



USAID
DEL PUEBLO DE LOS ESTADOS
UNIDOS DE AMERICA

**PERU | POLITICAS
EN SALUD**

USAID **50** ANIVERSARIO

Report on the management of the supply chain of pharmaceuticals and medical products in regional governments in Peru

USAID/Peru/Health Policies

Contract No. GHS-I-10-07-00003-00

Revised Draft

September 30, 2011

Prepared for:

Luis Seminario, COTR
USAID/Peru Health Office
Av. Encalada s.n.
Lima - Perú

Submitted by:

Abt Associates Inc.
4550 Montgomery Avenue
Suite 800 North
Bethesda, MD 20814

This document has been elaborated by USAID|PERU|Políticas en Salud Project, financed by the United States Agency for International Development (USAID) under contract No. GHS-I-10-07-00003-00.

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

Report on the management of the supply chain of pharmaceuticals and medical products in regional governments in Peru

CONTENT

| | |
|---|----|
| Executive Summary | 1 |
| 1. Introduction | 4 |
| 2. Supply chain management model | 7 |
| 2.1 Client oriented | 8 |
| 2.2 Incorporation of costs..... | 9 |
| 2.3 Liquid assets turnover | 9 |
| 3. Defining Management Parameters..... | 11 |
| 3.1 Market Dimension..... | 13 |
| 3.1.1 Service Quality Management | 14 |
| 3.1.2 Client coverage management | 14 |
| 3.1.3 Market share management | 15 |
| 3.2 Operating efficiency dimension..... | 16 |
| 3.2.1 Supply capacity management..... | 16 |
| 3.2.2 Supply dispersion management..... | 16 |
| 3.2.3 Distribution efficiency management..... | 17 |
| 3.2.4 Expense per user performance management..... | 17 |
| 3.2.5 Management of Expense Productivity Variation..... | 18 |
| 3.3 Operating Sustainability Dimension | 20 |
| 3.3.1 Inventory Turnover Management..... | 20 |
| 3.3.2 Management of Accounts Receivable Recovery Period..... | 20 |
| 3.3.3 Operation Cycle Management..... | 21 |
| 3.3.4 Cash Generation Capacity Management..... | 21 |
| 4. Diagnostic of Medicines and Supplies Provision Management..... | 23 |

| | | |
|-------|--|----|
| 4.1 | Market dimension | 23 |
| 4.1.1 | Service quality | 23 |
| 4.1.2 | Client Coverage | 27 |
| 4.1.3 | Market Share | 28 |
| 4.2 | Operating Efficiency Dimension | 29 |
| 4.2.1 | Supply capacity | 29 |
| 4.2.2 | Supply dispersion | 31 |
| 4.2.3 | Distribution efficiency | 33 |
| 4.2.4 | Expense per user performance..... | 34 |
| 4.2.5 | Expense productivity variation..... | 35 |
| 4.3 | Operating Sustainability Dimension | 38 |
| 4.3.1 | Inventory level..... | 38 |
| 4.3.2 | Accounts receivable recovery period..... | 39 |
| 4.3.3 | Operation cycle..... | 40 |
| 4.3.4 | Cash generation capacity..... | 41 |
| 4.3.5 | Summary of indicators..... | 43 |
| 5. | Inventory and Costs Management..... | 45 |
| 5.1 | Incentives..... | 45 |
| 5.1.1 | Measurement: Availability..... | 45 |
| 5.1.2 | Allocation of financial resources form..... | 46 |
| 5.1.3 | The role of the DIRESA..... | 47 |
| 5.2 | Costs..... | 47 |
| 5.2.1 | Purchasing costs | 47 |
| 5.2.2 | Inventory management costs | 47 |
| 5.2.3 | Costs of losing sales (not being able to meet orders)..... | 48 |
| 5.2.4 | Medicines and supplies costs | 49 |
| 5.2.5 | Variability | 49 |
| 5.2.6 | Strategic considerations | 53 |

| | | |
|-------|--|----|
| 5.3 | Incorporating costs and an efficiency ratio..... | 53 |
| 6. | Annex # 1 Management Indicators Technical Sheet..... | 58 |
| 6.1 | Market Dimension..... | 58 |
| 6.1.1 | SERVICE QUALITY INDICATOR TECHNICAL SHEET..... | 58 |
| 6.1.2 | CLIENT COVERAGE INDICATOR TECHNICAL SHEET..... | 59 |
| 6.1.3 | MARKET SHARE INDICATOR TECHNICAL SHEET | 60 |
| 6.2 | Operating Efficiency Dimension | 61 |
| 6.2.1 | SUPPLY CAPACITY INDICATOR TECHNICAL SHEET | 61 |
| 6.2.2 | SUPPLY DISPERSION INDICATOR TECHNICAL SHEET | 61 |
| 6.2.3 | DISTRIBUTION EFFICIENCY INDICATOR TECHNICAL SHEET | 62 |
| 6.2.4 | EXPENSE PER USER PERFORMANCE INDICATOR TECHNICAL SHEET | 63 |
| 6.2.5 | EXPENSE PRODUCTIVITY VARIATION INDICATOR TECHNICAL SHEET | 64 |
| 6.3 | Operating Sustainability Dimension | 65 |
| 6.3.1 | INVENTORY TURNOVER INDICATOR TECHNICAL SHEET | 65 |
| 6.3.2 | ACCOUNTS RECEIVABLE TURNOVER INDICATOR TECHNICAL SHEET | 65 |
| 6.3.3 | OPERATION CYCLE INDICATOR TECHNICAL SHEET..... | 66 |
| 6.3.4 | CASH GENERATION CAPACITY INDICATOR TECHNICAL SHEET | 66 |
| 7. | Bibliography..... | 67 |

TABLES

| | |
|--|----|
| Table # 1 Management Indicators..... | 12 |
| Table # 2 Market Dimension Indicators..... | 15 |
| Table # 3 Operating Efficiency Dimension Indicators..... | 19 |
| Table # 4 Financing structure of medicines and supplies purchase at regional level (2010)..... | 21 |
| Table # 5 Operating Sustainability Dimension Indicators..... | 22 |
| Table # 6 People who attended Health Establishments and received the medicines prescribed..... | 23 |
| Table # 7 People who attended non MINSAs Health Establishments and received the medicines prescribed..... | 24 |
| Table # 8 Differential between prescription dispensing service in MINSAs and NON MINSAs Health Establishments..... | 24 |
| Table # 9 SIS affiliates that had consultation at MINSAs Health Establishments and received prescribed medicines..... | 25 |
| Table # 10 Differential in MINSAs vs NON MINSAs Health Establishments (in pp.)..... | 26 |
| Table # 11 SIS affiliates that had consultation at MINSAs Health Establishments and handed their prescription at the pharmacy and did not receive medicines..... | 27 |
| Table # 12 SIS affiliates that bought medicines in private drugstores and pharmacies..... | 28 |
| Table # 13 Comparison of MINSAs availability and Prescription Dispensing, ENAHO..... | 30 |
| Table # 14 Average Availability by DISAs/DIRESEs and Dispersion..... | 32 |
| Table # 15 Medicine expense productivity variation vs Dispensing Rate (2005-2007 vs 2008-2010)..... | 36 |
| Table # 16 Medicines Inventory by Region for 2008 (equivalent to number of months of sales)..... | 38 |
| Table # 17 SIS accounts receivable recovery period (2008)..... | 40 |
| Table # 18 Cash cycle by region for 2008 (expressed in number of months)..... | 41 |
| Table # 19 Management Indicators (at national level)..... | 43 |
| Table # 20 Cost of Non-served Prescriptions (national level)..... | 49 |
| Table # 21 Total costs incurred due to deficient Supply Management..... | 54 |
| Table # 22 Inefficiency vs Service Quality Variation..... | 55 |
| Table # 23 Inefficiency vs Service Quality Variation (50% higher vs 50% lower)..... | 55 |
| Table # 24 Intensity of health services used and soles spent in medicines per user served, according to efficiency levels..... | 56 |

GRAPHS

| | |
|---|----|
| Graph # 1 Supply Chain Management Elements | 7 |
| Graph # 2 National availability average 2006-2010 | 29 |
| Graph # 3 Availability of medicines vs dispensing of medicines | 30 |
| Graph # 4 DIRESA Ucayali – April 2011 | 33 |
| Graph # 5 National Efficiency Index 2005-2007 | 34 |
| Graph # 6 National Efficiency Index 2008-2010 | 35 |
| Graph # 7 Relation between inventory levels and prescription dispensing rates | 39 |
| Graph # 8 Effect of inventory and price reduction on cash generation | 42 |
| Graph # 9 Market indicators (national level) | 43 |
| Graph # 10 Operating Efficiency Indicators (national level) | 44 |
| Graph # 11 Operating Sustainability Indicators (national level) | 44 |
| Graph # 12 Inventories model by tier | 51 |
| Graph # 13 Inefficiency vs Service Quality Variation (by quintile) | 56 |

ACRONYMS

| | |
|---------|--|
| AEM | Specialized Medicines Storage |
| AUS | Universal Health Insurance |
| CDMI | Distribution Center for Medicines and Supplies |
| CCFR | Regional Optional Corporate Purchase |
| CCN | National Corporate Purchase |
| CCR | Regional Corporate Purchase |
| DAIS | Comprehensive Health Care Directorate |
| DARES | Strategic Health Resources Directorate |
| DESP | Executive Directorate of Human Health |
| DIGEMID | Medicines, Supplies, and Drugs General Directorate |
| DIRESA | Regional Health Office |
| DIREMID | Medicines, Supplies, and Drugs Regional Directorate |
| DISA | Health Office |
| DMID | Medicines, Supplies, and Drugs Directorate |
| EESS | Health Establishments |
| EDA | Acute Diarrheal Disease |
| ENAHO | National Household Survey |
| INEI | National Institute of Statistics and Data Processing |
| ICI | Integrated Consumer Report |
| IRA | Acute Respiratory Disease |
| MEF | Ministry of Economy and Finance |
| MINSA | Ministry of Health |
| MR | Micro Health Network |
| OGA | General Administration Office |
| OMS | World Health Organization |
| PEAS | Basic Health Insurance Plan |
| PIP | Public Investment Project |
| ROF | Regulations on Organization and Functions |
| RR.HH. | Human Resources |
| SIAF | Integrated Financial Administration System |
| SIGA | Integrated Administrative Management System |
| SIS | Integrated Health Insurance |
| SISMED | Integrated System for the Provision of Medicines and Medical-Surgical Supplies |
| U.E. | Executing Unit |
| USAID | United States Agency International Development |

Executive Summary

For more than half a century, Peru has been applying a series of strategies to enable its population to access medicines. While progress has been made in this direction and there is an apparent availability of greater financial resources, the gap is still too wide. Statistics on the quality of medicine dispensing services at public health establishments show in the last years a disturbing deterioration contrary to MINSA publications, asserting there is an increased supply capacity.

One of the most important restrictions to obtain better results lies in the capacity of the system to adequately manage processes. Within a rigid regulatory framework, often far from the reality, with a still incomplete decentralization process, transfer of functions and generation of regional competencies, together with a statutory perspective of process management, it is proposed to seek opportunities for improvement that may make it possible to obtain concrete results and generate social value in line with institutional mandates.

This study underscores the need and rescues the feasibility to implement management mechanisms in the public sector, in particular, for the supply of pharmaceuticals and medical products in the regional health offices, similar to those used in the private sector.

It is necessary to achieve a cultural change in the role of public managers; accountability can no longer be associated only to transparency and compliance with regulations. It is necessary to include as an imperative, the need to generate valuable results in accordance with their institutional mandate.

A management model is proposed, based on three dimensions: Market, Operating Efficiency and Sustainability, in which is useful to associate values and techniques of private management on the public management.

The first dimension is intended to manage the supply of final results (bottom line), in this case, the dispensing of all medications prescribed to the patient by the pharmacy of the health facility where he was treated. A private company would use concepts such as market share, customer coverage and quality of service. To manage these criteria, indicators have been developed to pursue objectives in the public sector equivalent.

When the obtained results are analyzed using this perspective, we find ourselves faced with a deterioration of the health establishments' capacity to supply the prescriptions of the people served. Even in regions where there is a higher alternative offer of services or competition, the results tend to be more negative. Where the public subsector is almost a monopoly, service quality and users' perception tend to improve. This leads us to consider three hypotheses:

- In regions where there is more formality and tax pressure, the tendency to judge public services critically is greater than in those where there is not (in Lima or Callao they will tend to be more critic tan in Puno or Apurímac).
- In regions where there is greater possibility to compare alternative services both public and private, the tendency to critically judge public services is greater than in

- those where there is not (again, in Lima or Callao they will tend to be more critic tan in Puno or Apurímac).
- The public subsector (at least in regards to medicines supplies) does not have the incentives or the capacity to compete with similar services provided by other sectors (EsSalud, private clinics and pharmacies, etc.).

The second dimension refers to the principle of efficiency; there is no reason why this has to be alien to public management. If the purpose is identified, equity must be pursued in an efficient manner. To obtain better or similar results using the same resources. Given the dynamics in public establishments, it is even possible to obtain better results with fewer resources. Unfortunately, due to the current inertia, there are several cases of fewer results despite having more resources. A private company would seek that its products offer (supply) be evenly distributed to all sales points, would measure the productivity of the resources used in its operation and would even monitor its evolution on a permanent basis. Mechanisms are proposed to manage supplies in this same way.

Findings based on indicators developed point out several areas for improvements in the supply process operation, especially in distribution. The supply capacity, or availability as defined by MINSA, is not being taken as a relevant factor to determine the quality of the final service. As this indicator is proposed, the purpose is to promote a greater willingness to generate inventories, without evaluating how much value they contribute. Equally important or even more important than the supply capacity in a particular region or field, is how evenly it is distributed. The medicines availability indicator makes no sense if it is not accompanied with an indicator of supply dispersion and even of efficiency in the distribution of such offer.

When we examine the capacity of financial resources(those used in the purchase of medicines) to generate value (dispensing of prescriptions) we find very disperse results, which are associated with the process management approach. Those regions which purchase in order to store; that is, those regions with a greater expense to inventory ratio, are those that tend to show lower results and, therefore, less productivity per sol spent.

The following is proposed based on the above:

- Using the availability indicator to evaluate the regional capacity to generate results in its supply process introduces a serious distortion in the system that causes regional health offices to increase their medication inventories.
- Instead of medicine availability per area, it is necessary to control the distribution of the supply capacity. The former is associated to stocks and the latter, to flows.

The third dimension proposes managing the liquidity of the supply chain to keep it continuous. A supply chain implies the administration of three types of flows: materials, information, and cash. Social demands are growing in greater proportion than public resources. Usage rates can be increased with an adequate management of cash flows and financing sources. Accounts receivable (in this case the SIS) and inventories must be managed so that cash cycles are as short as possible, without affecting service quality, but guaranteeing the financial sustainability or intangibility of the supply chain. Unlike what is

often believed, private companies value liquidity, even over profits. The basic concept is money turnover, not immobilization (stock).

Here the idea is related to keeping the “Cash to Cash” cycle as short as possible without affecting service quality. Having a high burden of immobilized assets diminishes any institution’s capacity to maneuver, in addition to all other related costs. One of the main weaknesses to keep a sustained medicines supply in health establishments managed by regional governments is their budgetary availability. Many purchase processes or purchase order generation processes are delayed or stalled due to lack of funds at the right moment. The Regional Office or Executing Unit is saturated with stocks; however, it is unable to replenish what they need with due anticipation. It is the result of poor programming of requirements, an inadequate management of purchase contracts and budgetary flows.

As a proposal and based on the above, regional health authorities and their supply policy should be oriented towards obtaining more efficient stock levels. Important price reductions have been obtained using the corporate purchase mode. However, the next steps should aim at consolidating these gains with an adequate cash cycle management. The work hypothesis is:

- The high inventories held by regional offices are preventing the supply process from being managed with the capacity to generate valuable results for the population.

An important idea is the incorporation of costs. Many public managers do not incorporate costs generated by poor management. There is confusion between cost, expenditure and budgetary control. What is considered as expense or budgetary disbursement is transferred as cost to public service users – in this case, delivery of medicines to the people – through an increasingly deteriorated service provision. As costs have not been incorporated, decisions made are far from adequate.

As shown in this study, it is possible to associate efficiency in process management to final results. The hypothesis is that:

- Regions that have showed greater approach to their market (less “lost sales”) and greater cash flow control (lower stocks and accounts receivable) have enabled greater access to health services for their target population.

1. Introduction

The efforts to organize an adequate supply system of essential medicines in Peru date back to 1959, when the first list of 20 medicines under an “essential” heading was established, which were produced and delivered directly by national laboratories to health posts and hospitals¹.

In 1962, the Social Medicines Program was created, offering the population 69 medicines at half the market price. Later, in 1968, during the military government, far-reaching measures were adopted in health and particularly in relation to medicines. In 1969, 153 generic drugs were purchased for the Ministry of Health’s national network through a public bidding process. In 1971, a basic medicines program was adopted in all public sector institutions. Important price reductions were achieved, which favored access to medicines by those sectors of the population which had never had such access before. The crisis of the military government as of 1975 brought with it the gradual deterioration of this program.

As of 1975, the WHO was able to create a space to discuss issues faced by developing countries with regard to access to medicines. In 1977, the first master list of essential medicines was published as a strategy to strengthen primary attention.

During the 1980-1985 period, the Essential Medicines Program was created, where the government opted again to distribute relatively inexpensive generic drugs. Due to lack of funds to sustain its operation, it was not possible to prevent the deterioration that was being dragged since the previous program.

Between 1985 and 1990, a new strategy was designed, creating the Basic and Essential Medicines Program. It included 68 medicines that had to be supplied by the public sector, based on the National Medicines Fund, which appeared in 1986 without any public treasury budget allocation.

A new proposal in 1990 gave rise to the Local Health Systems (SILOS) promoted by the Pan American Health Organization. During the 1991-1994 period, under an agreement with MINSA, UNICEF developed the Project for the Revitalization of Peripheral Services (PROSESEP). By the end of 1992, 59 pharmacies had been established, serving more than 210,000 persons.

Another important project during the 90s was the Local Medicines System (SILOMED) developed by MINSA in Cuzco, with Italian cooperation. The purpose was to develop a “systemic” model for the local supply of medicines.

In 1994, the Shared Administration Program for Pharmacies (PACFARM), ruled by Directive 006/93-SA, was launched. A decentralized supply system was established with public funding.

Aimed especially at the first level of service, it added a list of 63 items between essential medicines and medical material, to be distributed to public health centers and posts. The program’s sustainability was based on the drug revolving fund. An interesting aspect was

the relevance given to training, which accounted for 12% of total expenses. Scale economies were exploited, centralizing purchases by public bidding processes.

In April 1990, during the reorganization process of the Ministry of Health, the DIGEMID was created as a technical-regulatory body with responsibilities that included sanitary registration of medicines, issuance of regulations and control of medicines production, distribution and dispensing processes.

