

**E pluribus unum:**  
**Using group model building with many interdependent organizations**  
**to create integrated health care networks**

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**Abstract**

This paper reports on an action research case study of integrated obstetric care in the Netherlands. Efficient and patient-friendly patient flows through integrated care networks are of major societal importance. How to design and develop such inter-organizational patient flows is still a nascent research area. We have shown that a modification of an existing method to support inter-organizational collaboration by system dynamics based group model building (the Renga method (Akkermans 2001)) may be effective in achieving such collaboration. At the time writing, the action research project that this paper reports upon is still ongoing, but so far, perceived results are promising.

**1. Introduction**

**Health care networks in need of redesign**

The Dutch health care sector is responsible for 12,4% of the GNP (2006) and this percentage is rising.<sup>1</sup> The health care sector is confronted with a growing demand for high quality care,

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<sup>1</sup> Statistics Netherlands (Centraal Bureau voor Statistiek)

with more demanding clients and with limited financial options to meet this demand (Linden *et al.* 2001). For a long time, the health care sector has been characterized by specialization, differentiation and fragmentation. Patients are confronted with multiple care providers and with disconnected care processes. This fragmented care leads to a suboptimal performance of the system in terms of costs, effectiveness and quality of care. Chains of care processes need to be designed to fulfil the needs of the patient (Herzlinger 2004). So, the health care sector is challenged to collaborate, to coordinate better demand and supply and to provide more efficient care. Therefore, major redesign of care processes is necessary.

Redesign of care processes has been studied for several decades, mostly in the US and the UK. On the one hand one discerns studies in the field of operations management (Vissers *et al.* 2005). On the other hand one discerns studies in the field of organization theory, like how to build care networks? Different fields of research relate to studying redesign of care processes. There have been many applications of system dynamics to improve care processes (Vennix 1996; Edwards 2005; Liddell 2004). Also organizational network theory is used for studying the development of care networks (Wijngaarden 2006). From industry, concepts such as supply chain management and customer-buyer relations might be of use in designing client-oriented care.

Some of these studies discuss collaboration between and modelling with different care providers in order to improve process performance. However, these studies typically focus on 2 or 3 different groups or stakeholders (Vennix 1996) Little has been written about how to foster collaboration between and modelling with a *large* number of stakeholders ( $n>3$ ). *How can one make such a process manageable?*

This paper describes work in progress in the design of a process improvement project with 14 independent stakeholders in The Netherlands. This project is aimed at improving the care process for pregnant women. This paper describes this project and especially the design and methods used in more detail. The paper is structured as follows. Section 2 pays attention to health care networks and their developmental path. In section 3, the organization of the Dutch obstetric care system is explained. The methodology used and the design of the improvement process are described in section 4 and 5. Although this paper describes ongoing research, some results are presented in section 6. This paper is concluded by a short discussion (7), ideas for further research (8) and a conclusion (9).

## **2. Health care networks**

Organizational changes in health care and redesign of care processes are described by concepts like transmural care, shared care, integrated care, managed care, and disease management (Delnoij *et al.* 2002; Rosendal 2002). Applying the above concepts on health

care often results in the development of health networks. A health network can be defined in different ways. On the one hand, a health network can be defined as two or more health care organizations that have merged (Weil 2001). A common strategy for the development of these networks is the development of Integrated Delivery Systems (Fabbrocetti 2007; Gillies *et al.* 1993; Shortell *et al.* 1996, 2000), which is merely top-down oriented. One also speaks of vertical integration (Axelsson 2006). On the other hand, a health network can be defined as a formalized cooperation between independent health care providers (Meiboom *et al.* 2002). Often, these networks concern horizontal integration (Axelsson 2006). The research described in this paper concerns this second kind of networks.

The notion that networked firms are going to be the new dominant organizational form is increasingly taken for granted. No standard definition of this new organizational form exists, but according to Tapscott (1996) essential elements are the following: it is a grouping of a number of semi-independent organizations, each with their capabilities and competencies, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration. The interactions and interdependencies in these networks are so complex that it is virtually impossible to control and design them centrally and hierarchically, as management theory has long believed. In such highly decentralized networks - according to complexity theory - coordination and order emerge bottom-up, rather than being forced top-down (Axelrod 1997). Classical central hierarchical control is not possible since there is no single locus of formal authority. Power and influence replace the formal line and command, whilst communication, convincing and consensus building take the place of orders (Akkermans, 2001).

