Development of a Set of Indicators to Manage Medicines Supply Chain in Moroccan Public Hospital, Application of the SCOR Model

I. Ibn El Farouk1, A. Talbi2, F. Jawab3

Production engineering laboratory Sustainable Development (LPE2D)-School of technology of FEZ, Morocco
(Ecole Supérieure de Technologie de Fes, BP 2427, Route d’Immouzer 30 000 Maroc)
1imanefarouk@yahoo.fr; 2talbi@gmx.fr; 3jawabf@gmail.com

Abstract- In this survey, we present the results of our research about how to select relevant indicators to better measure and manage performance medicines supply chain in Moroccan public hospitals. In order to enable the pharmacist to select indicators, we have adopted a synthetic method and built a tool based on process modelling approach and the SCOR model. The article is made up of two main parts. The first is reserved to present the methodology, and the second one is to introduce an application of our tool in Casablanca Moulay Youssouf hospital (CMYH).

Keywords- SCOR Model; Hospital; Medicines; Process; Supply Chain

I. INTRODUCTION

Following budgetary restrictions, and with obligations of accreditation, imposed by the supervisions, hospitals have more and more recourse to reliable service. In this context, and in order to ensure better allocation of resources, evaluation and improvement of hospital performance are essential. Indicator is the way to measure performance level. In healthcare sector, the use of indicators is a major topic to managers. According to [1], performance indicator provides information which may lead us to think about the quality of an object related to healthcare system. This indicator is also of a great importance for researches and actions taken by healthcare providers and policy makers.

However, the performance evaluation and its management are not easy. The difficulty appears in the abundance of potentially important indicators. Faced to multiple choices and in the absence of a methodological basis, policy makers find themselves in the difficulty of making an appropriate choice of indicators in line with their targets. The risk involved by such situation is to achieve measurement tools disconnected from the strategy of the institution. It is necessary to note that this difficulty was highlighted by a great number of authors. In [2], authors estimate that developing indicators in the hospital is not easy and that this difficulty is due to the complexity of the hospital system. For authors in [3], positive health outcomes are dependent on how well the health delivery system is performing; the availability of medicines and other supplies depend on how well supply chain is performing. For them, to improve supply chain performance, we must understand how it is currently performing. This information enables us to locate where the supply chain is inefficient and determine how to adjust these deficiencies. They consider that several types of indicators have been developed to measure many supply chain and logistics activities. So, the choice of indicator can be daunting, and it could be inadequate to simply focus on one direction. To overcome this difficulty, authors suggest focusing on less performing areas aligned with the overall supply chain strategy. According to [4], many logistics experts consider that the choice of a reliable indicator is delicate and that this practice must go beyond a plain list of indicators. Jobin [5] believes that logistics managers in hospital are lacking recognition and the way to reverse this situation could be the deployment of an adequate system of performance management. However, an American survey of purchasing managers found that 40% of respondents consider themselves not satisfied with the performance indicators they use. Deployment of such system for logistics activities is necessary because they represent an important share in the budget of a hospital. This share was estimated by Chow and Heaver (1994) at 46%. In this chain, the circuit of drugs plays a central role and represents several issues:

Efficiency: medicines represent the second item of hospital expenditure. Besides the price, the logistic aspects represent an important load; it acts of the handling and delivery, unpacking, reception, invoicing, control operations [6].

Safety: the circuit of drugs is a transverse process depending on the human factor; any mistakes can be source of risks for patients [7].

Accessibility to the care: without an equitable access to the essential drugs, the basic right to healthcare is not insured. In developing countries, expenses related to healthcare are generally accounting for 25% to 70% compared with 10% in the developed countries [8]. In Morocco, the expenditure reserved for drugs amounts to 34% of the total expenditure of health. In addition to the expensive prices of drugs, the management of drugs provisioning in the Moroccan hospitals suffers from the absence of clear missions and rigorous procedures.

Within all these stakes, and in order to help pharmacist to better manage their activities, we have built a tool based on
processes modelling with the aim to make a set of indicators for medicines supply chain in Morrocan hospitals. Our paper is organized as follows. We first begin to introduce our research methodology, and explain each stage of the indicators selection tool (IST). Second, we present an overview of medicines supply chain and SCOR model, and the third section will focus on results of the deployment of the IST in CMYH.