The Integrated System for the Provision of Medicines and Medical-Surgical Supplies (SISMED) was established in 2002 as a public health strategy aimed at improving the accessibility to essential medicines by the population, especially the low-income population. The entire process management was structured under a single division and the resources available on a national basis to the various institutions taking part in the supply of medicines were consolidated. The regulatory agency for the pharmaceutical market (DIGEMID) also took up the leading role in the conduction of the entire medicine supply system of the public health subsector.

Is proposed a delivery system that would ensure the availability of essential drugs, adopting national standards to ensure proper and efficient management of the whole process of supply.

In 2005, pursuant to the Regional Governments Act, the Ministry of Health initiated the process for the transfer of duties and powers. It is up to the Regional Health Directorates assume the full use of the powers conferred on it, within which is included the supply of drugs.

In this situation, and since they lacked an approach to decentralization, the SISMED provisions became obsolete and presented inconsistencies in the regulations.

Meanwhile, the regional governments through their health offices, influenced by the MINSA's centralist tradition and regulatory approach, showed limited progress in the development of medicine supply systems adequate to the geographical and social context.

In 2009, the MINSA created the Acquisition Office for Strategic Health Resources (DARES) to be responsible for the programming, acquisition, storage and distribution of pharmaceutical products, medical and dental supplies. It took over responsibilities previously under the DIGEMID or the OGA.

Peru is no longer the country it was in the 60s. Much progress has been achieved with regard to health systems and towards improving the supply of medicines. However, it is clear that a significant part of the population is still unable to adequately access essential medicines, necessary for the recovery and maintenance of their health conditions.

Analyzing the above-described chronological events, patterns may be identified around the same contents, where differences were marked by the strategies used: subsidies, exemptions, negotiations with the pharmaceutical industry, large-scale purchasing, financing mechanisms, etc., a wide range of efforts guided by the forced presumption that once a sustained supply of low-priced quality medicines were available, the public institutions would

take care of making them available to the population that needed them the most, which eventually ends up confronting the system with old unresolved problems.

The managerial capacity of the system, translated into abilities for planning, making processes operative, optimizing resources and, above all, potential to obtain sustainable results, was and still is a key point. In a cultural context of public administration, where regulations are often considered an end in themselves rather than a means, the supply of medicines was managed from a statutory perspective, with great rigidity and reducing considerably the leeway for maneuvering.

The lack of technical preparation and experience, the need to develop a different profile for supply managers, to have them join the health team with an integrating view, seeing medicines as a means, as part of a whole, is still a pending task.

¹ Phang Romero, Carmen. Reforma del sector salud y la política farmacéutica en Perú/Reform of the health sector and pharmaceutical policy in Peru. Cadernos de Saude Pública. Fundacao Oswaldo Cruz, 2004.

2. Supply chain management model

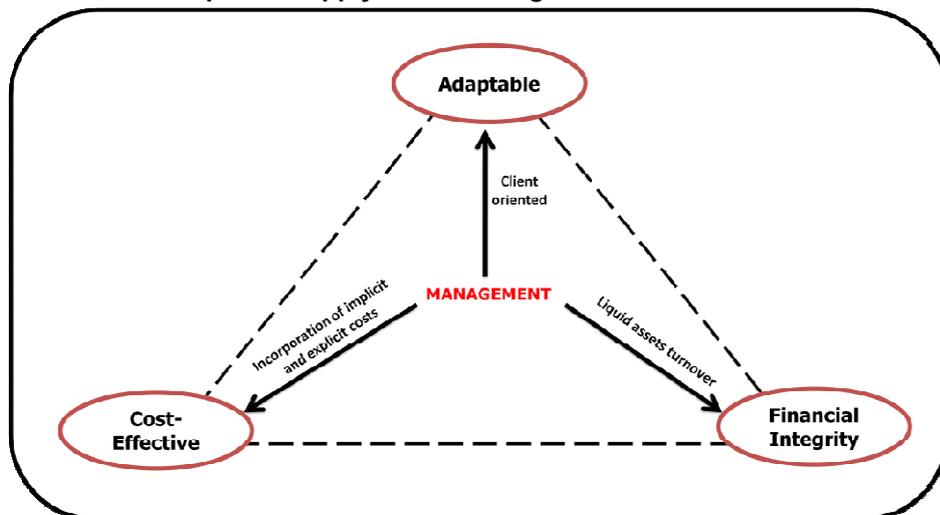
A medicines supply chain is the network of entities that plan, finance and distribute products, manage the related information and finances, from manufacturers, through intermediate warehouses and distributors, to the dispensing points and health establishments².

They represent a support to the entire health system and are essential to provide consistent availability of affordable, high quality products for treatment and diagnostic, in places geographically accessible to the target population. In addition, they convey feedback about supply and demand to the planners and manage financial flows for the system to avail of sufficient resources. A broken supply chain can paralyze the health system and undermine positive results.

Sustainability of the supply chain will be possible to the extent it manages to be adaptable and cost-effective and keeps its financial integrity. When properly managed, it will build its capacity to obtain satisfactory results on a continuous basis.

In this respect, supply management must focus as shown in the graph below:

Graph # 1 Supply Chain Management Elements



2.1 Client oriented

A management aimed at meeting the needs of clients is associated to the system's response capacity or to its adaptability, which is the ability to change rapidly in terms of volume, combination of products or location to face different conditions. The capacity of an organization to adapt enables it to rapidly detect changes in the market, reconfigure its processes to meet new requirements, share information across the borders of the organization and adopt new products and technologies.

These are adaptability and efficiency principles that rest on the "creativity" of public managers to combine what they perceive about public demands with their access to resources and control over the operational capability to produce value³.

A first approach to this element is to establish who the client is and internalize it. If it is perceived that the client is the Ministry of Health or the regulatory agency, then the management focus will aim at its demands, just like reality shows us it often happens.

For the purpose of this study and the design of a management system for the provision of medicines and supplies, the goal is to guarantee a consistent supply of affordable, high quality products for treatment and diagnostic, in places geographically accessible to the target population. For a Regional Health Office (DIRESA) it may be to place adequate medicines and supplies in the Region's health establishments, under good quality, quantity and opportunity conditions, making an efficient use of the resources intended for that purpose.

What needs to be guaranteed is the adequate supply of medicines where health services take place. The end clients will be the local people who will arrive at the health establishment, but the immediate users of the supply chain will be the pharmacies or dispensing points.

A second approach is to define the service level required. A supply chain, ultimately, must be measured by its responsiveness to clients, which leads us to understand what the service will mean to the client. Ideally, a patient served in a health establishment must receive full treatment; in other words, patients must be given all the products included in the medicines prescription.

A third approach is by estimating needs. Forecasts are important due to a series of reasons, among them because they are the ones that add the service level that the market requires in terms of lead times for the orders. Forecasts and client service must be the guides to define inventory levels.

The classic symptom of a poor process for estimating needs continues to be too much inventory and too much of the incorrect inventory, which is a typical consequence of a lack of knowledge of the market.

2.2 Incorporation of costs

The management of a supply chain necessarily implies making a series of decisions with regard to the allocation of resources, in this case public resources, so as to obtain results, in this case, the generation of public value. If costs, either explicit or implicit, are not duly incorporated and measured, decisions will be far from adequate.

By definition, the use of a resource (input) to be transformed into a result (output) entails a cost. Some indicator must be in place to show us whether such transformation is actually cost-effective. Irrespective of whether a public or private organization is concerned, the anticipated benefit must be higher than the cost incurred; otherwise, the social value would be destroyed in this case.

In a private, profit-oriented company, the concept is clear: all costs (explicit) reduce profit; therefore, they are accepted provided the benefits expected are higher than the costs incurred to generate them. There is an additional cost (implicit) concerning the opportunity cost of invested capital as defined by the shareholders.

In the case of the provision of medicines and supplies in the public subsector, it is proposed to incorporate the shortage cost as a parameter. Taking as basis the principle that resources are very limited and social demands very high, there is always the need to optimize their use. The proposal further proposes a methodology to estimate management costs based on "lost sales".

Usually the higher costs faced by a supply chain are associated to their inventories. Immobilized capital, in this case very high, generates unnecessary costs that reflect in different ways, whether caused by problems to manage warehouses, resulting higher demand to expand storage capacity, deterioration of medicines, compliance with expiry dates, loss or theft, shortage of financial resources to activate purchases fluently, induction to consumption and non-rational prescription, which is ultimately expressed with the sustained deterioration of the capacity of Health Establishments in the public subsector to supply or distribute all the medicines prescribed to their target populations.

2.3 Liquid assets turnover

There is a principle in the management of private enterprise that evens out the management of financing sources in the public sector: "cash is better than profit" and this is the characteristic of a self-sustainable operation.

The provision of medicines and supplies must be a self-sustainable process, preserving its financial integrity. This means keeping cash cycles as short as possible, which will be achieved with an adequate management of the inventory turnover, accounts receivable (in this case SIS) and accounts payable (commit resources to initiate acquisition processes). Insofar as credit purchases are not allowed, the relevant cycles are the first two.

We will go in depth in this aspect in the inventory management section and when sustainability indicators are defined.

The next chapters of this study will discuss a management model based on these three elements, in the understanding that the focus of public managers lies in obtaining the results expected for the service they render.

It should be mentioned that the current organization of the Regional Health Directorates has at all times been considered as existing and usable. The proposal worked out has taken as a requirement the viability of its application in public management in its current condition. No structural changes are proposed nor the need of a new type of “institutional structure.” The hypothesis is that given the current conditions in the Regional Medicine Offices and Executing Units, it is possible to apply a new results-based (bottom line) management model.

What must also be made clear is that it is not a management proposal based on laws but on management principles. However, none of what is proposed contravenes current regulations in regards to the supplies of medicines and neither any provision of SISMED. What has been sought are maneuvering spaces to allow for an efficient management of the supply chain.

² Private sector role in health supply chains, MIT ZARAGOZA International Logistics Program, November 2008.

³ Moore, Mark H., Creating Public Value: Strategic Management in Government, Harvard University Press, 1995

3. Defining Management Parameters

Any activity or service within an institution, moreover when it has strategic implications, must have the required performance coefficients clearly identified. These coefficients express the organizational capacity with respect to meeting client or end user expectations.

The definition of standards is associated to the need of permanent improvement processes of such standards. In this respect, improvements are reflected on the incorporation of new standards, higher than the previous ones. When a standardized performance indicator is defined, the implicit concept is to reduce its variability and thereby control it. Standardization in this case is the systematization of repetitive activities and the decrease of variability of a process result and the capacity to control it. Without control there is no management possibility, let alone improvement.

Results or performance indicators are not an end in themselves. A process is not managed to obtain coefficients or indicators. In turn, a coefficient that is particularly appropriate for a purpose may be completely useless for another. Before electing a performance indicator, public managers must choose its purpose. It is also important to keep in mind that one single measure (indicator) or a group of them is not useful in all circumstances.

When reference is made to a system or a supply chain, it is necessary to measure both the final results (expected by the user and the stakeholders) and the partial results of each process. Each of these must be evaluated to the extent it is in line with the final result. Maximizing results of individual processes does not guarantee that the system is reaching optimal performance.

Another important aspect is that the proposal envisages a client-oriented management, great emphasis on the control of results, responsiveness, transparent methods to review performance and high concern for money value and efficiency generation. A public manager's accountability requires the establishment of clear objectives; efficiency requires a "hard look" at objectives. Focus must be placed on results instead of procedures and the need to use in the public sector management tools that have been "tested" in the private sector.

The purpose of this section is to design a management system for the provision of medicines and supplies based on the model defined in the previous chapter, using control indicators, of processes and of results. The underlying criterion is that by controlling the evolution of these indicators and taking corrective measures every time they deviate from the desired values, it will be possible to keep the supply process within the limits of efficiency and with the capacity to deliver results.

It is worth mentioning that the indicators proposed are for the Public Manager (Regional Medicines Director or Executing Unit Manager). There are a series of other indicators designed for specific processes, the usage level of which corresponds to staff that are closer to the operating area.

Three orientations or dimensions are proposed: Market, Operating Efficiency and Operating Sustainability. Table 1 below shows a summary of these indicators and Annex 1, their technical sheets.

Table # 1 Management Indicators

| Dimension | Indicator | Scope | Period | Purpose |
|---------------------------------|----------------------------------|---------------|-----------|--|
| Market | Service quality | Regional | Quarterly | Evaluate final process results. |
| | Client coverage | Regional | Quarterly | Indicates % of clients served. |
| | Market share | Regional | Quarterly | Indicates non-served market. |
| | | | | |
| Operating Efficiency | Supply capacity | Regional/E.U. | Monthly | Evaluate supply capacity in Health Establishments within the scope |
| | Supply dispersion | Regional/E.U. | Monthly | Evaluate distribution quality |
| | Efficiency of distribution | Regional/E.U. | Monthly | Shows possibilities for improving distribution quality |
| | Expense performance x user | Regional | Quarterly | Evaluate expense productivity |
| | Expense productivity variation | Regional | Quarterly | Evaluate variation in expense productivity |
| | | | | |
| Operating Sustainability | Inventory turnover | Regional/E.U. | Monthly | Evaluate adequate inventory levels |
| | SIS accounts receivable turnover | Regional/E.U. | Monthly | Evaluate liquidity and SIS accounts receivable management. |
| | Operation cycle | Regional/E.U. | Monthly | Evaluate liquidity, duration of cash cycle |
| | Cash generation capacity | Regional/E.U. | Monthly | Shows capacity to generate liquidity |

3.1 Market Dimension

It is related with the social value that the process generates for its target market or final clients. As mentioned, public managers need to obtain results; it is their *raison d'être*. Under this approach, management transparency is related to the capacity to create public value through the optimization of public resources. Accountability must be related to the fulfillment of its social mandate. In this dimension, it is sought to develop performance indicators for results, not for production or process compliance.

A public manager's accountability must be understood as what the population expects in exchange for the room for discretion granted in decision-making regarding the provision of a service. It is a form of working guided by the needs of the client and driven by the market.

Market-oriented management, more than some type of behavior, is seen as an "attitude" or rather a "culture" of the whole organization. This approach suggests that improvement criteria must be incorporated into effectiveness, efficiency and, hence, the capacity to generate value for clients.

Incorporating the foregoing, public managers must consider what citizens really expect, as a reference, to head the operation. The presumption is that if they are aware or if they have a good perception of the result that their target population expects, they must organize their institution and design their activities to meet these goals. What they need is to use their imagination beyond their traditional mandate as public servants and even beyond "their instinct towards bureaucratic entrepreneurial initiative"⁴.

If the new decision rules are results-driven, the need arises to trust the ability of a public manager to capture them with a quantitative indicator. Where accountability for the performance of a certain public function cannot be reflected through internal measurements but through external evaluations of client satisfaction.

Furthermore, this definition of client and service close to the private sector, leads to consider some assumptions:

The first one is that transactions must be voluntary. Very seldom do private consumers pay for a service they will not use. Taxes, due to their coercive nature, are a good example, moreover if we consider that there may exist great variability in the relation between users that go to public health establishments and those who pay taxes, among the different regions of Peru. In those where there is greater payment participation (urban regions, with more formal development) the tendency to judge public services negatively could be stronger than in those where tax pressure may be less (rural, less formal, regions).

The second one is that literature on marketing proposes that an individual (client, patient, user) determines its satisfaction based on the relation between expectations on service and experience with this kind of service, under the assumption that alternatives are homogeneous and the price is relatively constant. In other words, the possibility must exist to compare the service (competition). In those regions where there are greater possibilities to compare services, the attitude may probably be more critical when dealing with public

services. For instance, in Lima or Callao there are more quality references than in Apurímac or Puno.

The private sector learns about consumer satisfaction through price mechanisms under competition assumptions, but the public sector must learn about client satisfaction through approximate indicators (proxy) and the most common are surveys on preferences and citizens' satisfaction.

3.1.1 Service Quality Management

It is associated to the final supply result. While final users of the supply chain are health establishments, the goal must be that once the client or patient was served in a health establishment (public subsector) he receives in his pharmacy 100% of the medicines that were prescribed (in the adequate quality and opportunity conditions). This study has not incorporated the analysis and description of the dispensing or sales of medicines, as it does not form part of the logistic process. However, the quality of the service offered must be measured. Further on we will see that despite the existence of a great supply capacity in several areas, results are still far below expected.

Efficiency levels would be given by offering quality service to the target population, which in this case means that a client, user or patient that visited a public health establishment (subsector) receives in the pharmacy of such establishment the medicines prescribed. According to the national standards obtained from the National Households Survey, the minimum expected, as a baseline, would be that 80% of the cases receive all or most of the medicines. An efficiency level would start at 87%.

Below this performance standard, we must evaluate the supply capacity (availability) of Health Establishments. Where it is high, we must review if missing items have a high turnover. In addition, we must evaluate the dispensing process (who prescribes, who dispenses, what are the service hours). It is also necessary to ask those responsible for such establishments, complete and updated inventories in order to initiate an audit if the data do not coincide with their ICI registry.

If the supply capacity is low, missing items must be replenished, starting with those showing high turnover. We must also review the procedure and consumption replenishment periods. If the supply capacity (availability) dropped to critical levels, it is a sign that the replenishment and distribution system is not working properly. *This indicator must be revised regionally on a quarterly basis.*

3.1.2 Client coverage management

A second indicator, maybe more "acid", would be to measure that users that are affiliated or included in the Integrated Health Insurance (SIS) receive all the medicines included in the prescription, according to their coverage plan.

According to national standards obtained from the previously mentioned source, it should be expected that at least 95% of SIS affiliates receive their medicines as prescribed, in the pharmacy of the health establishment were they were served. Under 84% is considered a

critical result. A poor quality ratio will result in poor client coverage, so corrective measures would be much the same. However, it is necessary to verify if for some reason the establishments or micro networks or networks associated to these results are promoting some other payment mechanism, usually from the local inhabitants' pockets. It should be evaluated if income from Directly Collected Resources of these establishments is higher than the regional average, which would indicate the need to take corrective administrative measures. *This indicator must be revised regionally on a quarterly basis.*

3.1.3 Market share management

A third service quality indicator is related to measuring the number of SIS affiliates that have had to go to private drugstores and pharmacies to buy prescribed medicines. This may be because the establishment they attended did not have the product, the product was not included in their coverage plan or they preferred to buy it where there was more guarantee over the quality (perceived).

It is advisable that the manager identifies the reasons why this behavior is occurring to intervene where possible. His goal is that the prescription is attended to, not that medicines are purchased elsewhere. In any case, from an institutional point of view, he is losing sales.

This ratio is the result of the two previous ones, which indicates how many patients with purchasing power preferred, or were forced, to buy somewhere else (lost sale). For this case, 3.8% is an acceptable result, more than 10% is critical. *This indicator must be reviewed regionally on a quarterly basis.*

Table # 2 Market Dimension Indicators

| Dimension | Indicator | Critical Level | Actions |
|-----------|-----------------|----------------|---|
| Market | Service Quality | <80% | <ul style="list-style-type: none"> • Verify supply capacity in Health Establishments. Review if missing items have a high turnover. • Evaluate dispensing process. • Request complete inventories and initiate audit with ICI. • Replenish missing items, beginning by those of high turnover. Consumption replenishment procedure must also be revised |
| | Client Coverage | <84% | <ul style="list-style-type: none"> • Verify if Health Establishments are promoting payment mechanisms (out-of-pocket payments). • Evaluate if income from Directly Collected Resources of these establishments is higher than the regional average. |
| | Market Share | >10.0% | <ul style="list-style-type: none"> • Verify actions due to low service quality and client coverage |

3.2 Operating efficiency dimension

“The suggestion from skeptics, that efficiency is one of the many values that public managers should be keen to pursue seems rather strange in the best of cases. From this perspective, it implies that a manager may sacrifice efficiency in order to promote other values. However, given a goal in particular, he would not like the decision to pursue it efficiently”⁵.