One approach for developing such networks is using collaborative improvement models like the Breakthrough Series (BTS) from the Institute for Healthcare Improvement (Kilo, 1999). The BTS brings together groups of health care organizations that share a commitment to making major rapid system changes to specific aspects of their health care organization. Approximately 20-40 organizations participate in a 6- to 13-month program involving three 2-day learning sessions alternating with action periods (Wagner *et al.* 2001; Minkman 2005). However this approach seems promising (Pearson *et al.* 2005), some remarks can be made. BTS surpasses the individual case level and is brought into action on a more national level needing several participating regions or cases. Also, one is only allowed to participate if one is willing to improve care processes and if project management resources are available at the start. In practice, these conditions are not always easily fulfilled.

Akkermans (2001) designed a facilitation approach to intra- and inter-organizational network development that is aimed at, on the one hand, creating favourable conditions for spontaneous bottom-up emergence of successful network relations and, on the other hand, developing – from a top-down perspective – workable business processes to embed those

network relations in. This facilitation approach is based firmly on concepts of system dynamics modelling and process consultation, or, to use the terminology of the system dynamics field, group model building (Vennix 1996; Andersen and Richardson 1997; Vennix 1999). This generic facilitation style is embedded in a project design that lends itself especially well to collaboration between groups from different organizational units.

### 3. Case setting

#### 3.1 The Dutch obstetric care system

The Netherlands have an unique system of obstetric care, consisting of a first, second and third echelon (figure 1). Women are assigned to an echelon on the basis of their initial risk. The first echelon is responsible for low risk pregnancies, the second and third echelon for intermediate and high risk pregnancies. The risk can change during pregnancy, resulting in a referral from one to another echelon. The risk and referral criteria are set up by the Royal Dutch Organisation of Midwives (KNOV) and the Dutch Society of Obstetrics and Gynaecology (NVOG). Underlying this system lies the assumption that being pregnant and giving birth are physiological processes, involving no illness or disease. When no complications are expected, delivery can take place at home (Oudshoorn, 2003).

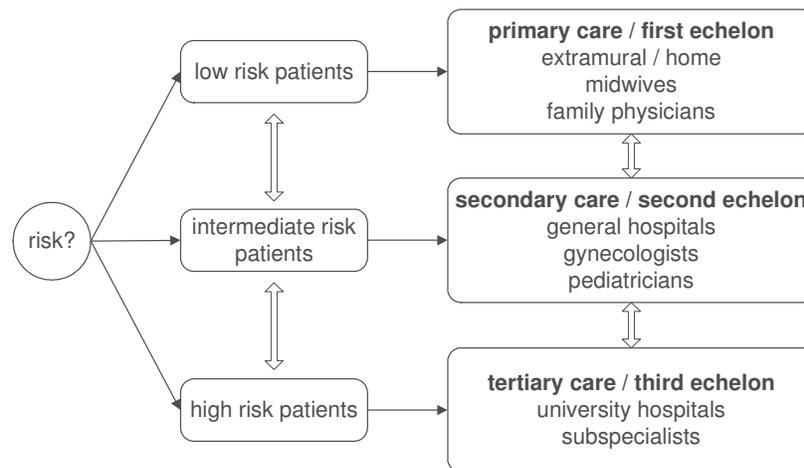


Figure 1. The Dutch obstetric care system

The aim of obstetric care is the enhancement of a (physically and emotionally) optimal outcome of the pregnancy and the delivery/birth for both the mother and the baby. Obstetric care consists of antenatal care (care for mother and baby during pregnancy), intrapartum care (care for mother and baby during labour and delivery) and postpartum care (care for mother and baby after delivery). Many professionals are involved in this care process, as is illustrated in figure 2. However, this research project focuses on gynaecologists and midwives, because they are primarily responsible for the overall care process.

