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Improving health coverage systems through simulation

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***Abstract*—Health coverage is considered and promoted as one of the main funding mechanisms to improve access to health services while providing protection against financial risks.**
By exploiting the technique of simulation with the aid of software ARENA, we proposed some alternatives to improve the services provided by the latter.
***Keywords*—*Health* coverage, Discrete event simulation, Performance**

I. INTRODUCTION

Coverage is designed to alleviate the financial cost caused by an alteration in health, whether caused by an illness or accident.

The coverage product is given by the coverage companies in the form of a contract usually signed between the insurer and the insured. However, this contract may involve other parties, both in terms of training and execution [1]

Health coverage can be defined as a contract by which the insurer, in exchange for a premium, promises, in the event that the insured person is, during the guaranteed period, affected in his own person by an illness or even by an accident, on the one hand to pay him certain sums, especially during his incapacity, on the other hand to refund to him all or part of the medical and pharmaceutical expenses necessitated by the realization of the risk.

The aim of this reform is to provide all insured persons with the same benefits, to improve the quality of care and to rationalize healthcare expenditure. A new restructuring of the disease coverage was initiated by the application of a new scheme, represented by a new organization, namely the CNAM National Health Coverage Fund. This system aims to improve the coverage, equity, and financing of the health system.

Today, coverage is more than just a response to the diversity of risks, as the techniques developed in coverage have made it possible to develop various types of products trying to meet the concerns of customers.

This was reflected in a set of measures taken to implement a program to modernize and upgrade coverage companies, which aims to improve the financial base of coverage companies, quality of services, developing their human resources, modernizing their internal management methods, diversifying coverage products, renovating their communication channels and, above all, adapting them to the needs and expectations of the customers.

This institution is constantly being criticized by citizens. Due in particular to the continuing high inflows, the limitations of reception, the lack of equipment and the narrowness of the waiting room and, more importantly, the non-optimized use of resources.

Consequently, these institutions must seek strategies for:

• Improvement of the quality of service by the concerned operational staff.

• Optimizing the allocation of available resources to best meet the needs of the population.

In order to clarify matters and bring solutions together, we take a real case to study it deeply: this is the case of the "National Health Coverage Fund of Gabes".

We see that the latter can serve better. Indeed, the main objective of our research is, in fact, organizational, that is to say, it deals with the reorganization to make a decision to achieve an improvement, and several researchers have

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developed various methods for improving the performance of public services.

It should be noted that simulation modeling has become an increasingly attractive tool to assist health decision-makers in evaluating the alternative system in order to improve the performance of health coverage funds. Also, the model translates and implements with the simulation software "ARENA".

The overall objective of our research paper is the combination of computer tools for solving a management problem with decisional dimensions. It is the development of a simulation model to explain the health coverage system and propose a set of solutions to improve the current system.

The evaluation of the current coverage reform made it possible to identify several investments and necessary preparatory steps for the improvement of the national health coverage fund:

• Increase the remuneration of health care providers to improve their morale and make them more responsible.
• Invest in physical infrastructure, as most health centers require renovations.
• Modernize administrative procedures, which in their current state make the system vulnerable to corruption.
• Changing the public's perception of the government's responsiveness to its needs and its ability to provide services adequately.

For a country that now wants to finance its health coverage system, its financial capacity depends on its current and future economic situation, the size of the formal sector of the economy that can be imposed, or which can bring about contribution in the form of a health coverage scheme for employees, the effectiveness of the current health system and the current level of health expenditure, some of which can be used to finance health coverage.

This paper is outlined as follows: In the next section, we present a brief literature review on the application of simulation in health care. Section 3 describes the system of health coverage. Section 4 includes an improvement of the existing system.

II. THE EFFECTIVENESS OF SIMULATION TECHNIQUE TO IDENTIFY AND RESOLVE MEDICAL COVERAGE PROBLEMS IN THE LITERATURE

Medical simulation reinforces knowledge through field experience, but above all, it will help to understand the barriers to their implementation [2].

