



LOGISTICS IN THE HOSPITAL: METHODOLOGY FOR MEASURING PERFORMANCE

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ABSTRACT

In this paper, we focus on the development of a methodology for the performance of hospital supply chain via the three dimensions of cost, quality and safety. The first part of the article shows the interest of the hospital logistics in a hospital as well as the review of the literature on the assessment of performance. The second part describes the implementation stages of our methodology. Nous finish our work by applying the decision support system in a hospital in Morocco.

Keywords: safety, quality, hospital logistics, performance indicators, stock.

Nomenclature

CQS : Cost, Quality and Safety

DS: Decentralized Structure

CS: Centralized Structure

MAD: Moroccan Dirhams

INTRODUCTION

Managers of hospitals, are faced with the constraints of increasingly complex. They must find new solutions to an environment full of transformation and innovation. They must therefore develop new management tools and decision support to better manage their business with increased budgetary pressure. Instead of hospital supply chain and its impact on the performance of health facilities are well recognized [1, 2, 3, 4, 5, 6], Thus, the hospital performance measurement today considered an essential element of quality of care improvement process [7, 8, 9]. Currently expenditure control leads health facilities to reason and to optimize physical flows and associated flows of information in terms of overall performance of their supply chains [10]. Logistics can contribute greatly to the performance of the hospital. Everywhere health networks are faced with the impossible triad performance: cost, quality and safety. The evaluation and improvement of hospital performance are needed to better process management. Experts in the field confirm that the choice of performance indicators is not an easy exercise [11]. The health sector in Morocco is an inspiring site change commitments, partnerships and resources. Res cumbersome and costly hospital reform has allowed the supervision of hospitals in the spirit of improving the supply of care and that of the image of the public hospital for the population.

INTEREST OF THE STUDY

Definitions

According FREMONT hospital logistics is a complex function that manages the flow of products and very different distribution channels [12]. And Hassan 2006 defined the set design, planning, supply management, manufacturing (good and service), delivery and return management (reverse logistics) provider to the recipient

(patients), taking into account the trajectories of the patients in the hospital without which there is no flow of products (pharmaceuticals) [13]. In our article, we retain the definition of logistics as "patient satisfaction requirements (products or services) through an optimization of the various functions of the hospital."

Figure-1 illustrates hospital logistics chain and highlights its key players and their characteristics:

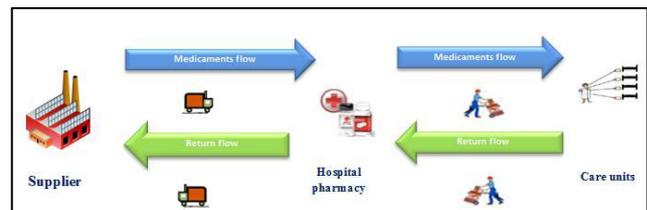


Figure-1. Supply chain in hospitals [14].

Interest costs in hospital logistics

According to the standard [AFNOR NF X50-150], the cost is any expense incurred for a given product, or who is responsible. Cost is an analysis element, an optimization criterion and a choice of solutions tool. In our study, we focus on the costs of hospital logistics.

Several experts considered the importance of logistics costs in health institutions, assessments Housley (1978) arrive at an estimate of 46% for North American hospitals [15]. According Henning (1980) by taking a similar approach as evaluating hospital logistics takes 42% of total spending of a hospital [16]. Chow and heaver (Figure-2) arrive at an estimate 46% [17]. This important part of logistics costs shows that logistical procedures in hospitals have become an important vectors of health expenditure reduction process. These data can support decision-making for improved function in this hospital.

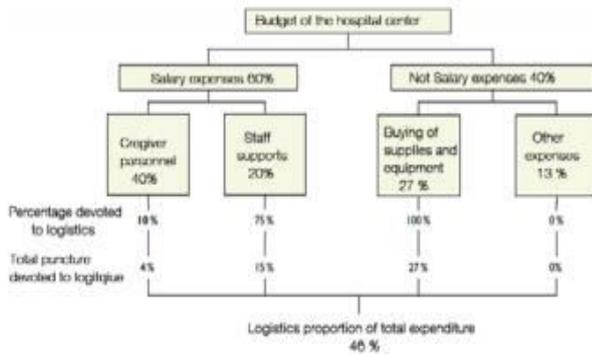


Figure-2. Proportion of logistics in the total expenditure of a health facility [17].