II. METHODOLOGY

To build the IST, we adopted a synthetic methodology. From researches done in designing indicators, we obtained an overall view on the subject. By analysing the propositions of three authors [9-11], we concluded that any approach to design relevant indicators must always be preceded by:

Describing activities: the aim is to clarify the actors, missions, and tasks. Fernandez [9] calls this step the identification of intervention points; the author highlights the importance of the process approach to identify these points.

Identification of performance drivers: these are the critical parameters to achieve targets. Voyer [10] evokes the notion of management concerns, and he considers that to ensure rigor in the selection of indicators, it is sufficient to match an indicator to each concern. Mendoza [11] refers to action variables, which is necessary to monitor developments closely to ensure the success of the system.

Even if the process of selecting indicators is generic and may be applicable to all types of organization, it is necessary to adapt it to each context. It is for this purpose that we designed IST. This tool, as shown in Figure 1, involves three stages. The first one is modelling process, which aims to describe the drugs supply chain, and highlight their key performance attributes. The second is cause and effect analyses, which aims to identify all kinds of dysfunctions which can affect the performance of supply chain. The third stage involves building metric of dysfunctions / indicators. The idea is to match an indicator to each dysfunction. The role of indicators is to check and predict the advent of dysfunctions and avoid as possible their occurrence.

![Fig. 1 Framework of IST](image)

III. MODELING MEDICINES SUPPLY CHAIN IN PUBLIC HOSPITAL

A. Medicines Hospital Supply Chain

Hospitals are large and complex organizations, and differ from most traditional organizations.

- Hospital offers an intangible product, which is unique and not widely available.
- Hospital has a human mission focusing on improving community health.
- Hospital is considered not-for-profit.
- Hospital strives to develop system that ensures a level of care to patient within limited resources.

Healthcare supply chain is also complex and different from the supply chain of other industries. Inpatient flows federate a variety of healthcare resources, such as medicines, medical supplies, linen, food, stationary, and cleaning supplies [12]. As the supply chain constitutes a large portion of hospitals operating expense, improving medication supply management provides an opportunity to optimize cost of healthcare [13]. Hospitals maintain an inventory of thousands of supplies, bandages, syringes, drugs, surgical instruments and medical devices. Supply chain costs consume as much as 40% of total operating budget, the second-largest expense for hospitals after labour. That’s why small improvements in supply chain performance can have a huge impact on a hospital’s bottom line, helping to reduce supply chain costs by as much as 10 to 12 percent. Inventory optimization can account for 10 percent of the overall savings [14]. The drugs supply chain needs to be managed efficiently in order to avoid all kinds of malfunctions or losses [15].

To improve hospital drugs supply chain, it is paramount to describe its functions. According to [12], the medicine flows include warehousing, inpatient department and outpatient department. Warehousing consists of making available medicines and medical supplies. The principal functions of warehouse are: purchase order, inventory, and distribution process.
Purchase order aims to quantify the need of medicine across hospital and place it to its suppliers.

Inventory process focuses on the movement of medicines. It includes: receiving, storage decision, inventory level and allocation of medicine flows.

Distribution process refers to scheduling and allocating of the flow of medicines.

In [15], authors join this description and consider that drugs supply chain includes selection, quantification, procurement, storage, distribution and use. They also confirm that the principles of wastage which may affect this process are: out stock, overstocking and expiry of medicines. To prevent this wastage, a revision of process is necessary. The process approach can improve the organizational because it enhances the collaborative work. It implies the use of process oriented performance indicators and obliges the members of an organization to work together to achieve the commons goals [16].

In hospital medium, the process view takes place with the increase of healthcare costs. The healthcare providers are beginning to use the business process reengineering to achieve a competitive advantage. They use this technique to discover the best processes for performing work [17]. To understand process, and how work is done, it is necessary to model them. A model is an abstract representation of the real world that reduces reality and enables to better assimilate the process operation.

Supply chain operations reference model (SCOR) is a modelling approach that provides standard guidelines to examine the configuration of supply chain identify and measure metrics in the supply chain [18].

