

APPLICATION OF SOFT SYSTEMS METHODOLOGY IN WAITING LINES IN PUBLIC HOSPITALS OF BRAZIL

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ABSTRACT

The patients' selection in public hospitals of the Sistema Único de Saúde (Unique System of Health – SUS) has been presenting countless problems, as waiting lines and bad quality of the infrastructure, that brings the user's dissatisfaction. For a system analysis of this problem, this paper proposes the use of Soft System Methodology together with the queuing theory, to facilitate the understanding and to suggest possible options, which will result in the choice of the best solution and improvement of the service quality in this section.

INTRODUCTION

The Brazilian public hospitals linked to the Sistema Único de Saúde (Unique System of Health) always faced many problems related to the quality of the service. In many cases, the clinical service was inside of the quality patterns, although the previous stages, as selection and wait of the consultation, were not appropriate.

Great part of the problems found in the patient's reception in these hospitals takes to the creation of undesirable waiting lines, sacrificing the patient which is already in delicate condition, once he sought an unit of health.

Many studies demonstrate that the human being perception for the indisposition of facing waiting lines doesn't simply involve the number of individuals that precede him, nor the time of waiting for the service. Several other factors as the general conditions of the wait enclosure and of sanitariums, the cordiality of the servers, the comfort of the environment, the visual communication, among others, can influence in the user's perceived quality. In that way, great waiting lines or long wait periods can be softened when the environment is pleasant and the individual feels comfortable while he awaits service.

The study of waiting lines involves data as number of users that arrive at the place, average time spent in the service, number of available servers and line type, which can be single or specific for each server. The queuing theory doesn't provide better or optimal solutions. Instead of that, operation characteristics are described for analysis of the performance of the system. In continuity situation, it is obtained the medium

value of the performance characteristics that the system will reach after a long period of time. The application of mathematical models in the problem of lines can help in obtaining the parameters for reception quality improvement of the SUS. However, it will also be necessary to make the evaluation of the remaining of the system, besides the lines, to obtain the desired quality.

For the entire evaluation of the reception system in SUS, this work proposes the use of Soft System Methodology (SSM) developed by Checkland (1981), Checkland (1999) and Ckeckland and Scholes (1990). SSM is constituted of seven steps that allow the identification and characterization of a problem, with consequent analyses and propositions, looking for the best possible solution inside of the inherent environmental conditions to the problem. This method is based on the fact that the lines problem and wait service involve several interrelated parameters, like a system, and SSM is a system methodology for evaluation and proposition of corrective actions.

The objective of this paper is the presentation of a proposal which uses SSM added to the queuing theory, with the aim of improving the quality of the patient's reception system in hospitals of SUS.

NOMENCLATURE

ANS - Agência Nacional de Saúde (National Agency of Health)
SSM - Soft Systems Methodology
SUS – Sistema Único de Saúde (Unique System of Health)

SISTEMA ÚNICO DE SAÚDE (UNIQUE SYSTEM OF HEALTH)

How the information systems can help the problem of the waiting lines of public health in Brazil? Quality problems in the area of health and related with the allocation of resources are seen by every part, of the execution of incorrect and unnecessary operations to incorrect prescriptions, the long waiting lines and to the lack of good medical service. Some solutions are being obtained through the information technology, including the use of information system to improve

the medical aid quality and control of costs, among them is the patients' computerized registration that aids in the medical service and it improves its quality in the following conditions: it accelerates the medical service, it reduces the barrier of the distance, it assures the data integrity, it reduces the pressure on the patient, it facilitates the medical research and it improves the adaptation of medical aid programs because it facilitates to learn more on their patients (LAUDON and LAUDON, 1999, p.368).

