

Hospital Logistics Activities

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Abstract

Hospital logistics is viewed as a vital part of a hospital that is in charge of purchasing, receiving, stock management, etc. It accounts up to 46 % of hospital budget, which is considered as a very substantial proportion, especially in the context of budgetary restrictions applied to all organizations including hospitals. The literature contains different definitions of hospital logistics as well as its activities, which vary depending on authors and studies. This paper tries to meet the need to clarify the logistics filed within health care institutions, and covers essentially its activities, their organization and management.

Firstly, we aim to determine logistics manifestations within hospitals and to identify exhaustively its activities. Secondly, we will focus on the organization and management of these activities in order to point out the department or service that handles them, through a comparison between various countries including France, Quebec, the United States and Morocco. The methodology followed is a literature review based on the analysis of more than 60 papers, mostly published between 2000 and 2017. The selected articles cover some topics related to hospital logistics, and deal with the activities and the responsibilities of the logistics department. Due to the diversity of hospital logistics activities, we observe that different departments are involved in their management and some of them are outsourced.

Key words

Hospital logistics, logistics activities, logistics management, organization of hospital logistics.

Introduction

Hospitals around the world are challenged by the increased pressure in terms of reducing costs and better manage their activities, while continuing to meet the needs of an increasingly demanding population. As a significant proportion of hospital cost is devoted to logistics activities, which can account for up to 46% of the hospital budget (Chow and Heaver, 1994; Bourgeon, Constantin and Karolszyk, 2001), hospital logistics can be a key driver for leveraging cost savings (Kidd, 2002; Acton, 2000), and an efficient way to improve hospitals' services (Landry and Philippe, 2004).

The literature in hospital logistics raises a wide range of activities which do not represent the core mission of hospitals, but they are necessary to provide health care to patients and take part into the definition of the service level. The aim of this article is to provide a global view of hospital logistics activities and their management

within healthcare institutions. First, because there is no single definition of hospital logistics, we will give a short overview of the most common definitions used in research studies. Then we will try, through a literature review, to list the activities in hospitals that are considered as being logistics activities. Finally, we will shed light on how these activities are organized and managed, through some case studies carried out in different countries.

Methodology

The research approach is based on the analysis of scientific articles and thesis, which have addressed and dealt with logistics aspects in the healthcare sector. Book chapters, dissertations and conference articles were excluded from this synthesis. We mainly used electronic databases such as ScienceDirect, Eruudit, Taylor & Francis, Cairn, Google Scholar, etc. for relevant keywords including expressions such as *hospital logistics*, *logistics activities*, *logistics management*, *hospital*, etc. in both French and English languages. A focus is set on publications from the year 2000 until 2017. However, some papers published earlier are included and retained for the importance of their content. In total, more than 60 papers were selected, covering logistics or management in hospitals. The selected papers dealt with topics related to hospital logistics, and somehow identified activities that are in its scope, including in:

- The definitions given to hospital logistics,
- The description and identification of activities related to hospital logistics,
- Case studies showing the activities and responsibilities of the logistics department,
- The treatment of a particular issue related to hospital logistics and proposals for improvements.

The objective is not to identify as many articles as possible, nor to make a review of the latest advances in hospital logistics, but rather to delimit the field of hospital logistics and to determine the extent of its scope.

What is hospital logistics?

Logistics has initially emerged in the military sector, then rapidly developed in the industry to finally integrate the service sector (Colin, 2015). Similarly, logistics is strongly present in the health sector. The literature reviews of Narayana *et al.*, (2014) and Volland *et al.*, (2017) highlighted the extent of studies carried out on logistics in this area. However, the examination of these studies reveals that an immense variety of definitions exists for hospital logistics. For some authors, it is a set of support activities, whereas others see it as a flow management technique.

