

**Organizing home care in the future:  
using system dynamics to assess organizational changes**

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**Abstract**

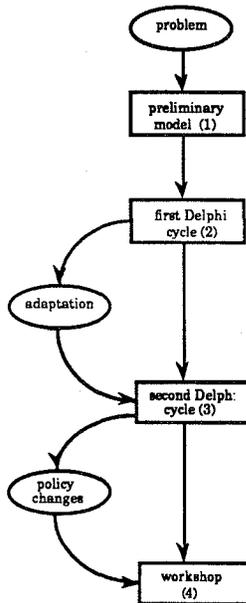
In the near future the organization of home care in the Netherlands will be reorganized. In order to show some of the dynamic consequences of these changes, a preliminary model was developed. In this paper we will discuss the use of the preliminary model to elicit the ideas from policy makers about future changes in the organization of home care. This is done by conducting a Delphi study to keep the time investment of the policy makers as limited as possible.

**Introduction**

In the Netherlands the organization of home care is one of the main policy issues in primary health care. Due to the aging of the population the demand for health-care increases because elder people relatively need more health-care than younger people. The ageing of the population can't be influenced but by giving care outside hospitals one can prevent the hospitals from becoming overcrowded. One of the most likely options in this respect is to give certain care at home instead of giving these in a hospital. Such a shift, from secondary to primary health care, will have great impact on the organization of home care. It is unavoidable that the organization has to change dramatically. One of the major problems in changing such a complex organization is the large number of unknown consequences. For instance with regard to the number of workers, needed in this new organization and with regard to possible consequences for the quality of care. These problems are of great concern for policy makers. In order to assess potential effects of changes in the organization of home care policy makers invoke their mental models of the system. Mental models, however, are often incomplete and little accurate. Furthermore mental models are not capable in establishing the difficult dynamic consequences of large complex structures, such as the organization of primary health care (Forrester, 1961 ; Meadows et. al., 1982). A computer seems more suited to calculate such dynamic consequences. Building a computer model can assist in assessing potential effects of such organizational changes. But the construction and use of a model does not necessarily induce organizational changes. In order to accomplish this it is important to have the 'problem-owners' participate in the process of model-building (Meadows et. al., 1982; Meadows and Robinson, 1985). Most policy makers, however, have lack of time which means that full participation is often impossible. In this paper we will discuss a way of having people participate in the process of modelbuilding without asking too much of their time. In order to realise this we chose for the preliminary model approach (Vennix et. al., 1988). In this approach a project group designs a preliminary model and next asks relevant policy makers to criticize and possibly improve this preliminary model. To elicit policy makers' ideas on this preliminary

model we will employ the Delphi method (Linstone and Turoff, 1975). The whole process consists of four stages: (figure 1)

figure 1 The preliminary model approach



First we will develop a preliminary model (1) of the organization of home care. This model will be criticized by participants in the first Delphi cycle (2). The results of the first cycle will be fed back in the second cycle (3) in which we will next ask for potential organizational changes. Finally all the participants in the Delphi will be brought together in a workshop (4) in which they are able to simulate some of the organizational changes with the aid of a STELLA model and discuss the potential impact of these changes with each other. In this paper we will first focus on the place of the model in a scenario study of which it is part (section 1), next we will discuss the preliminary model (section 2) and the process of consulting a number of experts with the aid of the Delphi technique (section 3).

### 1. The scenario study

The model-building process is part of a broader scenario study (Wennink, Kooiker; 1989) which is conducted by the Netherlands Institute for primary health care (NIVEL). This scenario is conducted to investigate possible scenario's about the organizational structure of future home care. In order to make the necessary estimations two different studies are distinguished: (1) Trend study and (2) Care study.

In the trend study a statistical model is developed to predict the future use of primary health care facilities in the Netherlands (Kooiker, 1989). With the model three estimations are made of primary health care use for the years 1990-2005. A demographic extrapolation was used as a benchmark estimate. A trend extrapolation consisted of an estimate of the size of the user groups and the expected enlistment in each group. Finally these estimations are compared with the expected supply of primary health care over the same period to find potential discrepancies.

The basic goal of the care study is to generate possible shifts in the use of home care. These shifts may take place within primary health care or between primary and secondary health care facilities. The object of investigation will be the chronically ill because they are considered most important for the use of future home care.

One of the estimations of the trend study is the number of workers necessary to supply a certain amount of care in the near future. These numbers are necessary in order to be able to develop scenarios about the organization of future home care. However it is likely that there are more relations than the influence of future use or the demographic development which influence the number of workers. In the preliminary model we will show some of these relations.