Interest of quality in hospital logistics

ISO¹ 9000 defines quality as "ability of a set of inherent characteristics fulfills requirements" (ISO 9000). Quality management is an element of the management system of the organization that focuses on obtaining results, based on quality objectives as appropriate to meet the needs, expectations or requirements of Parts interested (ISO 9001). The quality and quality of care have been many definitions over the past decades and literature on the subject is abundant. Since eighty years, quality of care has often been synonymous with effective care for the patient. Donabedian defined the quality as follows: "high quality care is to maximize the well-being of patients after taking into account the benefit / risk at every stage of the care process" [18]. Pressure is put on hospitals to improve the quality and they will produce indicators to provide information on the quality of their services and to improve transparency. In the literature there are several methods such as Six Sigma, FMEA, SPC, design of experiments, ... have been used to improve and optimize the quality of products and / or processes.

Interest of security in hospital logistics

The mission of a hospital has evolved over time, it is increasingly characterized by a rich business environment where zero risk does not exist. The hospital system must master, manage and prevent risk, but hospital security is very varied in nature, and risk management operates today as an essential component of the strategy of a hospital system. The term "patient safety" is the term most used and comes from the English translation of "patient safety".

The WHO¹, in its recent International Classification for Patient Safety (CISP) above provides the following definition:

"Patient safety is defined as the absence, for a patient, from unnecessary or potential harm associated with healthcare. Impairment associated to health care is a violation arising from or associated with the formulated or analysis undertaken projects while care was provided and

which is not due to trauma or an underlying disease. "Several research studies have been conducted in recent years on risk management in hospital logistics chains. They are found work Pons *et al* 2005 suggested the integration of a risk management approach to a purchase structure of medical devices [19]. Thus, we find the work of Aloui 2007, which proposed a risk-control system [20]. Roussel did a study in 2008 on the issue of integrating a risk management approach to procurement structure adaptable to all organizations [21]. This work has shown the importance of providing security in the performance of hospital logistics.

In the literature there are several methods such as, FMEA, HAZOP, HACCP, ... were used for the risk management in health facilities.

CQS importance of concepts: Results of a questionnaire

In order to assess the importance of CQS concept in the performance of the hospital supply chain. A questionnaire was administered to eight hospitals in different Moroccan specialties. For reasons of confidentiality, will be referred to these hospitals H1 to H8. Nous have developed a structured questionnaire to assess seven areas below:

- Axe 1: Human Resources
- Axe 2: Environment
- Axe 3: Cost
- Axe 4: Quality
- Axe 5: Security
- Axe 6: Information system
- Axe 7: Technical Skills & Medical

For each axis, a set of questions has been defined in order to obtain the relevant information. The questionnaire was submitted to the heads of logistics processes in the hospitals concerned at: Strategic, Tactical and Operational. Through this questionnaire, we aim primarily to assess the importance of each axis in the performance measurement hospital logistics chain.

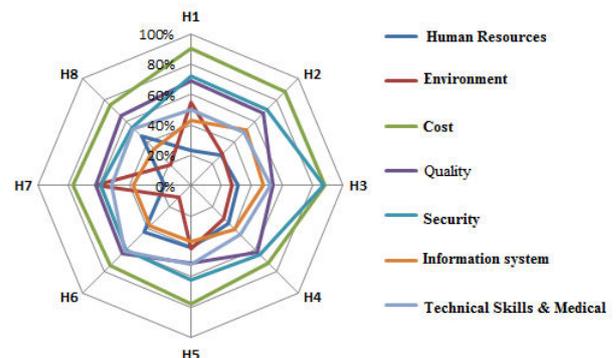


Figure-3. Performance level by priority and hospital.



From the results of this survey we found that the level of performance of the three axes CQS axis is larger at the eight hospitals. Yet we have found that the cost axis presents the best performance for managers. The other axis of performance is very important but is not the same level as CQS.

Interest of pharmacy in healthcare facilities

Pharmacy occupies an essential role in the operation of a health facility. It is not directly involved in the act of care but is involved in many activities that contribute to the successful implementation of this act [22]. It presents the intersection of the flow of pharmaceuticals (drugs, medical devices, bandages objects and equipment).

According DELOMENIE 1996 This service represents nearly 15% of the hospital budget [23]. His mastery and profitability are vital and go through high productivity and efficient use of resources to improve the quality of care. It should optimize the organization of physical and information flows, to better meet user expectations of service delivery, promote quality, safety, traceability, minimize costs.

