfill basic requirements for lifesaving after mass disasters that strike without warning. It does not provide life supporting first aid by uninjured bystanders, the crucial first link, nor is it flexible enough to bring ATLS to the disaster scene within a few hours(Pretto, 1991). In Sampung event, Korea had centralized command system and disaster plan according to civil defense model. But they didn't delegate and coordinate roles to the main charged offices immediately; therefore, they couldn't operate the command system efficiently and manage the scene medical clinic. It does not initiate rapidly enough the life support chain the disaster scene via transportation to the most appropriate hospitals.

2. Disaster management system and planning

The provision of services for a large disaster is organized through a hierarchical system (Dow, 1991). ICS (Incident Command System) is a set of personnel, policies, procedures, facilities, and equipment, integrated into a common organizational structure designed to improve emergency response operations of all types and complexities(Heide, 1989). ICS organization is built around five major functions that are applied on any incident. There are incident command, operations, logistics, planning and finance and administration(ICS, 1994).

Emergency Medical Services system is coordinated disaster planning. A local disaster

therefore may be managed under the disaster policy of a particular city or county. Such local emergency management agencies generally coordinate the planning and distribution of the resources at their disposal; these may be under either local government or private ownership. The state health and medical plans for disasters rely heavily on networking these local plans together, and tend not to own many resources themselves(Dow, 1991). In Korea, disaster management structure system is relatively well organized in terms of hierarchy. But its' activation through mutual aid isn't easy because disaster plan doesn't have operational guideline and isn't drilled together with related authorities and community. The various independent emergency responding organizations need to be coordinated based on negotiation and corporation. In disaster plan, description of strategies of their joint decision-making is needed. Planning is supported of command and operations, and designed to provide resource and situation status information about the incident. In pre-event stage, EMS system prepare the education for lay person or paramedical personnel, logistics in order to rescue or transportation, designated trauma hospital and team, and disaster response plan (Edmund, 1991). But people show frequently apathy because disasters are low probability events. Therefore to get a motivation is one of the most difficult aspects of the planning and preparedness process(Heide, 1989).

Planning should be practical, inexpensive, realistic, and applicable. One of the greatest importances to disaster preparedness is the tendency to believe that it can be accomplished merely by the completion of a written plan. A written plan can be an illusion of preparedness if the other requirements are neglected. It is based on valid assumption about human behavior, incorporates an inter-organizational

perspective, is tied to resources, and is known accepted by the participants(Heide, 1989). In Seoul City plan, the suggested purposes were not fitted the disaster situation. Even though health and medical services at scene are continuing process, it wasn't described how to operate the related resources. In disaster planning, inter-organizational coordination is one of the major disaster problems. In Korea, plan was usually made the charged public officer without consultation of the experienced field commander or profession, or community representatives. A system perspective in disaster preparedness requires inter-organizational planning. Planning must take into account all of the organization and persons involved in the response, even the unexpected one. Disaster plans must be familiar to those who will use them, and accepted by them as legitimate and appropriate ones(Heide, 1989).

In contents, Seoul City disaster plan described the ambulance service would be supported by the hospital or health center in affected or adjacent district. And it included that the paramedic should be dispatched for rescue and transport the patient, be supported drugs and equipment. But it didn't describe the fill-up system of equipment and drug, and the role and relationship of the related agencies or Institutes. It need to be supplemented about the contents of the scene treatment, emergency room monitoring, the allocation of medical personnel (EM physicians, nurses) to the scene, assessment of health and medical needs, health surveillance, mental health, and public health information.

3. Disaster management process

In Sampung event, Korea had made mistakes in absence of proper organization on of a staff prepared to act in accordance with a pre

arranged plan, rescue operations were not efficiently directed, coordinated, and controlled. They led to confusion, delays, and duplication of efforts, difficulty the speedy mobilization of all available resources. Disaster management process is not separate to the EMS system. EMS system should make a harmonious coordination of community resources such as transportation, communication, hospital, and physician services (Cayten, Evans, 1983). First of all Korea had problems that the EMS components were not arranged and developed. In addition disasters differ from routine emergencies is that they frequently create non-routine tasks. They also create tasks for which no organization has clear-cut responsibility. These tasks include situation analysis, multi-organizational resource management, inter-agency communications, logistical support, search and rescue, triage and casualty distribution, casualty lists, issuance of passes, hazardous material treatment, and handling of the dead(Heide, 1989).