In Brazil, the crisis in the health has been causing the decrease of the service quality and the increase of the waiting lines, going against the patients' insatiable demand for high quality service (MOTTA, 1996; PASSOS and ROCK, 1997; CORRÊA et al., 2000). Therefore, the doctor-patient relationship is abased by health system by the patients' endless lines, that they are assisted in an inhuman way by the doctors pressed by the time and for the environmental conditions. The wear of the doctor-patient relationship is a reality in the current days (AZEVEDO, 1985; ROSA, 1991), however the doctor should have pleasure well in the exercise of his action and the patient treaty, with ethics, humanism and respect will give larger value to his doctor because he will perceive that their expectations of quality of the expected service were assisted.

In despite of the crisis, now there are a crescent pledge of the professionals and institutions of the health area in improving of the medical services quality realized for the patients. Gradually had occurred an incorporation, in the field of the attendance to the health, of notions linked to the citizenship, to the consumer's rights and the professionals' ethical responsibility. The quality of an assistance service is directly associated to the quality of the inter-relationships among patients and the professionals of the attendance (MARTINS, 1997).

The sector health won new challenge, with the promulgation of the Federal Constitution of Brazil (Constituição Federal do Brasil). The Constituição (BRASIL, 1988), that instituted SUS, was defined in its article 196, "the health as right of all and to owe of the State, guaranteed by social and economical public politics that seek to the reduction of the risk of diseases and of other offences and to the universal and equalitarian access to the actions and services for its promotion, protection and recovery". So much, the federal government's paper won new meaning, becoming him promoter, regulator, the one who fiscalizes and, in certain cases, executioner of actions in the extent of the sector. SUS is inserted in a movement of sanitary reform, that doesn't begin, nor becomes exhausted with its creation. The construction of new bases conceptual, financial and operational of the system became the larger objective of the sector Health. The foundations of that process are the beginnings of political-administrative decentralization, with only direction in each government sphere; integrality of attendance, understood as articulate and continuous group of the actions and preventive and healing, individual and collective services, demanded for

each case in all from the levels of system complexity; and the community's participation (BRASIL, 1988).

In agreement with the decree n°. 3.507 (BRASIL, 2000), Art. 2nd, which deals about the quality patterns of the service, in agreement with the sections: I observed in the installment of whole and any service to the citizens and users; II appraised and reviewed periodically; III measurable; IV of easy understanding; and V published the public.

Art. 3rd, of the same ordinance, it treats that the organs and the federal public entities should establish quality patterns in the Service to the Citizen. We mentioned among the sections: I the attention, the respect and the courtesy in the treatment to be dispensed the users; II the priorities to be considered in the service; III the time of waiting for the service; VI the procedures to assist to complaints; VII the forms of identification of the servants; VIII the system of visual signaling; and IX the conditions of cleaning and comfort of their dependences.

Some examples of Quality Patterns of the Service rendered the citizen in the area of the Health (BRASIL, 2002b), already defined and implanted by hospitals, agencies and institutions that work directly with the citizen in agreement with the models of Patterns, they are related in accordance with (BRASIL, 2000). In the Art. 3°. that deals about the attention, respect and courtesy in the treatment to the users: every user is entitled to be assisted with attention, respect and courtesy, it can be evaluated through the following subjects: 1) our customer is assisted with attention, respect and courtesy; 2) our team is prepared to assist him with attention, respect and courtesy; 3) here you are assisted with attention, respect and courtesy.

In the section III, of the same article, that refers at the time of waiting for the service to establish limits of time for their users' service, can be evaluated them through the subjects: 1) the time of waiting for the first service, in the emergency service is of 60 minutes and for service ambulatorial is of 75 minutes; 2) the time of waiting for consultation service up to 4 hours, in the marked shift; 3) this reception is prepared to assist him up to 15 minutes, with specific times of waiting for each area; 4) the time of waiting depends on the media used for contact: through it Dials ANS (National Agency of Health), immediate; in the nucleus, immediate; through e-mail, in until one day.