These indicators measure the use of resources and the operations that support the delivery of medicines and supplies to Health Establishments, to be subsequently made available to the population as prescribed. In the public health subsector, where one of the characteristics common to all regions is the limited financial resources, it is proposed to meet the goals of each process optimizing the shortage mentioned.

3.2.1 Supply capacity management

It measures the competence of a health micro network, region or the defined area, to guarantee the continuous provision of medicines and supplies during a certain time, according to the characteristics of its target market and the complexity level of the health establishments. A desirable condition would be to have reference systems and the list of medicines and supplies to be managed by each health establishment previously defined according to their complexity level.

In general terms, availability, as defined by MINSA, turns out to be a good approach for this indicator; however, it should be expressed in consumption months per item. Previously, the DIRESA must have defined what an acceptable supply level for each step of the supply system is: how much corresponds to a health micro network, how much for an operating health network and even per executing unit.

Each person responsible for medicines in the executing units must control that maximums and minimums are not exceeded. In both cases it is necessary to take urgent corrective measures (redistribute surpluses or replenish missing items) as in one case, resources are being immobilized with a high opportunity cost, and in the other, one faces the risk of not being able to meet the clients' needs. *This indicator must be reviewed on a monthly basis.*

3.2.2 Supply dispersion management

It refers to how evenly supply is distributed. It is desirable that all health establishments in every area have a similar supply capacity. The problem arises when the physical distribution to the dispensing points has not been adequately executed and the guidelines set with the previous indicator have not been followed. The corrective measure is to redistribute items throughout the specified territory so their presence is even. *This indicator must be reviewed on a monthly basis.*

3.2.3 Distribution efficiency management

In addition, an indicator is proposed, to show what the maximum supply capacity level that can be achieved is, given the items available at the health establishment and sub-warehouse or warehouse, as the case may be. It often happens that there are over stocks of some products in some of the establishments or even warehouses that are missing or under the minimum agreed inventory level in others. What it is proposed, is that these inefficiencies may be detected and corrected. The result must be as close to 100% as possible. The corrective measure is, again, to redistribute medicines and supplies. *This indicator must be reviewed on a monthly basis.*

3.2.4 Expense per user performance management

The manager must evaluate and be accountable for productive expenditures. In an environment where there is an increasing demand for health care service but where public funds are persistently limited, optimization of return is to be expected, in this case, by obtaining the highest possible dispensing rate (service quality) for a determined expense level. Supplies are being associated to results: how internal processes are made operative and how this translates into results. The principle is to achieve greater results using the same resources, or similar results using fewer resources.

In the 2008-2010 period, the national average was S/.3.6 of expenses in medicine purchases per user visiting the pharmacy of the health establishment where he/she was served, with a 70% dispensing rate (in 70% of the cases, all or most of the medicines prescribed were dispensed). An efficient result would place the DIRESA in expense per user levels between S/.2.2 and S/.28, with dispensing rates above 82%.

Higher expenses with lower results point out several problems:

- **Purchasing prices are too high:** There is no participation in national corporate purchases, prioritizing regional purchases, where it is not possible to obtain competitive prices. It is advisable to review purchase modalities, number of regional processes, participation in national purchasing, generation of purchase orders, relations with suppliers. The transparency of purchasing processes may be compromised.
- **There is over- purchasing:** Warehouses are full of medicines and supplies and health establishments are overstocked. The cause is usually an overestimate of needs and an inadequate administration of purchase agreements. The solution requires correcting the latter and exchanging medicines with other regions.
- **Purchases are not being made according to needs:** Warehouses are full of medicines and supplies; however, health establishments have a low supply capacity in some items and are overstocked in several others. Patients are not receiving the medicines they need. The cause is usually an inadequate estimate of needs and a poor management of purchase agreements. It is necessary to improve contract administration and exchange medicines with other regions.

- **An adequate distribution process is missing:** The warehouses of the DIRESA and of the Executing Units are full of products, but there is no supply capacity at the health establishments. Distribution processes in the scope under analysis must be reviewed.

Low dispensing results with a low expense level per user may mean insufficient availability of financial resources. However, we must consider that regions with the highest dispensing rates evidence the lowest expenses per user. *This indicator must be reviewed on a monthly basis.*

3.2.5 Management of Expense Productivity Variation

It indicates how the administration of budgetary resources is evolving, together with its capacity to obtain results. The relative costs of a public result may vary for two reasons: on the one hand, there may be a change in the price of supplies used to offer such public service, like the prices that are paid for medicines⁶. On the other hand, there may be changes in the way how resources are combined to produce the result, which are precisely the variations in productivity. To simplify calculations, inflation is not considered and price reductions obtained through corporate purchasing are not included.

For the period 2008-2010, efficiency levels were above 30% in dispensing rate per each sol spent in purchasing medicines (each nuevo sol spent in purchasing medicines generated as a result 30pp in prescriptions dispenses in full). It is a considerable improvement with respect to the period 2005-2007, when efficiency levels began at 25% per sol spent.

For the period 2008-2010, under 19.5% per sol is considered critical.

The negative variation of expense productivity is a result of not having resolved in due time the problems evidenced by the expense-per-user performance indicator previously mentioned. *This indicator must be reviewed on a quarterly basis.*

Table # 3 Operating Efficiency Dimension Indicators

| Dimension | Indicator | Critical Level | Action |
|----------------------|--------------------------------|--|---|
| Operating Efficiency | Supply capacity | 90%-85% | <ul style="list-style-type: none"> • Control that maximum and minimums are not exceeded • Redistribute surpluses or replenish missing items |
| | Supply dispersion | >8% | <ul style="list-style-type: none"> • Physical distribution to dispensing points has not been adequately executed • Redistribute identified items so that their presence is even. |
| | Distribution efficiency | <85% | <ul style="list-style-type: none"> • Again, redistribute medicines and supplies |
| | Expense per user performance | S/.2.2 - S/.2.8 in expense per user dispensing rate > 82%. | <ul style="list-style-type: none"> • Purchasing prices are too high: Review purchase modalities, number of regional processes, participation in national purchasing, generation of purchase orders, relationship with suppliers, transparency in purchasing processes • Over purchasing: Verify estimate of needs and exchange medicines with other regions. • Purchases are not being made according to needs: Improve contract administration and exchange medicines with other regions. • No adequate distribution process: Evaluate distribution process. |
| | Expense productivity variation | >15% | <ul style="list-style-type: none"> • Verify problems evidenced by expense-per-user performance indicator. |

3.3 Operating Sustainability Dimension

These indicators are built to manage the system's operating capacity to sustain itself, through a timely administration of the collection-purchase-sale-collection cycle. That is, its capacity to realize its resources and use them adequately so that the provision of medicines and supplies does not stop. In terms of private enterprise administration, it is the cash-to-cash cycle (CCC).

Indicators are related to the system's capacity to turn its inventories over rapidly, recover its accounts receivable (SIS) in short terms and keep the cash cycle as short as possible.

The sustainability of a system with cash cycles of close to 12 months is very demanding in financial resources, precisely a factor scarce in health regions and the reason why often supply activities are paralyzed.

The purchase price of medicines and supplies (costs) is relevant in this dimension, to the extent it favors the generation of cash by an institution. It is understood that medicines are "sold" to final users, but are "paid" through the SIS (during 2010, 53% of medicine purchases in the regions were financed with these resources) which in primary health care has an almost fixed rate per "complete treatment". The lower the purchase price, the lower the variable cost, the higher the contribution margin. The contribution margin is the surplus revenue with respect to variable costs, it is applied to cover fixed costs and finally, it determines, in this case, the institution's capacity to generate its "own" cash.

3.3.1 Inventory Turnover Management

It indicates the amount of medicines and supplies immobilized to guarantee uninterrupted supply or, in other words, how many times it rotates per year. The higher inventories (less rotation or turnover) the higher the capacity to sustain uninterrupted supply, but also greater resources immobilized, less liquidity or budgetary availability, higher costs associated to inventory purchase and administration. In this respect, it is necessary for process managers to previously define what is the adequate inventory level required in all stages of the distribution network. This aspect will be discussed in the warehouse and inventory administration section.

The adequate tools to control inventory levels are purchase contract administration (they allow +/- 25% variations and additional expansions), the exchange with other regions and redistributions between Health Establishments and/or micro networks. *This indicator must be reviewed on a monthly basis.*

3.3.2 Management of Accounts Receivable Recovery Period

Another aspect that requires to be controlled is the rate at which accounts receivable (SIS) become liquid, to which end this indicator has been designed. It is desirable that times be as short as possible. A high result may indicate, at a local level, that SIS forms are not being adequately or fully processed. In this case, it is convenient to review the operating capacity of these proceedings and implement measures to speed them up.

It is important to point out that depending on multiple variables, each region or executing unit may prioritize a certain financing source to purchase medicines and medical supplies. In the case of Donations and Transfers (SIS) during 2010, they financed an average of 47% of expenses incurred in the purchase of medicines and supplies. However, there were regions where this figure was 75% (and in others, 6%). *Regions or executing units that tend to depend more on this financing source should carry out a monthly control of this indicator.*

Table # 4 Financing structure of medicines and supplies purchase at regional level (2010)

| | RDR | DyT | RO |
|----------------|---------------|---------------|---------------|
| Average | 31.25% | 47.27% | 21.47% |
| Maximum | 60.38% | 72.57% | 50.22% |
| Minimum | 2.07% | 5.99% | 9.69% |

Source: MEF/SIAF

3.3.3 Operation Cycle Management

The sum of the accounts receivable recovery period and the inventory level gives us the operation cycle indicator, which is the time interval that it takes for the region or executing unit to turn into cash the assets used to provide medicines and supplies to its target population. Larger cycles imply longer immobilization time of financial resources to the detriment of other objectives or of being unable to continue purchasing due to lack of budgetary availability.

3.3.4 Cash Generation Capacity Management

Again, if the result will be influenced by the ability to manage reimbursements with the SIS, it measures, as its name says, the capacity of the selected area to generate its "own cash".

Assuming that the SIS reimbursement tariff per consultation is kept constant and so is the administrative component (reasonably fixed), the capacity to generate its own cash will be defined as follows:

$$CGC = MC \times R$$

where CGC = Cash Generation Capacity
 MC = Contribution Margin
 R = Annual Cash Turnover

$$MC = \frac{(\text{SIS Tariff} - \text{Variable Cost})}{\text{Fixed Cost}}$$

Table # 5 Operating Sustainability Dimension Indicators

| Dimension | Indicator | Critical Level | Action |
|---------------------------------|----------------------------------|----------------|---|
| Operating Sustainability | Inventory turnover | >7 months | <ul style="list-style-type: none"> • Administration of purchase contracts • Exchange with other regions • Redistribution between Health Establishments and/or micro networks |
| | SIS accounts receivable turnover | >2 months | <ul style="list-style-type: none"> • Review functionality of SIS proceedings and implement measures to speed them up |
| | Operation cycle | >9 months | <ul style="list-style-type: none"> • Review inventory levels and recovery processes of payments for SIS consultations. |
| | Cash generation capacity | <40% | <ul style="list-style-type: none"> • Review cost of medicines, fixed costs, functionality of SIS proceedings, inventory levels. • Implement measures to reduce costs and time |

⁴ Moore, Mark H., *Creating Public Value: Strategic Management in Government*, Harvard University Press, 1995

⁵ Christopher Grandy, *The "Efficient" Public Administrator: Pareto and a Well-Rounded Approach to Public Administration*, *Public Administrator Review*, Nov/Dec 2009.

⁶ It is estimated that comparing 2005 with 2010, as a result of corporate purchases, global price reductions have been between 20% and 25%.

4. Diagnostic of Medicines and Supplies Provision Management

Below is a diagnostic of the situation concerning the management of medicines supply in the national public subsector, based on the analysis of the mentioned indicators. This same methodology is applicable to any region.

4.1 Market dimension

The indicators created are (1) Service quality, (2) Client coverage, and (3) Market share.

4.1.1 Service quality

The purpose of the medicines and related products supply process is that patients who attend consultation at public health establishments find in their pharmacies all the medicines prescribed. Results are shown below:

Table # 6 People who attended Health Establishments and received the medicines prescribed

| | Year | | | |
|----------------------|-------|-------|-------|-------|
| | 2004 | 2006 | 2008 | 2010 |
| All | 53.8% | 52.5% | 56.6% | 56.1% |
| Most | 19.3% | 20.2% | 14.2% | 12.7% |
| Very few | 15.9% | 14.6% | 15.0% | 14.3% |
| None | 7.6% | 9.2% | 9.6% | 13.2% |
| Not available | 3.3% | 3.6% | 4.6% | 3.8% |

Source: INEI/ENAH0

What may be observed is the disturbing increase of the share of people who attended a Health Establishment of MINSA and did not receive any medicines (13.2% in 2010 versus 7.6% in 2004). It is worth mentioning that this is the case of people who approached an establishment, was seen by a health professional and finally did not receive what had been prescribed to them to improve or maintain their health conditions.

If we compare those who received all or most of the medicines prescribed, we note that during 2004, 73.1% replied they did, compared to only 68.8% in 2010.

For the purpose of making a comparative evaluation, the same indicator was created for users that visited non MINSA Health Establishments:

Table # 7 People who attended non MINSA Health Establishments and received the medicines prescribed

| | Year | | | |
|----------------------|-------|-------|-------|-------|
| | 2004 | 2006 | 2008 | 2010 |
| All | 58.6% | 56.5% | 61.1% | 68.5% |
| Most | 19.8% | 22.6% | 15.8% | 12.7% |
| Very few | 17.0% | 15.6% | 16.0% | 12.1% |
| None | 4.2% | 3.6% | 4.6% | 4.2% |
| Not available | 0.4% | 1.6% | 3.9% | 3.7% |

Source: INEI/ENAH0

When differences are compared (table # 8) it is clear the relative deterioration being evidenced by the medicines dispensing service at public sector Health Establishments.

Table # 8 Differential between prescription dispensing service in MINSA and NON MINSA Health Establishments

| | Year | | | |
|----------------------|-------|-------|-------|--------|
| | 2004 | 2006 | 2008 | 2010 |
| All | -4.76 | -4.00 | -4.52 | -12.35 |
| Most | -0.43 | -2.46 | -1.60 | 0.04 |
| Very few | -1.12 | -1.07 | -1.01 | 2.23 |
| None | 3.37 | 5.56 | 5.03 | 9.08 |
| Not available | 2.94 | 1.98 | 0.66 | 0.08 |

Source: INEI/ENAH0

If we analyze the results by region for MINSA Health Establishments (Table #9) it is surprising to see the low results obtained during 2010 in Ica (48%), Lima (49.4%), Tumbes (50.2%), Tacna (50.3%), and Callao (50.5%). We are concerned that in all cases there are 20 pp decreases with respect to 2004. In addition, we are talking about coastal regions, predominantly urban and, at least in Ica, Lima and Callao, with a good professional personnel supply / offer.

The good performance of the following regions is noteworthy: Apurímac (88.7%), Huánuco (87.3%), Cajamarca (85.5%), Loreto (84.2%) and Amazonas (84%), Andean and Amazon regions, predominantly rural and with less relative professional personnel offer.

Table # 9 SIS affiliates that had consultation at MINSA Health Establishments and received prescribed medicines

| | year | | | |
|---------------|-------|-------|-------|-------|
| | 2004 | 2006 | 2008 | 2010 |
| Amazonas | 83.5% | 81.4% | 82.4% | 84.0% |
| Ancash | 80.0% | 72.9% | 73.3% | 61.4% |
| Apurimac | 95.8% | 90.1% | 79.0% | 88.7% |
| Arequipa | 70.1% | 68.7% | 68.5% | 71.2% |
| Ayacucho | 53.1% | 81.5% | 52.6% | 68.5% |
| Cajamarca | 80.2% | 87.6% | 87.0% | 85.5% |
| Callao | 65.3% | 47.9% | 43.6% | 50.5% |
| Cuzco | 74.9% | 79.5% | 70.5% | 81.8% |
| Huancavelica | 92.0% | 93.9% | 78.7% | 81.6% |
| Huanuco | 87.8% | 89.0% | 87.7% | 87.3% |
| Ica | 76.1% | 73.3% | 63.1% | 48.0% |
| Junin | 75.9% | 72.1% | 78.2% | 77.4% |
| La Libertad | 63.1% | 46.2% | 65.6% | 61.0% |
| Lambayeque | 74.0% | 77.1% | 64.4% | 70.5% |
| Lima | 63.6% | 54.5% | 41.2% | 49.4% |
| Loreto | 45.6% | 75.7% | 84.8% | 84.2% |
| Madre de Dios | 71.4% | 80.3% | 75.6% | 66.8% |
| Moquegua | 70.1% | 88.0% | 83.6% | 84.9% |
| Pasco | 71.1% | 42.0% | 76.7% | 71.0% |
| Piura | 73.8% | 64.3% | 59.2% | 41.5% |
| Puno | 71.2% | 84.0% | 78.2% | 73.4% |
| San Martin | 76.3% | 70.4% | 68.4% | 74.4% |
| Tacna | 67.0% | 69.3% | 60.9% | 50.3% |
| Tumbes | 77.7% | 53.7% | 66.7% | 50.2% |
| Ucayali | 70.4% | 73.7% | 80.1% | 56.8% |

Source: INEI/ENAHO

When comparing these indicators with their NON MINSA equivalents, we find the following differences:

Table # 10 Differential in MINSA vs NON MINSA Health Establishments (in pp.)

| | year | | | |
|---------------|--------|--------|--------|--------|
| | 2004 | 2006 | 2008 | 2010 |
| Amazonas | 6.16 | 4.30 | 0.30 | 7.46 |
| Ancash | -7.36 | -3.67 | -12.02 | -23.56 |
| Apurimac | 7.49 | 4.48 | 10.06 | 15.77 |
| Arequipa | -10.65 | -13.02 | -12.77 | -16.31 |
| Ayacucho | 15.38 | 9.63 | 5.25 | -4.89 |
| Cajamarca | 1.97 | 9.01 | 8.33 | 3.72 |
| Callao | -11.49 | -28.95 | -27.06 | -32.93 |
| Cuzco | 8.01 | 13.05 | 4.62 | 1.06 |
| Huancavelica | -8.04 | 3.05 | 4.73 | -6.46 |
| Huanuco | -0.66 | 6.51 | 13.63 | 0.48 |
| Ica | -8.07 | -2.39 | -16.89 | -21.61 |
| Junin | 10.50 | -3.20 | -1.05 | -6.08 |
| La Libertad | -28.90 | -31.51 | -9.43 | -18.98 |
| Lambayeque | -13.84 | -7.90 | -23.77 | -10.39 |
| Lima | -15.53 | -13.93 | -26.25 | -28.31 |
| Loreto | -30.06 | -7.04 | 2.62 | -7.84 |
| Madre de Dios | 5.58 | -7.45 | 6.38 | -9.96 |
| Moquegua | 2.16 | -0.36 | -3.62 | -2.36 |
| Pasco | 3.02 | -10.73 | 3.78 | -2.00 |
| Piura | -1.64 | -8.62 | -3.10 | -36.91 |
| Puno | -3.63 | 0.00 | -7.88 | -13.62 |
| San Martin | -3.82 | -2.01 | -6.64 | -9.83 |
| Tacna | -21.54 | -13.08 | -25.03 | -27.28 |
| Tumbes | -8.74 | -35.75 | -9.80 | -27.30 |
| Ucayali | -16.20 | -22.00 | -11.66 | -29.75 |

Source: INEI/ENAH0

It is possible to identify what regions offer lower quality services to their population (Callao, Piura, Ucayali, Lima), and where more attention should be paid in training processes and strengthening of management competencies. It would be important to replicate the experiences of Apurimac and Amazonas in other places.

