

MODELLING AND EVALUATION OF HEALTH NETWORKS

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Abstract: The health system has to face a complex and uncertain environment with which the patient is constantly faced. In this study, that concerns the performance of health care, we propose to analyse the processes with a logic of network. We will show that modelling is a method to evaluate and improve health networks. Our study will particularly consider the relevance and perspectives of a modelling within a process approach. This is mainly a particular application concerning the activities of an oncology network, "ONCOLOR", together with the production of guidelines for medical care. Copyright © 2005 IFAC

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1. INTRODUCTION

In many countries, the health sector is in constant transformation to adapt itself to a complex environment that is in continuous change. Health organizations are required by their institutions and the populations to be consistent with regard to the quality, safety and efficiency of the services they provide. They must give a response to the growth of health expenditures, changes in user behaviours, media effects of public health problems, science progress and the integration of new technologies. At an international level, health networks take different forms according to the specificities of each country but they always constitute an answer to this complex and changing context. In this study, we focus, more particularly, on the French health system and its health networks.

2. THE EMERGENCE OF HEALTH NETWORKS.

2.1 Reorganization of the health system.

Today, health organizations have chosen to develop projects of networks in order to be more efficient in their activities. These networks aim to develop the coordination and cooperation between not only health professionals and institutions but also patients. In France, these networks emerged in 1999 and are under the responsibility of the French social security. Besides, they receive grants from the French government. Today there are more than 1000 health networks. A major result of this new way of thinking is a strong cooperation within the health system, which works individually without exchanging strategic information. For example, we can mention all the information on a patient who must be known by health professionals. Today, these networks are an important choice, not only for the health and social

system, but also for the development of these systems.

Our interest concerns, in particular, those networks developed in the domain of oncology, to help patients suffering from cancer. In fact, the French cancer plan has become a major priority for the French government. Its objectives are: *“to insure in four years, the coverage of all French regions by a cancer network coordinating all actors, ensuring the quality and equity of care on the whole territory. In four years, cancer research will be necessarily developed within the framework of networks”*.

2.2 Hospital and health networks

Today, hospitals are urged to be involved in networks and to give collective responses satisfying the quality, safety and efficiency requirements of the services delivered to the patient. The organisation of hospitals is moving towards the development of less subdivisions and more multidisciplinary relations (Grandhay, 2003).

These new forms of organization coordinate care production by sharing resources and skills and by promoting exchanges between professionals. Thus, patients are the centre of health network, and professionals should assure them a global and gradual access to a quality and adapted care. A first hypothesis concerns the patient, who is now considered as the centre of the new health organisation. These new organisations give him the benefit of a global and well-adapted care. For this reason, the members of the hospital and the members of these networks have redefined the global nature of treatment to take into account the somatic, psychological and social aspects at the various phases of the disease by insuring health education.

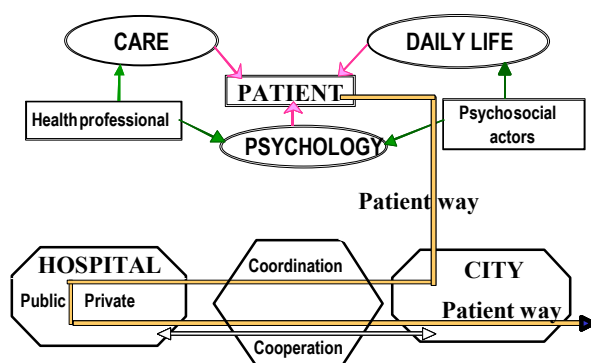


Fig. 1. Organisation in a health network

2.3 Health networks and professionals

A second hypothesis is the implementation of the network, which contributes to the improvement of practices in the medical world, traditionally centred on an individual practice of medicine (Grémy, 1997). Professionals have to make sure the scientific validity of the treatments they supply and of the medical decisions, which exceed sometimes the frame of their knowledge. These are often defined in a complex context, which requires a global approach of the treatments.

The network organization for oncology research is an example of that. Indeed, the great number of health professionals involves a multiplicity of stages and a specific organisation of treatment services. For a good medical decision, the complexity of the diagnosis and the therapeutic processes require a specific organization. This cooperation requires an increase in the collective skills together with the distribution of good practices and guidelines that are the main goal of health networks.

3. THE CHALLENGES OF HEALTH NETWORKS

3.1 Alliances in health networks.

As other organizations, in order to ensure their development and their durability, networks have to develop their efficiency with the implementation of the evaluation and optimisation methods of their processes. Health networks are difficult to manage (Schweyer and al, 2002) for some reasons. Firstly, because the health system and members of the network are a complex organization with a continuous development. And secondly, because there are many uncertainties in their environment.