In agreement with the technical orientations contained in (BRASIL, 2002a) for the ambulatory organization it should be verified the whole structure and organization of the unit service of attendance. This document of work orientation is used as Visit Ambulatorial's Itinerary. The perfect characterization of the functionality of the clinic will depend on the application of this itinerary in a correct way and with discernment. In this article, it is just mentioned some relative aspects to the Structure and Functionality to evaluate the readiness of human

resources, materials and physical, verifying besides, as example: 1) if there are been sections of the unit that present repressed demand; 2) if there is collection of taxes in the service, mainly when it treats of clinic of the hospital; 3) the actions of sanitary surveillance; the day of the professionals work versus productivity; 4) the date consultations system: existence or not of date headquarters.

Based on the same technical orientation (BRASIL, 2002a), used as a guide to evaluate quality and the user's satisfaction, is mentioned as some relevant aspects:

- to verify if there are lines, the conditions of the waiting room, the waiting time and the hygiene conditions of the sanitary installation;
- to interview the user using the random choice, to identify the degree of satisfaction of the same. Thus, it is necessary the elaboration of a previous guide;
- to verify, for sampling, if the registrations of the services are complete, with every service description and service operation of file of those documents;
- to check random the duration time of the consultations.

Some studies in Brazil related with the health care and with the patient's service time that were accomplished, as: the time spent in the consultations in the homeopathic service at the Health Center of Barra Funda-SP (SILVA et al., 1986); the consultation time in the analysis of employees and doctors' depositions of the public services of health in the municipal district of Duque de Caxias-RJ (ROSA, 1991); the waiting time in the evaluation for a certain population of the services offered by a Basic Unit of Health of the Maringá city -PR (SOUZA, 1996); the waiting time in the evaluation of the degree of the users' satisfaction with the building of the clinics of the Clinics Hospital Central Institute in relation to the general offices and doctors service (RAMPAZZO et al., 1997); the waiting time of the consultation in the evaluation of the ambulatorial service quality in pediatrics sector in the Unicamp Clinic Hospital, an academic hospital in Campinas-SP (FRANCO and CAMPOS, 1998); the punctuality in the service and the consultations duration time in the evaluation record of the care services to the health of the São Paulo University at campus of Ribeirão Preto and of Medirp health system, that can be answered by the employees of São Paulo University-USP (SISUSP, 2002).

In most of the researches accomplished in Brazil it can be verified on its medical consultation evaluation that the subject of the service time is always measured, sometimes of a way qualitatively and other quantitative evidencing its relevance because impact in the patient's satisfaction as the service quality rendered by the doctor. It influences directly on the doctor's revenue because it is through an appropriate service system, including the dating that happens the schedules optimum of the doctor's service.

SOFT SYSTEMS METHODOLOGY (SSM)

Soft Systems Methodology or SSM was proposed by Checkland (1981), starting from the verification that the

methodologies "hard", as the Operational Research, Systems Engineering and Systems Analysis (structured methods) were limited for the resolution certain problems, because it supposes: an objective reality of systems in the world; the well-defined problem to be solved; that the factors main are technical; the use of a scientific approach for problem-solving and one correct solution. Like this, that methodology looks for to enrich, through understanding of a certain situation, without worrying directly with the algorithmic resolution of a die problem, being applied, especially, in environment where the subject is not as much as "making", but "what must be made".

SSM should be applied in problems that are flexible "soft" because they aren't usually well defined and structured. It is also concerned with the human factors, mainly with the different views of the problem to be analyzed, when the problem analyst generates through these views an acceptable perception of the system in that all agree. Therefore SSM can be defined as a method of "problems structuring", instead of "problem-solving", since, predominantly, works with problematic situations, unstructured and characterized by disagreements and uncertainties relate with the nature of the problem context.