### 1.1 The model

As the previous text shows the scenario study is rather static, it does not account for possible (system) dynamic consequences of a change in the organization of health care. However, if the organization of a system is changed, unforeseen effects often occur. The building of a system dynamics model seems an appropriate way to give policy makers more insight in present feedback processes and their effect on a (possible) future change in the organization of health care. In the trend study a trend extrapolation estimates the expected supply of primary health care. In the preliminary model we will also give an estimation of the future supply in primary health care, i.e. the number of workers necessary to supply a certain amount of care.

In the next sections we will explain the process of model-building and the use of the model in the Delphi workshop. Before this we will explain the preliminary model.

## 2. The preliminary model

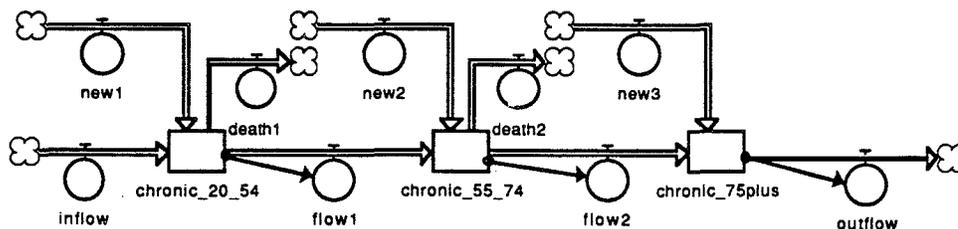
In order to be able to make a model which will provide insight in the processes which influence the number of people working in primary health care, it is necessary to locate the factors which influence these numbers. According to a study of Bensing (Bensing et. al., 1987) there are six possible factors: (1) the influence on supply, (2) the supply itself, (3) the influence on demand, (4) the demand itself, (5) policy and (6) the influence on policy.

Of course it is not possible to take all these factors into account in a model. In the preliminary model we will make a selection of the factors which have most influence on the number of workers. The preliminary model consists of three sub-models, which are interrelated: (1) Demand, (2) Supply and (3) Finance.

### 2.1 Demand

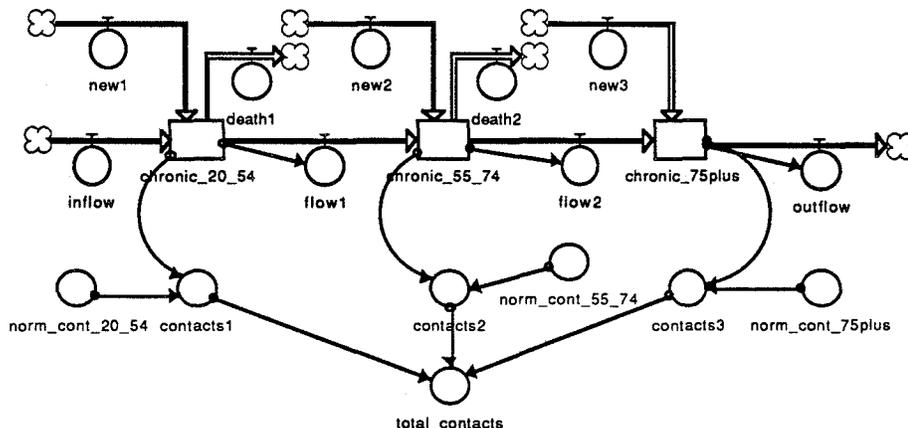
This part of the model consists of three age categories of chronically ill. The first group is between 20 and 54 years old, the second between 55 and 74 years old and the last consists of chronics who are over 75.

figure 2 The patient categories



The number of patients, who will flow from one level to the next is defined by the average time in each level. For the category 20-54 this is 35 years for the category 55-74 this is 20 years and for the category 75 plus this is 6 years. The flows 'new 1,2,3' are the number of people who become chronic after the age of 30 or 55 or 75. The flows 'death 1,2' and 'outflow' are the patients who die before reaching the next age category.

