Balancing the Capacity in Health Care

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INTRODUCTION

Diagnostics and treatment of patients often involve several different clinics. When improving quality and efficiency in health care we therefore need to consider the entire pathway from the patient's first contact with a health institution until the final discharge from the hospital and rehabilitation after the end of treatment. A system view is needed to consider the stochastic nature of acute patient arrivals, the variety of pathways through the clinics, and the stochastic time needed for diagnostics and treatment.

A balancing of the capacity at the different clinics, in order to deliver health care services in due time, to improve the overall productivity or use of capacity, calls for a reallocation of resources. A successful accomplishment of such a process requires a common insight and agreement by the clinics and therefore representatives from the clinics participating in the analytical process. The clinician participation enables elucidation and use of information on organisational behaviour of importance for the daily operations. This type of information does not appear from the registered patient data and implies analytical tools, which are both simple and intuitive and capable of handling and displaying the type and amount of information needed in a trustworthy and consistent way.

BACKGROUND

Different concepts for organisational improvements developed in an industrial environment have been introduced to—and applied in—the health care sector over the years. We shall briefly comment on four of them.

In Business Process Reengineering (Hammer & Champy, 1993), a fundamental rethinking and radical redesign of business processes is in focus. The word processes is the keyword. It is also the word that gives corporate managers the greatest difficulties. Most business people are not "process-oriented." They are focused on tasks, on jobs, on people, on structures, but not on processes. A business process is defined as a collection of activities which takes one or more kinds of inputs and creates an output of value to the customer.

An indispensable tool in Business Process Reengineering is process mapping (Johanneson, McHugh, Pendlebury, & Wheeler, 1993). Competitive realignment through identifying and exploiting "Break Points" is achieved by reengineering core business processes. This, in turn, requires an extensive understanding of the activities which constitute the core business processes and the processes which support them, in terms of their purpose, trigger points, inputs and outputs, and constraining influences. This understanding can be achieved by "mapping," "modelling," and then measuring the processes using various techniques that have been developed and refined over the years from simple flow diagrams to advanced simulation modelling charts.

With total quality management (TQM), inspired by Deming's "Out of the Crisis" (Deming, 1982) followed a systematic work describing goals for quality, preventing adverse events, monitoring quality, and constant improvements in quality. In health care many efforts to improve the quality are based on developing care pathways (deLuc, 2001), which specify how the patients' flow through the health organisation should be in order to achieve good quality. From mapping the pathways for the various types of patients, good quality is specified, actually delivered quality is monitored and ways to improve the quality are constantly considered. Mapping and diagramming are important ingredients here too. In TQM, the system's view is in focus as well. It is a mistake to assume that if everybody does his job, it shall be all right. The whole system may be in trouble. In much of the TQM activity in health care, the aim is to specify good quality in standard pathways. However, the capacity needed to deliver the desired quality is very seldom brought into focus.

The concept of the Learning Organisation (Senge, 1990) is to a considerable extent based on systems thinking and mapping tools such as the "Causal Loop

Diagram (CLD)" and the "Stock and Flow Diagram" (SFD). Both types of mapping are core elements in the modelling theory called System Dynamics (Sterman, 2000). According to the ideas of the Learning Organisation, the diagrams play an important role in involving the managers and employees in the efforts to improve the organisation. Its abilities to elicit peoples' mental models of how things are run in their part of the organisation, to share information and different views and to clarify necessary conditions for organisational improvements is stressed. With the CLDs and SFDs it is possible to pick up most of the soft and hard data (information) about how the organisation works. In relation to the SFDs, several simulation programmes have been developed to handle and apply the organisation's knowledge consistently in simulating the consequences of organisational changes before their implementation.

In Lean Thinking (Womack, Jones, & Roos, 1990), there is a focus on the value stream, for example, the flow of patients from the contact before diagnosing to the end of treatment. If the work in the organisation does not create value for the patients, it is regarded as waste and should be eliminated or at least reduced to a minimum. The same goes for obstacles preventing a continuous flow of patients in the process of diagnosing and treating.

Despite the differences explained in this short and not necessarily exhaustive list of concepts for organisational improvements, they have much in common when it comes to the mapping tools and techniques. When dealing with changes in health care organisations, I agree with those (Hsieh, Tan, & Lin, 2003; Reidd, Compton, Grossmann, & Fanjiang, 2005) who stress the importance of using a system approach and selecting tools which enable the analyst to work with a system rather than independent entities, that is, departments and processes.

The need in health care to do analysis from a systems perspective, implying the use of hard, soft, and stochastic data, in a coherent and consistent process of analysis and the involvement of clinicians in the modelling process, lead us to focus on the systems thinking (system dynamic) tools.

One can find recommendations from clinical professionals for using systems thinking as a tool for development in the health care sector in general (Beirema 2003; Nolan 1998), and system dynamic is applied in various health care contexts such as accident and emergency departments (Lane, Monefeldt, & Lund, 2000), queuing problems (Waaler & Iversen, 1998), waiting lists (Gonzales-Busto & Garcia, 1999; Van Ackere & Smith, 1999), and in the development of new health care initiatives (Homer, Hirsch, Minniti, & Pierson, 2004; Wolstenholme, 1999). The documentation of the applicability of system dynamics in health care is increasing. In a resent publication from the U.S. Academy of Science System Dynamics is on the list of systems engineering tools recommended for use in the process of improving the health care sector in the country (Reidd et al., 2005).

THEORY AND METHODOLOGY

As a modelling approach system dynamics has three characteristics (Lane, 2000). First is the use of "feedback loops." They are present in every system and often identified and visualised in simple causal loop diagrams. In health care, it is often reasonable to let these diagrams show the flow of patients and the variables or information controlling the flow—such as the capacity or the utilisation of capacity. In general terms, they show how information is followed by controlling action based on policies, followed by a new information collection. These closed loops of causal links involve delays and nonlinear relationships.

The second characteristic is computer simulation. Although humans can conceptualize system structure and loops, they lack the cognitive capability to deduce the consequent dynamic behaviour of the system without assistance. Computer simulation is therefore used rigorously to deduce the behavioural consequences over time of the hypothesized causal network (flow of patients). Such behaviour sometimes turns up to be counterintuitive, and may be explored further using simulations models.

The third and last characteristic is the need to engage in mental models. The most important information about social institutions is only held as "mental models," and is not written down. These mental models are complex and subtle, involving hard, quantitative information, and more subjective or judgemental aspects of a given situation. Such models are the basis for organisational decision-making. Hence eliciting, debating, and facilitating change in the mental models of decision-makers can result in improved ways of managing a system. Modelling work must therefore