According to Landry and Beaulieu (2002), hospital logistics is a set of design, planning and execution activities which enable the purchase, inventory management and replenishment of goods and services surrounding the provision of medical services to patients. The French Association of Supply Chain and Logistics (ASLOG) states that, hospital logistics involves the management of patient, product and material flows and the related information to ensure quality and safety at a defined level of performance and efficiency from provider to patient (the client of the care process) and, as appropriate, to the final recipient, slightly upstream of the patient in order to allow specialists to serve the patient. For Ducasse (1995), hospital logistics covers at least three meanings:

- The traditional activities in hospitals that aim to the management (purchasing, production, procurement, storage, distribution, etc.) of the material flows necessary for the production of care (medicines, medical and hotel supplies, meals, linen, waste, etc.)
- An engineering that aims to the use of flow modeling techniques to spotlight the hospital organizational choices or to implement physical distribution technologies in the hospital context.
- A managerial approach aiming, from the processes and flows (patient flow, physical flows, information flows), to redesign the medical products and the hospital organization, taking into account the expectations of the environment.

Costin (2010) argues that the main mission of hospital logistics is to provide the different actors of the hospital with the material means to operate. Its role is essential in the care process. It provides care units with the processing and synchronization of physical and informational flows, as well as the optimal means, in order to provide patient care at the lowest cost. Hospital logistics, according to Sampieri-Teissier (2002), is divided into two categories: 1) Traditional logistics, which focuses on the management of raw materials used directly or indirectly for the production of the service. 2) The logistics of services, which is the management of patient flows by acting on the demand and capacities, it aims to arbitrate between patient wait times and optimization of capacities.

This brief summary of definitions shows that hospital logistics is a complex domain of the health service system (Böhme *et al.*, 2013; Rivard-Royer and Beaulieu, 2003; Beaulieu and Landry, 2002), considering the large number of flows (physical flow, information flow and financial flow) as well as the different activities involved to ensure the provision of care to the patient.

Hospital logistics activities

Over the decades, the logistics function in healthcare institutions has evolved from a purely hotel role to the enlargement of its scope of responsibility through numerous and varied activities (Rivard-Royer and Beaulieu, 2004). Depending on authors and studies, logistics in healthcare facilities takes various forms and the range of its activities is not clearly limited. Costin (2010) states that, the field of hospital logistics is different from one health facility to another, it depends on its size, capabilities, activities and internal culture.

For Pokharel (2005), logistics activities involve planning, designing, implementing and managing material flows in a supply chain to support functions such as procurement, distribution, inventory management and packaging. Aptel and Pourjalali (2001) suggest that logistics activities in hospitals include purchase, receiving, stock management, information system management, food service, transport and home care services. Other authors have tried to classify logistics activities into categories, grouping them into blocks of activities. In this sense, Chow and Heaver (1994) have distinguished three major activities: 1) Procurement: includes purchasing and inventory management of various products. 2) Production: manages the various activities, such as laundry, kitchen, sterilization, etc. 3) Distribution: ensures the delivery of various products from the storage areas to the various points of use, or the transport of waste to shipping areas. This categorization of activities was completed by Beaulieu *et al.*, (2014), with transport activities, which include the transportation of materials (mails, samples, etc.), and persons (staff or patients) within health facilities or between the sites of a hospital center (figure 1).

