

## **Reorganising the clinical treatment of stroke patients**

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With the aim of improving patient outcome, the County of Funen - after adoption of a new hospital structure in May 2001 - decided that stroke treatment in future should be carried out in 2 stroke units and one rehabilitation unit. The County has a total catchment area of approx. 470,000 inhabitants. Stroke treatment has so far been carried out in 8 different hospital units in the county. In June 2001, a working group with a multidisciplinary representation from the units involved, including general practice and the municipalities, was set up with the task of making proposals as to how treatment should be organised and which capacity the new units should have. Altogether, 16 different departments were involved in the work.

This poster shows how ideas from System Dynamics and the simulation program I think was used to help the working group in their considerations.

### **Expectations to process and analysis – choice of method**

From the outset, it had been requested that planning should be based on specific analyses of the expected patient flows. As it was also found crucial that the entire working group could support the suggestions and conclusions of the group, it was decided that the analysis should be based on the ideas of System Dynamics.

### **The process**

The working group has held 5 meetings between 18 June and 26 October 2001. The group consisted primarily of management representatives from the units involved in the current treatment of the patient group. A secretariat, which should also be responsible for the analytical work, was affiliated to the working group. After the working group had been set up, the first step was to introduce the participants – including the secretariat – to the analysis method used: System Dynamics and the simulation program.

Based on the present patient pathways, national and local clinical guidelines and the insight of the working group, the expected future pathways and guidelines for stroke patients in the new framework were defined. At the same time, the patient flows were illustrated through for example the number of patients that is expected to be referred to the different treatment modalities and the corresponding stages of diagnosis and treatment. It was ensured that the illustration included a sufficient description of the system – structure and data – to make it possible subsequently to build a simulation model. A model to simulate the expected patient flows under different capacity conditions.

All data, as well as the structure and calculation of the model, have been presented and discussed at the meetings of the working group.

### **Model of patient flows**

Figure 1 shows the structure of the model. Only stock and flow quantities representing the different patient conditions and flows are shown. The strokes are generated from the population. When admitted to the hospital's stroke unit, the first phase is the acute phase, where the patient is stabilised and diagnosed to a specific treatment. Few of the patients, admitted under suspicion of having had a stroke, are discharged after a few days. The suspicion is soon disproved and the conditions rapidly improve. For a similar small group, it is

decided, that the treatment given in the acute phase, is not to be followed by rehabilitation treatment. They are therefore discharged and told to return for a subsequent ambulatory control. For most of the patients admitted, the acute phase is followed by an intensive rehabilitation treatment. Hereafter patients are discharged with an appointment

- for an subsequent outpatient control visit,
- to continue with ambulatory treatment in day care hospital,
- for a longer rehabilitation in the Rehabilitation Treatment Center or in the local community.

Figure 1 shows the possible patient flows in the treatment of stroke patients.

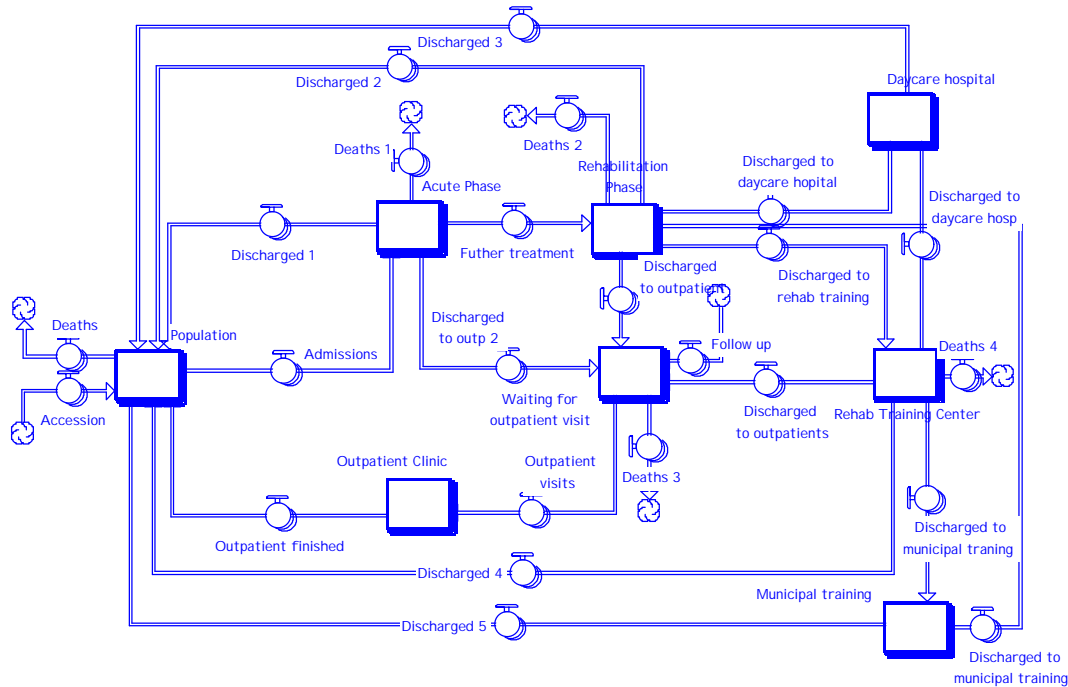


Figure 1: Patient flows and conditions in the stroke treatment – model structure

While one of the future three organisational units, which are to carry out stroke treatment in the County of Funen – the Rehabilitation Treatment Centre – is explicitly shown in the figure, the other two - the University Hospital of Odense and Svendborg Hospital - are both represented by the Acute phase, the Rehabilitation phase, and the Outpatient clinic. The first two show the number of patients staying in the respective stroke units. Arrays are used in the model. This can be seen from the stratification in figure 1. The patient flows for Odense and Svendborg thus have separate layers, but as the courses of treatment are the same in the two geographic areas, they can be shown in the same structural layout.