In a health network, the objectives of each organization can be divergent and even contradictory between partners who have their own organisational objectives. So, the analysis and the organisation of networks have to take into account this internal complexity. In this case, the systemic approach offers an interesting perspective.

Nevertheless, in France, these networks constitute a new way of developing the health system. As we mentioned before, an important research work concerns the development of every partner in the network.

3.2 Evaluation of health networks

The social aspects of the health network must not hide the economic aspects of these new organizations. As it is recommended by the systemic approach, we must develop these two points of view and we must integrate them to evaluate performance and to ensure the continuity of the development of the network.

In all countries, every evaluation method is linked to the objectives. For example, in the United States, there are several types of organizations with a connected evaluation like “managed care organization” (Iglehart, 1992): PPO (Preferred Provider Organization) and HMO (Health Maintenance Organization).

The methods to evaluate the organizations are generally validated and used in other sectors (Larcher, 2001). According to the specificities, adaptations are necessary to the French context of health networks (ANAES, August 1999).

In this study, with systemic modelling, we approach the analysis and evaluation of health networks and associated processes. We introduce and adapt steps of the already tested method in the industrial sector.

4. THE MODELLING OF HEALTH NETWORKS

4.1 Contributions of the industrial sector

As already mentioned, (Baubeau and al, 1995), we must solve the complexity of health networks with methods and tools from the industrial engineering domain (Dickinson and al, 1998; Grandori and Soda, 1995). These adaptations of industrial methods to the social system have been also underlined by Meinadier (1998).

Many works and experiences led by ANAES (National Agency of Health Accreditation and Evaluation) showed the interest of the transfer of the process approach to the health sector (ANAES, April 1999). Other tools and methods such as FMEA (Failure Mode and Effect Analysis), the Ishikawa diagram and the value analysis were successfully used by professionals to solve many problems.

With regard to the analysis and evaluation of networks, we will focus on the process approach, a relevant step to create indicators that fulfil the professionals' expectations. According to ANAES (May 2002), the continuous improvement of quality should take into account the process approach: "*any activity in the field of health contains sub-processes with many interactions for the production of multiple results*".

4.2 Systems analysis and the modelling of processes

The systemic approach is characterized by its finality, its global nature, and its self-organization. The system is both, more and less, but also other than the sum of its components. (Bertalanffy, 1973; Meinadier, 1998). To analyse and optimise a complex organization, it is necessary to identify the subsystems and their components with various internal and external interactions. In our study, these subsystems are "processes" which are specific of the activities and of the finality of the system

Such process is a set of structured and organized activities to be carried out by professionals or groups of professionals. This process supplies a product or a service, which contributes to a tactical or a strategic achievement of objectives. The process transforms input elements (a signal, an information, or a raw material) into output elements (a product or a service) with an added value (Lorino, 2003).

Processes are aimed at "the customer" and his goals. The different entities with interfaces defined by the procedures carry out the activities. (Brandenburg and Wojtyna, 2003; Cattani and al, 2001; Mougin, 2002). The management of these interfaces determines the quality of the process and of the global approach of the system.

The modelling of health networks with the systemic approach has to take into account several layers of the organisation with the numerous interfaces. The element of the study can be a process in the services of various hospitals. The network elaborates and manages the strategic level that impacts on services and processes. Those processes relative to the services involved in the network will have numerous

interactions with the other processes of the establishment to which they belong. Therefore, the modelling of the activities of a network is quite complex. To illustrate our comments, we shall approach the modelling of an oncology network with regard to its mission of production of guidelines for the various professionals.

5. A CASE STUDY IN AN ONCOLOGY NETWORK

5.1 Organization and analysis of the network

Our investigation concerns ONCOLOR, the French oncology network in Lorraine. Introduced in 1993 and approved by the Regional Hospitalisation Agency of the Lorraine region in June 1998. This network aims at improving the global medical care offered to patients affected by cancer by providing treatments which main features are quality and proximity. This network is a partnership, on the basis of the voluntary service, of 53 public and private hospitals, as well as liberal professionals. It is a gradual network with highly specialized locations that constitute the reference structures and take care of the standard cases in cancer. The associate members are establishments which carry out medical treatments services for patients affected by cancer.

At first, we carried out an external modelling of the network by identifying its interactions with the environment. In a second time, we identified the main processes of the network following the three levels proposed by (Anthony, 1965): the strategic, the tactical and the operational level.