4.1.2 Client Coverage

One of the objectives of the policy in Peru is that payment capacity is not a barrier to access health services. In this respect, it would be desirable that when SIS affiliates arrive at a public health establishment they receive all the medicines prescribed to them.

Table # 11 SIS affiliates that had consultation at MINSA Health Establishments and handed their prescription at the pharmacy and did not receive medicines.

| | year | | | |
|---------------|-------------|-------------|--------------|--------------|
| | 2004 | 2006 | 2008 | 2010 |
| Amazonas | 4.4% | -0.5% | 4.8% | 4.2% |
| Ancash | 2.1% | 9.2% | 18.0% | 20.7% |
| Apurímac | 1.6% | 2.3% | 7.7% | 2.0% |
| Arequipa | 15.4% | 7.2% | 20.3% | 22.6% |
| Ayacucho | 4.3% | 1.5% | 4.8% | 10.2% |
| Cajamarca | 4.5% | 5.8% | 6.2% | 5.4% |
| Callao | 7.8% | 19.3% | 14.2% | 18.8% |
| Cuzco | 6.4% | 5.7% | 9.7% | 6.9% |
| Huancavelica | -1.9% | -2.4% | 0.6% | -1.2% |
| Huanuico | 1.8% | 1.0% | 4.8% | 8.0% |
| Ica | -2.0% | 8.2% | 32.2% | 38.8% |
| Junín | 9.2% | 12.1% | 6.4% | 16.2% |
| La Libertad | 3.6% | 11.0% | 14.4% | 23.7% |
| Lambayeque | 10.1% | 5.8% | 8.7% | 17.8% |
| Lima | 13.9% | 16.7% | 29.3% | 28.8% |
| Loreto | 5.7% | 6.6% | 7.5% | 10.7% |
| Madre de Dios | -0.5% | 13.6% | 16.7% | 27.1% |
| Moquegua | 2.2% | 4.6% | 6.6% | 16.2% |
| Pasco | 2.2% | 8.2% | 3.5% | 7.7% |
| Piura | 4.7% | 12.7% | 15.9% | 28.4% |
| Puno | 3.6% | -1.1% | 12.5% | 0.9% |
| San Martín | 19.3% | 8.8% | 11.7% | 12.3% |
| Tacna | 4.0% | -1.7% | 14.8% | 23.8% |
| Tumbes | 5.7% | 25.3% | 13.1% | 27.6% |
| Ucayali | 13.1% | 4.0% | 13.0% | 28.4% |
| Total | 5.6% | 7.4% | 11.9% | 16.3% |

Source: INEI/ENAH0

A deterioration is observed in general, as the national average increased between 2004 and 2010 by more than 10 pp in SIS affiliates that did not receive medicines. Exceptions are in the regions of Amazonas, Apurímac, Cajamarca and Puno. It is critical in Ica, Lima, Ucayali, Madre de Dios, Piura and Tumbes, mainly.

4.1.3 Market Share

The fact that SIS affiliates need to go to private Drugstores and Pharmacies to obtain medicines prescribed after consultation is a critical indicator for the supply system. While this can be due to medicines not included in the coverage plans, the upward trend indicates the persistence of other causes.

Table # 11 SIS affiliates that bought medicines in private drugstores and pharmacies

| | year | | | |
|---------------|-------------|-------------|-------------|--------------|
| | 2004 | 2006 | 2008 | 2010 |
| Amazonas | 2.6% | 0.0% | 3.2% | 2.8% |
| Ancash | 1.3% | 4.0% | 9.6% | 10.5% |
| Apurimac | 0.0% | 0.9% | 1.7% | 1.5% |
| Arequipa | 10.5% | 5.6% | 12.8% | 14.8% |
| Ayacucho | 0.9% | 0.1% | 1.7% | 4.7% |
| Cajamarca | 3.1% | 2.9% | 4.5% | 3.3% |
| Callao | 3.5% | 13.4% | 12.5% | 16.8% |
| Cuzco | 1.0% | 2.5% | 4.3% | 3.7% |
| Huancavelica | 0.0% | 0.0% | 0.3% | 0.0% |
| Huanuico | 0.5% | 0.5% | 2.7% | 4.5% |
| Ica | 0.0% | 4.7% | 18.3% | 26.7% |
| Junin | 7.4% | 6.2% | 2.9% | 10.2% |
| La Libertad | 2.9% | 9.9% | 10.9% | 18.3% |
| Lambayeque | 6.1% | 5.5% | 8.3% | 16.5% |
| Lima | 10.5% | 13.6% | 23.6% | 23.9% |
| Loreto | 3.6% | 4.2% | 4.3% | 6.8% |
| Madre de Dios | 0.0% | 4.7% | 7.2% | 16.2% |
| Moquegua | 1.4% | 2.0% | 4.5% | 6.3% |
| Pasco | 1.3% | 3.6% | 1.7% | 4.2% |
| Piura | 3.3% | 9.7% | 11.5% | 23.4% |
| Puno | 1.2% | 0.0% | 4.9% | 0.5% |
| San Martin | 9.0% | 6.3% | 8.4% | 7.5% |
| Tacna | 3.0% | 0.0% | 8.1% | 14.4% |
| Tumbes | 5.3% | 19.9% | 10.4% | 24.4% |
| Ucayali | 9.6% | 2.6% | 6.4% | 21.5% |
| Total | 3.3% | 4.5% | 7.1% | 10.6% |

Source: INEI/ENAH0

Again our attention is drawn to Ica (26.7%), Tumbes (24.4%), Lima (23.9%) and Piura (23.4%). Huancavelica (0.0%), Puno (0.5%) and Apurímac (1.5%) are noteworthy.

The case of Ica is disturbing, as 38.8% of SIS affiliates did not receive medicines at the health establishment where they had consultation; however, only 26.7% was able to purchase them in some private establishment. There are a 12.1% of consultations that did

not receive medicines despite needing them. During 2010, 5.7% of medical consultations in MINSA Health Establishments throughout the country did not receive medicines, apparently, from any source.

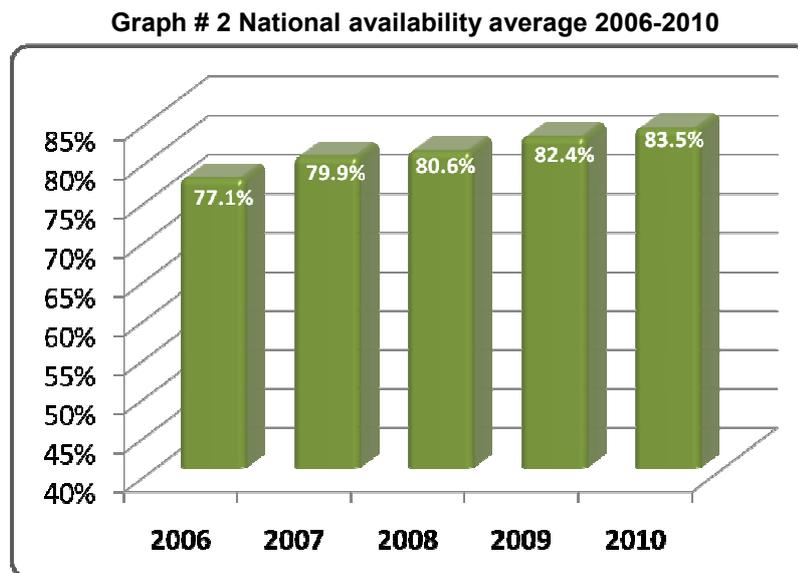
We may conclude from the market dimension analysis that the medicines supply service in the public health subsector establishments has suffered considerable general deterioration in the last 7 years. Medicine supply managers are not fulfilling their social mandates as to the provision of medicines. There are exceptions in the Health Offices of Apurímac, Huánuco, Cajamarca, Loreto and Amazonas. The critical regions are Lima, Tumbes, Ica and Ucayali. Our attention is drawn to the performance of Lima, where DISAs were under the MINSA portfolio until 2010.

4.2 Operating Efficiency Dimension

The indicators designed are five: (1) Supply capacity, (2) Supply dispersion, (3) Distribution efficiency, (4) Expense per user performance (5) Expense productivity variation.

4.2.1 Supply capacity

Graph # 2 below shows availability of medicines (supply) at public subsector Health Establishments throughout the country from 2006 to 2010.

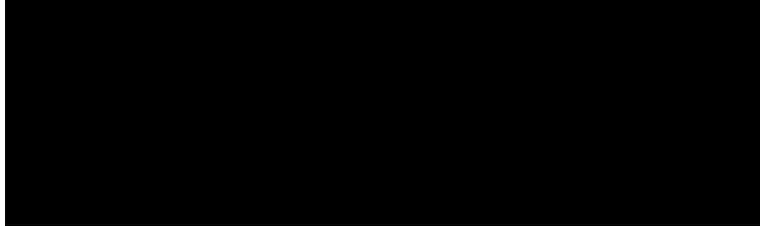


Source: DIGEMID-MINSA (Estimated for 2010)

What may be noted is that the medicines supply capacity has been consistently growing during the period in question. A desirable result would be that this greater use of public resources (greater supply capacity = greater inventories in Health Establishments) were accompanied by the dispensing of medicines to Health Establishment users.

In this respect, when comparing the previously mentioned figures with those of the National Households Survey (ENAHU), we obtain the following results:

Table # 13 Comparison of MINSA availability and Prescription Dispensing, ENAHO

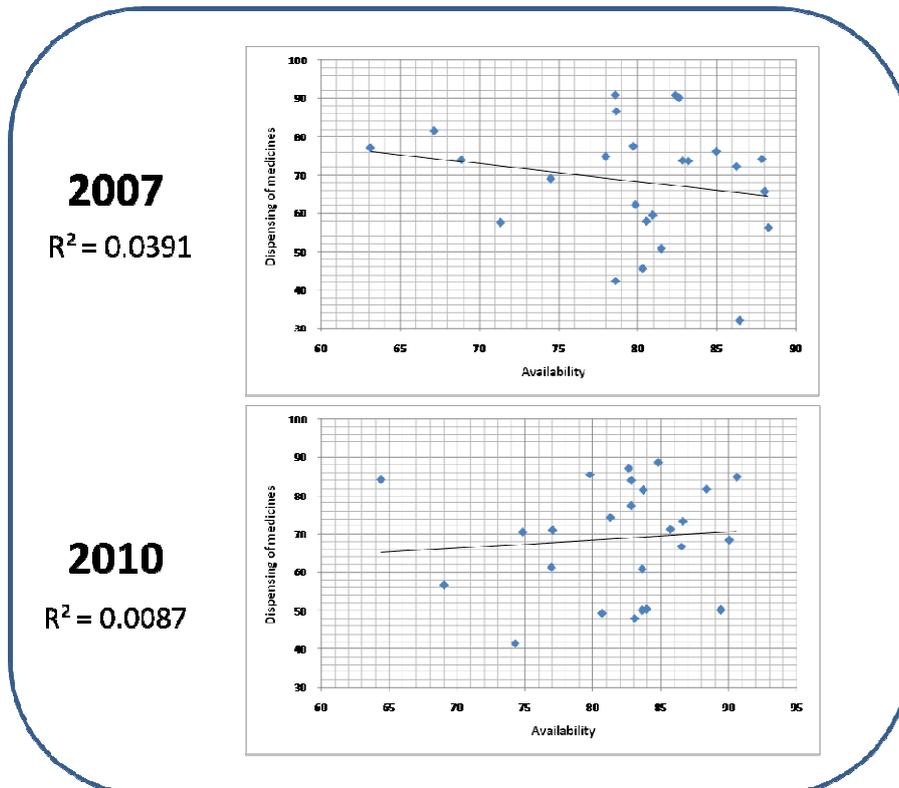


Everything indicates that as health establishments administrate greater inventories and improve their quality supply of medicines, users' perception goes the opposite way.

In order to analyze results in greater detail, Graph #3 shows the relation between availability of medicines (MINSA) and dispensing of medicines (ENAHO) for 2007 and 2010.

The first one evidences a slight inverse relation and the second one, again, a slightly positive relation. However, in both cases, results are statistically hardly significant and non-conclusive.

Graph # 3 Availability of medicines vs dispensing of medicines



Source: DIGEMID/MINSA and INEI/ENAHO

Availability, as an added data, does not measure the impact caused when there is a shortage of the medicines with the greatest demand or turnover. From the client's or user's point of view, the general availability level of a health establishment is unimportant; what clients need is the medicine that has been prescribed to them. An internal process indicator cannot be used as a results indicator. A suggestion to make the MINSA availability indicator more representative would be to weigh every medicine by its turnover or participation in consumption.

In other words, the problem is not the supply amount, but quality. In addition, there are doubts about the consumption data and inventories entered into the SISMED module and the representativeness of the Integrated Consumption Report – ICI.

4.2.2 Supply dispersion

A desirable result is that the supply capacity be distributed as evenly as possible, as it sends a positive signal about how distribution is handled.

To measure both supply capacity and supply dispersion, Table #14 considers July 2010 and April 2011 for comparative purposes, as information is available for both months in the same detail.

The national availability average of medicines (μ) decreases slightly, from 80% to 78.3%. Dispersion (σ) increases slightly, from 15.2 to 15.8.

DISA Apurímac II has the highest availability (supply capacity) and the lowest dispersion at a national level. All indicators show that its distribution is being properly managed.

In turn, DISA Lima Norte has low availability and one of the highest supply dispersion levels in the country. More serious still is the case of DISA Piura II.

Low availability may obey to an inadequate estimate of needs and budgetary limitations; however, a high dispersion level is a clear signal of distribution problems. It may be asserted that DISAs or DIRESAs Piura I, Lima Norte, Huánuco, Piura II, Ucayali, Cajamarca I, Pasco and Callao have problems in distribution, in the estimate of needs and in managing their purchase processes.

On the other hand, DISAs or DIRESAs of Apurímac II, Tacna, Ayacucho and Cuzco show positive results.

Table # 14 Average Availability by DISA/DIRESA and Dispersion

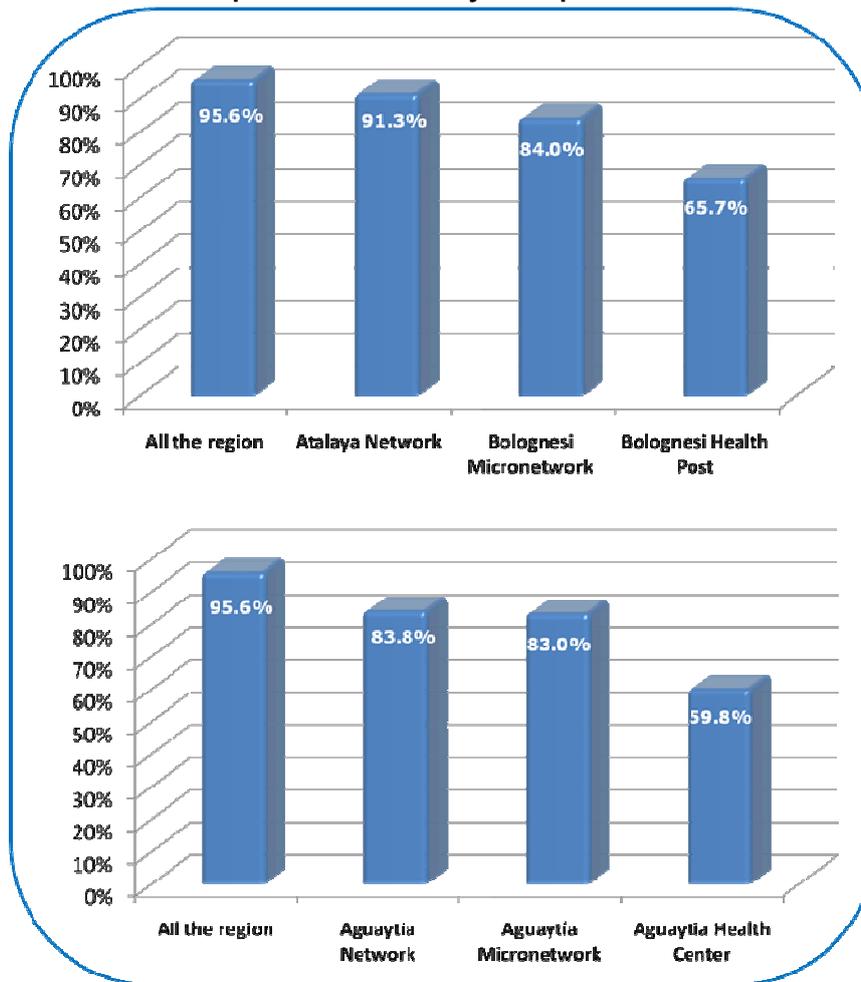
| | Jul-10 | | Abr-11 | | Var. pp | |
|----------------|--------|----------|--------|----------|---------|----------|
| | μ | σ | μ | σ | μ | σ |
| Amazonas | 82.2 | 17.4 | 76.8 | 16.0 | -5.4 | -1.3 |
| Ancash | 76.3 | 17.7 | 77.8 | 16.9 | 1.5 | -0.8 |
| Apurimac I | 78.9 | 9.9 | 85.5 | 10.6 | 6.7 | 0.8 |
| Arequipa | 84.5 | 10.6 | 86.4 | 9.8 | 1.9 | -0.8 |
| Ayacucho | 88.9 | 15.2 | 86.4 | 8.0 | -2.5 | -7.2 |
| Cajamarca I | 59.0 | 42.6 | 59.4 | 20.4 | 0.4 | -22.1 |
| Callao | 82.1 | 7.2 | 75.6 | 19.3 | -6.5 | 12.1 |
| Apurimac II | 92.2 | 10.1 | 88.4 | 4.8 | -3.8 | -5.3 |
| Cajamarca II | 80.9 | 12.7 | 79.8 | 12.5 | -1.2 | -0.1 |
| Cuzco | 88.6 | 9.6 | 83.7 | 9.6 | -4.9 | 0.1 |
| Caljamarca III | 83.0 | 8.1 | 77.1 | 11.2 | -5.9 | 3.1 |
| Huancavelica | 82.5 | 9.5 | 82.8 | 8.3 | 0.3 | -1.1 |
| Huanuco | 84.1 | 19.1 | 76.4 | 28.1 | -7.6 | 8.9 |
| Ica | 80.1 | 16.4 | 85.2 | 14.9 | 5.1 | -1.5 |
| Jaen | 85.3 | 5.9 | 80.1 | 9.6 | -5.2 | 3.7 |
| Junin | 78.1 | 12.1 | 80.7 | 13.0 | 2.6 | 0.9 |
| La Libertad | 83.5 | 13.9 | 86.7 | 12.4 | 3.2 | -1.6 |
| Lambayeque | 75.3 | 19.6 | 77.2 | 12.1 | 1.9 | -7.5 |
| Lima Ciudad | 80.3 | 14.2 | 72.4 | 10.6 | -7.8 | -3.6 |
| Lima Este | 77.3 | 12.0 | 70.5 | 15.3 | -6.7 | 3.3 |
| Lima Norte | 86.8 | 7.5 | 70.7 | 37.8 | -16.0 | 30.3 |
| Lima Sur | 76.0 | 13.9 | 76.3 | 9.5 | 0.3 | -4.4 |
| Loreto | 64.1 | 25.2 | 77.6 | 18.3 | 13.5 | -6.8 |
| Madre de Dios | 84.7 | 16.5 | 79.7 | 14.9 | -5.0 | -1.6 |
| Moquegua | 85.8 | 10.3 | 84.4 | 12.8 | -1.4 | 2.5 |
| Pasco | 68.2 | 7.7 | 73.8 | 20.9 | 5.6 | 13.2 |
| Piura I | 75.3 | 33.0 | 62.8 | 38.1 | -12.5 | 5.1 |
| Puno | 86.3 | 24.9 | 82.8 | 14.7 | -3.5 | -10.1 |
| San Martin | 82.0 | 13.8 | 79.1 | 19.5 | -2.9 | 5.8 |
| Piura II | 67.4 | 12.5 | 65.4 | 26.5 | -2.0 | 14.1 |
| Tacna | 86.2 | 15.7 | 86.1 | 6.6 | -0.1 | -9.0 |
| Tumbes | 86.6 | 8.0 | 84.5 | 13.6 | -2.1 | 5.6 |
| Ucayali | 68.0 | 27.6 | 71.8 | 23.1 | 3.8 | -4.5 |
| | 80.0 | 15.2 | 78.3 | 15.8 | -1.7 | 0.6 |

