Personnel planning in health care: an example in the field of rheumatology

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ABSTRACT

This paper describes a methodology for manpower planning in health care. The methodology is applied in the field of rheumatology. This methodology uses the concept of political rationality: different actors with different mental models, goals, languages and power interact in a bargaining process with incomplete and imperfect information. A Group Decision Support Systems approach is advocated where interactive model building stimulates shared meaning and communication. In health care important decisions usually have a multi-level and multi-actor character. A bottom up procedure, starting at the detailed level gives a justification when aggregating to an higher level. Consequently the project was started with discete event models before applying continuous simulation like system dynamics. Besides the modelling and communication processes the creation of a network of key decision makers in health care applying this approach is seen as a major product.

1. Introduction

In the Netherlands, but also in other western countries, manpowerproblems in the field of health care are regular items on the agenda of policy makers. At the one hand structural elements determine the demand and supply of manpower. At the other hand more cyclical phenomena can be observed. Examples are the supply of dentists and ophtalmologists in the Netherlands. The Ministry of Welfare, Health and Culture therefore initiated a research project evaluating the existing manpower planning methodologies for the health care sector. About the same time the National Board for Hospital Facilities, an advisory body of the Dutch government, was confronted with a question implying a new standard for the number of medical specialists, especially rheumatologists, for The Netherlands. For both purposes the authors of this paper were independently approached and decided to integrate both projects.

The authors have the opinion that the use of simulation models in the context of Group Decision Support Systems (GDSS) will offer good possibilities to support policy makers in the field of health care and give arguments for it in this paper.

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The twofold formulated research question is:

-How to design and develop a methodology for decision making in the field of manpowerplanning for health care purposes?
-How to design and develop a group decision support system for capacity decisions (the number of rheumatologists) with respect to rheumatic diseases? This research question was also put forward by The Dutch Society of Rheumatologists.

The first question is aimed at obtaining an generic approach to be used for manpowerplanning of different medical specialist groups. The second question can be interpreted as a pilot study for the first question. This paper concentrates on the first question.
The research approach chosen consists of a combination of a Delphi study, a workshop and a scenario approach, and is based on a study of recent publications in the field of manpowerplanning (Postma et al., 1992). The Delphi study and workshop are interactive means to generate consensus on needed models and data. The scenario approach is based on simulation models. The scientific challenge of this part of the project is the determination of the necessary level of aggregation of the simulation models and the relation between these levels. We started the project at the regional or local level with an object oriented approach (individual patients and medical specialists), using discrete event simulation. At the national level, however, a system dynamics approach seems to be better. At this time we expect that a combined approach is needed. One of the goals of this project is to develop a group decision support system, in which gaming elements are included. This fits the way policy decisions are made or prepared in the Netherlands, namely negotiations and interactions at different levels of decision making.
The above mentioned elements will be worked out in the following sections of this paper. We will start with some characteristics of the Dutch health care system.

2. Some characteristics of the Dutch health care system

Decision making in Dutch health care is an activity in which many participants on different levels play their roles. Decision making is not just a "top down" process, but is also initiated and implemented "bottom up" and "middle out". Therefore it is necessary to gain more insight in health care levels and participants.

2.1. Levels

Organizations and institutions can be classified according to levels of decision making; see table 1.

LEVELS	ORGANIZATIONS/INSTITUTIONS
INTERNATIONAL	WHO EC International professional associations
NATIONAL	Government Departments Advisory boards National professional associations
REGIONAL	Provincial boards Sickfunds Cooperation of hospitals or physicians
LOCAL	Hospitals Universities Departments Physicians

Table 1: Levels, Organizations and Institutions in Dutch health care

This table gives only an impression of the different relevant levels and organizations/institutions. For instance, if we zoom in and have a more detailed look at the Dutch advisory boards, we observe more than five relevant boards.

2.2. Participants

Because of the multitude of possibilities it is of no use to enumerate all types of participants. One can better think of networks or relation patterns of participants. For example, in the field of reumotology, at the hospital level more than 10 different participants work together in one way or another and have a very close relation.

