

Emergency Medical Service Reference Model for Low Impact and High Frequent Disaster in Indonesia

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Abstract: Located in archipelago and intersection of 3 tectonic plates, Indonesia susceptible to the low impact and high frequency types of disaster such as flood, fire, landslides etc. These disaster types unexpectedly create more economic losses and disturb stability of social and economic order since less preparation and lack of reference model. One of the important humanitarian aid of catastrophic event like disaster is healthcare distribution system. This study aims to find out an appropriate emergency medical service (EMS) model for developing country like Indonesia considering nature of low impact and high frequency disaster. The EMS has two famous reference model: Anglo American and Franco German with the difference in the flow of medical doctor, ambulance, medical equipment, and the use of medicine. We conduct a deductive assessment of those two reference model and create recommendation of suitable EMS model for developing countries like Indonesia. The disaster's stakeholder such as National Board of Disaster Countermeasure (BNPb), Indonesian Red Cross (PMI), hospital and any other organizations involved in health care aids services can take benefit of our recommendation.

1 INTRODUCTION

As the world has been witnessing an improvement of life quality, the importance of emergency medical service for emergency, disaster, and catastrophic conditions is getting more recognition nowadays. Disasters, both natural and manmade disasters, have high dependency on emergency medical services. Therefore, humanitarian logistics covering logistics aid for vulnerable people, in which disaster healthcare is included (Tomasini and Wasenhove, 2009; Kovacs and Spens, 2007), also had been gaining considerable attention.

As a result, there has been needs for emergency medical service as well as humanitarian aid logistics for events of disaster. While humanitarian logistics could partly rely on social and volunteer activities, emergency medical service fully rely on the involvement of local government or the municipals. Therefore, building reliable emergency medical service to response immediate disaster is a

must for the citizen, rather than rely on the one operated by volunteers.

Being an archipelago, between two oceans, on intersection of three tectonic plates, and lying right on equator, makes Indonesia vulnerable to disasters. Java Island as the most inhabited island in Indonesia, bear the risk of both natural and manmade disasters, especially the small scaled ones.

This research aims to develop emergency medical service for disasters in Indonesia considering currently exist response system for disaster mitigation. As reference model, we will refer to the two previously mentioned basic model of emergency medical service.

2 LITERATURE REVIEW

A supply chain is essentially a network consisting of suppliers, manufacturers, distributors, retailers and customers that manage material flows, information flows and financial flows (Wassenhove, 2005). The

difference between supply chain in business context and supply chain in disaster will face uncertainty, like when, where, what, how much, where from and how many times to procure and distribute to disaster area.

2.1 Humanitarian Supply Chain

Humanitarian supply chains provide the response to disasters. The definition of humanitarian supply chain is derived from the definition of basic supply chain, “a set of approaches utilized to efficiently integrate suppliers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time; in order to minimize system wide costs while satisfying service level requirements”. This concept can be used in the humanitarian supply chain when applied in the disaster relief and excluding the term “customer” or “store” (Yadav and Barve, 2015). Thomas and Kopczak (2005) from The Fritz Institute define there are seven activities include in the humanitarian supply chain, such as preparation, planning, procurement, transportation, storage, tracking and custom clearance. Supply chain in humanitarian needs to be flexible and able to respond quickly to unpredictable events effectively (between life and death) and efficiently (treating great number of victims) under heavy budget constraints (Heasilp et al, 2010; Costa et al, 2012).

Humanitarian supply chain consist of more than just humanitarian organization. The list goes to donors, aid agencies, NGOs, governments, the military, logistic service providers and suppliers as the main actors in HSC. (Sahebi et al, 2016).

2.2 Humanitarian Aid Logistic

Logistics is an important factor in humanitarian aid operations, to the extent that logistics effort account for 80 percent of disaster relief (Trunick, 2005; Kovacs and Spens, 2007). Delivering humanitarian aid needs to be in rapid response to serve the disaster victims and minimizing the impacts.