B. SCOR Model

The Supply Chain Operations Reference-model (SCOR) is the product of the Supply-Chain Council (SCC), an independent, not-for-profit, global corporation with membership open to all companies and organizations interested in applying and advancing the state-of-the-art in supply-chain management systems and practices. The SCOR-model captures the Council’s consensus view of supply chain management. While much of the underlying content of the model has been used by practitioners for many years, the SCOR-model provides a unique framework that links business process, metrics, best practices and technology features into a unified structure to support communication among supply chain partners and to improve the effectiveness of supply chain management and related supply chain improvement activities.”[19]. SCOR is based on three concepts: process, levels, and measures.

1) SCOR Processes:

The SCOR model consists of five basic processes: plan, source, make, deliver and return. The SCOR modelling approach starts with the assumption that any supply chain process can be presented as a combination of those processes (e.g.Fig. 2) [20].

![SCOR framework](image)

The five core management processes are [20]:

a) PLAN: Assess supply resources; aggregate and prioritize demand requirements; plan inventory for distribution, production, and material requirements; and plan rough-cut capacity for all products/channels.

b) SOURCE: Obtain, receive, inspect, hold, issue, and authorize payment for raw materials and purchased finished goods.

c) MAKE: Request and receive material; manufacture and test product; package, hold, and/or release product.

d) DELIVER: Execute order management processes; generate quotations; configure product; create and maintain customer database; maintain product/price database; manage accounts receivable, credits, collections, and invoicing; execute warehouse processes including pick, pack, and configure; create customer-specific packaging/labelling; consolidate orders; ship products; manage transportation processes and import/export; and verify performance.

e) RETURN: Defective, warranty, and excess return processing, including authorization, scheduling, inspection, transfer,
warranty administration, receiving and verifying defective products, disposition, and replacement.

2) SCOR Levels:

Process decomposition models are developed to address one specific configuration of process elements. SCOR is based on hierarchical modelling. The hierarchical structure plays a critical role in modelling the interactions among strategic, tactical and operational [20]. Fig. 2 shows the four levels for SCOR.

a) **Top level (process types):** is the first level, it represents the core management processes and the metrics and measures corresponding to the management processes.

b) **Configuration level (process categories):** in this level, configuration of supply chain is described. For example, the source process has variants like source stocked product, source make-to-order product, source engineer-to-order product.

c) **Process elements level (decompose processes):** each of the level process elements is detailed in this level. It consists of process elements and the input measures, parameters and output metrics associated with it [20].

d) **Implementation level (decompose process elements):** it represents the tasks associated with process elements.

3) SCOR Measures:

SCOR provides criteria and metrics to measure the supply chain performance. The metrics are the indicators by which an organization can measure how they are in achieving their desired positioning within the competitive market context. Reliability, responsiveness and flexibility are customer-oriented metrics. Cost and assets are metrics which measure supply chain from the viewpoint of internal performance of a supply chain.

a) **Reliability:** it measures the capacity of a supply chain in delivering the correct product to the correct place at the correct time in the correct condition and packaging in the correct quantity with the correct documentation to the correct customer.

b) **Responsiveness:** it is related to the velocity at which a supply chain provides products to the customer.

c) **Flexibility:** the agility of a supply chain in responding to marketplace changes to gain or maintain competitiveness.

d) **Cost:** measure cost generated by operating the supply chain.

e) **Assets:** the effectiveness of managing assets to support demand satisfaction [22].

SCOR associates to each item a number of performance attributes. Table I depicts the Level 1 metrics.

Following this literature review, we conclude that SCOR Model is an adequate tool to achieve the modelling of hospital drugs supply chain. SCOR offers the advantage to:

- Visualize the entirety of supply chain.
- Put forward the interactions between processes.
- Model the complete frame of a supply chain.
- Give the principals key performance attributes of a supply chain.