According Martinelly Di *et al.*, 2005, hospital pharmacy represents a significant share of the expenses of a health facility [14]. It is part of the hospital logistics activities that used to support the care of sick business. He must not consider pharmacy as "isolated" in the hospital, but as the central link in the pharmaceutical supply chain that aims to pharmaceuticals available to the patient.

In the current study, we focus on the organizational aspect of the event grouping pharmacies for the drug circuit.

In this context, the grouping of stocks at the hospital is to pool resources and master inventory, reduce waste and provide better centralized inventory management with visible traceability. Expenditures on pharmaceuticals are an important part of total spending on which it seems possible to act quickly. The obligation to control spending is in itself an additional and sufficient reason to undertake a pharmacy grouping approach.

In most cases, the grouping aims to reduce operations costs and increase system efficiency.

PREVIOUS RESEARCH: PERFORMANCE MEASUREMENT

Problems of hospital logistics

According to the literature review and survey results that the priority of performance analysis of hospital supply chain through CQS axes, managers of hospitals

should focus on the integration of these axes in the evaluation of the supply chain in the health sector Figure-4.

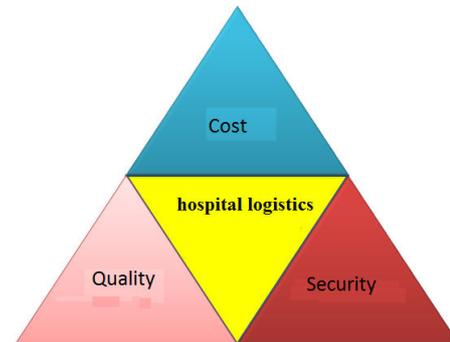


Figure-4. The hospital logistics via dimensions Cost, Quality and Security.

Hassan 2006 [13] and Fateh Mebrek 2008 [24], arrive to identify the problems of hospital logistics and are divided into three:

- Characters Organizational problems;
- Problems in performance measurement;
- Problems information system.

Performance measurement in the health field

Definitions dashboard and indicator

The dashboard is a performance management system is a continuous process that is part of an iterative cycle from planning goals and leading to it, It's a way to select, arrange and present the essential and relevant indicators, summary and targeted manner [25].

The indicator is the component of the scorecard used performance evaluation tool and gap analysis to make improvement actions in the future and found the definition "a performance indicator is information to help an actor, individual or collective, more generally, to drive the course of action towards the achievement of a goal or to enable it to assess the outcome. "

Features of performance indicators in the health sector

In the health sector, the awareness of the need to drive performance gains ground, however, a difficulty remains: the number of indicators that could be interesting is enormous to the point that managers do not manage to spot.

According to Smith, the characteristics of good indicators of performance in the field of health is divided into two steps, that of the design of the indicator and of its application [26].



Table-1. Characteristics of good indicators of performance [26].

Steps	Characteristics of indicators
Indicators Conception	Face validity / content validity: with what degree of accuracy the indicator does measure what it is supposed to measure? Reproducibility: how the indicator Would it be the same if the method by which it was product was applied again?
Application of indicators	Acceptability: how the indicator is it acceptable for people to be evaluated and the evaluators? Feasibility: how valid, reliable and consistent data can they be collected? Reliability: to what extent is he has an error minimal or measuring the extent to results could be replicated if they were again be collected by another agency? Sensitivity to change: to what extent indicator he has the ability to detect changes in the unit of measurement? Predictive validity: the extent to which indicator may predict accurately?

STEPS OF THE PROPOSED METHODOLOGY

Integration of CQS concepts in the performance analysis of hospital supply chain plays a very important role in improving the performance of a health organization. For the drive, it is essential to develop a structured and flexible approach that meets their requirements issues.

This approach is intended first pragmatic and experimental. It is based on existing experience, with the goal:

- The identification of convergences of opinions from a working group,
- And consensus with a group of experts.

A working group was formed around the coordinators and two experts in science of labor organizations, he understood pharmacists who have been involved in a development activity indicators experience in hospital pharmacy.

In this perspective, we have proposed an approach for analysing performance of the stock. Our contribution is the integration of CQS concepts.