In disaster circumstances in which the local system is undetermined, the alternatives would be to immediately evacuate those needing further care, particularly the critically ill and injured, to distant sites that have receiving facilities, establish a field hospital in vicinity of the incident or implement both options. The incidence of extricating live survivors begins to off dramatically following the initial 24 hours. In the rescue literature, this phenomenon has been called the golden 24-hour period analogous in concept and urgency to the golden hours in trauma management(Barbera, 1991). Early care of the injured begins in the prehospital setting and life saving trauma and disaster management involves a strong chain of care. Bystanders with a basic knowledge of proper first aid and hazard recognition; a well-integrated first responder program; a rapid response transport service; and specialized receiving facilities capable of

immediately managing victims of acute injury in their emergency centers, operating rooms, intensive care units, and later rehabilitation units(Pepe, 1991). In urban MCI management, as much as, follow day-to-day routines. That is, avoid using special mode of operation during a major incident. Quickly establish a centralized, easy-to-quick identify incident command post and an easy-to-identify incident commander (Pepe, 1989).

1) Communication and information sharing

Disasters create the need for coordination among organizations. This requires inter-agency communication network utilizing compatible radio frequencies. A number of observations in disasters have revealed a lack of per-impact communications among local disaster response organizations. Inter agency communication can be facilitated by the availability of inter-agency radio networks, but some of the most difficult problems are people rather than equipment issues. One of the most important ways in which disaster response organization members can get to know and trust each other and become familiar with the function of other organizations is during joint planning and training activities(Heide, 1989). And the other technical problems are inter-agency communications frequency sharing agreements, the development of radio caches, two-way use of scanners and one activated receivers(Heide, 1989; American hospital association, 1973). In current time, computer is not only useful storing and analyzing disaster information but also for sharing it.

Because normally daily telephone traffic at disaster, in necessary, unlisted number and hot-line telephone should be utilized for the bulk of communication because hospitals rely on telephone to contact their medical personnel (American hospital association, 1973).

In communication and information system, Korea has difficulties to cope with emergent situation efficiently because they had dual access phone number such as 119 and 129 at emergency. And they couldn't establish emergency information system because they had diverse networking systems between organizations, and hospital communication systems were not settled yet. This lead not able to treat by on-line medical direction during transport even at normal emergency situation.

Disaster is characterized by great uncertainty. Initial actions are undertaken based on vague and inaccurate information. In disaster, the most crucial types of information that need to be shared are those related to an on going assessment. Information sharing is required inter-organizational teamwork. Multi-agency sharing information about the present, predicted extent and location of disaster damage, secondary threats, vulnerable populations, and structure, activities, transportation route, and response activities generates the need for standardized maps and mapping grid systems. The provision of standardized maps and familiarity with standardized way of describing locations on the maps are essential components of disaster communication(Heide, 1989). In Sampung event, Korean headquarter of rescue didn't obtain the blue print of building and they proceeded the activity by rule of thumb. While the rescue proceeded at the basement the activities of taking away steel beams and blocks of concrete also went on over the ground. It was very dangerous for rescuers. And they didn't distribute the essential equipment to rescuers on time, and confirm the list of casualties.

2) Transportation

One transportation problem not easily solved is traffic congestion, particularly in the early stages when emergency vehicles are converging

on the disaster site(American hospital association, 1973). In Sampung event, although all personnel in charge of citizens' safety and EMS had assembled at the scene but they had not controlled traffic around the scene. Besides over one hundred cars of going out the scene obstructed the passage of ambulance. Ambulances should be required have two-way radio communications with the medical dispatching center and local hospitals in order to operate in the situation. Every ambulances and hospital should be on the same radio frequency. Like as Korea, if they have not communication network, they have to abide by the medical protocol. Written prescribed medical procedures, adopted by the regional EMS councils after consultation with the regional EMS medical advisory committee and approval by the Department. Review of medical protocols by the regional councils shall be made on an annual basis with notification to the Department of changes (Pennsylvania, 1998). But there are two medical directions 119 and 129, they don't have the conforming process by the committee and these directions don't correspond with the EMT curriculum.