<table>
<thead>
<tr>
<th>Performance attribute</th>
<th>Level 1 metrics</th>
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<tbody>
<tr>
<td>Reliability</td>
<td>Delivery Performance</td>
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<td></td>
<td>Fill Rates</td>
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<td></td>
<td>Perfect Order Fulfillment</td>
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<td>Responsiveness</td>
<td>Order Fulfillment Lead Times</td>
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<td>Supply Chain Flexibility</td>
<td>Supply Chain Response Time</td>
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<td></td>
<td>Production Flexibility</td>
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<td>Supply Chain Costs</td>
<td>Total Supply Chain Management Costs</td>
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<td></td>
<td>Value-Added Productivity</td>
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<td></td>
<td>Warranty / Returns processing Costs</td>
</tr>
<tr>
<td>Supply Chain Asset Management Efficiency</td>
<td>Cash-to-Cash Cycle Time</td>
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<tr>
<td></td>
<td>Inventory Days of Supply</td>
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<td></td>
<td>Assets Turns</td>
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IV. APPLICATION OF IST IN CASABLANCA MOULAY YOUSSEF HOSPITAL (CMYH)
The framework of the study is the pharmacy of a big public hospital in Casablanca; this pharmacy feeds 11 care units.

A. First Stage: Modellings of Medicines Supply Chain and Definition of the Key Performance Attributes

1) Modelling of First Level: Processes of Drugs Supply Chain:

Modelling of this level aims to clarify all processes of drugs supply chain. SCOR plans five types of process: planning, procurement, production, distribution and return. For our case study, we have retained only four levels, because pharmacy of CMYH does not produce any pharmaceutical substance.

a) Planning activities (Plan) consists in organizing the logistic circuit of the drugs at the hospital. The pharmacist must plan the annual procurement of the drugs, to define the modes of distribution of each category of drugs, to fix the share of each service of care in the budget allocated by the ministry of health.

b) Procurement (Source) consists in feeding the pharmacy in drugs. It includes the quantification of the annual requirement in drugs, the placing of the order, the reception of the drugs, the storage of the drugs and the inventory control.

c) Distribution activity (Deliver) consists in feeding of the units of care in drugs according to their need.

d) Return of drugs (Return) goes from units care to pharmacy. It concerns expired or unutilised drugs.

e) Figure 3 depicts Level 1 and puts forward the flow of the drugs from the suppliers until the unit of care.

Fig. 3 Level 1 of source medicines

2) Modelling of the Second Level: Types of Drugs Procurement Process:

We will focus on procurement drugs process (Source). On This level, we have to specify the categories of this process:

S1: centralized supply: it concerns drugs registered on the national nomenclature of pharmaceuticals products. The purchases of these drugs are done according to an operational budget which is granted by the Moroccan ministry of health. This kind of procurement is done from only one supplier who is division of supplies; it is a public authority which gathers the demands for medicinal products at the national level. The Moroccan health ministry offers 746.000 euros to CMYH for this supply.

S2: decentralized supply: it hold for the drugs which do not appear on the nomenclature national and also for the purchase of the drugs in urgent need. CMYH has 20.000 euros for this kind of supply.

Figure 4 depicts these two under processes.

Fig. 4 Level 2 of “SOURCE” drugs
3) Modelling of the Third Level: Detailed Process Element Information:

In this level, SCOR envisages five under processes of the procurement process: Schedule Product Deliveries, Receive Product, Verify Product, Transfer Product, and Authorize Suppliers Payment. This level aims to determine the entries and the exits of each under process. Considering the importance of the centralized supply in terms of budget, we will limit ourselves to S1. Figure 5 shows this third level.

**S1.1/ Schedule Product Deliveries:** this stage aims to calculate the quantity of each drug to be ordered to meet the annual need in drugs. The input of this under process is the annual need of drugs estimated by doctors. This need is called a gross need (GN). The pharmacist analyses this need and obtains a net requirement. The analysis is done according to some parameters: Open stock (OS), Packaging Unit (PU), Shelf Life of drugs (SL), Budget (B), and data on national health (DNH). The final quantity of drugs is a function of all those parameters.

**S1.2/ Receive and Verify Deliveries:** this under process consists of receiving drugs shipped by the procurement direction. It consists in checking the following items: quality of drugs, shelf life, invoice, quality of packaging.

**S1.2/ Transfer drugs:** place medicines in the pharmacy local. Storage must also follow the safety instructions and respect the FIFO (first in first out). The objective of this step is to make medicines quickly accessible and visible to the preparer.

The inputs and outputs have been determined, it is necessary to view the activities and actors involved in the process. This is the goal of modelling of Level 4.