The work takes place in two phases' Figure-5'. La first is process analysis chosen the supply chain. The second is the performance measure through CQS concepts in the context of the actual situation of work:

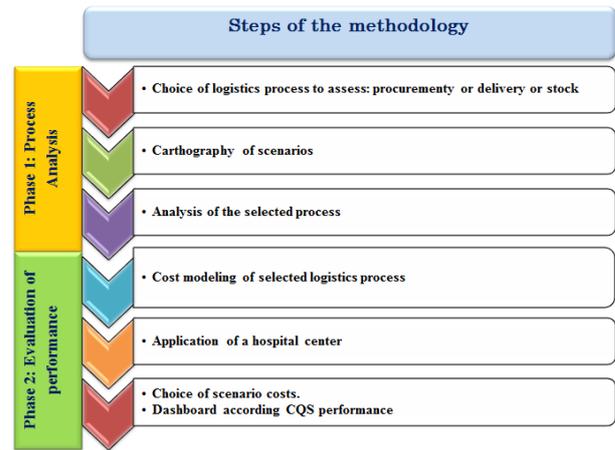


Figure-5. Methodology steps of performance measurement.

First phase: Process analysis

Choice of logistics process to assess

The approvisionnement process is often overlooked by managers of hospitals that may yet bring a real benefit to the structure by improving performance and allowing it to reduce costs. Moreover, if proper management can require a significant investment at the beginning, once set up, it saves valuable time. So this is a pilot process of the performance of hospitals in the Operational level, Tactics, Strategy, which is why we choose to work on the process in case of approvisionnement pharmacies grouping.

Cartography of scenarios

In the hospital pharmaceutical supply chain upstream and downstream two types of structure can be centralized and decentralized exist in hospitals in general. Figure-6 shows logistics flows for both scenarios:

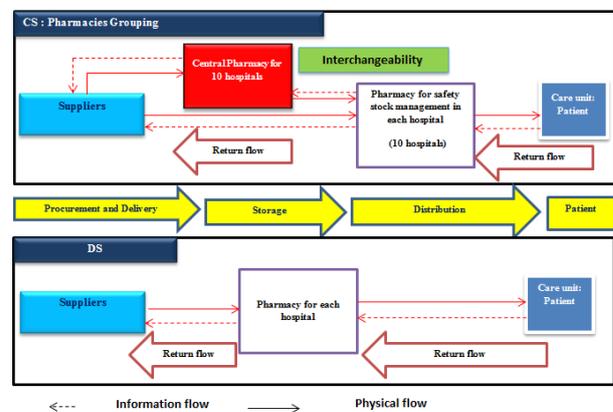


Figure-6. Decentralized and centralized structures of a hospital in general [27].

Analysis of the procurement process

We have summarized the descriptions of the procurement process for the two structures:



Table-2. descriptions of the procurement process for the two structures.

Process	DS	CS
Procurement	<ul style="list-style-type: none"> ✓ The supply made for an independent hospital; ✓ No grouping of common controls to minimize costs; ✓ Low Traceability; ✓ Resource cost increases; ✓ The redemande product available at another hospital. 	<ul style="list-style-type: none"> ✓ Most orders made for the central pharmacy; ✓ Order consolidation; ✓ Delivery done for the central pharmacy ✓ Strong Traceability; ✓ Reduced resource costs;

Second phase: Performance evaluation

Modelling supply costs

To build our valuation model of the costs procurement, we introduce the following notations:

C_{tp}: Total procurement cost

C_{aq} Acquisition cost

C_{po} Cost for placing orders

C_{p_{ij}} Unit purchase cost of product j for month i

N_{ij} Number to buy products j for month i

Cl_{ij} Unit cost of launching products j for month i

M_{ij}= 1 if the product is ordered otherwise 0

Finally, the calculation model via the costs procurement is:

$$Procurement = \sum_{ij}(C_{p_{ij}} \times N_{ij}) + \sum_{ij}(Cl_{ij} \times M_{ij})$$

Application Case Study

In order to validate our methodology, we applied our methodology to a centre hospital in Morocco which is made up of four hospitals:

Table-3. Part of the hospital logistics in 4 hospitals.

Institutions	% of logistics in the budget
Institution H1	33%
Institution H2	27%
Institution H3	29%
Institution H4	33%

The chosen hospital is one of the largest hospitals in Morocco. It brings together hospitals with various specialist with a multi-site platform created since 1954. However, the centre was only created in 1983 by Law No. 37-80 and Decree No. 2-82-74 relating to hospitals. Hospitals and had already built their history apart from that of the Hospital, the thing that showed fallen until today. Each hospital had its own resources, its own leaders and its own difficulties. Therefore, activities are carried redundantly in several institutions and sometimes in several departments within the same hospital.

Three Important considerations managers of the hospital center:

- a) Absence of central pharmacy
- b) Very Low Pharmaceutical Human Resources: 15 pharmacists and 17 pharmacy technicians 4 sites.
- c) Low Numbers of references managed by pharmacies 1600 (about 600 medicines and medical device in 1000).