Ideally transfer of disaster victims will occur through an organized regional disaster plan that includes specialized transport mechanism. Unfortunately regional plans are not in place universally. Critical care practitioners therefore should acquaint themselves with local capabilities, transport options, and potential referral mechanisms before a crisis forces hasty action(Pepe, 1991). In addition transferring between facilities doesn't go sooth, because every patients want to be treated at 3rd level ER and information for distribution of patients doesn't share through communication channel between hospitals. And they don't have any specific criteria of transferring between hospitals and transferable record system. Private

hospitals avoid treating the emergent patients who don't ability to pay and take a long time to reimbursement in case of the occupation and automobile.

3) Scene response

Scene response refers to the efforts conducted at disaster scene in terms of supplying treatment to people who suddenly become patients as results of disaster (American hospital association, 1973). Disaster medical system are three key elements: rapid medical response- medical assistance at the disaster site; patient evacuation-movement of patients from the disaster site to medical care; and definitive medical care- the provision of acute in patient care(Moritsugu, 1986). The rapid responding medical personnel will potentially have to manage large members of casualties. Disaster triage systems such as START (Simple Triage and Rapid Transport) or other methods may be necessary and mass casualty medical care may be indicated(Barbera, 1991). The injured patients representing in critical condition is not the only concern of rescue personnel and scoop and run rapid evacuation is not always the appropriate priority(Pepe, 1991). In Korea, they didn't make a scene clinic. Medical care unit at scene is a command post to coordinate emergency medical care activities, to assess promptly the disaster's magnitude, to select the zone to be used for first use classification and identification (triage & tagging), to administer first aid to the wounded and to establish the line of communication with regional hospitals(WHO, 1983). Over six thousands people joined the rescue but they were lay community people. At the scene, there were no emergency physicians and nurses for first 2 days which is the duration saved the 92% of live victims. Patients were not triaged and stabilized. They

transported to the near hospital without distribution plan and they made a second disaster area in the hospital. In initial phase, triage and evaluate all patients to the usual receiving facilities. Therefore, triage officers should transport the critically ill and injured to the usual trauma center if that is the routine, even if the number of victims appears to be large. Often they can adapt to such load(Pepe, 1989). But basic concept of triage at scene is to do the greatest good for the greatest number of casualties. At the same time triage implies making the most efficient use of available resources. There are a number of different approaches to disaster casualty distribution. Which approach is most practical may be depend on the size of community, the number of area hospitals, and the difference in capabilities of these institutions(Heide, 1989). The hospital pooling system may be advantageous to predetermine a method for equitably distributing the initial disaster casualties, like as using the first-wave protocol(Heide, 1989). In disaster plan may include procedures for polling each hospital to obtain information about its staffing, number of empty beds, operating room availability and other resources.

4) Resource management

Procedures for ongoing need assessment, information sharing and coordination with agencies are a prerequisite to efficient resource management in disasters. Much of the emphasis of disaster planning in many communities has traditionally been on the mobilization and reinforcement of resources. But more recently it has been recognized that uncontrolled mobilization and over-response are common problems in disaster. In a study of 29 major disaster, only 10-15% of the casualties were injured seriously enough to require overnight admission to the hospital; only 6% of the hospitals

suffered supply shortages, and only 2% had personnel shortages(Heide, 1989). The lack of a mechanism for outsiders to find out whether or not their assistance is needed may contribute to over-response in disasters. Organizations making use of volunteers cannot always count on the required task being completed, or if completed, it is uncertain with what efficiency, speed, or quality the task will be carried out. The volunteers play a significant role in decreasing the toll of death and destruction caused by disasters. But volunteers are not always familiar with the standard terms or routes used in communications. They don't know who to ask for what, or under what conditions to support difficulties(Heide, 1989). The same situation was made at Sampung event. At initial stage many volunteers attended the rescue activity. Even though they had no signal as a rescuer, they saved over 70% of the live casualties. But they should have been withdraw from the scene after the public professional rescue team was established. They did still not abide by the headquarters' command anyway.