Logistic operations in humanitarians is the processes and systems involved in mobilizing people, resources, skills and knowledge to help vulnerable people affected by disaster (Wassenhove, 2006). Humanitarian logistics is an umbrella term for a mixed array of operations (Kovacs and Spens, 2007). The Fritz Institute (2004) defined humanitarian logistic as “tasks, all the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials as well as information, from the point of origin to the

point of consumption for the purpose of meeting the beneficiary’s requirements and alleviate the suffering of vulnerable people (Vitoriano et al, 2013)

The purpose of humanitarian aid logistic to aid people in their survival. There are two main streams of humanitarian logistics that can be distinguished named as continuous aid work and disaster relief. While the focus of disaster relief operations is to design the transportation of first aid material, food, equipment and rescue personnel from supply points to a larger number of destination nodes geographically scattered over the disaster region and the evacuation transfer of people affected by the disaster to the health care centers safely and very rapidly (Barbarosoglu et al, 2002; Kovacs and Spens, 2007).

Humanitarian aid logistic focus on delivering rescue team and goods. In disaster relief, the most needed goods by disaster victims such as water, medicine, chlorination tablets, tents, blankets and protein biscuits for malnourished children (Dignan, 2005; Kovacs and Spens, 2007). The procurement process of humanitarian aid including healthcare is separated into three phases according to disaster life cycle, preparedness, response and recovery.

Vaillancourt (2011) mentioned the first phase is planning the emergencies and prepare the relevant materials for different types of needs into kits. The phase continue to deliver the goods to the people in need, the second phase. This phase can be somewhat challenging due to infrastructure and unpredictable demand. In the response phase might focus on different needs and thus there exists a multitude of kits such as medical, educational, water and sanitation and household. The last phase is aim to enables the postponement of inventory allocations to specific countries (Scholten et al, 2010).

To reduce the great number of victims, the Emergency Medical Service (EMS) is employ during the second phase of disaster, in the response phase. EMS can be defined as “a comprehensive system which provides the arrangements of personnel, facilities and equipment for the effective, coordinated and timely delivery of health and safety services to victims of sudden illness or injury. (Al-Shaqsi, 2010). EMS is really helpful and beneficial during the disaster because it is an integral part of any effective and functional health care system that serve medical and trauma emergencies utilizing advanced clinical technology. However, previous literature does not discuss on the suitability assessment of using EMS model as well as the applicability of EMS in Indonesian context.

3 REFERENCE MODEL

The methodology used in this study is exploratory analysis employing qualitative and literature review to generate reference model in providing Emergency Medical Service during disaster. There are two well-known model implemented in Emergency Medical Services system, called as the Franco-German model and the Anglo-American model. The Franco-German model of EMS delivery is based on the “stay and stabilize” philosophy (Huiyi, 2007). In the Franco-German model, physicians and technology are sent to the scene in the hope of providing a higher level of emergency care before the patient’s arrival at the hospital (Arnold, 1998). Figure 2 illustrates medical service process of Franco-German model.

On the other hand, the Anglo-American model is based around “scoop and run” philosophy (Dick, 2003). Here, patients are brought to hospital-based emergency departments so that they may be provided a higher level of care (Arnold, 1998). Figure 3 illustrates medical service process of Anglo-American model.

Arnold (1998) argued that most countries develops new emergency care systems in recent years following the Anglo-American model, as exemplified by emergency medicine in the United States. However, there is no comparative multinational studies exist to demonstrate the superiority of one model over the other. Critics have noted several problems with the Franco-German model: Physicians are not well trained, not well supervised, and not subject to the same quality-assurance controls as physicians in Anglo-American systems (Arnold, 1998).

This study focuses on the former two terminology of emergency medical services model, Franco-German model and Anglo-American model as their applicability in developing countries like Indonesia. Indonesian Ministry of Health had showed the list of medicine in the condition of medical post during disaster whether within or without physician in the team through Regulation of

Indonesian Ministry of Health No. 059 Year 2011.

The proposed model of healthcare aid supply chain during disaster in consideration of Emergency Medical Services as the supporting part on the supply chain can be seen in Figure 1.

Beside the model that provide the application of Emergency Medical Services in healthcare aid supply chain during disaster there also several aspects should be considered to maintain better performance in the

supply chain. Those several aspects is described in Figure 2 and can be seen in the following points:

- Demand management;
- Distribution model; and
- Coordination.