## Results

With this model, the working group has carried out simulations of the expected operations with different sizes of capacity in the three units, where it has been decided to carry out the future stroke treatment. The operations is described by numbers, such as use of bed-days, clinical examinations as well as the bed occupancy rate (utilisation of capacity) in each of the three stroke units.

The method of analysis and the process the working group has gone through have given the participants a joint insight and understanding of the system in focus. This has created a considerable consensus of opinion as to the future pathways, guidelines and capacity. Systematic consensus in connection with planning an organisational change of clinical treatment is expected to facilitate the implementation.

**Further perspectives for use of the model**

During the course of the project, the possibilities of preventive initiatives have briefly been discussed. The model makes it possible to specify the effect of varying preventive measures with regards to the incidence of stroke. Likewise, it is possible to take the effects of the municipal rehabilitation programmes on re-admissions into account.

In addition to these overall policy considerations, the model makes it possible to test the different everyday management behaviour. This is taken into account by means of feedback loops, which indicate management reactions on variations in the utilisation of the capacity in a stroke unit. The loops are shown in figure 2. This show a causal loop diagram (slightly simplified) corresponding to the drawn up stroke model. When the bed occupancy rate is too high, the management behaviour can be:

- procurement of temporary extra capacity by borrowing beds from other wards (B1)
- intensified (shorter) rehabilitation time (B2)
- increased number of patients discharged without rehabilitation (B3) and
- exceptional discharge of admitted patients awaiting rehabilitation (B4).

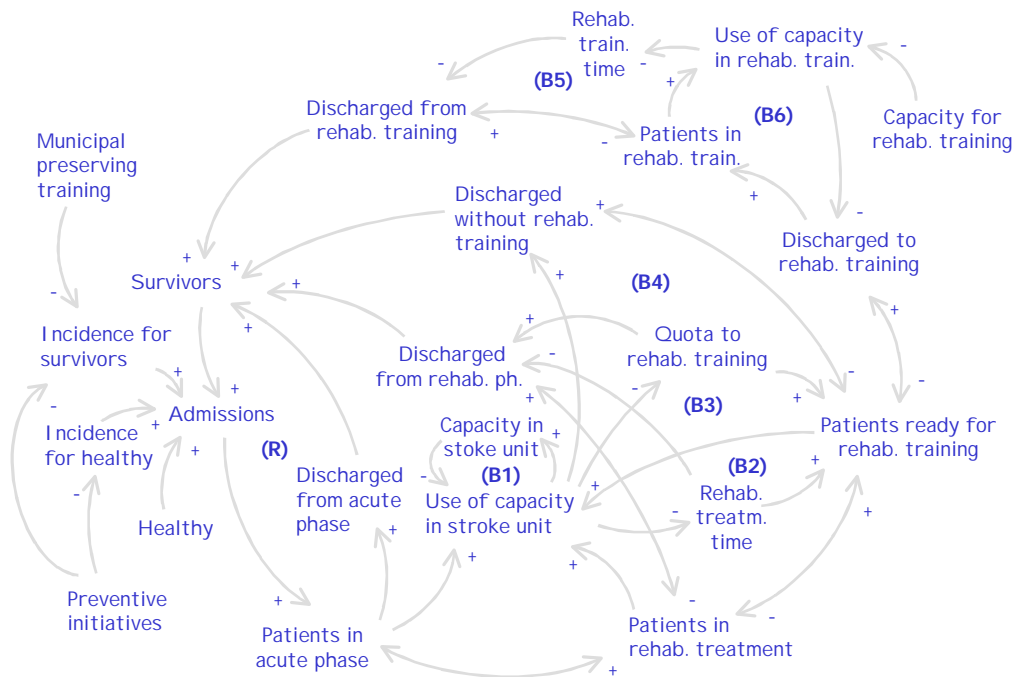


Figure 2: Patient flows for stroke – causal loop diagram

Also in the rehabilitation units, there are options for reaction to an undesirably high utilisation of capacity. This can be in the form of

- a reduction in the time the patients are receiving rehabilitation (B5) or
- a refusal of patients from the stroke unit waiting discharge to long rehabilitation treatment (B6).

The causal loop diagram further shows an accelerating loop (R) in connection with the patients who survive the stroke. The more that survive, the more will suffer another stroke and subsequent re-admission, all other things being equal. A consequence of a successful treatment resulting in a better survival rate could therefore be an increase in the number of stroke patients, and thus cause an increased need of resources.

This complex of problems and the many possibilities of acting on the ineffective management situations have not yet been examined and evaluated. Crucial overall questions are for example:

- To what extent can the daily stress be handled with the management resources available at present?
- What impact will re-admissions have on the total admission to the stroke units?

You can get the answers from the poster representation at the System Dynamics Conference on 28 July – 1 August 2002.

The working group's use of System Dynamics and the simulation program provided consensus about the recommended capacity in a restructured organisational framework for stroke treatment – and is consequently an ideal launching of the implementation phase in the form of common understanding and commitment. It also makes it possible to shed light on, challenge, test, and evaluate the daily management options, not to forget policy considerations as to preventive measures and co-ordination with the local authorities.