The importance of simulation in decision making is manifested in:

- The model has an explanatory role: It must help to understand the functioning of the system over time, by reproducing the mechanisms underlying problem situations, and to make the complexity intelligible. They simulate past situations, but they are primarily developed to support future decisions, tactical or strategic. They are a support to guide the decision makers in the management of projects.
  • The model must be a support for reflection and action, share a common knowledge and an understanding of the system functioning between the actors [3].
  • Simulation can lead to change our perception of reality or its representation.

- Through scenarios, the model is used as a kind of laboratory, not only to reproduce and analyze past situations but also to test scenarios that are never produced (What would happen if ... ?)

• Highlighting possible actions such as strategies, management. The model is a flexible decision-making tool that can be used for strategic and perspective purposes.

• These simulation models, based on a systematic and interdisciplinary approach, make it possible to create educational tools to assist decision-making in environments that are becoming more and more complex for the decision-maker, with problems in which the financial, Social and environmental issues become more interdependent.

A simulation is a tool for analyzing offers submitted by coverage companies. Reimbursement rates vary according to the demand, needs and financial means of the applicants. Simulators can assess the number of reimbursements for ophthalmological or dental benefits, and even hospitalization expenses. It also possible to do a mutual simulation family or civil servant. It is also quite possible to get rates for teenagers or the elderly.

The simulation of the health coverage funds service, arising from the needs arising from the increasing complexity of these services. It is a discipline whose objective is to be able to model, in our case, the process of the flow of the insured [4].

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III. Description of the health coverage system

Health insurance is a product that covers both cash and in-kind benefits. Its potential benefits are:

- Prevent households from getting poorer because of high health costs that they would have to pay for themselves.
- Increase accessibility and use of services for which payment is normally required when needed.
- Influence provider behavior and the user to improve the quality, efficiency, and effectiveness of the service.
- Use the skills of private providers to achieve national health goals.
- Generate additional and stable resources for health.
- Increase resources for priority health services and expand access to disadvantaged populations.
- Assist in the redistribution of health resources to address socio-economic and geographic inequities.

The health insurance is based on three fundamental principles:

- Equal access to care: it must be guaranteed to all, regardless of income and place of residence, which presupposes the existence of a public and universal health insurance system.
- Quality of care: the care offered by health professionals must be of a very good standard.
- Solidarity: everyone must contribute to health insurance according to their means and receive according to their needs.

In August 2004, a reform of the health insurance was launched to:

- Preserve these three principles
- Fight against waste and abuse
- Allow everyone's effort to lead to a balanced social protection system

In concrete terms, the reform is structured around three main axes:

- The personal health record that contains health information; made up and updated by the doctor, it is computerized in strict respect of medical confidentiality.
- The care path coordinated with the attending physician chosen by each insured person of 16 years and older to be cared for, followed and oriented in the health care system
- The new vital card, carrying a photograph of identity, is the key to access the personal medical file.

The CNAM's mission is to manage health coverage schemes, compensation schemes for work-related injuries and illnesses in the public and private sectors and the granting of sickness benefits.

The insured person is covered by one of the three care means:

- The public sector: outpatient care is provided in public and semi-public health facilities, as well as in the social security clinics with payment of a user fee.
- The private sector: private care is carried out according to a path which consists in consulting a family doctor first chosen in accordance with the mode of the third-party payer, the insured having only to pay the user fee.
- The reimbursement system: the insured person can access all the healthcare providers agreed to the payment of all the services and reimbursement later according to conventional rates.

CNAM has imposed compulsory health coverage on all CNRPS affiliates, which are public sector officials and CNSS affiliates, which are semi-state, and private sector officials more than two million and half of the affiliates.