4) Modelling of Fourth Level: Actors and Acts:

The SCOR model does not provide any specific tools for this level. We limited ourselves to present details of S1.1: build schedule procurement. Figure 6 presents the results.

The modelling of the fourth level of “build schedule procurement” (e.g. Fig. 6) shows that this process suffers from some constraints, and it also engages a numbers of actors. Constraints are:

**Budget:** is the budget allocated by the authority. This budget limits the amount of purchases.

**Price:** the pharmacist has no power to negotiate prices. Note that drug prices are high in Morocco. According to [23], in Morocco drug prices are generally higher (30 to 189% in Tunisia and 20 to 70% compared to France).
• **Shelf Life**: each drug has a shelf life. Procurement is limited by this deadline.

• **Data on national health**: data on morbidity, the nature of diseases and epidemics of the time.

• In the other hand, actors are:

  • **Pharmacist**: the manager of the pharmacy, he guarantees the availability of drugs. He analyses the needs for medicines and decides for purchases order.

  • **Preparer**: He is in charge of recording the movements of inventories, making the receipt of medications and monitoring compliance with quality standards and safety.

  • **Doctors and nurse of units care**: they are the customers of the pharmacy. They are influencing the medicines procurement management. They have to ensure the rational use of drugs to prevent waste, to express a correct estimate of needs and to avoid breaks or overstocks.

  • **Division of supplies**: it is an entity of the Ministry of Health, external to the hospital. It consolidates the drug needs at the national level. It is responsible for purchasing drugs through tenders. It carries out partial deliveries.

5) **Key Performance Attributes of Drugs Supply Chain Management in CMYH**:

According to SCOR Model (e.g. Table I), supply chain performance can be measured by following items:

1. Quality of delivery
2. Quality of order fulfilment
3. Respect of lead times
4. Speed of response
5. Value of wastage
6. Inventory days of supply

Concerning CMYH, this means providing care units by drugs requested, at the right time and in correct quality conditions. However, the medicines availability must be at a reasonable cost. The principals key performance attributes for drugs supply chain of CMYH are:

- Avoid inventory shortage.
- Avoid excess of stock and wastages
In further work, we will limit ourselves to inventory shortage. In fact, drugs inventory shortage is a very recurrent in public Moroccan hospitals and may have adverse effects on the health of the poorest populations. Indeed, a breakdown situation can lead:

- The expectation of the patient which can aggravate his condition
- Support by patient: In 2007, health expenditures in Morocco were 33.2 billion dirham, according to OMS. 57% of this amount was borne directly by patients [23].

An inventory shortage may be due to different dysfunctions in the process flow of drugs supply. To highlight these dysfunctions, we opted for Fault Analysis tool. This will be the subject of the second stage of our study.

B. Second Stage: Defining Indicators of Inventory Shortage

Drugs inventory shortage means that drugs requested by unit care are not available in pharmacy. This kind of incident may have a lot of reasons. To identify those reasons, we built a QC Story. Figure 7 shows the results.

Through this analysis, we obtained that shortage inventories can be due to following reasons:

a) Lack of checking of annual order fulfilment.

b) Incorrect up date of stock.

c) Frequent deliveries incidents.

d) Delay in sending the annual order.

e) Unexpected increase of drugs consumption.

f) Underestimation of the average consumption of drugs by the units care.

These risks are called inducers. In order to overpower them, we have built some indicators which enable to anticipate their advent. So, the next and the final stage is to make the metric of drivers/indicators.

C. Third Stage: Metric Indictors/Indicators

The idea here is to suggest indicators, that pharmacist can follow continually to anticipate and avoid the advent of an inventory shortage. To make indicators we have to answer three questions in advance:

1. What is the parameter affected by the malfunction?
2. How the malfunctions appear?
3. What is the normal situation?

The results are regrouped in the following metric (Table II).

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1 Word Health Organization
To simplify the updating of the indicators, we took care to limit their number while trying to cover all the possible dysfunctions. In fact, the contribution of each indicator remains in the interpretation of the results and the decision making.