Given the discussion untill now, we conclude that there are many levels and actors in the field of health care. These actors participate in different networks on different levels. The interests of these actors and networks can be more or less opposite but also more or less compatible. This might result in political activities such as power plays, lobbying and possibly manipulation of communication and information. The methaphor of the "garbage can" could be a valid one (Cohen, et al., 1972).

The Dutch health care system therefore can be characterized as a multi-level and multi-actor system, with coalitions, and negotiation and political decision making. Moreover the context of the health care sector at the macro level is dynamic and sometimes even turbulent: developments in politic, economics, law, technology, medical-ethics, demographics, and epidemiology will be taken into account.

3. Changing visions on rationality

It is a well known fact that there is a gap between economic theory and the way decisions are taken in practice. In micro economic theory the paradigm of unbounded rationality is still alive (Douma and Schreuder, 1991). However, axiomatic foundations like perfect foresight, knowledge of all alternatives and the ability to select the best alternative are not realistic when studying processes of real problem solving of individuals and groups. Especially when looking at the Dutch health care system, the "garbage can" character as described in section 2 gives a poor resemblance with the traditional economic way of looking at reality. The last 40 years, visions on rationality have

been changing and the gap between theory and practice has been closing slightly.

Newell and Simon (1972) concentrate on individual problem solving. Human problem solving is restricted by the nature of the cognitive system. Individuals are not able to optimize and in general use simple heuristic rules to come to a satisfactory solution of a problem.

Simon introduced "bounded rationality" and this opened the way to many other approaches of rationality. Simon (1976) mentions "substantive rationality" and "procedural rationality". The latter refers to the use of heuristic rules and search for satisficing solutions. "Substantial rationality" resembles in some ways the properties of the homo economicus and gives a link with the phenomenon of the modern computer. Computers made it possible to define very large sets of alternatives and provide impressing processing power when searching for good alternatives. In many cases the efficiency of this search process is influenced by the quality of the selecting algorithm. Therefore "substantive rationality" is almost an "algorithmic rationality" (Takkenberg, 1983) and the homo economicus is transformed into the "homo informaticus". We find examples in applications of mathematical programming and game theory.

When studying planning and policy making, we nowadays notice the use of computers and software for decision support that relax cognitive restrictions of man in solving semi-structured problems.

In practice, looking at the ill-structured problems of health care manpower planning, we notice that the paradigms of procedural rationality and substantive rationality need extensions to give a sufficient explanation of the actual decision making processes. Therefore we will introduce "political rationality" (Baakman, 1990), enabling the description of decision making in a situation where different actors with different mental models, goals and languages play a role: multi-actor situations. Planning situations in health care will be considered from this political paradigm. Power relations have a strong influence. In general, planning in health care often resembles bargaining with incomplete and imperfect knowledge.

In our view choice and the implementation of decisions have to rely on a certain consensus among participants and has to be based on the use of validated models to gain confidence (Smits, 1990). The related methodology as sketched in the introduction will be described in more detail in section 5 and aimes at the construction of validated conceptual and empirical models that enable communication between participants. Communication will probably lead to the required consensus. In this respect "Group Decision Support Systems" can be considered as an adequate support instrument. DeSanctis and Gallupe (1987) describe GDSS as follows: "Group Decision Support systems combine computer, communications, and decision technologies to support problem finding, formulation and solution in group meetings". Recently research for a fundamental basis of GDSS was published by Scheper (1991).
We will now first pay attention to a problem mentioned before, namely the level of aggregation in modelling.

4. Choosing the level of aggregation in simulation practice

Reality can be viewed very globally or more detailed. At first sight, manpower planning for health care at the national level requires an aggregate model, but these models may be too abstract. At a global level, variables of the detailed level are frequently lost. In our opinion the choice of the level of description and analysis in simulation is an important one.
When using detailed models, we in general have to restrict ourselves to a partial view of a system. This is caused by both technical constraints of the computer support system and cognitive constraints of the participants. For example, it is practically impossible to construct empirical (operational) models of health care at the national level when flows of individual patients and detailed decisions of medical specialists have to be taken into account.
Even if such an outstanding technical DSS could be constructed, the analysis of its dynamic behaviour would be hampered by our cognitive system. When using aggregate models, we often assume that the model is sufficiently representative for all subsystems. This assumption has to be tested and forces the researcher to analyze a sample of subsystems in more detail.