5) Hospital plan

In city plan, hospitals should be classified into three groups such as major medical center', emergency care hospital', and first-aid centers' by handling patients with acute injuries. Each hospital would decide on its own whether to institute its disaster plan(American hospital association, 1973). The need to organize a regionalized medical care network for disaster situation. It is important to designate the charged hospital by treatment level and region such as the highest hospital center, regional based hospital, satellite medical care unit, specific care center, special medical care center and primary care center(WHO, 1983).

In disaster time, hospitals and health care centers activated their emergency plans, and

mobilized their resources for on site medical care. They will send out either medical teams or rescue teams trained in first aid(WHO, 1983). Each hospital should prepare a disaster management plan based on its own operational capacity. The operational capacity of a hospital or health center may cover a range of services from first aid and immediate emergency care and subsequent transfer to definitive treatment. The disaster plan should be developed in conjunction with other community emergency facilities for hospital outreach. The planning should be consultation and review with the local civil authorities and with other medical institutions on establishing an effective command for appropriate action in the area(WHO, 1983).

In Korea, the local private clinic should get the permission from the health center to open and close. They can make a referral system within district when disaster occurs, but they didn't have any plan to mobilize the hospital.

In hospital's disaster plan should be the appointment of a disaster committee, which will coordinate and supervise disaster drills and will review the hospital's master plan. This committee also should be responsible for coordinating the hospital master plan with the over all community plan. The hospital committee must work with local and state government authorities to make emergency operating arrangement should provide assistance to the city disaster coordinator and to all groups and agencies involved in disaster planning. Among the groups with which it must interact are state or local civil defense agencies, local government officer, local police and fire departments, the American National Red Cross, other hospitals, and industrial, medical and nursing staffs. The Standard of joint commission on Accreditation of hospitals require every hospital to have a disaster preparedness plan developed in conjunction of community's other hospitals and

appropriate agencies. It is the responsibility of the hospital to find out what its role in that plan is(AHA, 1972). Two ways in which the hospital disaster plan may be integrated with community plans are through individual coordination with all other agencies and through interaction with a centralized agency having control over all activities. Although the latter method seems to be the most efficient to effective, the size and resources of the community dictate the type of planning and organization chosen. The key to performing all vital task in hospital planning, comprehensive planning, in written form, coupled with frequent exercises and drills under simulated disaster conditions and a concomitant critique and updating of emergency plan (American hospital association, 1973).

Hospital plans are tested regularly as required for accreditation, but seldom under disaster conditions. In the situation, hospital, which didn't set up the scene clinic, took a main role in disaster medical response. But since almost all hospital had not hospital disaster plan, there were no hospital which had drilled with the related agencies and community in Korea.

6) Community plan

True preparedness of disaster involves the community. Preparedness of health services at local level requires participation of community leaders and general population(Poncelet, 1996; WHO, 1983).

Regional health centers stress primary care, disease prevention and health promotion. But when a disaster hits communities, the demand for health services increase considerably. This means that the health center which is in particular service area have to assume that they are responsible for dealing with the situation. Apathy toward disaster preparedness pervades