To illustrate our results, we focus on analyzing the exceptional deliveries rate (EDR) for January 2012. Care units are fed each month by the requested drugs, however, during the month, pharmacist of CMYH can authorize exceptional deliveries if necessary. EDR measures the frequency of these deliveries, that’s because they have to be limited. To be relevant, value of exceptional deliveries must be assessed in relation to the average consumption value. The indicator is valued in DH\(^2\).

\[
\text{Exceptional delivery rate} = \frac{\sum \text{Value of monthly exceptional delivery}}{\sum \text{value of average monthly consumption}}
\]

Indicator (e.g. Fig. 8) shows that during January 2012, the exceptional demands for drugs formulated by the intensive care unit have reached twice its consumption average, for the surgical unit and the service of the surgery; these requests represented more than half of average consumption. This alarming report pushed us to carry out the analysis of the structure of these requests and we have made a Pareto diagram of the drugs requested exceptionally during the month. The graph (e.g. Fig. 9) shows that the 20\% of the drugs which account for the 80\% of the value of the exceptional requests during month of January

\[^2\] DIRHAM : currency of MOROCCO

<table>
<thead>
<tr>
<th>N</th>
<th>Inductor</th>
<th>Question1</th>
<th>Question2</th>
<th>Question3</th>
<th>Indicator</th>
<th>Formula</th>
<th>Update frequency</th>
<th>Data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unexpected increase of drugs consumption.</td>
<td>What is the parameter affected by the malfunction?</td>
<td>How the malfunction appears?</td>
<td>What is the normal situation?</td>
<td>List drugs whose quantity is lower or equal to the minimum threshold.</td>
<td>weekly stock sheet</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>List of drugs whose quantity is lower or equal to the safety threshold.</td>
<td>weekly stock sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lack of checking of annual order fulfillment.</td>
<td>Drugs quantity requested of by the services of care.</td>
<td>A fast fall of the levels of stocks.</td>
<td>Keep a minimum stock by drugs.</td>
<td>accumulation of delivered quantities value per month</td>
<td>monthly annual order registry of receptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Delay in sending the annual order.</td>
<td>annual order deliveries the by supply direction.</td>
<td>Deliveries are distributed equitably over the year.</td>
<td>Supply direction service rate.</td>
<td>value of accumulation quantities which must be delivered</td>
<td>monthly annual order registry of receptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Incorrect up date of inventory.</td>
<td>the physical inventory is different from the theoretical inventory</td>
<td>the physical inventory is equal to theoretical inventory</td>
<td>Discrepancy rate</td>
<td>physical inventory - theoretical inventory</td>
<td>monthly stock sheet inventory sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Underestimation of the average consumption of drugs by the units care.</td>
<td>consumption annual average of the drugs by the services of care</td>
<td>increase of monthly consumption of drugs</td>
<td>Exceeding order rate</td>
<td>accumulation of the quantity requested monthly per care unit</td>
<td>monthly Internal purchase order. Annual order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Underestimation of the monthly consumption of drugs by the units care.</td>
<td>quantity of medicines requested monthly by care units</td>
<td>exceptional requests of drugs during the month</td>
<td>Average value drugs consumption by service= target.</td>
<td>Exceptional deliveries rate.</td>
<td>monthly stock sheet</td>
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</table>
2012 belong to the following categories: the anaesthesia, pneumology, infectiology. “SODIUM CHLORIDE 0.9% INJECTABLE POCKET 500 ml” is top of the list with 56%.

The analysis of the EDR has revealed some organizational problems in intensive care unit and which may influence feeding of the drugs. First, this unit suffers from a human problem, indeed this service has only one principal nurse who, at the same time, has to take care of patients and feed the care unit in drugs and medical devices. This lack of human resources impacts negatively the achievement of logistics activities. Because of time lack, nurse cannot follow rigorously medicines consumption, the monthly orders are done in a random way and for this reason, nurse is obliged to ask for drugs during the month. On the other hand, we note that the intensive care unit has a problem of the storage space; indeed the service does not have a space dedicated for the pharmacy. Because of this lack of space, the EDR is high, a drug like “SODIUM CHLORIDE 0.9% INJECTABLE POCKET 500 ml” counts 12 units/packing, the intensive care unit consumes on average 775 units per month, the equivalent of 38 packing. Because the packaging unit of this drug is quite large, it is not possible to place the entire monthly consumption on the premises of the nursing unit.