Finally, we identified and chose the key processes that had to be analysed, estimated and optimised. More particularly, we considered the process of production of regional guidelines and good medical practices. The main objective is to optimise the medical care service offered to the patients. This process creates a special value for the various parties involved (professionals, patients, health care system). Its interactions with patients give it a major role in the evaluation of the health network.

5.2 Modelling of the health network.

Interactions between the network and its environment are complex, numerous and in perpetual change (fig. 2).

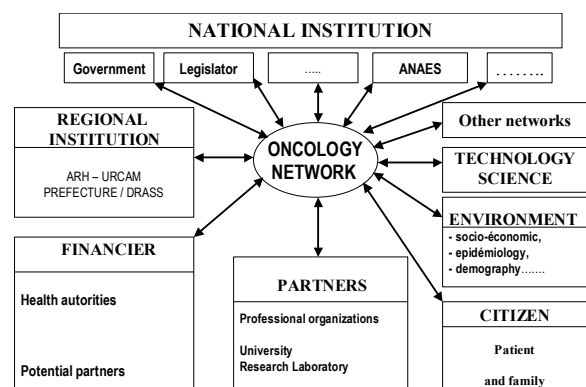


Fig. 2. External interactions network

To ensure its development and its survival, the network has to adapt and to adopt a favourable configuration to the fulfilment of its objectives, by considering the fluctuations of the environment. We were inspired by the classic decomposition of R.N. Antony (1965) for the internal modelling of the processes implemented in the network, as in industrial organizations (Burlat, 2000). The various activities of a network concern the operational, tactical and strategic levels. For the Oncolor network, the strategic levels concern authorities such as the board of directors, which determine the important orientations, such as the choice of the projects and the common programs to be developed.

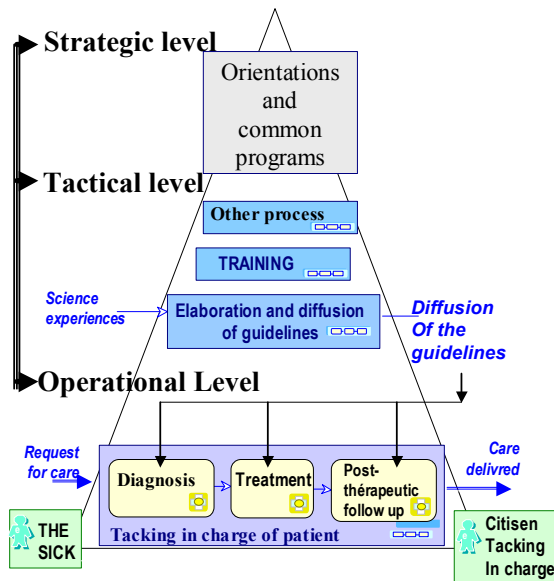


Fig. 3. Levels of action of the ONCOLOR network

The tactic level concerns projects and incitements with the establishments of the network, as well as elaboration and distribution of regional guidelines of good practices.

Finally, the operational level concerns missions and short-term objectives with patients, which are taken in charge by health professionals in hospitals.

We shall note that thematic networks, such as ONCOLOR, require coordination and cooperation between the various treatment providers.

The modelling of this activity for the network has to approach, first, the strategic level, later the tactic level and finally its application with hospital services or general practitioners.

5.3 Modelling of guidelines production

The fast development of scientific knowledge and technical progresses led to the elaboration of professional recommendations of good practices (Institute of Med, 1990). The objective is to optimise the quality of treatments by helping professionals to integrate the current scientific data into their daily practice. The missions of the networks are: to produce guidelines but also to find the best means to

promote their appropriation and implementation by professionals.

The guidelines are synthetic documents covering the spheres of diagnosis, therapeutic... The network (ONCOLOR) has elaborated 106 guidelines, 86 are available on the Web site of the network. This activity concerns more than 350 doctors who contribute with their efforts to help professionals and patients.

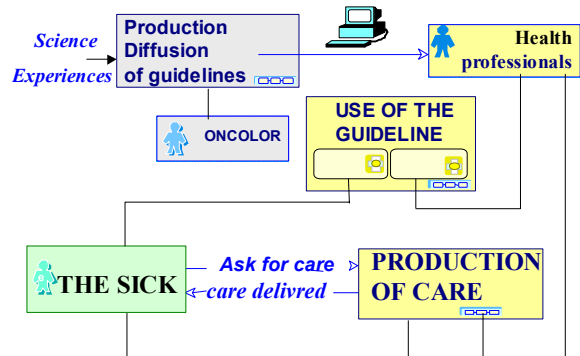


Fig. 4. Modelling the strategic level

At this level, we tested and implemented the process supported by MEGA International with these three main elements: actors, activities and processes. The approach process uses the logigrammes by connecting, activities, procedures and means of the organization. It enables the evaluation of the internal operations with the procedures, with zooming it is possible to investigate the various levels of the health network. A gradual approach of the processes, procedures and operations makes possible to integrate indicators (mainly temporal) on various levels. The possibility of analysing the various processes allows a validation with professionals but also approach the critical points that must be improved. Finally, synthesis tools make it possible to build indicators for a global vision of the network.