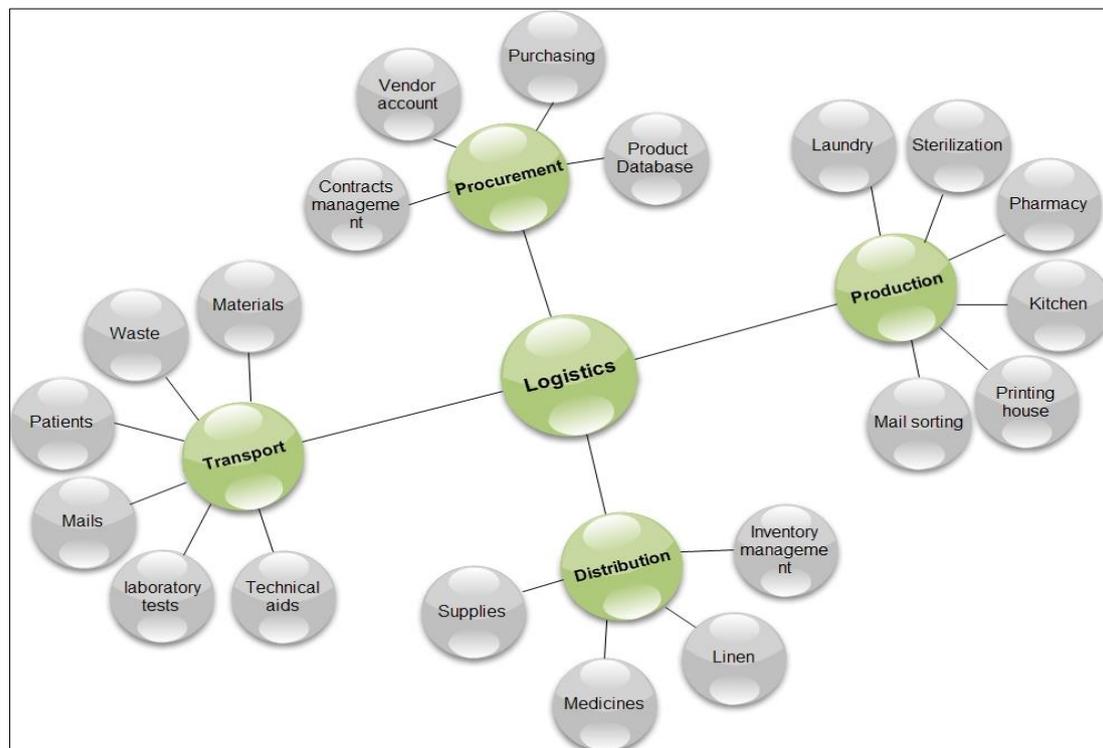


Figure 1. Hospital logistics dimensions

Source: Chow and Heaver (1994), adapted by Beaulieu *et al.* (2014)

Similarly, Dembińska-Cyran (2005) identified four major activities of hospital logistics: 1) Inventory management activities such as purchase, receipt and inventory control of stock and supplies. 2) Transport management activities such as transport of patients to and into hospitals, delivery of pharmaceutical and medical products etc. 3) Production activities such as laundry, cafeteria, sterilization, etc. 4) Distribution activities such as delivery and sorting of bulk items into order requests for individual departments.

Swinehart *et al.*, (1995), for their part, have identified five main activities in health facilities, whose implementation involves several types of inputs and outputs in order to provide a variety of products and services to the patient. These activities are: 1) Inbound logistics, includes receiving, storing and disseminating hospital supplies, pharmaceutical and food products. 2) Demand management, includes those activities associated with recognizing, managing and scheduling the use of resources needed to meet the needs. 3) Operations/services, are those activities associated with directing or regulating the movement of the patient

through the treatment cycle. 4) Outbound logistics, are activities associated with the after-hospital care of the patient. This includes follow-up treatments, scheduling of home care, rehabilitation, and social service. 5) Customer relations/patient services, are the non-essential, ancillary activities offered by hospitals. These include volunteer services, candy strippers, social services, gift shop, patient education, etc.

In order to provide an overview of hospital logistics activities, we have drawn up, through the literature review, a list of 27 activities that are included in the area of hospital logistics (table 1). For each activity, several references were documented and classified from the most recent to the oldest.