governmental bodies as well as the public at large. The main reasons are to low the apathy in public lack of awareness, under estimation of risk, reliance on technology, and fatalism. Public apathy, as well as economic restraints, is reflected in a lack of political support for disaster preparedness. Without federal funding, many government officials have felt that they could only justify the most basic preparedness programs. Sometimes this has been limited to the drawing up of a written disaster plan and assigning the position of disaster coordinator (Heide, 1989). In order to activate this plan it will be necessary to train the health personnel to deal with the situation. And what is most important is to teach and train the community itself, so that at a given time it will join together actively and in an organized the element of support for existing medical and health services. The training contents for community include first aid, rescue of casualties, transportation of injured, mutual aid, census taking, the search for missing, camps for the victims, the organization of brigade, and post disaster rehabilitation activities(WHO, 1983). Resuscitation components should attempt to meet the crucial time limits of reanimatology. At the local level, the means for rapid notification of the event must exist. The lay public should be trained in LSFA (Life Supporting First Aid). Uninjured survivors would administer LSFA. The entire population, including school children, must be can be educated in LLSFA before the event(Pretto, 1991). Korea doesn't have community plan and education program of disaster preparedness. Community education program for first or lay person should be established. At disaster, community did not activate the plan according to description of law; they had no preparedness plan for lay person because community people did not participate in making a plan, so they

had no idea of coping with disaster. Although there were sporadic education programs, these were usually not announced to community people. Even though they join in the education program, they can't do it properly because programs are usually consisted of lecture session not practice of skill. Adequate preparedness requires planning with the media. The propensity for the media to share information and to assume the command post' perspective fatalities the establishment of a central source of disaster information(Heide, 1989).

4. Disaster evaluation

Assessing the level of preparedness in the health sector is based on coordination, planning, training and research, and resources and logistics(Poncelet, 1996). In order to revise current disaster plan and protocol, it needs to evaluate the relief effort over the first 48-72 hours with specific emphasis on. Areas of evaluations are as follows: Detection and extrication team function, Medical resuscitation team function: Interaction between detection/extrication teams and medical resuscitation teams: Available of detection/extrication equipment and medical supplies: Availability of medical evacuation: Overall relief effort organization: and Ensuing injury and death patterns(Ricci, 1991; Villarreal, 1997).

The analysis of coping procedure after disaster identifies the similar problems such as lack of a common organization, poor on-scene and inter-agency communication, inadequate joint planning, lack of valid and timely intelligence, inadequate resource management, limited prediction capability(Heide, 1989). Post-disaster critiques turn out to be defenses or justification of what was done, rather than objective assessments of problems and mistakes. Valuable lessons may be missed because of the

basis held for one's own community or organization(Heide, 1989). As the result the local medical society and the civil authorities involve reorganized the serious deficiencies in the ability to handle a disaster situation. This provides for an avenue of communication between the medical profession and civil authorities. After that time, the civil authorities involved are planning to obtain the necessary equipment to tie them into the system, installation of two way radio equipment was installed all of the area hospitals for use in disaster(American hospital association, 1973).

After Sampung, Korea made an evaluation report. It was also a descriptive report rather than a suggestion of practical alternatives. The important missing point of this evaluation report were disregarded the community preparedness plan involved community people, necessity of community education, linkage between hospital and community, establishment of hospital disaster plan and drill with related agencies. Therefore, the new Seoul plan also lacks the mechanism of activation of plan. The plan can not transcend the desk plan syndrome. If similar event like as Sampung collapse occurred, they would be doubt to make any change in operating the disaster plan.

V. Conclusion & suggestion

After Sampung event, Korea made the Disaster Management Law and gave efforts to arrange the structure and equipment of EMS system. But they didn't consider the tasks, which may be taken a long time, of development strategy of activation of preparedness plan and drill, education according to emergency medical service model. Because they depend on civil defense model, they don't consider the preparedness of community based on maintain the chain of life saving. From now on, Korea

should make a disaster preparedness system by emergency medical model and practical plan to take action. In hospitals' the evaluation of disaster preparedness, personnel and materials in hospital treatment are satisfied to the criteria relatively, but disaster plans weren't prepared and drilled at all. The Internal or external disaster preparedness plan in hospital should be made and drilled with the related agencies. And hospital disaster committee should include the representatives of community and the rescue and preventive agencies' officers. For emergency scene response, preparedness plan and drill should be activated and personnel training should be reinforced.

In Korea, disaster preparedness plan should be considered as the prevention program for public health based on the feedback of previous evaluation.