CNAM's mission to prevent occupational risks:

- Development of statistics
- Technical assistance to companies
- Means of inciting and encouraging prevention
- Affiliation and registration

IV. Terms of Coverage

Outpatient services: In order to obtain the reimbursement of services performed on outpatient units, that is to say out of hospitalization, the insured must seek

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treatment and obtain his medication from a structure approved by the CNAM.

For outpatient care such as consultations, complementary examinations, and medications, the insured is reimbursed by the CNAM on presentation of prescriptions, original invoices and sheets of care-filled and sealed. These documents may be filed directly by interested parties to the CNAM sent by their related entities.

For the hospitalization which is in an approved structure. The insured will only pay the user fee based on the CNAM pricing.

Sanitary evacuation abroad: The conditions of medical evacuation abroad are fixed by the decree of the law.

The evacuation procedure is as follows:

- The patient presents the observation summary signed by the pathology specialists' staff accompanied by a medical file and a photocopy of the health insurance booklet or insurance card at the CNAM.
- The CNAM checks the file and the affiliation.
- The CNAM sends the file to the National Health Council.
- The CNAM provides care to a foreign provider, a ticket and a provision whose amount varies depending on the country and whether it is the first evacuation or an appointment of control.

The evacuee does not make any payment for the care relating to the pathology that is the object of his evacuation. The country of destination and the provider are chosen by the CNAM according to a transparent and fair procedure that takes into consideration the quality of care.

Relationships between healthcare providers and the Fund are governed by a general agreement and sectoral agreements that organize the contractual relations between the CNAM and health professionals.

They determine:

- Conventional fees
- Payment terms
- Dispute resolution
- The commitment of the members on the medical control of expenses:
  - Coordination of care
  - Medical references
  - The medical file ...

We have seen that there are various important factors to be managed for the proper functioning of the CNAM. In particular, we are interested in simulating the cycle time of the insured's journey in order to reduce the waiting time. To do this, we need to put in place a rational approach, using appropriate methods and tools for the development of performance indicators that structure the information needed to decide what actions to take to achieve the objectives.

V. Improvement of the Current System

The reform of the health coverage system has been imposed with the objectives of unifying mandatory schemes and ensuring adequate coverage of all risks, maintaining complementary forms of coverage, extending health insurance to offer private care.

The reimbursement rates applied by the Tunisian health insurance reform:

- 80% for consultations and additional examinations such as analysis and radiological imaging.
- 90% for hospitalization and functional rehabilitation.
- 100% for medical evacuations abroad and hemodialysis.
- 67% of medication.

The CNAM is organized into regional structures charged the granting of services and central structures mainly responsible for monitoring the activity and its evaluation. The CNAM has regional and local centers, taking the regional center of Gabes as an example of a study in our research.

The results provided by the output of the ARENA model are summarised in the following table:

TABLE 1.SUMMARY OF ALTERNATIVE RESULTS ACCORDING TO DIFFERENT CRITERIA

	Criteria			
Alternatives	Number of served insured patients	Waiting time	The rate of resource utilization	Total cost
0	285	274.32	0.41	326
1	283	264.44	0.57	326
2	291	251.08	0.48	326
3	314	203.03	0.51	391
4	320	165.21	0.62	456
5	320	161.03	0.72	522
6	320	161.03	0.85	464

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VI. CONCLUSIONS AND FUTURE SEARCH

In this work, we have improved the performance of the current system by exploring the possibilities of adding resources using ARENA software. By the simulation of some alternatives, most of the performance measures were improved. This project demonstrates, despite the complexity of both the data requirements and the simulation program itself, that simulation techniques can be used successfully in such a decision support system.

This work opens the way to various research opportunities that are on two levels: a deepening of the research and an expansion of the research. Expansion of research: the field of enlargement action can be:

- Generalization of the work on all coverage institutions (health coverage, social coverage and pension and social security coverage)
- More alternatives are evaluated or deepening the research through the use of standard, normalized or fuzzy goal programming.

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