Table 1. List of hospital logistics activities

	Logistics activities	References
1	Purchasing/ buying	(Zepeda <i>et al.</i> , 2016) - (Beaulieu and Roy, 2015) - (Ben Oumlil and Alvin, 2011) - (Burns and Lee, 2008) - (Dembińska-Cyran, 2005) - (Eaton, 2000)
2	Procurement	(Costin, 2010) - (Haszlinna Mustaffa and Potter, 2009) - (Beaulieu and Patenaude, 2004) - (Rivard-Roye <i>et al.</i> , 2002)
3	Stock management	(Zepeda <i>et al.</i> , 2016) - (Beaulieu and Roy, 2015) - (Bijvank and Vis, 2012) - (De Vries, 2011) - (Little and Coughlan, 2008)
4	Distribution	(Haszlinna Mustaffa and Potter, 2009) - (Dacosta-claro, 2002) - (Marriott <i>et al.</i> , 1998) - (Michelon <i>et al.</i> , 1994) - (Burnette, 1994)
5	Receiving	(Dembińska-Cyran, 2005) - (Rivard-Royer and Beaulieu, 2002) - (Swinehart <i>et al.</i> , 1995) - (Burnette, 1994) - (Aptel and Pourjalali, 2001)
6	Replenishment	(Bruyère <i>et al.</i> , 2014) - (Rivard-Royer and Beaulieu, 2002) - (Beaulieu and Landry, 2002) - (Blouin <i>et al.</i> , 2001) - (Chow and Heaver, 1994)
7	Information system management	(Beaulieu <i>et al.</i> , 2014) - (Pan and Pokharel, 2007) - (Fabbe-Costes and Romeyer, 2004) - (Aptel and Pourjalali, 2001)
8	Transport	(Granlund and Wiktorsson, 2013) - (Dobrzańska <i>et al.</i> , 2013) - (Haszlinna Mustaffa and Potter, 2009) - (Dembińska-Cyran, 2005)
9	Pharmacy	(David <i>et al.</i> , 2017) - (Uthayakumar and Priyan, 2013) - (Kelle <i>et al.</i> , 2012) - (Dacosta-claro, 2002)
10	Patients flow	(Karaa <i>et al.</i> , 2016) - (Kriegel <i>et al.</i> , 2016) - (Villa <i>et al.</i> , 2014) - (Sampieri-Teissier, 2002)
11	Food service/ Catering	(Granlund and Wiktorsson, 2013) - (Kriegel <i>et al.</i> , 2013) - (Costin, 2010) - (Benanteur, 2004) - (Dacosta-claro, 2002)
12	Laundry	(Granlund and Wiktorsson, 2013) - (Kriegel <i>et al.</i> , 2013) - (Costin, 2010) - (Dembińska-Cyran, 2005) - (Benanteur, 2004) - (Dacosta-claro, 2002)
13	Cleaning/ Hygiene	(Costin, 2010) - (Benanteur, 2004) - (Rivard-Royer and Beaulieu, 2002)
14	Sterilization	(Tlahig <i>et al.</i> , 2013) - (Van De Klundert <i>et al.</i> , 2008) - (Reymondon <i>et al.</i> , 2007)
15	Printing	(Chow and Heaver, 1994)
16	Telecommunication/ Telemédecine	(Pan and Pokharel, 2007) - (Aptel and Pourjalali, 2001)
17	Mail service	(Granlund and Wiktorsson, 2013)
18	Planification/scheduling	(Liu <i>et al.</i> , 2017) - (Lapierre and Ruiz, 2007) - (Landry and Beaulieu, 2002)
19	Design	(Beaulieu <i>et al.</i> , 2014) - (Dembińska-Cyran, 2005) - (Landry and Beaulieu, 2002) - (Burnette, 1994)
20	Forecasting	(Liu <i>et al.</i> , 2017) - (Jack and Powers, 2009)
21	Reception service	(Landry and Beaulieu, 2002)
22	Waste management	(Ahlaqqach <i>et al.</i> , 2017) - (Granlund and Wiktorsson, 2013)
23	Home care logistics	(Liu, Xie and Garaix, 2014) - (Liu <i>et al.</i> , 2013) - (Aptel and Pourjalali, 2001) - (Swinehart <i>et al.</i> , 1995)
24	Maintenance	(Costin, 2010) - (Pan and Pokharel, 2007) - (Dembińska-Cyran, 2005) - (Landry and Beaulieu, 2002)
25	Safety and security	(Costin, 2010) - (Landry and Beaulieu, 2002)
26	Construction	(Costin, 2010)
27	Upkeep of green spaces	(Costin, 2010) - (Hassan, 2006)

Organization and management of logistics activities within hospitals

Prior to the 1950s, most hospitals did not have a dedicated materiel management department. Each department handled its own inventory needs. The need to eliminate redundant ordering and personnel expense generated the

emergence of a separate materiel management department, that is primarily created to become a central purchasing/receiving/distribution center, has evolved into a vital support service of health care facilities (Burnette, 1994). However, hospitals despite their similarities, may have different management practices including the management of logistics activities (Sampieri-Teissier, 2002). The responsibilities and the activities of the materiel management department are often different from one hospital to another (Aptel and Pourjalali, 2001), and the term usually used to refer to this department is also different and varies widely across countries (Beaulieu and Landry, 2002).

In this paragraph, we will provide a summary of some case studies carried out in different countries, with the purpose to show how logistics activities are handled, and how logistics departments are called.