VI. Reference

- Seoul city (1995, 1996, 1997, 1998). Casebook of disaster.
- Seoul city (1996). Description of Sampung collapse.
- Chosun Daily Newspaper (1995). June 29 July 30.
- The Korean Press Institute. Web-site.
- Ministry of Legislation (1995). Disaster Management Law.
- Comprehensive information about Law. Web-site.
- Ministry of Legislation (1998). Principal Law of Civil Defense and Fire.
- Korea Research Institute Health and Social affairs (1996). The management of Mass casualty Incidents and political issues. research report 96-13.
- Korea Institute of Health Services Management (1997). Evaluation report of EMS system.
- Seoul City (1997, 1998). Civil Defense plan.
- Seoul City (1998). 98 disaster management plan.
- Kim Sekung (1995). Review of The Event of Sampung Collapsing in medical side. Journal of Korean Medical Association, 39(2), 169-192..
- Korean Red Cross (1998). Annual evaluation report, unpublished.
- Ministry of health and Welfare (1996). Yearbook of Health and welfare statistics.
- Ministry of health and Welfare (1995). The Law of Emergency medical services.
- Cayten, C., Gene, Evans, J. William (1983). EMS systems Evaluation, Systems approach to Emergency Medical Care. Appleton-Century-Crofts.
- WHO (1983). Health service organization in the event of disaster. Scientific publication No. 443.
- AHA (1972). Emergency services, The hospital emergency department in an emergency care system.
- Pennsylvania EMS Department (1998). EMS manual, Title 28 Health and safety.
- Boer Jan (1997). Criteria for the assessment of disaster preparedness-II. Prehospital and Disaster medicine, 13-16.
- Insook Lee, Eun Kyeong Oh, Joong Eui Rhee, Yeo Kyu Youn (1999). Study for the Efficient Operation System in the Emergency Department of University Hospital, Korean Emergency Medicine.
- Insook Lee (1998). Evaluation of Emergency Room Triage Performed by nurse, The Seoul Journal of Nursing, 12(1), 32-52.
- Shin Youngsoo, Kim Yongik, Kim Changhup (1994). A Study for establishment of EMS system. Community health care system demonstration team, Seoul National University
- American Hospital Association (1973). Readings in disaster preparedness for hospital.
- Pennsylvania emergency medical services (1999).

Catastrophic casualty disaster management plan.

Heide Erik (1989). *Disaster response, principles of preparation and coordination*, Mosby.

FEMA (1984). *Federal emergency management agency : objectives for local emergency management*, Washington, DC.

ICS U.S. (1994). *Coast guard office of response*, ICS intermediate student guide.

Lillibridge Scott, Noji Eric, Burkle Fredrick (1993). *Disaster assessment: The emergency health evaluation of a population affected by a disaster*. Annals of emergency medicine, 22(11), 1715-1720.

Ricci Edmund, Pretto Ernesto (1991). *Assessment of perhospital and hospital response in disaster*. Critical care clinics, 7(2), 471-485.

Pepe Paul, Kvetan Vladimir (1991). *Field management and critical care in mass disasters*. Critical care clinics, 7(2), 401-420.

Barbera Joseph, Cadoux Claude (1991). *Search, rescue and evacuation*. Critical care clinics 7(2), 321-337.

Dow Alasdair, Clark William, Farmer Christopher, Nolan Jerry, Baskett Peter (1991). *Organizations and academic perspective*. Critical care clinics, 7(2), 257-270.

Moritsugu Kenneth (1986). *The National disaster medical system: A concept in large-scale emergency medical care*. Annals of Emergency Medicine, 15(2), 169-171.

Al-Madhari A., Keller A. (1997). *Review of disaster definitions*. Prehospital and disaster medicine, 12(1), 17-21.

Ricci Edmund, Pretto Ernesto, Safar Peter (1991). *Disaster Reanimatology potentials: As structured interview study in Armenia*. Prehospital and disaster medicine, 6(2), 159-166.

Pretto Ernesto, Safar Peter (1991). *National medical response to mass disaster in United States*. JAMA, 266(9), 1259-1262.

