Healthcare Supply Chain Framework for Optimization Process: Literature Review and Some Issues

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Abstract

At present, conditions throughout the world require good health services, coronavirus attacks make this relevant for further research. Good health services need support from good supply chain management. Performance in the supply chain can be operated well if a framework for the supply chain structure is available. The heathcare supply chain management system will be different when the context and environment are different from normal conditions. In the case of the Covid-19 pandemic the community needs a fast response from hospital services. The speed of the number of patients increases exponentially. This will affect the performance of the manufacturing supply chain where human resources will be reduced exponentially. The limited number of hospitals that are referred to patient care is limited, increasing the complexity of the problems faced by the healthcare supply chain. The challenge that must be resolved is how the available resources are optimized to achieve their main objectives. For the stages of answering this challenge, an appropriate framework is needed. Based on the literature review and interviews with parties involved in the healthcare supply chain, a framework was developed to manage the healthcare supply chain. The main components of the proposed framework include: the objective function, performance indicators, constraints, risk, and players.

Keywords: Supply chain, healthcare, framework, optimization

1. Introduction

Covid-19 virus attacks almost all over the world including in Indonesia. The rapid spread of Covid-19 and its impact on death rates requires a response in the form of good health service resilience and rapid response. The number of referral hospitals assigned to treat Covid-19 patients is limited. This has an impact on the capacity to treat patients to be limited. Facilities needed by hospitals to treat Covid-19 patients are the availability of doctors, nurses, beds, medicines, and personal protective equipment. The usage cycle of personal protective equipment required by doctors and nurses has a short time. This causes the number of personal protective equipment needed to increase following the time needed to treat patients who need approximately 14 days. Hand sanitizer products have increased demand because they are needed by doctors, nurses, and the community to reduce the spread of the Covid-19 virus. This condition illustrates the problems faced by the current health service supply chain. On the other hand, the need for medicines, personal protective equipment (masks, gloves, protective clothing) and hand sanitizers are produced by the manufacturing supply chain. The supply of labor in these two types of supply chains also requires attention. In the health supply chain the supply of doctors and nurses requires an adequate ratio with the number of patients who need treatment. The risk of doctors and nurses experiencing the impact of being victims of the Covid-19 virus will cause disruption of the ideal ratio of the number of doctors and nurses in a health service supply chain. Whereas in the manufacturing supply chain, the number of employees needed to produce the product can be disrupted inadequate due to being a victim of the Covid-19 virus. Another disturbance that occurs in the manufacturing supply chain is the process of distribution of raw materials to finished products due to the location-based lockdown policy from the government. The time needed to distribute the

product is longer than the normal time. This condition will provide a longer response time for supply and demand. Based on this description, the problems faced by health service supply chains and manufacturing supply chains are becoming increasingly complex. This case is a special case where the health service supply chain needs a fast response from the manufacturing supply chain. This study provides a proposed framework that can be used to manage the health service supply chain so that it is able to carry out optimization based on the structure and operational processes required.

2. Method

The methodological steps used in this research are conducting literature studies related to the concepts of supply chain healthcare and supply chain manufacturing. The interview process was carried out to get a picture of the problems faced by the healthcare supply chain during the corona pandemic. The data obtained is then analysed to compile an appropriate framework for managing the health supply chain in the case of a corona pandemic. This research is a preliminary research to develop a healthcare supply chain management model.