In **France**, the logistics department is referred as *direction des services économiques* “economic services directorate” which typically manages all the support activities required for the delivery of healthcare (Landry and Beaulieu, 2002). A survey carried out on 126 French hospitals indicated that only 31% of them have a logistics department (Aptel and Pourjalali, 2001). This survey was updated in 2008 with 55 hospitals and showed, this time, that 82% have a dedicated logistics department, which handle in most cases: linen service, food service, receiving, supplying, purchasing, internal distribution to medical departments and inventory management (Aptel, Pomberg and Pourjalali, 2009). In contrast, Marriott *et al.*, (1998) state that the supply management of health facilities in France is under the responsibility of different departments:

- Pharmaceutical and sterile products are managed by the hospital pharmacy.
- Diagnostic products and reagents are managed by the analytical laboratories or the pharmacy.
- Medical equipment (non-sterile) is managed by the economic services.

Materiel management is the expression used in the **United States** to designate the department responsible for logistics activities within hospitals (Landry and Beaulieu, 2002). The same surveys conducted on French hospitals, were carried out on 75 US hospitals, and revealed that almost all of them have a logistics department. Whose main responsibilities are related to: purchasing, supplying, receiving, inventory control and internal distribution (Aptel and Pourjalali, 2001; Aptel *et al.*, 2009). It was noted that the information system management has started to fall outside the responsibility of the logistics department and to be assigned to other departments or outsourced.

In **Quebec**, the expression *service des approvisionnements* “supply service” is used to refer to the logistics department, which manages some aspects of logistics, including purchasing and the store management (Landry and Beaulieu, 2002; Beaulieu and Landry, 2002). Other authors state that the departments dealing with the supplies replenishment in Quebec are organized into two services. The purchasing service, which manages the contract negotiation specific to the type of care offered by the establishment, places the purchase orders and defines the operational characteristics for the products. The central store service, has responsibility for receiving the merchandise at the docks, controlling the central store inventory, delivering the products to the final users, and, occasionally, managing the local storage units (Dacosta-Claro and Lapierre, 2003).

According to Pan and Pokharel (2007), the logistics department in **Singapore** is referred as *logistics division* or *material management division*. The authors, in their study on a sample of 8 hospitals concerning the responsibilities of the logistics departments, found that:

- The three most common items handled by logistics divisions are medical equipment, stationeries, and office equipment.
- Six hospitals reported that supplies of goods to operating theatres, radiology, wards and laboratories also falls in their purview.
- Some hospitals require their logistics division to handle services such as telecommunications, maintenances and engineering services.
- All material management divisions or logistics divisions have responsibilities in purchasing, receiving, internal distribution, supplier management and inventory management.

These case studies highlight a common point that is the existence of a dedicated department of logistics. However its scope is not always clear, it differs from one country to another and even more between hospitals from the same country. Also, as mentioned, the management of logistics activities in most cases involves other departments besides the logistics department. To enrich and support this conclusion, we will present the case of **Morocco** even if we are convinced that we couldn't provide a whole picture.

To our knowledge and according to other authors, few studies have been carried out on hospital logistics in Morocco (Bouachouch and Mamad, 2014). For this reason, in this paper, references were made to the Moroccan legislation pertaining to hospitals. The decree No 456-11 of 6 July 2010 concerning the internal regulation of hospitals, helps identify 15 activities that could be included in the hospital logistics scope according to table 1, which are managed by various departments (table 2).

The majority of logistics activities are under the responsibility of the *pôle des affaires administratives* “administrative affairs division”, whose mission is the management of human and financial resources, and the management of technical and support services. In particular, it is in charge of:

- supplying and distributing medicines, fungibles, equipment, etc.,

- food service for patients and staff, as well as cleaning and safety of buildings,
- hospital waste management,
- establishing and implementing a maintenance plan of medical equipment, technical facilities, buildings and fleet,
- Information management.

The *service d'accueil et d'admission* "reception and admission service" is responsible for various activities such as reception and directing patients, organizing patient admissions and discharge, managing patient movements inside the hospital, organizing and managing patient records, etc. The *pôle des affaires médicales* "medical affairs division" and the *pôle des soins infirmiers* "nursing care division" are involved in scheduling and resource management activities.