Poncelet Jean, Goyet Clade (1996). *Disaster preparedness: Institutional capacity building in Armenia*. World Health Statistics Quarterly, 49(3-4), 1333-1337.

Mallonee Sue, Shriat Sheryll, Stennies Gail, Waxweiler Rick, Hogan david, Jordan Fred (1996). *physical injuries and fatalities resulting from the Oklahoma City bombing*. JAMA, 276(5), 382-387.

Villarreal Marcus (1997). *Quality management tools for mass casualty emergency responses and disasters*. Prehospital and disaster medicine, 12(3), 200-209.

Pepe Paul, Stewart Ronald (1989). *Ten golden rules for urban multiple casualty incident management*. Prehospital and disaster medicine, 4(2), 131-133.

- 국문초록 -

주요개념 : 재난관리, 응급의료체계평가, 지역사회중심 프로그램

우리나라 사고예방과 재난관리 모형 개발을 위한 연구

이 인 숙*

우리나라의 경우 지역사회 재난 관리계획과 훈련이 보건의료적 모형이라기 보다는 민방위 모형에 입각하기 때문에 사고 현장에서의 환자 중증도 분류, 합리적 환자 배분 및 이송, 병원 응급실에서의 대처 등이 체계적으로 이루어지지 못하고 있으며, 지역사회가 이에 즉각적으로 반응할 수 없다. 본 연구는 삼풍 붕괴사고 시에 대응방식과 그 후의 우리나라 응급의료 체계를 분석함으로써 대형사고 예방과 재난관리를 위한 우리나라 응급의료체계의 개선방안과 간호교육에서의 준비부분을 제시하고자

* 서울대학교 간호대학

한다.

1. 삼풍 사고 발생시에는 이를 관장할 만한 법적 근거인 인위적 재해에 관한 재난관리법이 없었다. 따라서 현장에서는 의학적 명령체계를 확보하지 못했기 때문에 현장에서의 응급 처치는 전혀 이루어지지 못하였다. 현장에서의 중증도 분류, 응급조치와 의뢰, 병원과 현장본부 그리고 구급차간의 통신 체계 두절, 환자 운송 중 의료 지시를 받을 수 있도록 인력, 장비, 통신 체계가 준비되지 못하였던 점이 주요한 문제였다. 또한 병원 응급실에서는 재난 계획이 없거나 있었다더라도 이를 활성화하여 병원의 운영 체계를 변환해가지 못하였다.

2. 삼풍 백화점 붕괴사고 한달 후에는 인위적 재해에 대한 재난관리법이 제정되고, 행정부 수준별로 매년 지역요구에 합당한 재난관리 계획을 세우도록 법으로 규정하였다. 재난 관리법에는 보건의료 측면에서의 현장대응, 주민 참여, 응급의료적 대처, 정보의 배분, 교육/훈련 등이 포함되어 있어야 한다. 그러나 법적 기반이 마련된 이후에도 한국 재난 계획 내에는 응급의료 측면의 대응 영역은 부처간 역할의 명시가 미흡하며, 현장에서의 응급 대응과정을 수행할 수 있는 운영 지침이 없이 명목상 언급으로 그치고 있기 때문에 계획을 활성화시켜 지역사회에서 운영하기는 어렵다. 즉 이 내용 속에는 사고의 확인 /공고, 응급 사고 지령, 요구 평가, 사상자의 중증도 분류와 안정화, 사상자 수집, 현장 처치, 생명보존과 내과 외과적 응급처치가 수반된 이송, 사고 후 정신적 스트레스 관리, 사고의 총괄적 평가 부분에 대한 인력간 부처간 역할과 업무가 분명히 제시되어 있지 못하여, 사고발생시 가장 중요한 연계적 업무 처리나 부문간 협조를 하기 어렵다. 의료 기관과 응급실/ 중환자실, 시민 안전을 책임지고 있는 기관들과의 상호 협력의 연계는 부족하다. 즉 현재의 재난 대비 계획 속에는 부처별 분명한 업무 분장, 재난 상황에 따른 시나리오적 대비 계획과 이를 훈련할 틀을 확보하고 있지 못하다.