In agreement with Checkland (1981), SSM has seven steps to structure the problem in a chained way, analyzing it under two concerns, the first, related to the real world, where steps 1, 2, 5, 6 and 7 are developed referring to the day by day in which the people live and with which link, and second, to the systemic thinking, where steps 3 and 4 are developed, in which the analyst uses system concepts to try to understand what is happening in the real world. What matters during the application of SSM, isn't follow the sequence of the step 1 to the step 7, but the content of each step and the relationships among them, because it is interactive. SSM life-cycle of through their steps is presented briefly:

- step 1 Situation problematic unstructured. Identification of the problematic situation to be structured and solved. Learning and understanding the problem situation;
- step 2 Problem situation expressed. Representation of the problem in an illustrative way, which should capture all of the system elements and their inter-relationships. It should involve information on the people's activities and their purposes, problems areas, limits, control, all of the conflicts sources and details on the environment. Some techniques can be used as the brainstorming and rich picture;
- step 3 Root definitions of relevant systems. Now the root definitions, the essence of the relevant systems, are defined. They describe what the system is which is his objective. The human activity system usually has more than a root definition in agreement with the considered perspectives. In agreement with Flood (1988), each element of mnemonic CATWOE (Customer, Actor, Transformation, *Weltanschauung*, Owner, and Environmental Constraints) composes the root definition in agreement with the Table 1. The system in study belongs to a proprietor or owner, and it acts under environmental restrictions, transforming inputs in products, through some activities and of actors, affecting a group of possible interested, under the visions of the world

vision of those involved, that gives meaning to the transformation;

- step 4 Conceptual models. Construction of a model in the form of a diagram, in that the relationships and the activities of the human activity system are represented for each root definition. Once the SSM team has agreed on a root definition (and the CATWOE participants) they temporarily forget about the existing system and model their "ideal" system to do the job. Here we can come up with lots of crazy ideas, though eventually we need to choose the "best";
- step 5 Comparison of models and real world (step 4 e 2). Use of the Conceptual Model to question the real world situation. From the discussion at step 5, certain possible changes are identified;
- step 6 Changes: systematically desirable, culturally feasible. Discussion of the changes. They are likely to vary in desirability and feasibility: desirable: is it technically an improvement? and feasible: especially, does it fit the culture? Presentation of the diagnoses and of the possible suggestions to approximate the problematic situation of the systems thinking. Final step of SSM provides the suggestions that can be implemented;
- step 7 Action to improve problem situation. The final step of SSM provides the suggestions that can be implemented.

Table 1 – Root definition elements: CATWOE

<i>Acronym</i>	<i>Description</i>	<i>Ask checklist</i>
C	Customer	Who are the victims or beneficiaries of the system?
A	Actor	Who executes the activities?
T	Transformation	What does input is transformed in products/services?
W	<i>Weltanschauung</i>	What world visions do make relevant system?
O	Owner	Who can the system stop?
E	Environmental Constraints	Which characteristics of the external environmental can affect the system?

SSM has a philosophy of continual improvement. But in another sense we hope for convergence. We hope that some of the issues agreed in the early stages will not resurface, that discussions arising during implementation will be more focussed as the participants' skills in SSM and understanding of the enterprise increase.

LINES

The pioneer of the studies of the queuing theory was the Danish engineer A. K. Erlang, in the telephony industry, in the early 1920s (TURBAN and MEREDITH, 1994). That theory was extended, especially after World War II, for several situations, like: determining access to telecommunications networks; determining the capacity of an emergency room in a hospital; determining the number of runways at an airport; determining the number of elevators in a building; determining the number of flights between two cities; determining the number of first class seats in an airplane; determining the size

of a restaurant or the work in large computer systems (TURBAN and MEREDITH, 1994).

Several authors present studies on the queuing theory like Turban and Meredith (1994), Ragsdale (2001); Winston (1994) or Anderson et al. (2003), with the presentation of several conditions and models for its evaluation. The calculation of the characteristics of operation of the several situations that involve waiting lines, can be obtained through several specific software, which can be found in Internet. It is also possible to use software package like Microsoft Excel.