2.1. Literatur review

The basic differences between the two types of supply chains are: manufacturing supply chain priorities are source management, production, and distribution in partnership with suppliers and distributors [1]. On the other hand, the healthcare supply chain focuses on providing professional services by ensuring patients get the services they need [2]. The supply chain in health services is not only related to the integration and coordination of the planning process, but is also associated with the term "market development" and offering new "care products" [3]. Service quality in general is difficult to understand in terms of quality compared to goods [4]. In supply chain management in the health sector, the supply chain is more complex compared to other industries, because it impacts on human health which requires adequate and accurate medical supplies according to the needs of patients [5]. In the manufacturing supply chain and supply chain in health services have in common, namely the demand management, customer relationship management, and supplier relationship management [2]. The dominant relationships contained in the healthcare supply chain are relationships: doctor-patient, doctor-pharmacist, pharmacist-patient, pharmacist-vendor, hospital-doctor, and hospital-patient. The relationship between doctors and pharmacists in health services must have positive trust so that the service runs well [6]. The importance of information in hospitals such as VFS (visibility for sensing), VFL (visibility for learning), and VFI (visibility for integrating) with vendors impacts collaboration in the healthcare supply chain to run smoothly [7]. The cause of disruption of the supply chain in the health service is the workload of doctors who on average are disturbed 3.66 times per hour due to interruptions from peers, telephone interruptions from nurses [8]. In supply chain operations in health services, there are problems; like the pharmacist's mistake in using his own perception because the pharmacist cannot clearly read the prescription from a doctor [9]. The doctor's prescription must be analysed regularly and any changes must be monitored [10]. Also related to the efficiency of collectively in drugs [11]. Under certain conditions, drug stocks is managed not optimal under the limit of storage space [12] and management of health care support devices such as patient beds has also not been managed optimally [13]. Health services provide a variety of products and services ranging from the provision of medicines, doctors, treatments, to health information services [14]. Facilities owned by hospitals and their utilities to serve patients affect the structure of hospital costs, so optimization is needed related to the efficient use of facility resources [13]. Code standardization on medicines, operational re-engineering and implementing information technology are promising performance indicators for the advancement of healthcare

supply chain [15]. Managing the material and distribution process will improve the health supply chain performance [16, 17]. Hospital supply chain performance can be improved by paying attention to inventory control, procurement processes, and information sharing [18]. Risks that can occur in hospital operations can be mitigated by using outsourcing, spare capacity, and using local suppliers [19]. Risks in the supply chain can be reduced by collaborating in the supply chain starting from planning to sharing information [20,21,22]. The tracking system in managing patients plays an important role in minimizing risks in the healthcare supply chain [23]. Hospital supply chain visibility includes the extent to which hospital supply chain entities have relevant information to support patient care operations [24]. Supply chain resilience is generally influenced by inventory management, visibility, and decision plans used [25].

2.2. Analysis

The complexity of the problems faced by the healthcare supply chain during the Covid-19 pandemic are as follows: The speed of the number of patients requiring hospital care increases exponentially. These patients come from the community who contribute to the manufacturing supply chain performance that produces products needed by the community and healthcare supply chain to treat patients. Patients will get treatment at the hospital. This treatment will require a certain period of time. When the patient has recovered, this person will contribute back to the manufacturing supply chain. In the case of the Covid-19 pandemic in Indonesia, there was a scarcity of personal protective products and hand sanitizers as supporting facilities. Both of these products become the main products needed by physicians to treat patients. The usage cycle of these two products is short, so this product must be provided in large quantities. On the supply side, these two products face obstacles, because the production capacity of the manufacturing supply chain is insufficient for the needs of the healthcare supply chain and the needs of the community to cut off the spread of Covid-19. The relation of entities in these two types of supply chains can be described in Figure 1.
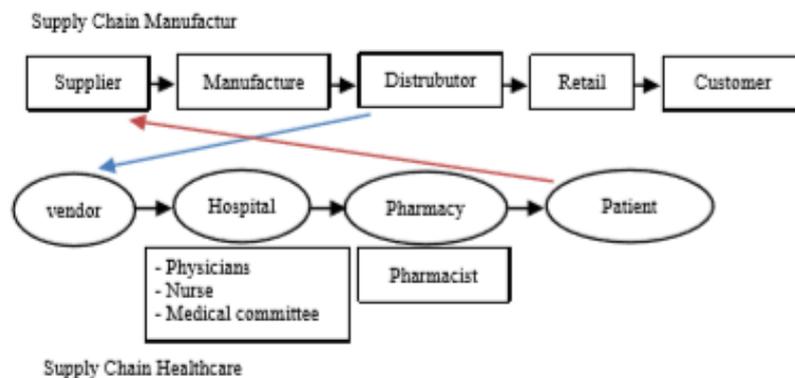
Figure 1. Relationship between healthcare supply chain and manufacturing supply chain.

The framework used to manage healthcare supply chain is based on the following information. In the context of problems and environments that affect the corona pendemi situation, the performance indicators used to solve this problem are (a) the ability of the hospital to serve patients to recover and (b) the capacity to accommodate the number of patients. The supply chain healthcare constraints to achieving this performance are: (a) reliability of physicians and nurses, (b) pharmacist reliability, (c) number of bed facilities and support facilities for patient care including personal protective equipment. The objective function to be achieved is the number of patients who need treatment can be well served. The identification of entities at risk is as follows: (a) Physicians and nurses

run the risk of being unable to service due to exposure to Covid-19, (b) Pharmacists run the risk of not getting a supply of drugs.