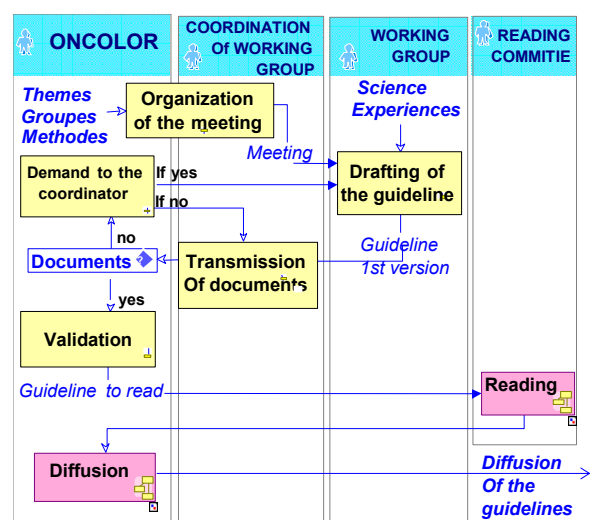


Fig. 5. Guidelines production process

The description of the guidelines production and update process identifies the various actors of the ONCOLOR network: the working actors, the

coordinators, the reviewing committees and the health professionals. Formulating the information is relatively practical, because it makes possible a clear identification of inputs and outputs for an activity. We find explicitly sub-processes as the process of guidelines distribution managed by ONCOLOR and the reviewing process managed by the reviewer committee. The presentation per actor/administrator of a part of the process allows a clear and simple validation with the professionals concerned.

We shall note that approach process enables the setting up of a database for the various actors of the processes and their missions. The quality and the indicators associated with approach process make it possible to integrating these additional data. The guidelines production process was completed by the updating process. This process is particularly decisive in this sector, since the scientific activity and the social demand of the sector are very important. At this level, our work allows us to identify a traceability of the activities. Modelling have led numerous professionals to suggest and validate information concerning the activities and their inputs and outputs.

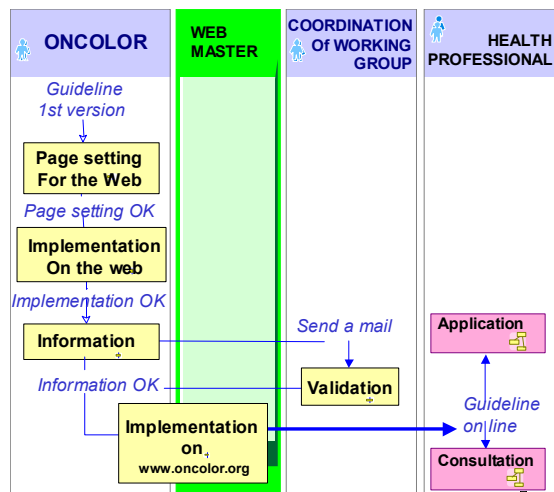


Fig. 6. Actors of guidelines distribution

The distribution of the guidelines managed by ONCOLOR (Figure 6) identified a sub-process of guidelines production. We notice the emergence of a new actor, while the other actors have already been identified in our database. This level is very interesting, because the activities concerned are the object of dysfunctions (FMEA type), which enable the identification of the causes that limit the use of the guidelines by health professionals. The identification of these causes also makes it possible to analyse the contents of some particular descriptions that are not totally formalized. For the integration on the Web site version, for example, the final analysis will confirm that the choices have a significant impact on the consultation of the guidelines by professionals and consequently on the patients health treatments.

6. CONCLUSION.

Concerning the production, distribution and implementation of the guidelines within the framework of the ONCOLOR network, the use of "the approach process" makes it possible to build a hierarchical and global model which can also be easily accessible by the various health professionals. The possibility of defining numerous indicators allows us to elaborate an evaluation system associated with the model. The FMEA-type dysfunctional analysis, in particular, is integrated into the functional model. Besides, the software support showed its relevance to investigate the various levels of action in a health network.

The use of the systemic modelling contributes to the evaluation and to the performance of the health networks and can easily exceed the frame of the guidelines production. We are approaching the completion of a global model (functional and dysfunctional) taking into account the main activities of the health network.