The subject of the time of a service, in this case the rendered medical service, takes in some situations to a delay in the waiting line and the inevitable of the waiting. An implication of the waiting starting from a psychological perspective is the feeling of emptiness that seems endless. The perception of the waiting is usually more important for the customer that the real time that he spent waiting and he also has economical implications for the service company, hospital or clinic, and for their customers, in other words, the patient (FITZSIMMONS and FITZSIMMONS, 2000).

The waiting line can have several economical interpretations, and it is always difficult to determine his real cost. For this reason, the balance between waiting cost and service rendering cost is rarely expressed. Besides, the service supplier should take into account, before making the decision, the physical aspects, behavior aspects and economical aspects of the consumer's experience of who is waiting (FITZSIMMONS and FITZSIMMONS, 2000).

The delay time in the patient's service can cause the formation of a line. The administration of lines is a constant challenge for the services rendered managers. The customers usually random arrive and they present an immediate demand for available services. If the capacity of services is being completely used in the moment of one's arrival, then it is hoped that the customer waits patiently, happening the line formation, in that the customer waits for his time to be assisted and the wait becomes inevitable.

The decisions taken in the planning activity and control of the capacity of the resources affect the performance of costs, incomes, floating capital, quality, speed, reliability and flexibility (FITZSIMMONS and FITZSIMMONS, 2000).

METHODOLOGY

This work is an exploratory study that proposes the use of the method SSM for the improvement of the problems of lines found in the service in hospitals of the Unique System of Health, together with the queuing theory. The place to be studied was delimited in the patient's reception in the hospital, where he faces a first line for the selection and one second line for the clinical service of the specific area to which was directed.

A bibliographical research was accomplished to look for data about the current situation of the hospitals of SUS, of the application of SSM in the resolution of administrative problems and of the mathematical theory for the study of waiting lines.

For being a theoretical study, an application was not accomplished at a specific hospital, being just proposed a method of the job of SSM for the improvement of the patient's condition during period of waiting by service.

PROPOSAL OF APPLICATION OF SSM IN LINES OF SELECTION OF PUBLIC HOSPITALS

Step 1: Problematic situation unstructured. The majority of public's Brazilian hospitals faces a serious problem as for the formation of lines in the rendered doctors services. That causes the patient's dissatisfaction, of the receptionists, as well as of the medical team, whose routine is prejudiced with overloads.

Step 2: Problem situation expressed. In this step it should be made a general evaluation of the existent system, characterizing all of the patient's steps from his arrival in the hospital, selection and waiting of service (Figure 1). That survey should contain data as: line in the selection, line addressed to the specialties to which the patients will be directed after the selection, conditions of the waiting rooms (seats, ventilation, illumination, cleanliness, readiness of water, access to sanitariums, signaling for smokers, independence of routes of traumatized patients, with infectious diseases or dead bodies), signaling interns of the hospital, quality of the selection service, quality of the system of patients' information (patients' computerized registration), among others. For the elaboration of the mathematical model of the waiting lines (selection line and line addressed to the medical specialties), it's necessary to identify the following parameters: population type (finite or infinite); users' frequency arriving in the system; medium time of service in both lines and order in that the users are assisted (FIFO - First in-first out, in agreement with the urgency or other).

Step 3: Root definitions of relevant systems. In this step, it can grow several roots definitions in agreement with each world visions, as of the administrator of the hospital, of the doctor, of the patient that waits, of a politician. A root definition is in the Table 2 in agreement with the authors' vision.

