

# Analysis of the pharmaceutical supply chain by the FMEA method: Case hospital Ibn Sina child-Rabat

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**Abstract**— The mission of a hospital is a complex task due to the variety of services it offers and other factors that come into play during operation: cost, quality, safety, delays, etc.. Hospital supply chain is an important part of the budget of a hospital. Therefore, the objective of this work is to optimize the medicament circuit in the hospital using the Failure Mode and Effects Analysis (FMEA) method that is widely used in many industries who wish to assess the reliability of a process and the inherent risks. Our work is structured as follows: The first part of this article presents the interest of hospital logistics and supply chain pharmaceutical. The second part presents the results of the methodology and its impact on the performance of the medication to the children hospital.

**Index Terms**— hospital management, FMEA, optimization, decision support, pharmacy

## 1 INTRODUCTION

Hospital systems are required on the one hand to ensure high quality service vis-à-vis patients, and secondly to optimize their supply chain. These constraints have led the hospital system to engage in a process of profound reorganization and control the growth of spendings and budgets. The place of hospital supply chain and its impact on the performance of health facilities are well recognized [1].

Given that spending on pharmaceuticals is an important part of total budget of the hospital, it is interesting to improve the flow of medicaments. This improvement requires analysis using the FMEA method of pharmaceutical supply chain.

## 2 DEFINITIONS OF HOSPITAL LOGISTICS

Logistics hospital has been the subject of several definitions. Chow and Heaver, described the hospital supply chain based on three main logistics activities [2]:

-**The supply:** includes purchasing and inventory management of various products.

-**The production:** manages the various activities, such as lingerie, kitchens, sterilization, etc.

-**Distribution:** ensures the delivery of various products storage areas to the various points of use, or transport waste to shipping areas.

According ASLOG<sup>1</sup> « the logistics of the hospital is to direct the patient, products, services and information from supplier

to recipient » [3].

In our article, we use the definition of logistics as « meeting the needs patients (products or services) through optimization of the various functions of the hospital»

### 2.1 Importance of Logistics Costs in Hospitals

Logistics activities account for a significant proportion of expenditure of the hospital system Figure 1 shows the costs of logistics activities [2] :

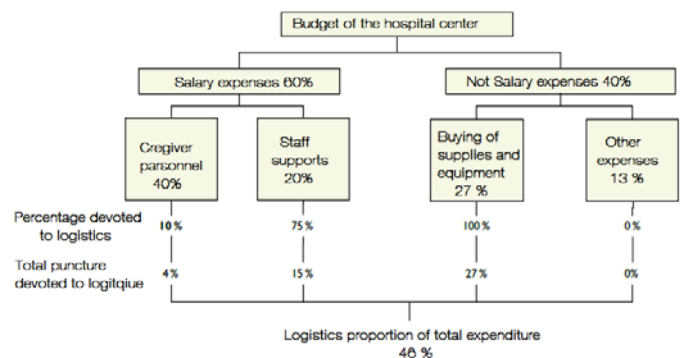


Fig. 1. Costs of logistics activities CHOW and HEAVER 1994

From the diagram, we can say that:

<sup>1</sup> Association of Supply Chain and Logistics

Logistics activities are 46% of the total expenditure incurred by a hospital.

Logistics accounts for 10% of the activity of nursing body, supposed to be dedicated and patient, a study of CSC<sup>2</sup> confirms that nurses spend a significant portion of their time managing logistics activities.

## 2.2 Previous Research

Hassan, showed extensive fields problematic at a pharmaceutical supply; pain encountered will be around [4]:

- Faults-level design activities (analyzing the flow of pharmaceuticals and layout of storage facilities);
- Faults-level organization and identification process (for the sake of objectification) of the supply chain of the hospital;
- Faults-level supply management, inventory management and estimating needs.

And Fateh Mebrek, has identified the following issues and has been approached in three categories [5]:

- Organizational problems: are directly related to the design of material and human resources, assigning resources to tasks, scheduling and planning.
- Information system problems: it is able to coordinate tasks, communication, random events (delay, failure, failure ...).
- Dashboard problem: it depends on forecasting tools dedicated users to help them make decisions.

To master the problems mentioned above, we seek to apply the FMEA method to optimize the performance of the pharmaceutical supply chain

## 2.3 Importance of the Circuit of medicament in hospital

Pharmacy occupies an important role for the operation of a health care role. It is not directly involved in the act of care, but it is involved in many activities that contribute to the successful implementation of this act. [6] It has the intersection flow of pharmaceutical products (medicines, medical devices, objects dressings and equipment).