3. 지방 정부 수준의 재난 계획서에는 재난 발생시 보건의료에 관한 사항 전반을 공공 보건소가 핵심적 역할을 하며 재난 관리에 대처해야 된다고 규정하고 있다. 그러므로 보건소는 지역사회 중심의 재난 관리 계획을 구성하고 이를 운영하며, 재난 현장에서의 응급 치료 대응 과정은 구조/ 구명을 책임지고 있는 공공기관인 소방서와 지역의 응급의료병원에게 위임한다. 즉 지역사회

재난 관리 계획이 보건소 주도하에 관내 병원과 관련기관(소방서, 경찰서)이 협동하여 만들고 업무를 명확히 분담하여 연계방안을 만든다. 이는 재난관리 대처에 성공여부를 결정하는 주요 요인이다.

4. 대한 적십자사의 지역사회 주민에 대한 교육 프로그램은 연중 열리고 있다. 그러나 대부분의 교육주제는 건강증진 영역이며, 응급의료 관리는 전체 교육시간의 8%를 차지하며, 이중 재난 준비를 위한 주민 교육 프로그램은 없다. 또한 특정 연령층이 모여있는 학교의 경우도 정규 보건교육 시간이 없기 때문에 생명구조나 응급 처치를 체계적으로 배우고 연습할 기회가 없으면서 국민의 재난 준비의 기반확대가 되고 있지 못하다.

5. 병원은 재난 관리 위원회를 구성하여 병원의 진료 권역 내에 있는 여러 자원을 감안한 포괄적인 재난관리 계획을 세우고, 지역사회를 포함한 훈련을 해야 한다. 그러나 현재 병원은 명목상의 재난 관리 계획을 갖고 있을 뿐이다.

6. 재난관리 준비도를 평가할 때 병원응급실 치료 팀의 인력과 장비 등은 비교적 기준을 충족시키고 있었으나 병원의 재난 관리 계획은 전혀 훈련되고 있지 못하였다. 그러므로 우리나라 재난 관리의 준비를 위해서는 현장의 응급의료체계, 재난 대응 계획, 이의 훈련을 통한 주민교육이 선행되어야만 개선될 수 있다. 즉 민방위 훈련 모델이 아닌 응급의료 서비스 모델에 입각한 장기적 노력과 재원의 투입이 필요하며, 지역사회를 중심으로 대응 준비와 이의 활성화 전략 개발, 훈련과 연습, 교육에 노력을 부여해야 한다.

7. 현장의 1차 응급처치자에 대해서는 법적으로 명시하고 있는 역할이 없다. 한국에서는 응급구조사 1급과 2급에 대한 교육과 규정을 1995년 이후 응급의료에 관한 법률에서 정하고 있다. 이 교육과정은 미국이 정하고 있는 응급구조사 과정 기준과 유사하지만 실습실이나 현장에서의 실습시간이 절대적으로 부족하다. 덧붙여 승인된 응급구조사 교육 기관의 강사는 강사로서의 자격기준을 충족할 뿐 아니라 실습강사는 대체적으로 1주일의 1/2은 응급 구조차를 탑승하여 현장 활동을 끊임없이 하고 있으며, 실습은 시나리오 유형으로 진행된다. 그러므로 우리나라의 경우 응급 구조사가 현장 기술 인력으로 역

할 수 있도록 교과과정 내에서 실습을 강화 시켜야하며, 졸업생은 인턴십을 통한 현장 능력을 배양시키는 것이 필요하다.

8. 간호사의 경우 응급전문간호사의 자격을 부여받게 됨에 따라, 이를 위한 표준 교육 지침을 개발함으로써

병원 전 처치와 재난시 대응할 수 있는 역량을 보완해야 한다. 또한 현 자격 부여 프로그램 내용을 고려하여 정규자격 간호사가 현장 1차 치료자(first responder)로 역할 할 수 있도록 간호학 교과과정을 부분 보완해야 한다.