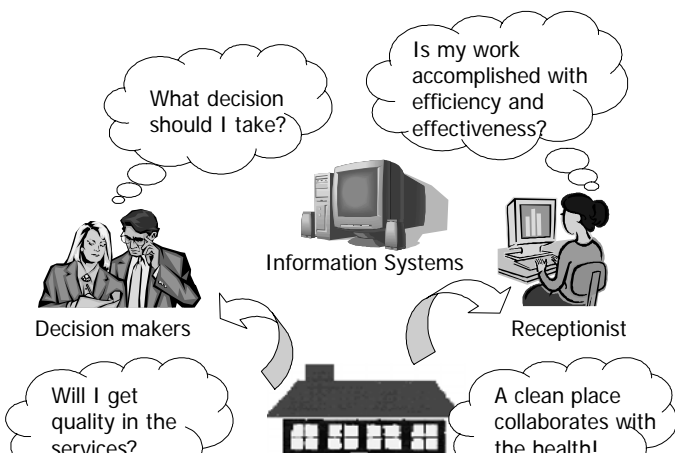
Figure 1 – The context of selection line of public hospitals

Table 2 – Root Definition

<i>Sigla</i>	<i>Description</i>	<i>Elements Characterization</i>
C	Customer	External customer: patient awaiting service and population potentially use Internal customer: Receptionists of the selection and personal of the cleaning and maintenance
A	Actor	Receptionists of the selection and personal of the cleaning and maintenance
T	Transformation	Modifications to be implemented for improvement of the service quality
W	<i>Weltanschauung</i>	The patients' perception and receptionists' perception
O	Owner	Responsible for the general administration of the hospital Budget and legal restrictions,
E	Environmental Constraints	epidemics, climatic alterations, environmental alterations (burning, accidents with pollutant etc)

Step 4: Conceptual models. For each definition root, a model should be built in agreement with a considered perspective. In this step, it will be also developed the generic model of single line using the queuing theory (hard solution), considering the parameters identified in the step 2 and 3. In this step, it is important that the problem was understood very well, reflecting all of the point of view (*weltanschauung*) of those involved.

Step 5: Comparison of the Conceptual Models with the Real World. In this step, it is verified the qualities and the failure of the conceptual model according to the real world restrictions. If necessary, return to the previous step or improve the model.



Step 6: Changes Systematically Desirable and Culturally Viable. The necessary changes diagnoses are presented in the conceptual model to adapt it to the real world conditions and the possible suggestions are shown. In this step it is defined the improvement suggestions for the problem in study.

Step 7: Action to improve problem situation. After the presentation of the possible suggestions, define the solution that better adapts under the point of view of the system theory. The evaluation and the patients' suggestions and users can aid the improvement of the rendered service quality by the hospital.

CONCLUSIONS

Some of the main benefits of the use of SSM are the problems structuring that are soft and the application in a business organization, as in this work, where SSM was applied in a hospital organization. The hospital is an organization that possesses complexity as any other one, and its application can be very useful to determine the situation problem. Besides, SSM is not just based on the processes, relationships and structure, but it considers the social and political subjects, in agreement with the point of view of all the parts involved in the resolution of the problem. Another contribution is the help in the understanding of the business.

Some of their disadvantages are in the fact of SSM does not possess a complete project of means to build a whole system. It is not appropriate for resolution of problems that are defined as hard, as the problem of the mathematical model of waiting lines. That problem should be treated through specific models in agreement with the queuing theory, and the parameters identified in the place.

The solution of the problem of the selection line can supply the amount of seats in the waiting room of selection, but it doesn't evaluate aspects as the color of the seat and of the appropriate material of the seat considering a hospital environment and the patient's expectations. These aspects can be evaluated by the SSM, which can supply suggestions of improvement of the other conditions and characteristics of the service environment.

The united solution of hard and soft problems supplies more options of possible solutions to be implemented by the decision making. The high administration of the hospital obtains a wide vision of the problem situation with the application of SSM, as general guide of evaluation and supply of suggestions. The mathematical model of the waiting line is used as an auxiliary tool, inserted in SSM, for the solution of the specific problem of lines.

The next step of this work will be the application of the models, SSM and lines, in order to minimize the problems found in hospitals of SUS, and to reach a better quality in the selection service and waiting line of clinical service.

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