figure 3 Patient flow and their demand for care

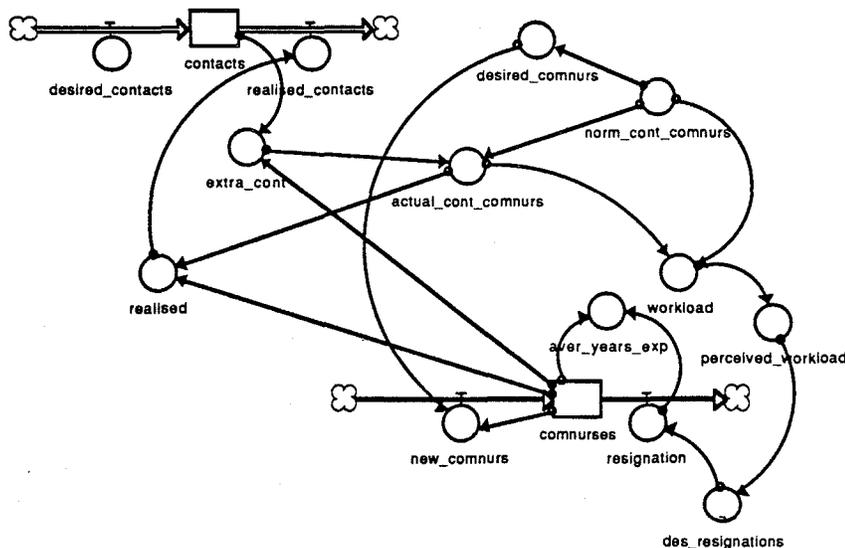


For each age category the amount of care they need is specified by the number of contacts they monthly ask for (contacts 1,2,3). The sum of these contacts produces the total number of contacts, which will be the input for the rest of the model. In the preliminary model the developments in demand are still independent from the developments in supply.

### 2.2 Supply

As the goal of the scenario project shows, the number of workers necessary to supply a certain amount of care is a central part of the project. Hence it is also the central part of our model. In this model, however, we will concentrate on the number of community nurses (nurses). The processes as described in the model are similar for other kinds of workers, such as home helps.

figure 4 Desired community nurses in primary health care and the number of contacts they can realise.



This part is the second sub-model: the number of nurses in primary health care and the number of contacts they can supply. As one can see this sub-model contains two parts: (1) nurses and (2) contacts.

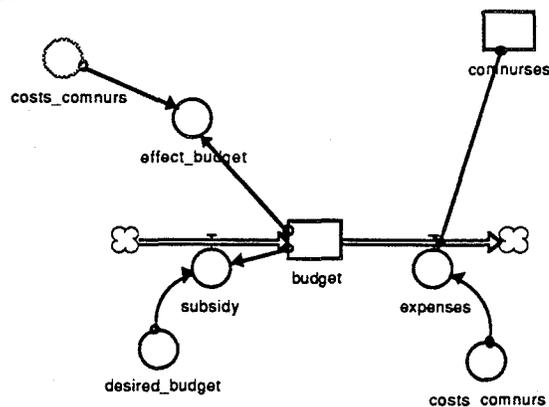
They are however so closely interwoven that discussing them as different parts is almost impossible. The number of nurses is related to the number of hired nurses and the number of dismissed nurses. The number of nurses is also influenced by the shortage of contacts. If the number of nurses can not meet the demands of the patients, more nurses are needed. As will be explained later the possibility of engaging new nurses depends on the money available. Another problem is the impossibility to hire new nurses immediately: in order to do their work they will need training, which will take rather some time. If there are not enough nurses to provide the care which is asked for, this is a problem because one can not give a patient less care. The consequence is that the available nurses need to work harder, in other words the workload will increase. It will take time before nurses recognise this higher work load as a structural problem. The zest for work will decrease especially when a higher workload keeps on for a while. Some nurses will ask for resignation, which will lead to an even higher workload for the remaining nurses. Literature shows that at a structural higher workload about sixteen percent (yearly) of the nurses will ask for resignation (Dogger, 1988). Of course the increase in workload has an upper limit. The increase in the number of contacts is maximally 50 % more than the contacts a worker will do under normal circumstances. Also the number of nurses which will ask for resignation is limited, some of them will keep on working even at a higher workload.

One of the striking things the model shows is that, after a cut of subsidies by the Government, the total average years of experience will decrease. More people are dismissed and more people will be hired. This will have a major impact on the quality of care and in the end on the health of the patients.

### 2.3 Finance

The financial sub-model is kept simple because an appropriate financial model was not available. In practice this will not be a major problem because just as in reality (in the Netherlands) up to now all the money, which is asked for, will be paid by the Government. Furthermore, the building of a suitable financial model is of no use because major changes in the way of subsidizing will take place in the near future.