According DELOMENIE 1996, this service represents nearly 15% of the hospital budget. [7] His mastery and profitability are vital and go through a strong and effective use of resources to improve the quality of care productivity. It should optimize the organization of physical and information flows, to better meet user expectations of service delivery, promote quality, safety, traceability, minimize costs.

## 3 APPLICATION OF FMEA METHOD ON THE PHARMACEUTICAL CHAIN OF CHILD IBN SINA

### HOSPITAL IN RABAT

#### 3.1 Contexte Work

According to [Dahan M & J. Sauret 2010] hospital medicament supply is unsecured and uncontrolled process. Failures are found everywhere. [8]

In the field of hospital management, the FMEA method has already been used, but in particular to eliminate the risk or errors cited example:

Objectives	Research work
Risk management at the hospital sahloul	PHD 2011 Imen Ben-KAHLA Touila Central School of Lille "Risk Management and Decision Support in the hospital supply chain: the case of operating theaters CHU Sahloul"
Prevention of medication errors	Article GISEH 2012 Goubella, Fadma; Delvosalle, Christian; El Hiki, Lahcen "Prevention of medication errors in geriatrics :Application of FMEA circuit of the medicament "

In our study, this method is applied for the purpose of quantitative classification: causes of failure in the medicament supply chain of the hospital and eliminates failure process, so it fits into the continuous improvement of the supply chain of hospital.

#### 3.2 Methodology and Conduct of the FMEA to the Children Hospital

To achieve our objective in all its complexity, we chose the FMEA method to enable stakeholders in the process to identify the various factors of dysfunction contained in the medication circuit in particular storage process.

The FMEA project must take place as all projects, with a pilot project, a team, objectives and methodology of work. The overall approach of this project involves several steps:

<sup>2</sup> Consulting Group

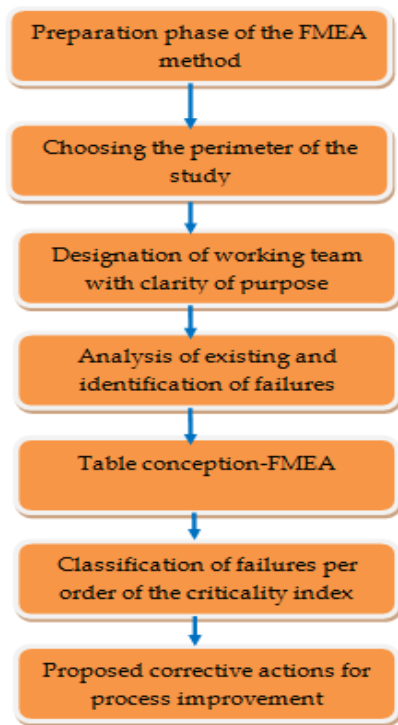


Fig.2 Stage of our work FMEA

### 3.3 Supply chain in the hospital of child and need of improvement

The Pharmaceutical Logistic Chain consists of processes shown in the figure below:

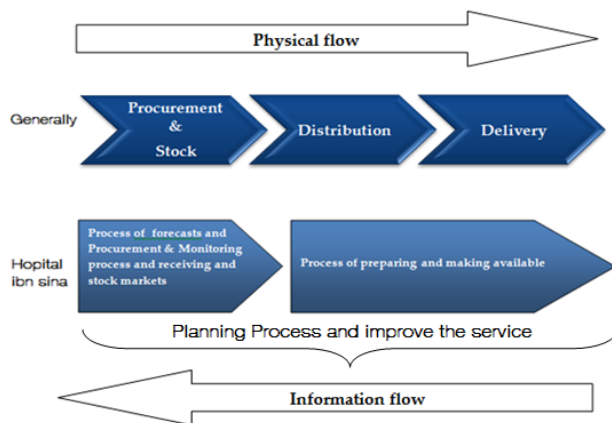


Fig. 3. Circuit medicament in children hospital

**-Process forecasts and procurement:** Ensure requests purchases and forecasts in the annual budget approved by management.

**-Process-monitoring and stock markets and reception:** Ensure the availability of products to customers through a rigor-

ous management of stock.

**-Preparing and making available:** Ensure the availability of products to services for patients at any time.

**-Planning Process and improve the service:** Follows the quality control and personal training support processes, etc.

The need to improve the process of market monitoring, receiving and stock is justified by the fact that he is out of control and is perceived as "unreliable" by hospital officials.

Furthermore, the stock management is not effective. Indeed, the current storage method does not take into consideration the care environment and changes in consumption, the storage method used is the conventional storage cabinets, and the scheme is not trolleys unused.