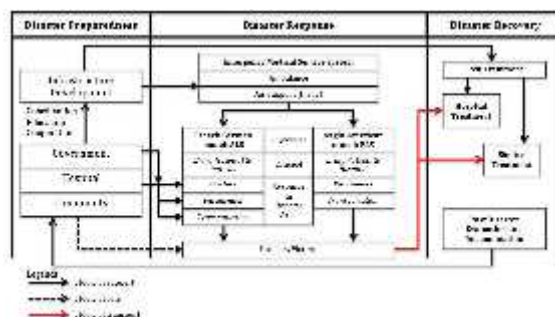


Figure 1: The model of healthcare aid supply chain.

Based on disaster life cycle in which EMS become main role in disaster response.

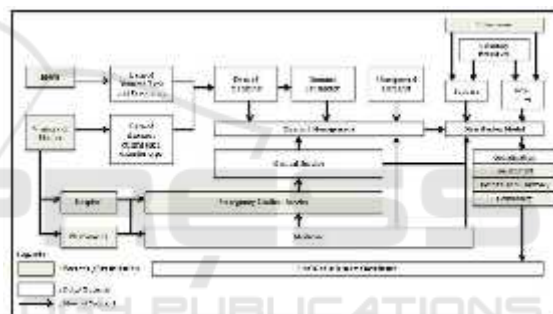


Figure 2: Aspects, participating parts, and material/data.

Flow of healthcare aid supply chain in Indonesia. BNPB is acronym for National Board of Disaster Countermeasure which responsible to manage disaster resilience and developed by Indonesian Government.

3.1 Demand Management

This aspect will be focused on how the supply chain fulfill the demand of healthcare services during disaster. There will be a rapid increasing on demand with limited supply of medicine, medical staff, physician, and medical equipment’s. This aspects will be affected by several consideration such as:

- Disaster type and frequency
- Disaster impact (risk and hazard)
- Disaster to diseases mapping
- Demand estimation

3.2 Distribution Model

This aspect will be focused on how the healthcare aid collected and disseminated to patients from disaster. It will be started from funding, sourcing, making or producing, up to delivering.

- Funding means the activity will be about the financial support to provide health care aid during disaster.
- Sourcing means the activity will be about the vendor selection (i.e. hospital, pharmacies) to provide medicine and medical staff to help patients from disaster.
- Make means the production processes of medical service operation
- Deliver means that the transportation or mobilization processes of medicine and medical services.

3.3 Coordination

This aspect will be focused on how the participating parts on health care aid supply chain coordinated to perform better medical services to patients from disaster. There are several considerations such as:

- Actors included hospital, pharmacies, medical staff, government, community, and other parts involved in disaster resilience especially in providing health care aid.
- Information to support demand estimation for supplying medical services to patients from disaster.
- Infrastructure to support medical services during disaster such as road and supporting part (i.e. fire fighter forces, army forces).
- Funding need coordination to avoid chaotic and corrupted system during disaster.

Indonesian government already maintain the system for management of medicine by published a regulation to overcome all aspects that explained in this study. Management of medicine based on the Regulation of Ministry of Health

Number 059, 2011 as below:

- Requirement planning
- Provision of drugs and medical supplies
- Storage and distribution
- Use and control
- Recording, evaluating, and reporting
- Destruction and disposal

Indonesian government also developed several considerations regarding provision of drugs and medical supplies also based on the Regulation of Ministry of Health Number 059, 2011. The considerations as follow:

- Type of disaster
- Disaster area and the number of affected victims

- Current medical stock

3.4 Human Resource and Transportation

Human resources such as doctors and/or paramedics are needed in disaster responses phase. If the Emergency Medical Service System adopt the French-German model then doctors and paramedics will be needed, otherwise if the Emergency Medical Service System adopt the Anglo-American model then only paramedics will be needed as main human resources. In the transportation, ambulance will help the doctors and/or paramedics to mobilize from and/or to disaster area. In the several developed countries, air support will provided by helicopter as another transportation mode. In Figure 1 and 2 can be concluded that in French-German model there is possibility the number of doctors can be larger and the number of transportation mode can be smaller, meanwhile in Anglo-American model there is possibility the number of doctors can be smaller and the number of transportation mode can be larger.

3.5 Medicine and Medical Equipment

The information explained in the regulation is the list of medicine supplies needed during disaster. The regulation distinguish the list into two type such as: list of medicine supplies for medical post without physician or doctor and list of medicine supplies for medical post with physician or doctor. There are two possibilities why the regulation distinguish the list into two terms. First, there is possibility that the regulation already recognized both model in Emergency Medical Service system. Second, there is also possibility that the regulation realize that there is some lack of physician in several medical post or clinic in rural area. The regulation itself noted that the information was adopted from a book entitled New Emergency Health KITs published by WHO.