Source: DIGEMID/MINSA

4.2.3 Distribution efficiency

Unfortunately, there is no national data available to calculate this indicator. Graph #4 shows the case of DIRESA Ucayali in April 2011. With an adequate redistribution of its medicines, the region could go from a reported availability of 71.3% to 95.6%.

Graph # 4 DIRESA Ucayali – April 2011



Source: DIREMID Ucayali

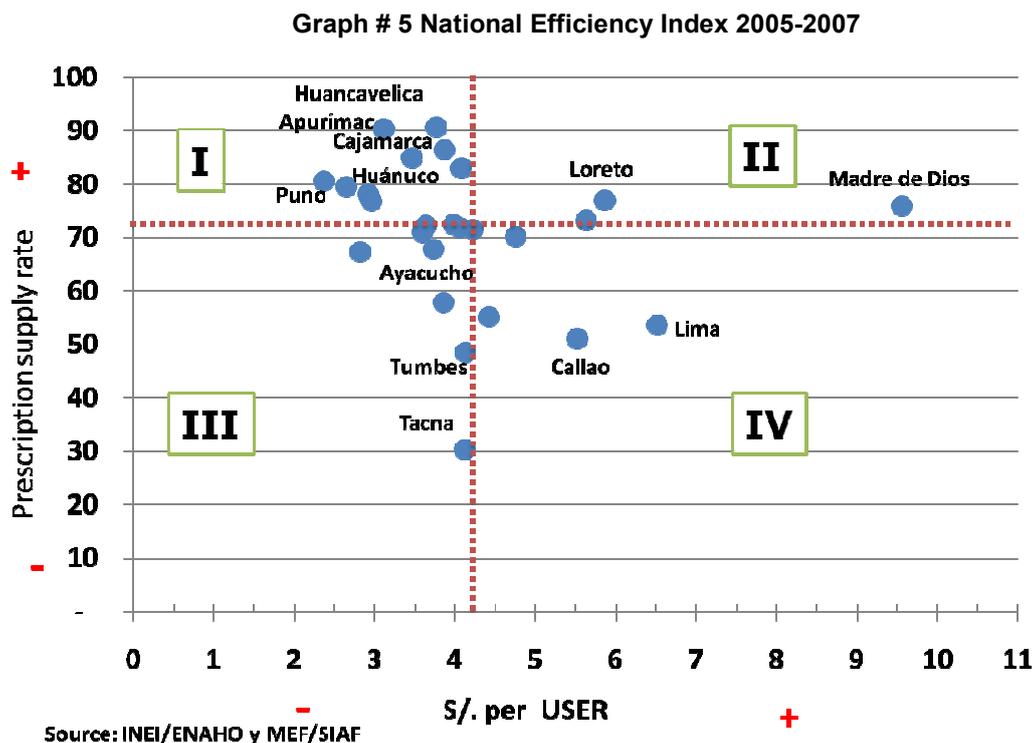
This indicator is a very useful tool to detect problems in the distribution and what the potential is to optimize it, whether at a micro health network, health network or even region level.

4.2.4 Expense per user performance

Below are the indicators for expenses per user and dispensing rate of prescriptions per region. The purpose is to define an efficiency parameter.

Graph #5 shows the results for all the regions for the period 2005-2007, considering financial resources as limitation and/or resource to be maximized. The vertical line reflects the prescription dispensing rate and the horizontal line, regional expenses in medicines per user. The graph has been divided in quadrants, taking as base the national averages in prescription dispensing rate and those for expenses in medicines per user.

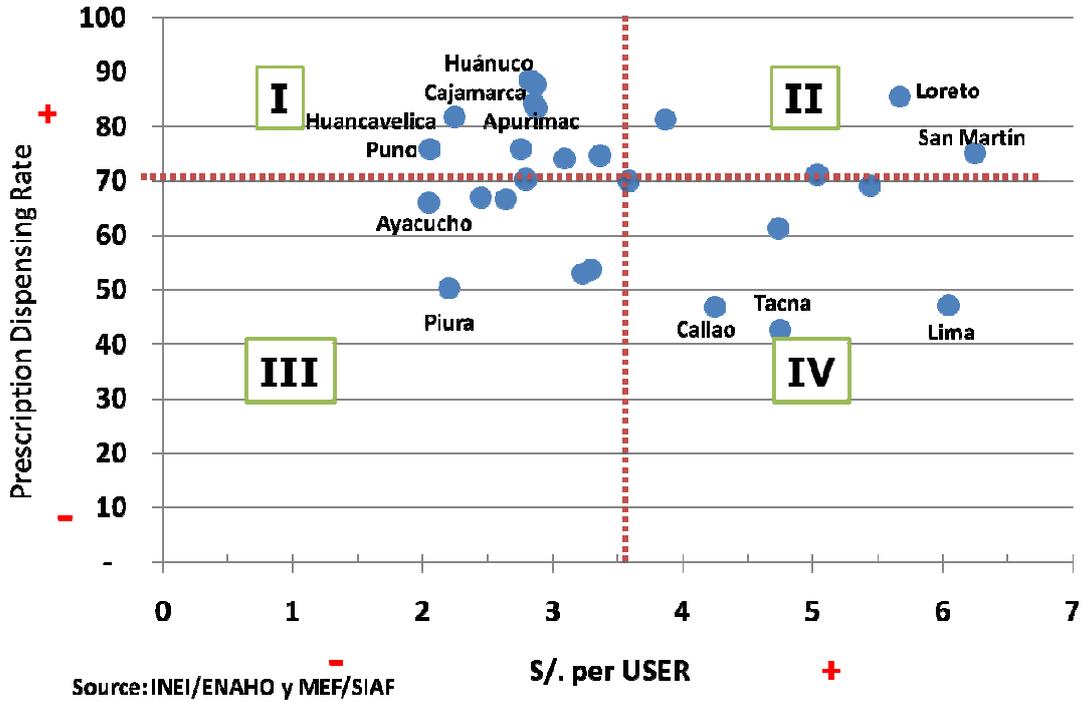
Quadrant I shows the regions that achieve the highest prescription dispensing rates with the lowest expenses per user. These are the most efficient in relation to financial resources. Quadrant II shows those that obtain good prescription supply rates, but with higher expenses per user. Quadrant III shows the ones that spend relatively little, but are unable to obtain good results. Quadrant IV shows the regions that despite spending more per user have low prescription dispensing rates.



Notorious for their efficiency: Huancavelica, Apurímac, Cajamarca, Huánuco and Puno. Lima and Callao are unfortunately notorious for the opposite.

For the period 2008-2010, we find that the national average expense per use has been reduced and service has evidenced deterioration (slight).

Graph # 6 National Efficiency Index 2008-2010



During the period 2008-2010, the DIRESA with highest expenditure in medicine purchases per user was San Martín; however, its dispensing rates are below those of Huánuco, Cajamarca, Huancavelica and Apurímac. It purchases medicines in a 300% proportion with respect to the above-mentioned regions, but fails to achieve good results. It is not a matter of spending capacity, but spending efficiency.

In addition, all DISAs or DIREAS located in Quadrants II and IV have problems in their purchasing processes, in the forecast or estimate of their needs and in distribution. They buy at high prices, they buy items they do not need and they buy to store.

4.2.5 Expense productivity variation

Table #14 shows a comparison of productivity variations per region for periods 2005-2007 and 2008-2010.

Table # 15 Medicine expense productivity variation vs Dispensing Rate (2005-2007 vs 2008-2010)

| | 2005-2007 | | | | 2008-2010 | | | | Δ% |
|----------------------|------------|-----------|-----|-------------|------------|-----------|-----|-------------|------------|
| | S/. | Disp. | Q | Prod. | S/. | Disp. | Q | Prod. | |
| Puno | 2.4 | 81 | I | 34.0 | 2.1 | 76 | I | 37.0 | 9% |
| Huancavelica | 3.8 | 91 | I | 24.0 | 2.2 | 82 | I | 36.4 | 52% |
| Cajamarca | 3.9 | 86 | I | 22.3 | 2.8 | 89 | I | 31.3 | 41% |
| Huanuco | 3.5 | 85 | I | 24.5 | 2.9 | 88 | I | 30.6 | 25% |
| Apurimac | 3.1 | 90 | I | 29.0 | 2.9 | 84 | I | 29.4 | 2% |
| Amazonas | 2.7 | 80 | I | 30.0 | 2.9 | 83 | I | 29.0 | -3% |
| Pasco | 3.9 | 58 | III | 15.0 | 2.8 | 76 | I | 27.6 | 84% |
| Ucayali | 4.1 | 72 | I | 17.7 | 2.8 | 70 | I | 25.2 | 42% |
| Junin | 4.0 | 72 | I | 18.2 | 3.1 | 74 | I | 24.0 | 32% |
| Cuzco | 2.9 | 78 | I | 26.8 | 3.4 | 75 | I | 22.2 | -17% |
| Moquegua | 4.1 | 83 | I | 20.3 | 3.9 | 81 | II | 21.0 | 4% |
| Loreto | 5.9 | 77 | II | 13.1 | 5.7 | 86 | II | 15.1 | 15% |
| Arequipa | 3.6 | 71 | III | 19.7 | 5.0 | 71 | II | 14.1 | -28% |
| San Martin | 5.6 | 73 | II | 13.0 | 6.2 | 75 | II | 12.0 | -7% |
| Ayacucho | 3.7 | 68 | III | 18.1 | 2.0 | 66 | III | 32.3 | 78% |
| Lambayeque | 3.0 | 77 | I | 25.8 | 2.4 | 67 | III | 27.4 | 6% |
| Ancash | 3.6 | 72 | I | 19.9 | 2.6 | 67 | III | 25.3 | 27% |
| Piura | 2.8 | 67 | III | 23.8 | 2.2 | 50 | III | 22.9 | -4% |
| Tumbes | 4.1 | 49 | III | 11.8 | 3.2 | 53 | III | 16.4 | 40% |
| Ica | 4.8 | 70 | IV | 14.7 | 3.3 | 54 | III | 16.3 | 11% |
| La Libertad | 4.4 | 55 | IV | 12.5 | 4.7 | 61 | IV | 12.9 | 4% |
| Madre de Dios | 9.6 | 76 | II | 7.9 | 5.4 | 69 | IV | 12.7 | 60% |
| Callao | 5.5 | 51 | IV | 9.2 | 4.2 | 47 | IV | 11.0 | 19% |
| Tacna | 4.1 | 30 | III | 7.3 | 4.8 | 43 | IV | 9.0 | 22% |
| Lima | 6.5 | 54 | IV | 8.2 | 6.0 | 47 | IV | 7.8 | -5% |
| Total general | 4.2 | 72 | | 16.9 | 3.6 | 70 | | 19.5 | 15% |

Source: ENAHO/INEI

S/. = Expenses in medicines per user

Disp. = Dispensing rate

Q = Quadrant

Prod. = Expense productivity

It once again calls our attention that Lima is the least productive region with regard to its spending in medicine purchasing. At a national level, during the analyzed period, the average was 19.5 pp in prescription dispensing per Nuevo sol spent in the purchase of medicines. Lima's performance was 7.8 pp per Nuevo sol. Puno had a performance of 37 pp per Nuevo sol spent in medicines.

Regions with higher expense productivity in medicine purchasing are Puno, Huancavelica, Cajamarca and Huánuco. The least productive are Lima, Tacna, Callao and Madre de Dios.

The region of Pasco showed the highest productivity increase during the analyzed period, with 84%, followed by Ayacucho, with 78%, Madre de Dios, with 60% and Huancavelica, with 52%.

On the downturn side, the region of Arequipa evidenced a 29% decrease, followed by Cuzco, with 17%, San Martín, with 7% and Lima, with 5%.

4.3 Operating Sustainability Dimension

Four indicators were proposed: (1) Inventory turnover, (2) SIS accounts receivable turnover, (3) Cash cycle and (4) Cash generation capacity.

4.3.1 Inventory level

Table #16 was prepared taking as reference the report on the financial situation of the SISMED at DISA and DIRESA level⁷, 2008 report, prepared by the Executive Office for Access and Use of Medicines of the DIGEMID.

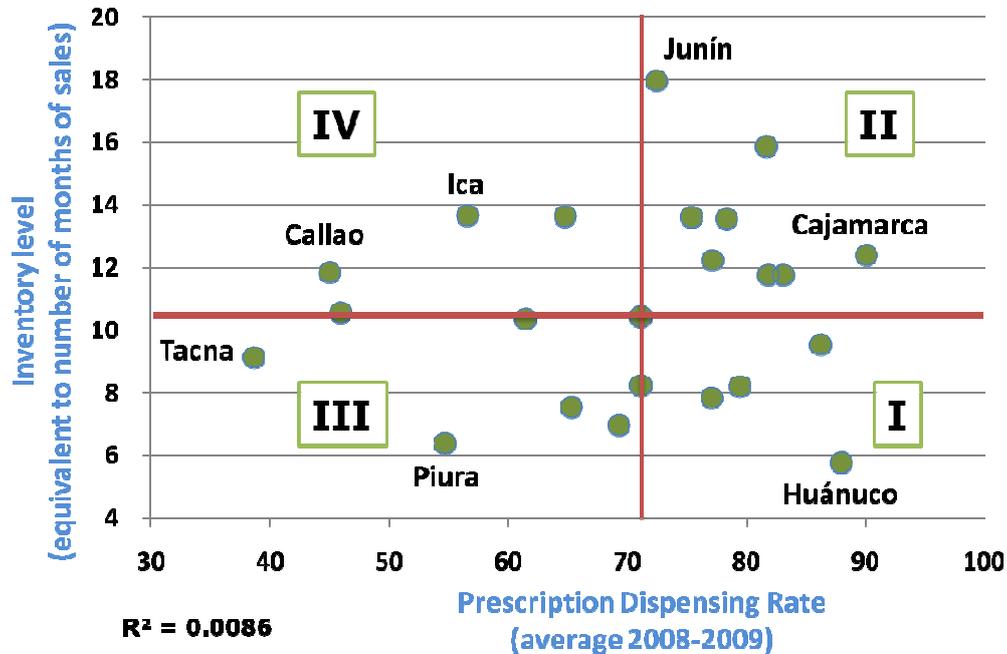
On average, during 2008, the Regional Health Offices kept an inventory equivalent to 10.51 months of sales. Junín evidenced the highest levels, with 17.93 months and Huánuco the lowest ones, with the equivalent of 5.78 months of sales or consumption

Table # 12 Medicines Inventory by Region for 2008
(equivalent to number of months of sales)



Graph #7 shows a relation between inventories and process results:

Graph # 7 Relation between inventory levels and prescription dispensing rates



Quadrant I shows the regions with the highest dispensing rates (in relation to the national average) but low inventory levels. Huánuco stands out. Quadrant II shows the regions with high dispensing rates, but also high inventories. Quadrant III shows the ones with low dispensing rates and inventories. Quadrant IV shows the regions with high inventories and low prescription dispensing rates. A low correlation coefficient indicates that, at least for 2008, there is no statistical relation between inventories and medicine dispensing service.

No significant relation could be found between the inventories and dispensing rate, as in the case of availability. At least, for 2008, having high inventory levels (capacity to immobilize resources) is a factor that does not contribute to better results.

4.3.2 Accounts receivable recovery period

This indicator shows the speed at which accounts receivable become liquid, mainly SIS accounts. It implies a fast management of SIS form filling process and recoveries. In this case, it is desirable that time periods are as short as possible (fast collection).

Table #17 shows the recovery situation of SIS accounts for 2008:

Table # 17 SIS accounts receivable recovery period (2008)

| Region | Months |
|-------------|-------------|
| La Libertad | 0.02 |
| Cuzco | 0.25 |
| Amazonas | 0.42 |
| Lima | 0.78 |
| Huanuco | 0.95 |
| Moquegua | 1.04 |
| Cajamarca | 1.07 |
| Arequipa | 1.07 |
| Apurimac | 1.21 |
| Puno | 1.23 |
| Junin | 1.28 |
| Ayacucho | 1.54 |
| Ica | 1.75 |
| Loreto | 1.89 |
| Tacna | 1.99 |
| Lambayeque | 2.20 |
| Piura | 3.02 |
| Ancash | 4.34 |
| Ucayali | 5.04 |
| | 1.29 |

Source: Financial Situation of SISMED at DISA and DIRESA level, 2008 Report.

The regions of Piura, Ancash and especially Ucayali have problems to manage their accounts receivable (at least they had them in 2008).