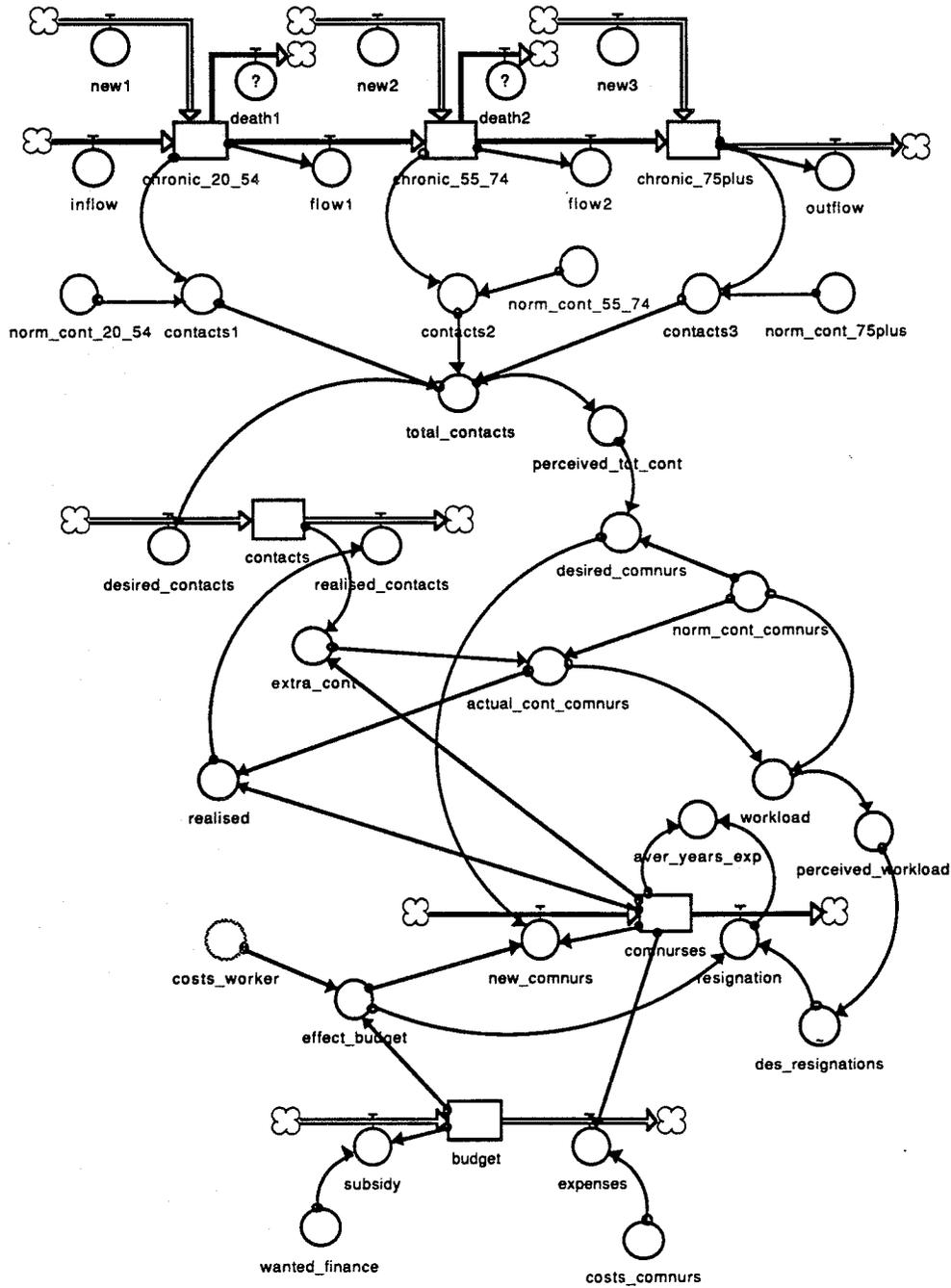
figure 5 Financial model



The major costs in primary health care are the wages of the nurses. The expenses in the financial model are calculated by the number of nurses \* wages per worker. The income (i.e. the subsidy) is

calculated by the difference between the money available (budget) and the desired budget. If the difference is negative, subsidies are provided, if the difference is positive, subsidies are equal to zero.

2.4 The overall model



Although we have discussed the three sub-models, it is necessary to discuss the relations between the sub-models. The most important relation which should be addressed is the relation between the financial- and the nurses sub-model. This relation is the "effect-of-budget". When the balance of budget is positive new nurses can be hired. Unfortunately in practice this is not very likely. The reason for using the effect of budget in the model is its impact on resignations when the government is going to cut subsidies. When there is a cut of the subsidies, one is not able to hire new nurses.

Nevertheless the desire for care will grow in the near future, because the number of chronics is growing (ageing effect) and it is likely that there will be a shift from the secondary to the primary health care facilities. This means a growing workload for the remaining nurses, which as the model shows, will lead to more resignations. If this situation keeps on for a while, it could endanger the quality of care as we have explained above.