V. DISCUSSION

The analysis of the EDR has revealed deficiencies of the system of restocking of the units of care in drug in CMYH. Indeed, the only mode of inventory replenishment in CMYH is the monthly orders; this mode is required by the Ministry of Health in Morocco. However, this mode cannot be adapted for all kinds of drugs. The feeding of the units of care must take account of several parameters, primarily: average consumption and packaging unit. That’s why we proposed to change the replenishment mode of drugs with high consumption. The mode suggested is a daily requisition. It concerns only some kinds of drugs, especially those with high consumption. This kind of requisition requires that is the assistant nurse of pharmacy who will be in charge of restocking of the drugs. First, a staffing level of drugs must be fixed for each care unit. The preparer should then carry out a daily inventory for drugs, if existing stock is lower than the drugs staffing level required for the care unit, the preparer must supplement stock.

This mode enables to better manage the delivery of the drugs with strong consumption by entrusting this task to the pharmacist preparers who control best the logistic aspects, and this mode will also make it possible to reduce the load of nurses who will be able to allocate more time to take care for patients, their principal mission at the hospital. The deficit in storage space would be also overcome.
The measurement of the EDR has required the recourse to a double analysis, we calculated two indicators. The first was the rate of exceptional deliveries per service, which served to locate the units of care most concerned by the measured object, and the second is the Pareto diagram of the drugs requested exceptionally, which made it possible to concentrate the analysis on part of the drugs which represent most of the exceptional requests.

VI. SYNTHESIS: INDICATORS SELECTION GUIDE

To synthesize, our contribution to the problem of piloting indicators selection in Moroccan public hospital medium is:

1. Suggestion of an approach based on the dysfunctions analysis, and this approach guarantees the exhaustiveness of piloting the performance.
2. Analysis and interpretation of the indicators.
3. Suggestion of personalized indicators and adapted to the studied system and this avoids the use of ready indicators.

We have also built a guide of selection indicator; it synthesizes all steps to follow and choose relevant indicators (Figure 10).

![Diagram](image)

**Fig. 10 Selection indicators guide (authors)**

VII. CONCLUSIONS

In the end of this survey, we conclude that the selection of indicators is a rigorous process whose outcome depends on some factors. The first one is human factor. Without the motivation of teams and their involvement, the process of selecting indicators cannot succeed. For example, the brainstorming whose objective is to detect potential risks is based primarily on the human factor. The second factor is the use of new technologies. To measure indicator, it is necessary to deal with important number of data. This cannot be achieved without the use of data integration system. However, the observation that we made is lack of the use of this kind of systems in CMYH.

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[23] A.ETALBI was born in 1958; he holds a Diploma of Engineering of State Automated Production of the Higher Institute of Materials and Mechanical Engineering (ISMC) of Saint Ouen in Paris (1985), the Doctorate of the University of Metz in Computer Engineering (1989) and PhD in Production Engineering from the EMI Rabat (2002).

I. Ibn El Farouk was born in 1979, holds a diploma of advanced studies in Engineering Logistics at the University Hassan II in Casablanca, MOROCCO, obtained in 2004.

She is a researcher in hospital logistics, registered with the Centre of doctoral studies at the University of Engineering in Fez. She has publications on the topic of performance and modeling of hospital supply chain.

Ms. Imane is also a consultant in logistics in the automotive sector and host of supplier performance.

F. JAWAB was born in 1968; is Professor empowered at the School of Technology of Fez, He is the pedagogical coordinator of master of business administration and engineering logistic in School of Technology of Fez.

Mr. JAWAB is the chairman of LOGISTIQUA, an international symposium in logistic.

A. Talbi was born in 1958; he holds a Diploma of Engineering of State Automated Production of the Higher Institute of Materials and Mechanical Engineering (ISMC) of Saint Ouen in Paris (1985), the Doctorate of the University of Metz in Computer Engineering (1989) and PhD in Production Engineering from the EMI Rabat (2002).

He is Professor at the School of Technology of Fez, He is responsible for the research team in Maintenance, and Quality is one of the three components of the Laboratory of Production Engineering, Energy and Sustainable Development.