Therefore we recommend a methodology with a bottom up approach: start with detailed studies of a sample of subsystems and later on take a justified step to a more aggregate level.
This recommendation will be sustained by the results of the Delphi study in the case of rheumatology. We concluded that the decision making and practice of rheumatology in the regions studied were rather different. Therefore a higher level of modelling (a national model) generates additional requirements to assure a sufficient resemblance between model and reality.
This approach also includes different modes of simulation: on a detailed level discrete event simulation with an object oriented approach will be used, and later on continuous models based on system dynamics will be tried. Following these steps the consistency between the detailed models and the aggregate models will be checked.

5. The methodoloy used in the rheumatology case

Decision making in the field of health care policy is a complex process: many participants representing different parties try to transform and influence the decision processes and the ultimate decisions. All participants are driven by particular, specific, hidden and/or private goals. It is difficult to arrive at policy decisions that are supported by all parties involved (consensus). This is particularly true for manpower planning in health care.
The methodology chosen and further developed in this study is of the policy-delphi type, that is, using a Delphi approach is combined with a structured workshop to construct a conceptual model of the problem situation (Vennix, 1990). Experts in model building as well as several experts in the field of health care are involved in these activities. The steps in table 2 describe the recommended methodology. Relatively new in this approach is the modelling on two levels of aggregation and therefore combining discrete event simulation and continuous simulation; the motivation was given in section 4.

1. Formation of a project group and a steering committee.
   Literature study.

2. Definition of a preliminary conceptual model.
   Development of a questionnaire for Delphi interviews.

3. First Delphi round with a sample of specialists.

4. Regional analysis of several selected geographical areas.
   Collecting data and constructing data bases.

5. Workshop with participants of all parties.
   Discussion of the preliminary conceptual model.
   Demonstration of a preliminary formalized model.

6. Adjustment of the conceptual model.
   Development of questionnaire for Delphi studies at regional levels.
   GDSS based on Discrete Event simulation of regional models.

7. Combining the regional models into a national model, using GDSS with System Dynamics or other continuous simulation methods.

8. Applications of the GDSS in negotiations with parties involved in the health care process concerned.

Table 2: GDSS methodology recommended for health care

The analysis of the actual organization of rheumatological care in the Netherlands is first performed on a regional level. In each region the actual demand and supply of rheuma care are analyzed and a prognosis is given of the desired care in the coming 20 years. This analysis is used for the building of a formalized empirical model of rheuma care on a regional basis, using discrete event simulation. Modern software like EXTEND, using the graphical user interface of Apple Macintosh, enables interactive modelling and stimulates communication.
Steps 6 to 8 of the methodology consist of building formalized (empirical, operational) models for several regions. A second Delphi round will be executed to evaluate the regional models. For building the national model the continuous simulation mode of EXTEND or the use of the STELLA package is quite adequate.
Once we have arrived at validated models (Kleijnen, 1992), the final step will be the exploration of the future through scenario analysis.

One of the main factors to be analyzed will be the influence of demographic evolution. In this respect a fascinating question concerns the tuning of the demand for physician manpower to the supply, a population with more aged people will be taken into account. When sketching the methodology, it seems that the modelling cycles play a central role. This is true, but in our opinion the process as a whole -where parties involved are stimulated to develop a common model and shared meaning- is of essential importance. This will be the ingredients for real communication and the basis for practicable decisions.

6. Conclusions

Manpower planning in health care is a process to be viewed with political rationality. This means that different actors have different mental models, goals, languages and power. The decision process resembles a negotiation process with many aspects, based on incomplete and imperfect knowledge.

The GDSS approach aimes at solid model building as well as the stimulation of communication between parties. Object oriented modern software using a graphical user interface plays a major role in interactive model building and exploration of the future by a scenario method. Discrete event simulation is used on the detailed levels where as systems dynamics (continuous simulation) is applied at the aggregate level.

In the setting of healthcare manpower planning we also consider the construction of a network of people involved as a major product.

Modelling complex manpower decision processes in the field of health care requires insight at both a detailed and at a more aggregated level. Therefore manpower planning research in this field needs to be aware of several levels of aggregation and the relation between levels. Our research is still ongoing and not yet finished. The foundations for an implementable GDSS, however, have been laid.

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