REFERENCES

- ANAES (Avril 1999). Evaluation d'un programme d'amélioration de la qualité. Les enseignements de 60 projets dans les établissements de santé français, 95p.
- ANAES (Août 1999). Principes d'évaluation des réseaux de santé, 139p.
- ANAES (Oct 2001). Evaluation des réseaux de soins : bilan de l'existant et cadre méthodologique, 63p.
- ANAES (Mai 2002). Construction et utilisation des indicateurs dans le domaine de la santé. Principes généraux, 39p.
- Anthony R.N. (1965). Planning and Control Systems : A Framework for Analysis, Graduate School of Business Administration, Harvard University, Boston, MA.
- Baubeau D., Marrel P., Le Coutour X. (1995). Planification et évaluation de l'organisation sanitaire : Apport des réseaux, *Santé publique* ; 2 : 209-215.
- Bertalanffy L. von (1973). La théorie générale des systèmes, Ed. Dunod, 1973, Paris, pp 29-51.
- Brandenburg H., Wojtyna J.P (2003). L'approche processus. Mode d'emploi. Ed d'Organisations, , 142 p.
- Burlat P. (2002). Modélisation et pilotage des organisations en réseau, Mémoire d'HDR, ENSMSE, Saint-Etienne, 115p.
- Cattan M., Idrissi N., Knockaert P. (2001). Maîtriser les processus de l'entreprise. Guide opérationnel. Ed d'Organisation, Paris, 288p.
- CreDES, Image (2001). L'évaluation des réseaux de soins. Enjeux et recommandations, CreDES n°1343, 73 p.
- De Rosnay J. (1975). Le macroscopie, Ed Seuil, Paris.
- Dickinson T., Saunders I., Shaw D. (1998). "What to Measure about Organisational Performance", *The Quality Magazine*, 7(1): 71-2.

- Genelot D. (2001). *Manager dans la complexité*, Ed INSEP (3^{ème}), Paris, 356p.
- Grandhaye JP. (2003) "Modelling of the control and driving of hospital projects in a complex environment", *actes 8th Symposium IFAC*, Göteborg, Sweden, september 22-24, 2003.
- Grandori A., Soda G. (1995). Inter-firm networks: antecedents, mechanisms and forms, *Organization Studies*, 1995, vol 16, n°2, p. 183-214.
- Grémy F. (1997). Filières et réseaux. Vers l'organisation et la coordination du système de soins, *Gestions hospitalières*, p. 433-438.
- Grimshaw J., Russel I. (1993). Effect of clinical guidelines on medical practice : a systemic review of rigorous evaluations. *Lancet*; 342: 1317-22.
- Iglehart J.K. (1992). Health policy report. The american health care system. Managed care. *New Engl J Med*; 327: 742-747.
- Institute of Medicine (1990). *Clinical Practice Guidelines : Directions for a New Program*, Field M.J. and Lohr K.N. (eds.) Washington, DC: *National Academy Press*.
- Larcher P. (1998). Réseaux de santé et filières de soins. Les enseignements des réseaux existants. *ADSP*, n°24, p. 21-29.
- Le Moigne J.L. (1990). *La modélisation des Systèmes Complexes*, Ed. Dunod, Paris, 192p.
- Lombrail P. (2003). Mesurer les performances hospitalières ? in *Le Bulletin de l'Ordre des médecins*. L'hôpital en mutation n° 17, p 13.
- Lorino P. (2003). Méthodes et pratiques de la performance, le pilotage par les processus et les compétences, Ed d'organisation, Paris, 521p. MEGA <http://www.mega.com>
- Meinadier J.P., (1998) *Ingénierie et intégration des systèmes*. Collection études et logiciels informatiques, Ed Hermes, 544p.
- Minvielle E. (1996). Gérer la singularité à grande échelle, *Revue française la gestion*, n° 109, p. 114-124.
- Mougin Y. (2002). *La cartographie des processus*, Ed d'Organisation, Paris, 248p.
- Naiditch M. et al. (2000). Apports potentiels des réseaux dans l'évolution des systèmes de soins *Perspective soignante*, n° 9, p. 6-28.
- Ray-Coquard I., Philip T., Lehmann M., Fervers B., Farsi F., Chauvin F (1997). Impact of a clinical guidelines program for breast and colon cancer in a french cancer center. *JAMA*; 278: 1591-95.
- Schweyer F-X., Levasseur G., Pawlikowska T. (2002). Créer et piloter un réseau de santé, ENSP, 112p.