4.3.3 Operation cycle

It indicates the period that the Executing Unit or the DIRESA have been financing the operation to serve the target population. It is defined as follows:

$$\text{Operation cycle} = \text{Recovery period CxC} + \text{Inventory level}$$

All periods are related to sales (consumption) and are expressed in months, as may be observed in Table 18 below.

Table # 18 Cash cycle by region for 2008 (expressed in number of months)

| | Accounts receivable | Inventory | Cash cycle | Annual turnover |
|--------------|---------------------|--------------|--------------|-----------------|
| Amazonas | 0.42 | 11.75 | 12.17 | 1.00 |
| Ancash | 4.34 | 6.98 | 11.32 | 1.54 |
| Apurimac | 1.21 | 11.75 | 12.96 | 0.98 |
| Arequipa | 1.07 | 8.23 | 9.30 | 1.33 |
| Ayacucho | 1.54 | 13.62 | 15.17 | 1.23 |
| Cajamarca | 1.07 | 12.38 | 13.45 | 0.92 |
| Cuzco | 0.25 | 10.43 | 10.68 | 1.27 |
| Huancavelica | - | 15.84 | 15.84 | 0.83 |
| Huanuco | 0.95 | 5.78 | 6.73 | 2.96 |
| Ica | 1.75 | 13.64 | 15.39 | 1.12 |
| Junin | 1.28 | 17.93 | 19.21 | 0.63 |
| La Libertad | 0.02 | 10.35 | 10.37 | 1.52 |
| Lambayeque | 2.20 | 7.55 | 9.75 | 1.50 |
| Lima | 0.78 | 10.56 | 11.34 | 1.34 |
| Loreto | 1.89 | 9.53 | 11.42 | 1.10 |
| Pasco | - | 13.54 | 13.54 | 1.06 |
| Piura | 3.02 | 6.38 | 9.40 | 1.46 |
| Puno | 1.23 | 12.21 | 13.44 | 1.12 |
| San Martin | - | 13.60 | 13.60 | 0.93 |
| Tacna | 1.99 | 9.12 | 11.11 | 1.30 |
| Ucayali | 5.04 | 7.85 | 12.89 | 1.29 |
| | 1.29 | 10.47 | 11.76 | 1.23 |

Source: Financial Situation of SISMED at DISA and DIRESA level, 2008 Report.

Annual turnover refers to the number of cycles that can be achieved in that period. The higher the turnover, the higher the liquidity.

What may be clearly observed is that the greatest source of financing problems in a regional health office, with regard to medicines and supplies, are not time periods or payment delays by the SIS, but inventory management, which is a critical aspect.

4.3.4 Cash generation capacity

Two simulations were made in order to evaluate the impact on cash generation (less use of financial resources): one considered the same inventory level and successive purchase price reductions in medicines; the other one considered a constant purchase price of medicines and successive inventory level reductions.

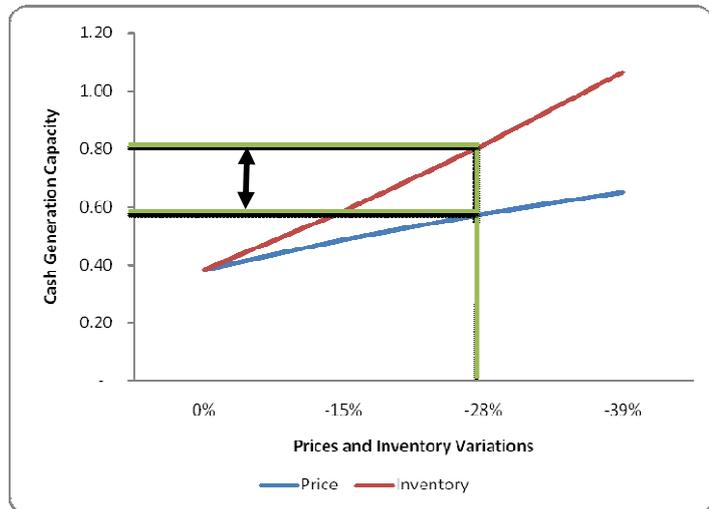
Graph # 8 Effect of inventory and price reduction on cash generation

Price Reductions
 Constant fixed cost
 SIS Rate = S/9.00
 SIS accounts recovery term = 2 months
 Inventory= 11 months constant

| Price Reduction | Cash Generation Capacity |
|-----------------|--------------------------|
| 0% | 0.38 |
| -15% | 0.49 |
| -28% | 0.58 |
| -39% | 0.65 |

Inventory Reduction
 Constant fixed cost
 SIS Rate = S/9.00
 SIS accounts recovery term = 2 months
 Average prescription price = S/3.00

| Inventory Reduction | Cash Generation Capacity |
|---------------------|--------------------------|
| 0% | 0.38 |
| -15% | 0.59 |
| -28% | 0.81 |
| -39% | 1.07 |



The effort to reduce stock would imply going from a national average equivalent to 11 months of sales (or consumption) to 7 months, which is possible with an adequate management of the supply process, compared to the effort that would mean a 28% reduction in the purchase price of medicines.

The effect with this change would be an increase in the regions' cash (cash flow) of more than 80% of the amounts currently handled to purchase medicines.

With 2008 figures, an inventory level equivalent to 7 months' consumption would have implied a reduction of S/.30 million in expenses allocated for the purchase of medicines. With expense levels reached during 2010, it would have represented national savings of S/.42 million; all this without considering storage and administration costs and the opportunity of those funds.

4.3.5 Summary of indicators

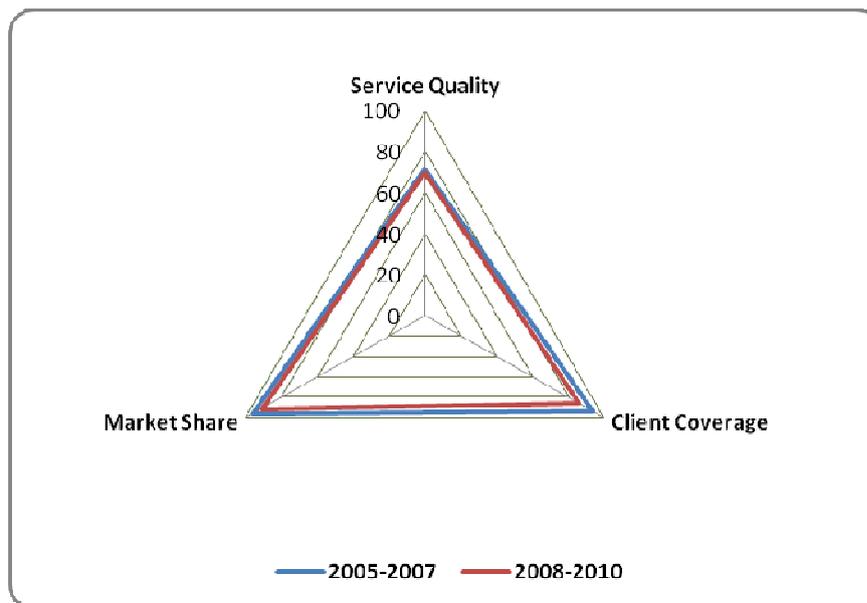
Below is a summary of indicators:

Table # 13 Management Indicators (at national level)

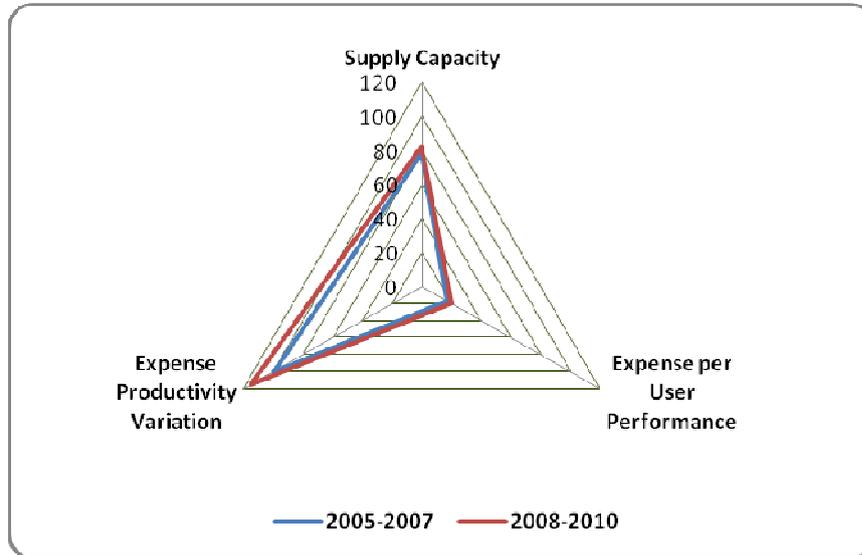
| Dimension | Indicator | 2005 to 2007 | 2008 to 2010 | Variation | |
|--------------------------|----------------------------------|--------------|--------------|-----------|-----|
| Market | Service quality | 71.51 | 70.01 | -1.50 | (-) |
| | Client coverage | 93.49 | 85.92 | -7.57 | (-) |
| | Market share | 3.88 | 8.83 | 4.96 | (-) |
| Operating Efficiency | Supply capacity | 78.50 | 82.16 | 3.66 | (+) |
| | Supply dispersion | N.A. | 15.20 | N.A. | |
| | Distribution efficiency | N.A. | N.A. | N.A. | |
| | Expense per user performance | 16.9 | 19.5 | 2.60 | (+) |
| | Expense productivity variation | 100.00 | 115.00 | 15.00 | (+) |
| Operating Sustainability | Inventory turnover | N.A. | 10.51 | N.A. | |
| | SIS accounts receivable turnover | N.A. | 1.29 | N.A. | |
| | Operation cycle | N.A. | -11.80 | N.A. | |
| | Cash generation capacity | N.A. | N.A. | N.A. | |

Which may be expressed by graphs, as follows:

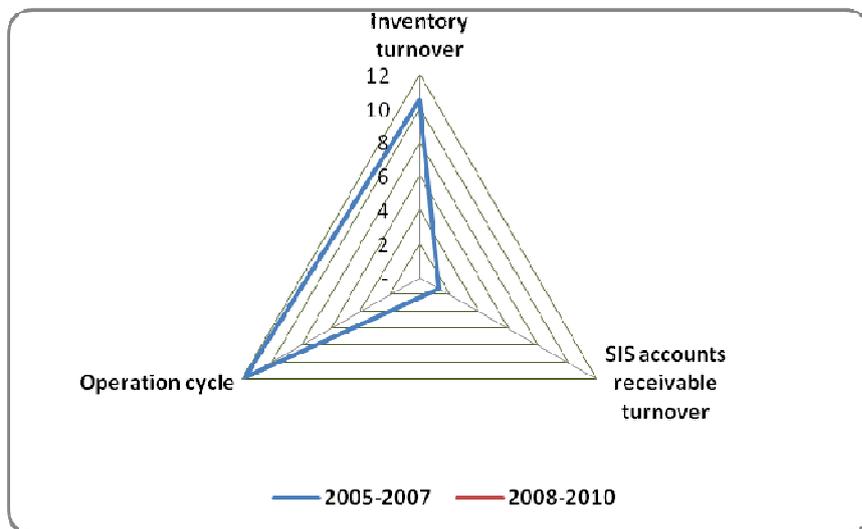
Graph # 9 Market indicators (national level)



Graph # 10 Operating Efficiency Indicators (national level)



Graph # 11 Operating Sustainability Indicators (national level)



⁷ SISMED financial situation at DISA and DIRESA level, 2008 Report. Executive Office for Access and Use of Medicines, DIGEMID-MINSA. July 2009.

5. Inventory and Costs Management

Inventories are immobilized assets, associated to a cost, with the purpose of keeping a dynamic supply process and meeting clients' needs according to certain required service standards or levels. Inventories are not an end in themselves, or an objective that may generate value. They are a redundancy incorporated to the system to neutralize management risks and errors. An inaccurate estimate of needs, poor acquisition management, erroneous methodologies to replenish consumed items in Health Establishments and the inability to implement a fluent distribution network end up reflecting on warehouses. All possible variability sources are located in inventories. While this behavior may contribute to prevent the supply process from stopping, it does not preclude that, ultimately, management problems are transferred to the final result. Higher inventories do not guarantee a better prescription dispensing rate.

The hypothesis of this report is that a DIRESA or Executing Unit that determines an inventory level adequate to the structure of its supply system and distribution network and follows it, is more efficient than those that have been unable to do it, and should show better relative results. Fewer inventories are a synonym of greater management efficiency and, therefore, better final results may be expected.

From this perspective, inventory administration is the permanent balance between keeping associated costs as low as possible and, on the other hand, keeping high service standards. To the extent these two criteria are duly internalized by those responsible for managing the supply process and incentives are adequately aligned throughout the entire supply chain, results according to expectations may be achieved.

5.1 Incentives

An incentive is the promise of a reward (or the fear of punishment) that stimulates certain behaviors and discourages others⁸. In an organization incentives must be in line with the objectives and with the results expected.

5.1.1 Measurement: Availability

Performance control and measurement systems, when not aligned with results expected, usually constitute sources of distortion in organizational behavior. There is no one performance indicator for all the supply chain; it is necessary to develop more than one to control processes considered critical in the generation of value. In addition, they must be directly related to client satisfaction.

As mentioned before, the medicines supply process across the country is measured by regulatory authorities with the availability indicator, which basically refers to the amount of inventory held by health establishments in each area and/or region in relation to its past consumption. As perceived, a larger stock in health establishments means greater opportunity to obtain greater availability. Even the DIGEMID specifies that keeping "a stock equivalent to 1-6 months consumption" is an acceptable availability level.

It is necessary to consider that this calculation does not include products in specialized medicine storages of the Health Offices and sub-storages located in many of their networks. Therefore, in a region with a three-tier supply chain, it is usual to find inventories equivalent to almost 12 months consumption on average.

5.1.2 Allocation of financial resources form

It is possible to induce the behavior of health care providers through payment mechanisms. These mechanisms can even affect the prescription of pharmaceutical products. Distortion arises when satisfying the real or perceived needs of users and, thus, retaining clients, is no longer a vital issue for the economic survival of health care providers, and another kind of behavior is privileged.

There are three general kinds of payment to health care providers, which may generate different behaviors towards the purchase and prescription of medicines⁹:

- **Budgetary transfer:** Resources are transferred as a budgetary item for the purchase of medicines and supplies; sometimes, they may be reallocated to other general expenses and sometimes the transfer is shielded for specific use. In this case, it is similar to budgetary allocations with financing sources from Ordinary Resources, used for national sanitary strategies and which account for approximately 20% of resources used in the purchase of medical supplies by the regions. The incentive is to spend the budgetary item, or else they are at risk that the item will be reduced or eliminated the following year. It is often even the cause why medicines or supplies already in the stocks of the Executing Unit are purchased.
- **Capitated payment:** Findings in this respect indicate that promotion and prevention activities are encouraged, thus reducing the subsequent medicine consumption. The idea is to transfer the financial risk of the financing party to the provider, who will act rationally, purchasing the medicines and supplies he needs according to the profile of his target population. Under no circumstance it is convenient for him to enter into an irrational prescribing practice or to undersupply his health establishments. Prevention / promotion are privileged over recovery. The experience in Peru for this payment mechanism is reduced for a short period of time and there are no clear results.
- **Production-based payment:** It is the mechanism that encourages greater production and prescription. It is usually used in the primary levels in Peru. Greater production means greater purchases of medicines and supplies and to achieve high availability levels, it also implies greater inventories. This case is similar to budgetary allocations with financing sources from Donations and Transfers (SIS) that represent approximately 48% of resources used in the purchase of medical supplies by regions. We must consider that in many cases, the salaries of personnel working in Health Establishments are associated to their production.

5.1.3 The role of the DIRESA

Another important factor to explain inventory levels is who takes up the role of medicines supplier and how payments will be made. In this respect, if practice is that the Executing Unit to which the DIRESA belongs buys the medicines and the Executing Unit Networks pay based on consumption (billing, SISMED-ICI integrated consumption reports or reimbursed SIS forms) the tendency will be to keep high inventories in the networks and health establishments. The cost of these immobilized resources is not absorbed by them. If the suppliers serve the Executing Units directly and they pay against delivery of the medicines or supplies at their warehouses, the tendency will be to reduce inventories. This element is very important when defining the structure of the supply chain.

5.2 Costs

If payment mechanisms promote purchasing, the supplier role that the DIRESAs take up favors storage and recognitions are associated to inventory readings; the possibility to incorporate the associated costs parameter is very limited when defining ideal inventory levels for each tier of the supply chain.

However, whether in an explicit and direct manner or by an alternative use of immobilized capital, the fact is that there are costs associated to the decision to store medicines and supplies. Not taking up or incorporating this parameter generates inefficient decisions and costs of other types (very high) associated with the service, which, again, is not incorporated by the public managers.

The different elements to determine the cost of inventories are:

5.2.1 Purchasing costs

Costs to process purchase orders, cost to transmit purchase order from the logistics department to the buyer, transportation costs, billing costs, price revision and payment, receipt cost, order review, registration in the warehouse stocks (SISMED software) and cost to introduce information in the logistic registries (SIGA, SIAF). To the extent a high cost to make purchases is perceived, attempts will be made to minimize these operations and higher inventory levels will be obtained.

At the Regional Health Offices, costs associated with purchasing (transaction costs) are viewed as fixed. Given the form – budgeting and allocation of financial resources – in accounting terms they are very close to being correct. The problem, and a very serious one, lies in the service quality side. Once its limited capacity and possibility to generate or activate acquisition processes is saturated, any additional request becomes slow.

We would still need to consider the costs associated with transparency of acquisition processes.

5.2.2 Inventory management costs

Cost of warehouse space, working capital cost due to immobilized inventories (opportunity cost of capital) cost of insuring medicines (non existing in the public subsector) cost of

stored medicine deterioration, expiry costs. As these costs increase, the tendency should be to reduce inventories.

As in the previous case, costs associated to the administration of inventories are perceived as a fixed amount, regardless of how much merchandise is administered. Again, service quality, in this case storage service, is affected. Meanwhile, when space problems are perceived in the storage, the usual tendency, promoted by the Ministry of Health itself, is to build a larger storage place or expand the one they have.

They have not internalized either the concept of immobilized capital financial cost. However, once their capacity is saturated, they stop buying and their storage places may be overstocked with medicines while they may be short of many other items.

5.2.3 Costs of losing sales (not being able to meet orders)

These costs are associated to the service quality intended for the target market. To the extent high standards are demanded in the fulfillment of orders, the tendency should be to increase inventories. Unfortunately, in many health offices, prescription dispensing standards in health establishments are used for declaration purposes rather than as performance goals.

An inadequate estimate of needs, the purchase programming and supply contract administration, the methodology promoted to store and distribute reflect in non-served prescriptions or “lost sales”. There is a destruction of social value and measuring this is beyond the scope of this study; however, we can try to quantify what revenues regional health offices and their executing units are missing due to the way in which their managers handle this process.

As an approach to non-served prescriptions, we will use the number of users (consultations) that according to the 2010 Households Survey (ENAH) did not receive any medicines upon presentation of their prescriptions at the health establishments where they were served. As price for each incomplete attention (SIS reimburses based on complete treatment) we consider the rate of S/.9.00 per consultation, which is the current reference for SIS reimbursements. Finally, we will assume that 30%, on average, accounts for the variable cost per first level consultation.