We focused our study on one-year for the products of the hospital medication type. Our study will be based on a comparative approach of two scenarios (DS / CS):

▪ **Evaluation of the procurement process**

In this first study, we compare the total cost of hospital supplies for both DS and CS scenarios. The results of the procurement process are:

Table-4. Evaluation of the procurement process.

Month	January	February	March
Cost DS (MAD)	706 206,00	592 779,00	648 476,00
Cost CS (MAD)	452 314,00	421 876,00	426 541,00
DS/CS	1,56	1,41	1,52
Gain (CS-DS)/CS	-0,56	-0,41	-0,52
Month	April	May	June
Cost DS (MAD)	683 465,00	594 924,00	604 890,00
Cost CS (MAD)	402 676,00	418 762,00	412 354,00
DS/CS	1,70	1,42	1,47
Gain (CS-DS)/CS	-0,70	-0,42	-0,47
Month	July	August	September
Cost DS (MAD)	682 323,00	657 899,00	579 839,00
Cost CS (MAD)	354 321,00	578 652,00	432 156,00
DS/CS	1,93	1,14	1,34
Gain (CS-DS)/CS	-0,93	-0,14	-0,34
Month	October	November	December
Cost DS (MAD)	188 407,00	590 893,00	637 569,00
Cost CS (MAD)	145 678,00	476 542,00	368 792,00
DS/CS	1,29	1,24	1,73
Gain (CS-DS)/CS	-0,29	-0,24	-0,73

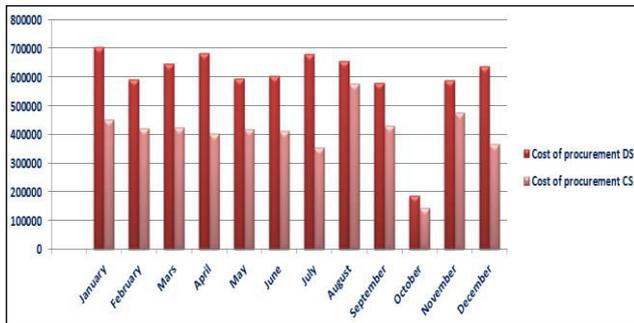


Figure-7. Cost of procurement comparison between the two structures.

From the results, we noticed that the costs of the procurement process are reduced in the case of the SC in relation to the DS for 12 months. This improvement is due to:

- Reducing costs acquisitions caused by grouping toward the commands hospital suppliers (price is negotiable as the quantity ordered is important month);
- Control and traceability facilitates the monitoring of the price for the buyer;
- Reduced cost for placing orders at the material and human resources;
- Interchange ability between hospitals in case of failure or refusal (case control common products if needed).

Conception of the dashboard of procurement according to CQS

After the previous study we found that the structure is more centralized than decentralized structure beneficial. that is why we decided to set up a procurement process performance measurement board table integrating dimension CQS:

Table 5. the dashboard of procurement.

Dashboard: hospital Logistics Process : Procurement Case: pharmacies grouping				
Indicator	Objectif	CQS performance axis	Frequency Measurement	Process related to the indicator
Stock rate	Measures of Procurement performance	Cost,Security	Monthly	Stock
Break rate	Prevent rupture	Cost,Security	Monthly	Stock
The suppliers of service rate	Avoid breaking and presumption	Cost,Quality ,Security	Monthly	All supply chain
Purchasing rate supplier	-Know The rate of active suppliers avoid delays in deliveries caused by supplier	Cost,Quality ,Security	Monthly	All supply chain
unforeseen needs Rate	-Evaluate Annual forecasts	Security	Monthly	Stockage
Needs satisfaction rate	Improve the reliability of Procurement	Quality	Monthly	Stockage
Purchases compliance deadlines rates	-Evaluate The supply efficiency	Cost,Quality ,Security	Monthly	All supply chain

CONCLUSIONS

Hospital systems must firstly ensure quality of service vis-à-vis patients, and secondly they must optimize their supply chain. They are forced to better organize and innovate to control costs while ensuring quality and patient safety care. Le this article has helped shed light on hospital logistics; we have shown the importance of logistics costs in health institutions, as well as performance analysis via the cost, safety and quality,

Also, the objective of this work was to lay the foundations for a more comprehensive reflection on systems measures the performance of hospital logistics. The implementation process of a performance management system can be an opportunity to validate the objectives by the dashboard.

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