3.6 Assessment of Reference Model

There are three phases in current healthcare distribution system during disaster in Indonesia. Firstly, the pharmaceutical and medical support distribution phase from national buffer stock during disaster. In this stage, all distribution will be responsible by Indonesian Directorate General of Pharmaceutical and Medical to support disaster victims. Secondly, the distribution phase from province to district. If the district has buffer stock and receive support from other source, the distribution can be proceed based on request from head of district

public health care office. Thirdly, the distribution process from district to remote hospital, field hospital, Indonesian armed force healthcare facility and private healthcare facility. In this phase, all medicine and medical support distribution will handle by district public health office to the healthcare unit based on the data of victims and disease type.

The paramedic personnel will use stock card form to record and control healthcare inventory during emergency response. All healthcare inventory received, usage and latest stock should report daily, weekly and monthly. This report process will be evaluate during disaster response phase.

4 CONCLUSIONS

Through limited resources of doctors and ambulance or transportation modes, EMS will provide medical services for low impact disaster such as fire and flood effectively. The problem is there are no specific model had been used of EMS in Indonesia. There are two contrary model had been known by worldwide, French-German model with the concept of 'bring the hospital to the patient' and Anglo-American model with the concept of 'bring the patient to the hospital'. This study provide the necessary information about both of the model and contextualized to Indonesian disaster management problems through healthcare aid supply chain mapping. There is some aspects should be considered to adopt the model in the future. There are: (1) demand management; (2) distribution model; and (3) coordination. By providing this model, further research can be conducted by starting considering to mapped cost effectiveness of the EMS model implemented in Indonesia with consideration of transportation cost, medicine price (this study already provide the list of medicine needed with its prices), and infrastructure condition in Indonesia. In another perspectives, different research also can be conducted to mapping the needs of preparing the model to be implemented in Indonesia.

REFERENCES

- Al-Shaqsi, S., 2010. Models of international emergency medical service (EMS) systems. *Oman medical journal*, 25(4), 320.
- Healslip, G., Mangan, J., Lalwani, C. 2010. *Modeling a Humanitarian Supply Chain Using the Structured Analysis and Design Technique (SADT)*. University of Hull Logistics Institute. UK.
- Kölsch, F., Fricke, K., Mahler, C., Damanhuri, E., 2005. *Stability of landfills – The Bandung disaster*. In: Proceedings of the 10th International Landfill Symposium, Cagliari, Italy.
- Kovacs, G., Spens, K.M., 2007. Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution and Logistics Management* 37 (2) 99 – 114.
- Sahebi, I.G., Arab, A., Moghadam, R.S., 2016. Analyzing the barriers to humanitarian supply chain management: A case study of the Tehran Red Crescent Societies. *International Journal of Disaster Risk Reduction*.
- Scholten, K., Pamela Sharkey Scott, Brian Fynes. 2010. "(Le)agility in humanitarian aid (NGO) supply chains." *International Journal of Physical Distribution and Logistics Management* 40 (8/9): 623-635.
- Stout, J., Pepe, P. E., Mosesso, V. N. 2000. A LI-Advanced Life Support Vs Tiered-Response Ambulance Systems. *Prehospital Emergency Care*, 4(1), 1-6.
- Thomas, A.S., Kopczak, L.R. 2005. *From Logistics to Supply Chain Management: The Path Forward in the Humanitarian Sector*. Fritz Institute.
- Vaillancourt, A. 2016. Kit management in humanitarian supply chains. *International Journal of Disaster Risk Reduction*.
- Vitoriano et al. 2013. *Decision Aid Models for Disaster Management and Emergencies*, Atlantis Computational Intelligence Systems 7, Atlantis Press.
- Wassehove, L.N. V. 2005. Humanitarian Aid Logistics: supply chain management in high gear. *Journal of the Operational Research Society* 57, 475-489.
- Yadav, D.K., Barve, A. 2014. Analysis of critical success factors of humanitarian supply chain: an application of interpretive structural modelling. *International Journal of Disaster Risk Reduction* 12, 213 - 225