Table 2. Management of hospital logistics activities in Moroccan hospitals

Departments	Medical Affairs Division	Nursing Care Division	Administrative Affairs Division	Medical Departments	Pharmacy Service	Reception and Admission Service
Scheduling	✓	✓		✓		
Procurement			✓			
Distribution			✓			
Pharmacy	✓		✓		✓	
Catering/ Food			✓			
Laundry			✓			
Hygiene			✓			
Waste management			✓			
Maintenance			✓			
Reception service						✓
Patient flow						✓
Telecommunication			✓			
Information system management						✓
Stock management			✓			
Mail service/ files archiving	✓		✓			✓
Safety and security			✓			

Discussion and conclusion

The basic role of hospitals is to provide healthcare to patients. To this end, there are numerous ancillary activities that must be taken into account. Maybe most of them are invisible for the patient but they have a significant impact on the way patients experience a visit to hospital (Dobrzańska, Dobrzański and Śmieszek, 2013). A large number of these activities belong to the field of hospital logistics, which includes purchasing, transportation, catering, etc. The responsibility of such activities tends to be divided between different departments. Even if hospitals in general have a dedicated department to handle and deal with logistics activities, they still fragmented between at least two or more departments. For example, in some cases, it was found that up to five separate teams of people were involved in stock replenishment activities and the associated processes (Kidd, 2002). Also, in other cases the responsibility for transport activities is divided between different departments, this lead to the multiplication of efforts without being able to take advantage of the synergies between the different transportation circuits and without having the overall picture of the costs of such practices (Beaulieu *et al.*, 2014).

In most cases, drugs management is ensured by the department of pharmacy, which is responsible for their negotiation, purchasing, distribution, storing and preparing the quantities of pharmaceuticals products as requested by the care units (Dacosta-Claro and Lapierre, 2003; Dacosta-claro, 2002; Beaulieu and Landry, 2002). This because the regulations require that the control of drugs must be carried out by a graduate of the pharmacy (Sampieri-Teissier, 2002) (Burnette, 1994).

Other than the management of logistics activities by hospital internal departments, service providers may also be called to take part in it (figure 5). Outsourcing logistics activities is an option that may be adopted by hospitals, where a specialist from the private sector is entrusted with managing and executing, wholly or partly, some activities such as catering, laundry, cleaning, etc. (Benanteur, 2004; Kriegel *et al.*, 2013; Azzi *et al.*, 2013; Marriott *et al.*, 1998). As an example, Granlund and Wiktorsson (2013), in their study on a Swedish hospital, state that all transportation activities (transports of waste material, laundry, food, pharmaceuticals and patients)

are ensured by a transportation department, working as an external part, from which the hospital buys services. In the Moroccan context, the outsourcing of logistics activities has become a managerial approach. It is noted that in some cases, hospitals outsource hotel activities such as cleaning, laundry, security service and catering (Kherbach and El Alami El Fellousse, 2007). In this sense, Kriegel *et al.*, (2013) argue that the range of services supplied externally will increase, and more highly ranked hospital logistic fields (e.g. pharmaceuticals, sterile goods) would be outsourced.

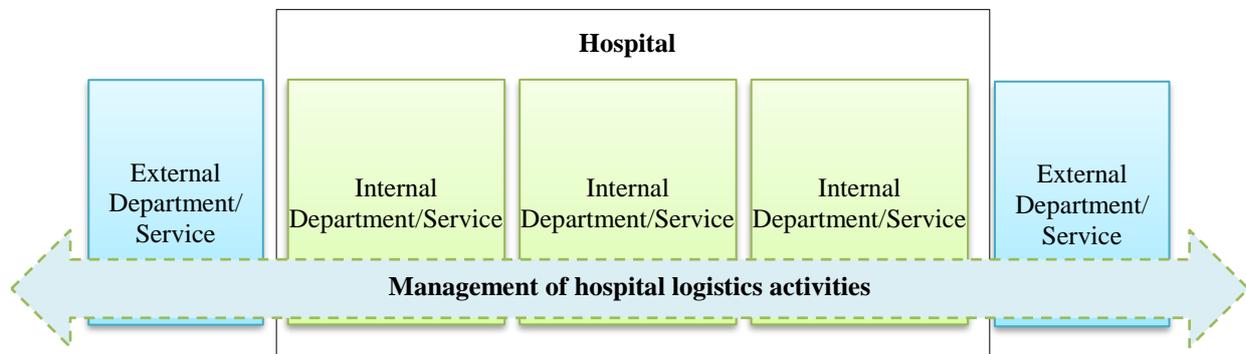


Figure 5. Departments involved in the management of hospital logistics activities

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