Table #20 shows the cost incurred by each region or the revenues not received for failing to adequately manage medicine supplies.

Table # 20 Cost of Non-served Prescriptions (national level)

| | Total Consultations 2010 | % not receive any prescribed medicine | Non-served prescriptions | S/. in "lost sales" | S/. Variable Expense | S/. Contribution to cover fixed costs |
|---------------|--------------------------------|--|-----------------------------|------------------------|-------------------------|--|
| Amazonas | 1,055,544 | 7.35 | 77,604 | 698,436 | 209,531 | 488,905 |
| Ancash | 2,004,324 | 10.78 | 216,060 | 1,944,540 | 583,362 | 1,361,178 |
| Apurimac | 1,098,336 | 1.92 | 21,132 | 190,188 | 57,056 | 133,132 |
| Arequipa | 1,430,484 | 7.45 | 106,572 | 959,148 | 287,744 | 671,404 |
| Ayacucho | 1,506,804 | 2.41 | 36,240 | 326,160 | 97,848 | 228,312 |
| Cajamarca | 2,077,716 | 7.50 | 155,784 | 1,402,056 | 420,617 | 981,439 |
| Callao | 1,002,204 | 22.86 | 229,092 | 2,061,828 | 618,548 | 1,443,280 |
| Cuzco | 1,714,248 | 5.98 | 102,444 | 921,996 | 276,599 | 645,397 |
| Huancavelica | 957,240 | 1.97 | 18,864 | 169,776 | 50,933 | 118,843 |
| Huanuco | 1,302,636 | 3.62 | 47,112 | 424,008 | 127,202 | 296,806 |
| Ica | 756,312 | 30.48 | 230,508 | 2,074,572 | 622,372 | 1,452,200 |
| Junin | 1,405,476 | 5.37 | 75,456 | 679,104 | 203,731 | 475,373 |
| La Libertad | 1,641,096 | 22.29 | 365,844 | 3,292,596 | 987,779 | 2,304,817 |
| Lambayeque | 1,457,040 | 12.15 | 177,000 | 1,593,000 | 477,900 | 1,115,100 |
| Lima | 8,742,132 | 31.31 | 2,736,792 | 24,631,128 | 7,389,338 | 17,241,790 |
| Loreto | 1,844,628 | 4.47 | 82,428 | 741,852 | 222,556 | 519,296 |
| Madre de Dios | 150,168 | 11.86 | 17,808 | 160,272 | 48,082 | 112,190 |
| Moquegua | 230,556 | 6.93 | 15,972 | 143,748 | 43,124 | 100,624 |
| Pasco | 438,036 | 6.96 | 30,492 | 274,428 | 82,328 | 192,100 |
| Piura | 1,554,564 | 32.16 | 499,956 | 4,499,604 | 1,349,881 | 3,149,723 |
| Puno | 1,804,392 | 4.77 | 86,112 | 775,008 | 232,502 | 542,506 |
| San Martin | 961,068 | 10.62 | 102,072 | 918,648 | 275,594 | 643,054 |
| Tacna | 265,152 | 15.27 | 40,500 | 364,500 | 109,350 | 255,150 |
| Tumbes | 311,280 | 33.64 | 104,700 | 942,300 | 282,690 | 659,610 |
| Ucayali | 843,156 | 31.01 | 261,480 | 2,353,320 | 705,996 | 1,647,324 |
| | 36,554,592 | 15.97 | 5,838,024 | 52,542,216 | 15,762,665 | 36,779,551 |

Source: INEI/ENAHO

5.2.4 Medicines and supplies costs

It is the purchase price multiplied by the quantity of products purchased. Products with higher prices should be purchased in less quantity, according to their turnover and those with lower prices, in greater quantities (always according to their turnover). Their failing to apply this rule and keeping in their inventories the equivalent to several months' consumption, without any technical criterion, results in cash deficits and problems to make timely purchases.

5.2.5 Variability

It generates costs insofar as it makes it necessary to find protection against a possible shortage through buffer inventories. A more variable demand or not very reliable consumer forecasts (estimate of needs) makes it necessary to increase buffer inventories. Delivery of orders beyond agreed terms, delays in purchase processes, disorganized administration of purchase contracts or unreliable suppliers induce to keeping higher inventories.

This variability and how it is managed, may contribute additional elements to explain how overstocking occurs in most of the regions of the country.

Graph #12 shows how storage and a three-tier distribution – very common in Regional Health Offices - system interact. Suppliers deliver their orders directly at the Specialized Medicines Storage (AEM) of the Regional Health Office (3rd tier). The parties responsible for the AEM keep a quantity of medicines and send the difference to the sub-storage of the Network (2nd tier) which in turn, serves Health Establishments within their geographical scope directly (1st tier).

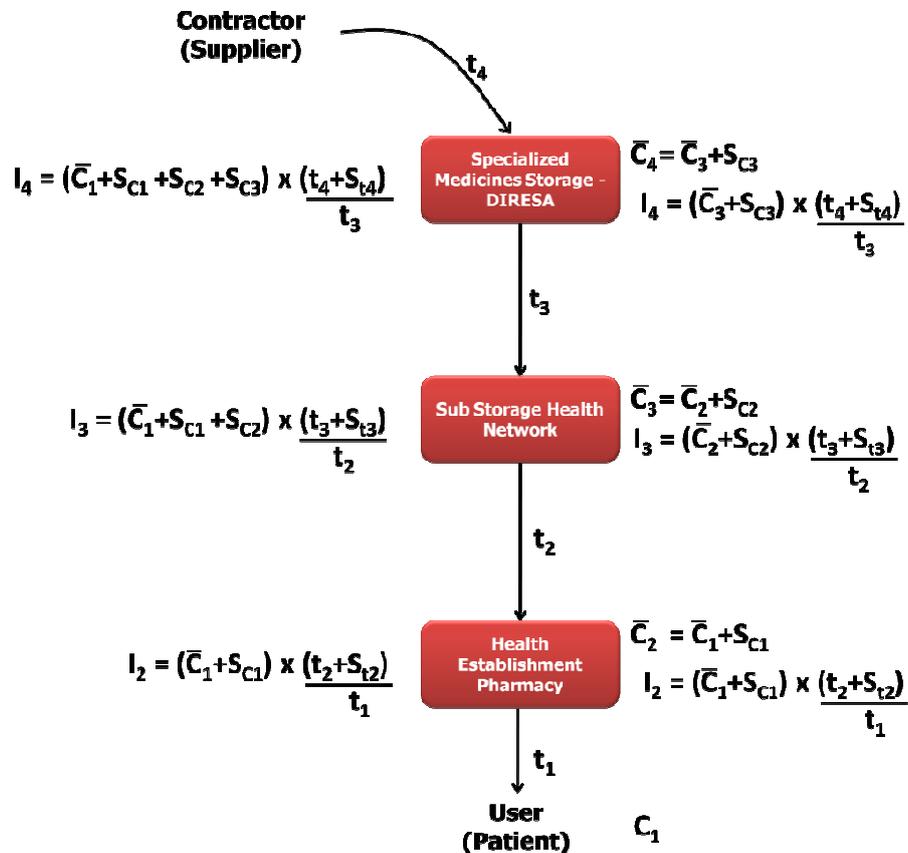
Inventories I_i are calculated based on expected consumption C_{i+1} of the next level and lead times t_i . In each case, averages over past behaviors and deviations over these averages are taken.

What may be observed is that the total inventory is according to final user consumption and all deviations perceived over consumption at each tier. The fact that each tier organizes its supplies according to the consumption observed in the next tier it serves, induces them to include their deviations.

Another observation concerns the lead times for dispatch and their deviations. As the system is configured, the more unstable or spaced out the supply, the higher the inventory will be. Purchase contract management becomes a key element.

To the extent the perceived variations interact (regarding consumption and replenishment time) in each tier of the supply network, inventories may increase considerably. On the contrary, if all tiers adjust their inventories only in relation to final consumption and its dispersion, there may be significant reductions, without affecting service level. Inventory levels should be considered only as a result of the forecast performance or the estimate of needs performance.

Graph # 12 Inventories model by tier



Where:

- C_i = Consumption per tier or level of the distribution system in months
- t_i = Replenishment time between tiers or levels (cycle per month)
- I_i = Inventory per each tier or level (in relation to consumption months)
- S_i = Deviations on average behavior

$$\text{Total Inventory} = I_4 + I_3 + I_2$$

Then we have that the entire system inventory can be expressed as follows:

$$\text{Total Inventory} = (\bar{C}_1 + S_{C1} + S_{C2} + S_{C3}) \times \frac{(t_4 + S_{t4})}{t_3} + (\bar{C}_1 + S_{C1} + S_{C2}) \times \frac{(t_3 + S_{t3})}{t_2} + (\bar{C}_1 + S_{C1}) \times \frac{(t_2 + S_{t2})}{t_1}$$

When the model should really be expressed as follows:

$$\text{Total Inventory} = (\bar{C}_1 + S_{C1}) \times \left[\frac{(t_4 + S_{t4})}{t_3} + \frac{(t_3 + S_{t3})}{t_2} + \frac{(t_2 + S_{t2})}{t_1} \right]$$

Where the total inventory of the system would be explained by the quality of the forecast on final consumption ($\bar{C}_1 + S_{C1}$) and the interaction between replenishment periods:

$$\left[\frac{(t_4 + S_{t4})}{t_3} + \frac{(t_3 + S_{t3})}{t_2} + \frac{(t_2 + S_{t2})}{t_1} \right]$$

The more inaccurate forecasts are perceived (estimate of needs) S_{C1} will tend to be greater and, therefore, so will the inventory¹⁰.

If purchase contracts are not properly administered and suppliers' lead times (contractors) are not controlled, S_{ti} will be really longer and, therefore, inventories will tend to grow.

The third aspect is how to structure replenishment times between the different network tiers (t_1 , t_2 and t_3).

The more space (less frequent) between replenishment times (higher t value) inventories will tend to be larger, transportation costs (freight) will be lower, inventory management costs will grow (not perceived by managers) and the process will be less flexible, with less capacity to respond rapidly to changes in consumer patterns or contingencies.

On the contrary, the less space between replenishments (more frequent) the system will tend to require fewer inventories, inventory management costs will also be lower (not perceived by managers), transportation costs (freight) will be higher (although not in the same proportion) and the process will be more flexible, with greater capacity to respond rapidly to changes in consumer patterns or contingencies.

Again we see that decisions will be associated to the perception of costs. If one considers that what is relevant to measure the social cost of having a better medicine supply is freight rates and not prescriptions served or medicines effectively delivered, the decision will be to space out replenishment. If it is possible to incorporate the "lost sale" cost, the decision would probably be the opposite. We will revert to this aspect later.

The rule for this case is based on the relation between the frequency with which replenishment is received and the frequency with which replenishment is required at the next tier. If the frequency with which replenishment is received is higher (more frequent) than the frequency with which the next tier is replenished, this tier will keep less inventory. Otherwise, the tendency will be to require more inventories. If all tiers are replenished and they replenish at the same intervals, total inventories will be equivalent to the number of tiers there are (for example, if the system has three tiers, each one would require one month consumption and the entire system would have the equivalent of 3 months).

As an example, a three-tier supply system (DIRESA, Health Network and Health Establishment) with one, two and two-month frequencies as replenishment periods and two, two and one month periods to replenish the next tier, would require a total inventory equivalent to 3.5 months consumption of final users or patients. If we add a margin of error of 30% in demand estimate, this inventory grows to an equivalent of 4.5 months. If we add

15% expected delay for replenishments, now the system will demand 5 month-inventories. Finally, if 30% variations are incorporated over consumption perceived in the tier each one serves, we would end up with total inventories equivalent to 6 months' consumption.

If we force the model on suppliers that have up to 30% variation in their lead times, with errors in demand estimates of up to 50%, the entire supply system inventory should not be more than the equivalent of 7 months' consumption; never the 10.5 month average seen in 2008 at national level.

5.2.6 Strategic considerations

There are strategic considerations such as lives saved or vital products, unexpected events, emergency reserves, which must be taken into account when defining inventories. One case may be sanitary campaigns. If an intervention of this kind is expected, inventory levels must be adjusted, but later they must adjust to demand in normal circumstances.

Vital medicines fall into this consideration. According to MINSA, they constitute a group of essential medicines, the lack or partial availability of which may generate serious consequences, as it compromises a patient's life or relapse, in the case of chronic disease. It is the responsibility of the Regional Health Office to define a policy on this kind of products, which may even be exempted from calculations regarding costs and turnover and have some kind of legal exemption.

5.3 Incorporating costs and an efficiency ratio

The implicit costs of how medicine supplies are managed in the public subsector are evidenced through the quality of the final process results.

Unfortunately, often in the apparent face of shortage of funds to sustain the operation, the first option is to refer to how limited budgetary ceilings are or to the sluggishness of reimbursements by the SIS, when the solution rather lies in the management of their own internal processes.

Previously we showed that keeping inventory levels of more than 7 months' consumption is almost unjustifiable and that if the DIREAS would follow this reference, their savings or reduced demand for public funds would be of S/.30 million. If we consider that there is S/.15.7 million in "lost sales", we could ascertain that the cost of inefficiency at national level is close to **S/.46 million**.

Table #20 below shows, in monetary terms, a classification of the regions based on costs incurred by an inadequate management of public funds. In some cases, the evidence is given by excess of inventories and in others, by incomplete consultations due to the lack of medicines prescribed.

Table # 21 Total costs incurred due to deficient Supply Management

| | Income not received | Excess inventories | Inefficiency cost | Total Purchases 2010 | % |
|--------------|---------------------|--------------------|-------------------|----------------------|--------------|
| Pasco | 82,328 | 204,766 | 287,094 | 1,964,033 | 14.6% |
| Tacna | 109,350 | 2,798,735 | 2,908,085 | 12,659,791 | 23.0% |
| Loreto | 222,556 | 561,763 | 784,319 | 15,390,559 | 5.1% |
| La Libertad | 987,779 | 1,333,428 | 2,321,207 | 19,530,373 | 11.9% |
| Tumbes | 282,690 | 213,909 | 496,599 | 3,161,092 | 15.7% |
| Amazonas | 209,531 | 1,336,763 | 1,546,294 | 4,146,785 | 37.3% |
| Huanuco | 127,202 | - | 127,202 | 7,530,471 | 1.7% |
| Cajamarca | 420,617 | 3,532,853 | 3,953,470 | 11,444,739 | 34.5% |
| San Martin | 275,594 | 1,265,820 | 1,541,415 | 9,936,255 | 15.5% |
| Junin | 203,731 | 3,014,988 | 3,218,719 | 11,711,893 | 27.5% |
| Arequipa | 287,744 | 409,823 | 697,568 | 14,726,449 | 4.7% |
| Ucayali | 705,996 | 119,367 | 825,363 | 5,626,535 | 14.7% |
| Ayacucho | 97,848 | 2,180,709 | 2,278,557 | 6,902,845 | 33.0% |
| Cuzco | 276,599 | 1,707,146 | 1,983,745 | 12,864,235 | 15.4% |
| Callao | 618,548 | 947,075 | 1,565,623 | 17,681,748 | 8.9% |
| Puno | 232,502 | - | 232,502 | 8,052,297 | 2.9% |
| Ancash | 583,362 | - | 583,362 | 10,919,847 | 5.3% |
| Apurimac | 57,056 | 1,432,224 | 1,489,281 | 6,368,967 | 23.4% |
| Lima | 7,389,338 | 5,247,682 | 12,637,020 | 14,632,665 | 86.4% |
| Huancavelica | 50,933 | 1,818,290 | 1,869,223 | 3,180,770 | 58.8% |
| Lambayeque | 477,900 | 122,127 | 600,027 | 7,598,693 | 7.9% |
| Ica | 622,372 | 1,124,506 | 1,746,877 | 5,796,309 | 30.1% |
| Piura | 1,349,881 | 537,506 | 1,887,387 | 2,711,620 | 69.6% |
| | 15,671,459 | 29,909,480 | 45,580,939 | 214,538,971 | 21.2% |

The important thing is to associate these “inefficiency” levels with the results of medicines and supplies provision, as the existence of a positive relation would be expected, that is, the regions that tend to use their resources efficiently should exhibit good results in the management of their supply chain, which would be evidenced through the service quality indicator.

Table # 22 compares the “inefficiency” level by region, according to the previously mentioned parameters, with variations in service quality between periods 2005-2007 and 2008-2010:

Table # 22 Inefficiency vs Service Quality Variation

| Region | % "Inefficiency" | Service Quality Variation |
|--------------|------------------|---------------------------|
| Pasco | 14.6% | 18.13 |
| Tacna | 23.0% | 12.33 |
| Loreto | 5.1% | 8.59 |
| La Libertad | 11.9% | 6.23 |
| Tumbes | 15.7% | 4.48 |
| Amazonas | 37.3% | 3.88 |
| Huanuco | 1.7% | 2.86 |
| Cajamarca | 34.5% | 2.17 |
| San Martin | 15.5% | 1.97 |
| Junin | 27.5% | 1.74 |
| Arequipa | 4.7% | 0.25 |
| Ucayali | 14.7% | -1.57 |
| Ayacucho | 33.0% | -1.78 |
| Cuzco | 15.4% | -3.51 |
| Callao | 8.9% | -4.18 |
| Puno | 2.9% | -4.71 |
| Ancash | 5.3% | -5.61 |
| Apurimac | 23.4% | -6.15 |
| Lima | 86.4% | -6.48 |
| Huancavelica | 58.8% | -8.89 |
| Lambayeque | 7.9% | -9.66 |
| Ica | 30.1% | -16.39 |
| Piura | 69.6% | -16.99 |
| | 21.2% | -1.50 |

If we consider the regions that are above the national average with regard to their capacity to improve the prescription dispensing rate (service quality) during the referred periods and their efficiency levels, differences are notorious:

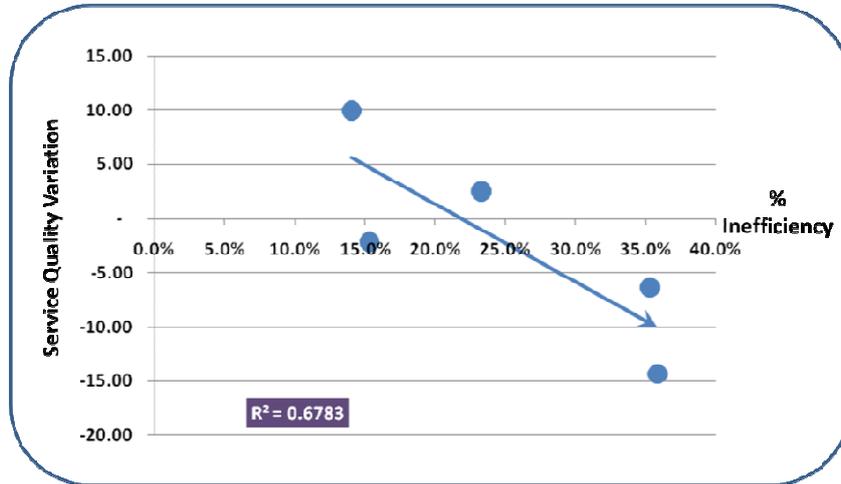
Table # 23 Inefficiency vs Service Quality Variation
(50% higher vs 50% lower)

| | % Inefficiency | Service Quality Variation |
|-------------------|----------------|---------------------------|
| Higher | 17.4% | 5.69 |
| Lower | 29.7% | -7.16 |
| Difference | 12.3 pp | 12.85 pp |

The most efficient regions in the use of their resources have shown improvement in the quality of their service of almost 13 pp over the less efficient.