The problem is observed after installation of several strategic questions: how can we improve medicament supply? What process should control the medicament supply for the pharmaceutical supply chain to be effective?, The current organization of the chain and storage areas of pharmaceuticals is it consistent with best practices in the hospital? If not, what organization should we look? and inventory management pharmacy is optimal? That is why we chose this process to apply the FMEA method

## 4. RESULTAT OF CASE STUDY

In order to highlight the different stages of market monitoring and reception and stock, we have prepared a flowchart of the process, in order to clarify the process and ensure that the project team FMEA can have a common understanding of its progress.

### 4.1 Stage of our work

To detect the causes, an Ishikawa diagram was created for each mode. Identifying the causes of failures allowed us to build the FMEA table for the whole process of market monitoring and receiving and storage.

This table contains a qualitative assessment: patterns, causes and effects of both a quantitative assessment (Occurrence O, Gravity G and the Probability of undetected D) on the other. Index of Criticality with  $Ic = O \times D \times G$  can prioritize failures [9]. The acceptability threshold was set at 10.

Beyond this threshold, corrective / preventive actions have been proposed a sample is shown in Table 1, the process operations of the upper threshold 10.

### 4.2 FMEA table

Activity or operation process	Potential failure mode	Effects	Causes	Evaluation				Activity or operation process
				O	D	G	Ic	
<b>Entering &amp; Introduction of stock</b>	-Damage to the product -Error of the given before	- No delivery distribution -Lag between the actual stock and the system	Manpower	4	1	3	12	- Raise awareness of the entry (manual input help)
<b>Monitoring delivery in individual sheets stock</b>	-Error of data input	- No delivery distribution - No match between the physical inventory and the system	Manpower	4	1	3	12	- Raise awareness of the entry (manual input help)
<b>Store the products in the conditions required by the manufacturer</b>	-Damage to the product	- No delivery distribution - Product in stock improper (financial loss)	Manpower Milieu	4	4	4	64	-Stock products one by one according to the conditions requested stock - Monthly Preventive control of storage conditions of the products delivered me - Educate human resources stock of the importance of product packaging
<b>Ranger la livraison FIFO</b>	- Damage to the product (risk of refusal)	- Product in stock improper (financial loss)	Manpower Method	4	3	3	36	- Raise awareness of storage to follow the method FIFO - Monthly Preventive Control classification storage products delivered me by the expiration date
<b>Receive Order of command to Distribution</b>	- command to Distribution illegible -Error on quantities / Recipient	-Delay in delivery -Non-delivery	Manpower	2	3	2	12	-Raise awareness of the importance of input control orders - Educate providers repeat the test before sending goods
<b>Management operations ruptures</b>	- Out Product	-Non-delivery	Manpower Method	2	3	2	12	- Follow rigor in the political Min / Max to secure stock
<b>Validate the command in the application and in the individual stock cards</b>	- Error in the validation	- Delay in delivery - Delivery improper	Manpower	4	1	3	12	- Raise awareness of the importance of the stock update given between the rack and the system - Preventive control monthly by an inventory correction shifts observed
<b>Check Lot Number and the expiration date to deliver</b>	- Error in the validation	- Delay in delivery - Delivery improper	Manpower	5	1	3	15	- Raise awareness of the importance of human resources audit and their impact on the distribution if customer need
<b>Deliver the order</b>	- Damage to the product	- Product in stock improper (financial loss)	Manpower Material	4	5	5	100	- Establishes a monthly routine preventive maintenance carts store before failure - Raise awareness of the importance of handling protection deliverable.

### 4.3 Discussion of results

The proposed actions are immediately implemented to improve this process. As a first step, an evaluation by the team projected was proposed to identify the most effective and least costly action to reduce malfunctions especially for a threshold higher than 10 operations, so the records of preventive controls was established for setting up the results found by the FMEA method.

It goes without saying that all the obstacles and difficulties have not been raised by the FMEA but nevertheless, it provided a different view on this process, decisions and improvement actions to be undertaken. This method has allowed a good understanding and a good analyze of the medicament circuit to identify areas for improvement in the future.

### Conclusion

The hospitals today are faced with many challenges contributing to greater efficiency in the health system. In this paper we worked on optimizing a supply chain of medicines. Furthermore, the identification of malfunction has put in place preventive measures to identify several shortcomings in the drug circuit to commit to a quality policy and continuous improvement of the hospital.

Our goal is to offer shares only, but also we will measure the criticality values after 3 months of this study, in order to monitor the performance of the pharmaceutical supply chain.

Thus, this analysis has also led the development of a thorough analysis and should lead to the revision of the medication with the aim of improving the efficiency of pharmaceutical

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