The proposed framework is how to manage the healthcare supply chain so that the expected function of the number of patients who need treatment can be well served.
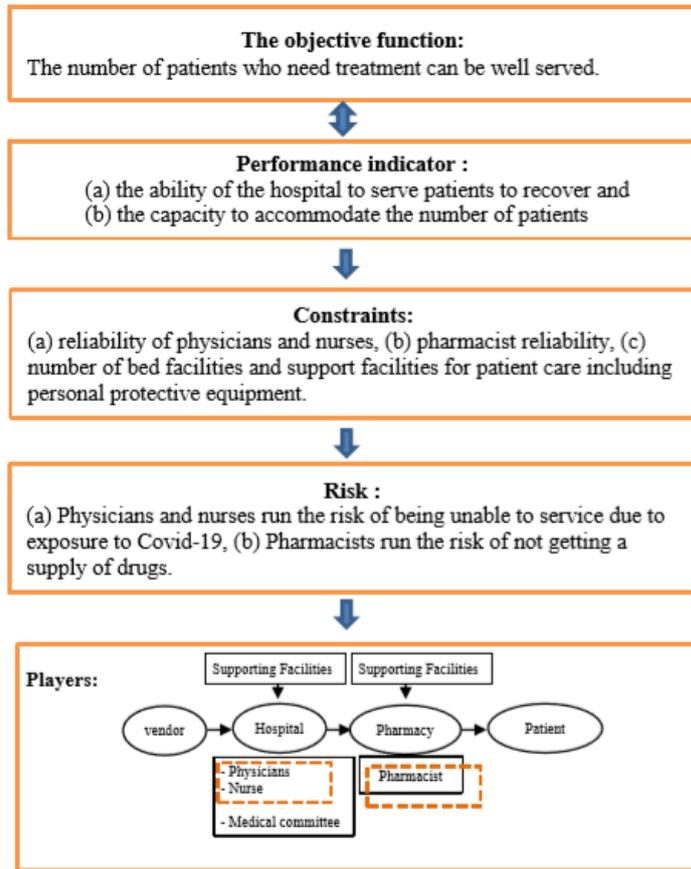

Figure 2. Framework to manage the healthcare supply chain

3. Discussion and Conclusion

Based on the literature review related to the concepts and structure of healthcare supply chain along with fundamental differences with manufacturing supply chains, it is obtained that dominant entities play a role in healthcare supply chain performance. The entity is a vendor whose role is to supply medicine and support facilities needed by doctors and nurses to treat patients. The hospital as an entity that carries out the process of caring for patients to recover. This process involves doctors and nurses with the support of adequate facilities. Pharmacy provides all medicines that are recommended by doctors to patients. The final entity of the healthcare supply chain is patients who need care. The factors proposed to improve the performance of healthcare supply chain are process management, procurement of facilities, and efforts to eliminate risk.

The management of healthcare supply chains becomes different when special cases occur, such as the Covid-19 pandemic case. Therefore this paper proposes a framework for managing healthcare supply chains in special cases. The main objective needs to be set to direct the system performance to achieve the desired state. The desired condition is the number of patients who need treatment get good service. The system must be able to measure its performance, so that the appropriate performance indicators to realize the main objectives must be identified. Based on the literature review and interview the

appropriate performance indicators are: (a) the ability of the hospital to serve patients to recover and (b) the capacity to accommodate the number of patients.

In the real case that occurred in Indonesia, the number of hospitals that were referred to as covid-19 patient care was very limited. So that the healthcare supply chain is limited in terms of the number of doctors, nurses, and supporting facilities. Constraints that occur in this supply chain are: (a) reliability of physicians and nurses, (b) pharmacist reliability, (c) number of bed facilities and support facilities for patient care including personal protective equipment. Besides the constraints, the supply chain in carrying out its activities has risks. The biggest risk that dominantly influences the achievement of performance indicators is the condition of doctors, nurses, and the supply of drugs needed. This risk factor is an important concern that must be managed properly. Management needs to be planned well for all entities / players involved in this healthcare supply chain. A complete description of this framework can be seen in Figure 2. The results of this framework are the results of preliminary studies that are the beginning of future research to complete the model of healthcare supply chain system optimization with special pandemic cases.

Acknowledgement

4. References

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