### 3. Participation of relevant policy makers.

As noted before we will conduct a Delphi study in order to have experts criticize and improve the preliminary model. In literature there is a distinction between two different types of Delphi, the classical Delphi and the policy Delphi. In the process of model-building we will use the policy Delphi. As we want to clarify the differences between the different groups involved, we use a policy Delphi because, contrary to classical Delphi, in a policy Delphi consensus is not necessary. In this process confrontation of the panel members is necessary, which is the reason for organizing a workshop at the end of the Delphi study. In this section we will discuss each Delphi cycle and the use of the workshop.

#### 3.1 The first Delphi cycle

In the first cycle we want the panel members to give their comment on the preliminary model. Before they are able to give this comment they need to know something about system dynamics and the technical aspects of STELLA (Richardson et. al., 1989). For this purpose we will develop a workbook (Vennix et. al., 1988). The first part of the workbook will contain an explanation of the principles of system dynamics and a brief explanation of the STELLA symbols. The second part of the workbook will contain an explanation of the three different sub-models and the overall model. Subsequently the participants will be asked to answer a number of questions. The questions asked will be aimed at eliciting knowledge on concepts and relationships between concepts as contained in the STELLA model. In other words participants will be asked whether they agree or disagree with the relationships between the concepts, i.e. with the way we conceptualized the home care system. The next question aims at finding out whether participants consider the model incomplete on some aspects. They are encouraged to indicate whether certain important characteristics are missing in the model. Next they are invited to actually draw in missing elements in the diagrams presented in the workbook. This information will be used by the project group to adapt the preliminary model.

#### 3.2 The second Delphi cycle

In this second cycle we will according to the comments that were made in the first cycle report about the results of the first cycle and the way we adapted the preliminary model to take their comments into account. We again employ a workbook in which we will ask participants to comment on the adapted model in order to arrive at a final model which can be used in the workshop to conduct a number of policy experiments.

In the second part of the workbook we will switch to the question of potential organizational changes in the home care system.

Currently there are three options for such changes which are most likely. First, a merging between the organizations of community nurses and home helps. Second, a merger between the organization of home care and elderly homes and third the commercializing of home care. Either of these changes has great impact on the number of workers necessary and the number of workers available. For example when home care is partly commercialised especially the highly experienced workers with a lot of experience will be hired by these institutes. Because a commercial bureau is able to pay higher wages they will succeed in snatching the experienced workers from social home care. This will have a negative influence on the quality of social home care. Another problem which will arise with commercial home care is the changing financial situation for social home care. At present everybody is paying a percentage of his salary for social home care. When people with higher salaries are going to use commercial home care instead of social home care it is likely they don't have to pay their contribution to social home care because they don't make use of it. This, however, will endanger the financial reserves of social home care. This and other consequences of organizational changes need to be prevented. In the workbook these three scenarios and their potential consequences will be sketched.

We will ask the participants if they agree with the consequences as we see them. They are encouraged to criticize and add consequences. The participants will also be asked to provide other possible organizational changes in the future and consequences of these changes. Finally the participants will be asked to indicate which of these changes they consider most likely in the future of home care. The project group categorizes and summarizes the various proposals of the participants and presents these in the final step of the Delphi, the workshop.

### 3.3 The workshop

In the workshop participants will be in a position to actually implement some organizational changes and study its effects with the aid of the Stella model.

The workshop will start with an introduction in which the goals of the workshop will be explained. After this introduction we will discuss the results of the second Delphi round, especially the likelihood of the various organizational changes the participants indicated in the workbook. In communication with the participants we will choose the most likely of these organizational changes to conduct experiments with.

The experiments will be conducted by small groups of three participants. Each group will conduct a different policy experiment. The groups will be asked to write down the results of the experiments. The workshop will be wrapped up with a plenary session in which the subgroups will report about the results of the experiments they conducted.

Because, as we noted before, the time of the participants is limited and therefore the workshop should not take any longer than about four hours. That's why we will divide the workshop as follows: one hour for the introduction and the discussion of the results of the second round and two hours for conducting experiments and one hour for the plenary session.

### Summary and discussion

In this paper we have discussed a system dynamics model to assess the effects of organizational changes in the home care system in the Netherlands. In order to limit the time investment from the part of the policy makers who are invited to participate in the model-building process we use the preliminary model approach. The Delphi technique is employed to consult a number of policy makers on this preliminary model. The purpose of this is threefold. First to elicit their criticism with regard to this preliminary model. Second to extract their ideas of likely future changes in the organization of home care and its potential consequences. Third in a workshop session

participants will be in a positions to use the Stella model to calculate the effects of organizational changes.

A number of policy makers has agreed to participate and currently we are producing the relevant workbooks and questions and are designing the procedure for the workshop.

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