Even when regions are grouped by quintiles and we associate efficiency in the use of resources with supply process results, we obtain the following:

Graph # 13 Inefficiency vs Service Quality Variation (by quintile)



All indicates that there is a significant correlation between service quality variation and efficiency levels by region.

Another interesting relation is between efficiency levels found and intensity of use of health services. If we group the regions by quintiles, there is a considerable difference between the four most efficient regions and the four least efficient, as shown in Table # 24:

Tabla # 24 Intensity of health services used and soles spent in medicines per user served, according to efficiency levels

| Classification | Efficiency | S/. x Consultation | Intensity of Use |
|------------------------|--------------|--------------------|------------------|
| 4 First Regions | 3.60 | 18.10 | 5.15 |
| 4 Last Regions | 63.01 | 9.37 | 4.07 |
| Difference | 59.40 | 93.2% | 26.5% |

Source: Integrated Health Insurance (SIS)

The ratio mentioned would also show that the “most efficient” regions have greater intensity in the use of health services or, in other terms, they enable greater access of their population (at least SIS affiliates) to health services. They also show higher expenses in medicines per user, which could mean that they deliver more medicines. Greater Access to services and more medicine deliveries are positive signs.

⁸ William D. Savedoff, Incentive Proliferation? Making Sense of a New Wave of Development Programs, August 2011.

⁹ Purchasing Pharmaceutical, Urika Enemark, Anita Albna, Enrique C.S. Vazquez. HNP Discussion Paper. September 2004.

¹⁰ Safety Stock: Everybody wants to use, nobody wants to own. James Workman and Natalie Scheidler. The Journal of Business Forecasting, Fall 2009.

6. Annex # 1 Management Indicators Technical Sheet

6.1 Market Dimension

6.1.1 SERVICE QUALITY INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Market |
| Definition | Service quality refers to the final results of medicines supply in the public subsector. User or patient must receive the medicines prescribed in the pharmacy of the health establishment where he was served. This indicator measures the degree of compliance of this service. |
| Scope | National and regional |
| Calculation methodology | <p>It is the result of dividing the number of patients that received medicines in the pharmacies of the Health Establishments where they were served according to the prescription presented, by the total number of patients that presented their prescription in such pharmacies.</p> <p>It is classified into those who received all their prescribed medicines, those who received most prescribed medicines, those who received very few, those who received none and those who do not know.</p> |
| Information sources | The information about the population that used health establishments and received medicines in their pharmacies: National Households Survey (ENAH) National Statistics Institute (INEI) |
| Interpretation | The best result is that 100% of the patients received all their prescribed medicines. The worst result is that 100% of the patients did not receive any of the prescribed medicines. |

6.1.2 CLIENT COVERAGE INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Market |
| Definition | Client coverage measures the percentage of users affiliated to the Comprehensive Health Insurance (SIS) that received the medicines included in their prescription after consultation. |
| Scope | National and regional |
| Calculation methodology | <p>It is the result of dividing the number of patients affiliated to the SIS that received their medicines at the pharmacies of the Health Establishments where they were served according to the prescription presented, by the total number of patients affiliated to SIS that presented their prescriptions at such pharmacies.</p> <p>It considers those who received all their medicines prescribed and those who received most of them.</p> |
| Sources of information | The information about the population that used health establishments and received medicines in their pharmacies: National Households Survey (ENAH) National Statistics Institute (INEI) |
| Interpretation | The best result is that 100% of the patients received all their medicines prescribed. As they move away from the result, client coverage decreases. |

6.1.3 MARKET SHARE INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Market |
| Definition | Market share measures the percentage of SIS affiliates that were served at the public subsector Health Establishment, did not receive all their medicines prescribed where they were served, and had to buy them in a private pharmacy or drugstore. |
| Scope | National and regional |
| Calculation methodology | It results from dividing the number of patients affiliated to the SIS that were served at Health Establishments of the public subsector and purchased their medicines in private pharmacies or drugstores, by the total number of patients affiliated to the SIS that were served at Health Establishments of the public subsector and presented their prescriptions in those pharmacies. |
| Sources of information | The information about the population that used health establishments and received medicines in their pharmacies: National Households Survey (ENAHO) National Statistics Institute (INEI) |
| Interpretation | Increasing percentages indicate critical deterioration of the dispensing service and loss of clients. |

6.2 Operating Efficiency Dimension

6.2.1 SUPPLY CAPACITY INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|--|
| Dimension | Operating Efficiency |
| Definition | The supply capacity consists of the items made available to users at the pharmacies of the Public Subsector Health Establishments. It is similar to the availability indicator published by MINSA. |
| Scope | Regional, Executing Unit, Operating Network, Micro Network |
| Calculation methodology | It results from dividing stock per item within the selected scope by its average consumption or expected monthly consumption The result obtained is the equivalent to consumption months |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). DIGEMID/MINSA website |
| Interpretation | Depending on the selected scope or area and on the Definition by the respective Regional Health Office |

6.2.2 SUPPLY DISPERSION INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|--|
| Dimension | Operating Efficiency |
| Definition | It is the standard deviation over the Health Establishments' supply (availability) within the selected area. |
| Scope | Regional, Executing Unit, Operating Network, Micro Network |
| Calculation methodology | The standard deviation of supply (availability) is obtained in all selected Health Establishments. |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). DIGEMID/MINSA website |
| Interpretation | A high dispersion indicator indicates that the supply capacity has not been evenly distributed in the selected area. |

6.2.3 DISTRIBUTION EFFICIENCY INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|--|
| Dimension | Operating Efficiency |
| Definition | It indicates the possibilities of improving the supply (availability) in a certain area, redistributing items held by Health Establishments including their storage places. |
| Scope | Regional, Executing Unit, Operating Network, Micro Network |
| Calculation methodology | <p>Every stock item within the selected area must be taken and divided by the average or expected consumption of each item in that area.</p> <p>The difference between the previous calculation and the supply capacity (availability) in the selected area is the indicator sought.</p> |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). |
| Interpretation | If the result is greater than zero, it indicates that there is room for improving the supply capacity in the selected area, redistributing items adequately in the Health Establishments, including their storage places. |

6.2.4 EXPENSE PER USER PERFORMANCE INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Operating Efficiency |
| Definition | It shows the relation between prescription dispensing and expenses incurred to purchase medicines per user served at the pharmacies of the health establishments consulted. It is an expense productivity evaluation. |
| Scope | Regional |
| Calculation methodology | <p>The result must be found dividing total expenses in the selected region by the total number of users that approached the pharmacies of the health establishment where they were served.</p> <p>Then this quotient is associated to the prescription dispensing rate within the selected area (service indicator). Expense per user and service quality obtained is the expense per user performance (expense x user vs prescription dispensing).</p> |
| Sources of information | <p>The information about the population that used health establishments and received medicines in their pharmacies: National Households Survey (ENAHO) National Statistics Institute (INEI).</p> <p>Expenses incurred to purchase medicines are obtained from an inquiry to the SIAF-MEF.</p> |
| Interpretation | <p>A higher prescription dispensing rate associated to similar or lower expense levels indicates superior performance levels</p> <p>A lower prescription dispensing rate associated to similar or lower expense levels indicates inferior performance levels.</p> |

6.2.5 EXPENSE PRODUCTIVITY VARIATION INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|--|
| Dimension | Operating Efficiency |
| Definition | It shows the variation in expense productivity between different periods. |
| Scope | Regional |
| Calculation methodology | It is the difference between expense performances calculated according to technical sheet 7.2.4 for two different periods. Unlike the previous one, which is considered a stock, this one is a flow. |
| Sources of information | <p>The information about the population that used health establishments and received medicines in their pharmacies: National Households Survey (ENAHO) National Statistics Institute (INEI)</p> <p>Expenses incurred to purchase medicines are obtained from an inquiry to the SIAF-MEF.</p> |
| Interpretation | If the difference is positive, it indicates that productivity is increasing; if the result is negative, it indicates that expense productivity is deteriorating. |

6.3 Operating Sustainability Dimension

6.3.1 INVENTORY TURNOVER INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Operating Sustainability |
| Definition | It measures the average time it takes for inventories to be sold within a certain area. It is a measurement of asset immobilization that takes liquidity away from the selected executing unit or area. |
| Scope | Regional, Executing Unit. |
| Calculation methodology | It results from dividing the valuated stock of medicine and supplies inventories within a certain period, by the sales made during that same period, multiplied by 360 (days of the year) |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). |
| Interpretation | It indicates the days, in relation to the sale, that the inventory will take to turn over. A higher result indicates a lower turnover. |

6.3.2 ACCOUNTS RECEIVABLE TURNOVER INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Operating Sustainability |
| Definition | It measures the average time it takes for SIS accounts receivable within a certain area to turn into cash. |
| Scope | Regional, Executing Unit. |
| Calculation methodology | It results from dividing the valuated stock from the SIS accounts receivable within a certain period, by the sales made during the same period, multiplied by 360 (days of the year). |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). |
| Interpretation | It indicates the days, in relation to the sales, that the SIS accounts receivable will take to turn over. A higher result indicates a lower turnover, that is, more time to turn into cash. |

6.3.3 OPERATION CYCLE INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|--|
| Dimension | Operating Sustainability |
| Definition | It measures the average time that medicines and supplies take from the time they enter the storage places until they are sold to users at the Health Establishments of the selected area, they become SIS accounts receivable and are finally reimbursed (turned into cash). |
| Scope | Regional, Executing Unit. |
| Calculation methodology | It results from adding inventory turnover days and the days it takes to collect the SIS accounts. |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI). |
| Interpretation | It indicates the number of days it takes for inventories to turn into cash, from the moment they enter the storage places and are reimbursed by the SIS. Shorter periods of time indicate better turnover and capacity of the selected area to obtain liquidity. |

6.3.4 CASH GENERATION CAPACITY INDICATOR TECHNICAL SHEET

| | |
|--------------------------------|---|
| Dimension | Operating Sustainability |
| Definition | It measures the capacity a selected area has, based on its fixed costs, variable costs and operation cycle, to generate working capital of its own. |
| Scope | Regional, Executing Unit. |
| Calculation methodology | $CGC = MC \times R$ <p>where CGC = Cash Generation Capacity MC = Contribution Margin R = Annual cash turnover</p> $MC = \frac{(SIS \text{ Rate} - \text{Variable Cost})}{\text{Fixed Cost}}$ |
| Sources of information | Information is obtained from the SISMED module, Integrated Consumption Report (ICI) and from the SIAF. |
| Interpretation | It indicates the capacity the selected area has to generate its own cash in the face of changes in costs, in stocks turnover (accounts receivable and inventories) and in SIS reimbursements rates, in this case. |

7. Bibliography

Akgün, Melek and Gürünlü, Meltem. «Cash to Cash Cycle as an integral performance metric in supply chain management: A theoretical review.» *The IUP Journal of Supply Chain Management*, 2010, Vol. VII.

Arguedas, Cinthya. *Revisión y análisis del marco normativo vigente según las funciones transferidas en el marco del proceso de descentralización*. Lima: Ministerio de Salud, Programa de Apoyo a la Reforma del Sector Salud PARSALUD II, Agosto 2010.

Behn D., Robert. «Why Measure Performance? Different Purposes Require Different Measures.» *Harvard University*, September/October 2003.

Callender, Carlos and Grasman, Scott E. «Barriers and Best Practices for Material Management in the Healthcare Sector.» *Engineering Management Journal*, December 2010.

Center for global development. *A Risky Bussiness, saving money and improving global heallth through better demand forecast*. Center for global development, 2007.

Chopra, Sunil and Meindl, Peter. *Supply Chain Management: Strategy, Planning, and Operations, Second Edition*. Person Prentice Hall, 2004.

Cosavalente, Vidarte Oscar. *Sistematización del proceso de implementación del monitoreo y evaluación de la descentralización en salud en el nivel regional*. Lima, Perú: Ministerio de Salud, PARSALUD II, 2010.

Debra Hadfield, Shelagh Holmes, Sue Kozlowski and Todd Sperl. *The Lean Healthcare pocket guide*. MCS Media, Inc., 2009.

DIGEMID-MINSA. «Situación financiera del SISMED a nivel DISA y DIRESA, Informe 2008. » Lima, Perú, Julio 2009.

Fischer, Marshall L. «What is the right supply chain for your product.» *Harvard Bussiness Review*, March-April 1997.

Gobierno Regional de Ayacucho. «Reglamento de Organizaciín y Funciones Red de Salud Ayacucho Norte.» 2011.

Gobierno Regional de Ayacucho. «Reglamento de Organización y Funciones Dirección Regional de Salud Ayacucho.» Huamanga, Ayacucho, 2010.

Gobierno Regional de Ayacucho. «Reglamento de Organización y Funciones Gobierno - Regional de Ayacucho.» 2007.

Gobierno Regional de Ayacucho. «Reglamentop de Organización y Funciones Red de Salud Huamanga.» Huamanga, Ayacucho, 2010.

Gobierno Regional de San Martín. «Proyecto de Reglamento de Organización y Funciones de las Redes de Salud de San Martín y sus orgánicas Desconcentradas: Microrredes de Salud.» Noviembre, 2009.

Gobierno Regional de San Martín. «Reglamento de Organización y Funciones de la Dirección Regional de Salud de San Martín.» Agosto, 2009.

Grandy, Christopher. «The "Efficient" Public Administrator: Pareto and a Well-Rounded Approach to Public Administration.» *Public Administration Review*, Nov/Dec 2009.

Kelly, Janet M. «The Dilemma of the Unsatisfied Client in a Market Model of Public Administration.» *Public Administration Review*, Jan/Feb 2005.

Kotwani, Anita. «Will generic drug stores improve acces to essential medicines for the poor in India?» *Journal o Public Health Policy*, 2010.

Lee, Hau and Billington, Corey. «Managing Supply Chain Inventory: Pitfalls and Opportunities.» *Sloan Management Review*, 1992.

Meier, Jeffrey K. Liker and David. *The Toyota Way Fieldbook*. New York: McGraw-Hill, 2006.

Ministerio de Economía y Finanzas. «Ley de Contrataciones del Estado D.L. N° 1017.» 2008.

Ministerio de Economía Y Finanzas. «Ley General del Sistema nacional de Presupuesto, Ley N° 28411.» 2004.

Ministerio de Economía y Finanzas. «Reglamento de la Ley de Contrataciones del Estado, D.S. N° 184-2008-EF.» 2008.

Ministerio de Salud. «Ley del Ministerio de Salud, Ley N° 27657.» 2002.

Ministerio de Salud. «Resolución Ministerial 829-2010/MINSA Norma Técnica de Organización y Funcionamiento del Comité Farmacoterapéutico .» Lima, Peru, 2010.

Ministerio de Salud. «Resolución Ministerial N° 1753-2002-SA/DM Directiva SISMED.» Lima, Perú, 2002.

MIT Zaragoza. «Private sector role in health supply chains.» *International Logistics program*, November 2008.

Moore, Mark H. *Creating Public Value: Strategic Management in Government*. Cambridge, Massachusetts: Harvard University Press, 1995.

Niaz Ahmad, Muhammad Usman Awan and Abdul Raouf. «Development of a service quality scale for pharmaceutical supply chains.» *International Journal of Pharmaceutical and Healthcare Marketing*, Vol. 3 No 1, 2009: pp. 26-45.

Pedersen, John and Rendtorff, Jacob. «Balancing values and economic efficiency in the public sector.» *Society and Business Review*, Vol. 5 No. 3, 2010: 293-302.

Pérez Fernández de Velasco, José Anatonio. *Gestión por Procesos*. Madrid: ESIC Editorial, 2010.

- Petersen, Heiko. «Integrating the forecasting process with the supply chain: Bayer healthcare's journey.» *The journal of busines forecasting methods&systems*, Winter 2003/2004.
- Phang Romero, Carmen. «Reforma del Sector Salud y la Política Farmacéutica en Perú.» *Cadernos de Saúde Pública Reports in Public Health*, Ago 2002.
- Phelps, Mike G. «Changing costs of public services.» *Economic & Labour Market Rivew*, December 2009.
- Philip C. Hopewell, Madhukar Pai, Dermot Maher, Mukund Uplekar, Mario C. Raviglione. «International Standards for Tuberculosis Care.» *WWW.STOPTB.ORG*, 2006.
- Prashant Yadav, Orla Stapleton and Luk N. Van Wassenhove. «Always Cola, Rarely Essential Medicines: Comparing Medicine and Consumer Product Supply Chains in the Developing World.» *Faculty & Research Working Paper (Social Innovation Center)*, March 2011.
- Raman, Narayanan V.G. and Ananth. «Aligning Incentives in Supply Chains.» *Harvard Business Review*, 2004 November.
- Rock, Laura and Johnson, Erick. «The Supply Chain Management Effect.» *MIT Sloan Management Review*, Spring 2003.
- Savedoff, William D. «Incentive proliferation? Making Sense of a New Wave of Development Programs.» August, 2011.
- Schachter, Hindy Lauer. «Does Frederick Taylor's Ghost Still Haunt the Halls of Government? A look at the concept of governmental efficiency in our time.» *Public Administration Rivew*, Sep/Oct 2007.
- Seiter, Andreas. *A Practical Approach to Pharmaceutical Policy*. The World Bank, 2010.
- Sobrino Ampuero, Cecilia. *Manual de Procedimientos Compra Corporativa Regional de Productos Farmamacéuticos*. Lima, Perú: USAID| Iniciativa de Políticas en Salud, 2009.
- Srethapakdi, Yimin An and Samuel. «Order Promising & Fulfillment and Client/Channel Collaboration in Supply Chain Management.» *The Massachusetts Institue of Technology*, 2006.
- Steven A. Melnyk, Edward W. Davis, Robert E. Spekman and Joseph Sandor. «Outcomer-Driven Supply Chains.» *MIT Sloan Management Review*, Winter 2010.
- Toyem, Charles A. «No excuses: Forecasting can be managed.» *Hospital Material Management Quarterly*, August 1994.
- Ulrika Enemark, Anita Alban, Enrique C.S. Vazquez. «Purchasing Pharmaceuticals.» *The World Bank*, September 2004.
- Wichowsky, Amber, y Donald P. Moynihan. «Measuring How Administration Shapes Citizenship: A Policy Feedback Perspective.» *Public Administration Review*, Sept/Oct 2008.
- Workman, James and Natalie Scheidler. «Safety Stock: Every body want to use, nobody wants to own.» *The Journal of Bussiness Forecasting*, Fall 2009.