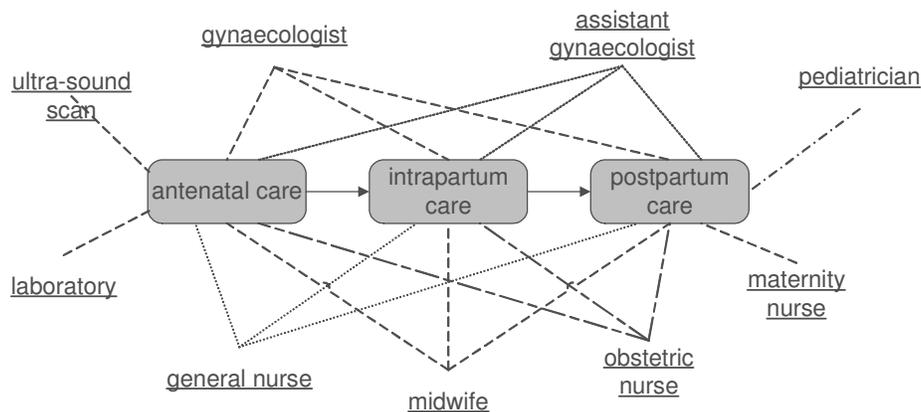


Figure 2. Professionals involved in the Dutch obstetric care process

The Netherlands count about 1900 midwives, 650 gynaecologists and 800 obstetric active general practitioners (Wiegers 2005). Midwives are working in small organizations (midwifery practices), which employ on average 3.5 midwives, or in a hospital (Wiegers 2005). Gynaecologists are working in hospitals. In 2006 about 185.000 children were born<sup>2</sup>.

The Dutch obstetric care system is questioned because of its perinatal mortality rate (out of fourteen the second highest in Europe<sup>3</sup>) and its maternal mortality rate (for example, the Dutch maternal mortality rate due to the pregnancy disorder preeclampsia is fourfold the rate observed in the UK (Steegers, 2005)). Possible explanations are: more foreign ethnicities, more smoking, higher age of mothers, more twin births, more obesities, less prenatal screening, more interventions during delivery, different attitude of Dutch caregivers and the Dutch system of obstetric care (Achterberg, 2005). Among many other factors the way the Dutch have organised obstetric care may be related to less technical effectiveness. Obstetric care is provided by different echelons, depending on the risk of a pregnancy. However, at the start of a pregnancy, it cannot always accurately assessed whether the pregnancy will be a low, mediate or high risk one. Often complications occur during pregnancies and women are referred to another echelon. Figure 3 (Anthony *et al.* 2005) shows that in 2002 most women started their pregnancy in the first echelon (85.7%) and that 28.2% of the pregnant women was handed over to the second echelon during pregnancy. While giving birth, another 16.9% was transferred.<sup>4</sup> It is expected that the total 'transferring rate' (45.1% in 2002) will increase the next decennia. Keep in mind that the numbers in figure 3 represent the number of women who are actually taken over. Data about the number of women that have consulted a gynaecologist a few times during their pregnancy but who still remain under control of a midwife are not counted in.

<sup>2</sup> Statistics Netherlands (Centraal Bureau voor Statistiek)

<sup>3</sup> Franx A. (2007). Presentation at Tilburg University

<sup>4</sup> Percentages are calculated on the total amount of actually births. Women with miscarriages are not counted in.

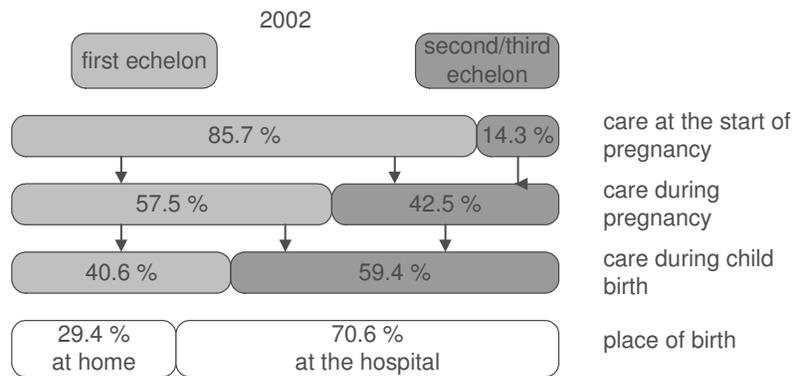


Figure 3. Distribution of pregnant women over the first and second/third echelon.

Data show that many women move between the first and second/third echelon. Often there is a lack of coordination, cooperation and exchange of information, which results in problems and in suboptimal decision making. This raises the question whether the current organization of obstetric care is the most efficient and effective one.

In 2006 a project started in Tilburg aimed at improving the performance of the obstetric care system. This working paper describes this project and especially the methods and design used.

### 3.2 Obstetric care in Tilburg

Tilburg is the sixth city in the Netherlands by count of its inhabitants (in 2006 a little over 200.000 inhabitants) and is located in the South of the Netherlands. Tilburg has two hospitals: one in the North (NH) and one in the South (SH). Together with about 45 midwives, working in 12 different midwifery practices (MP), they provide obstetric care for Tilburg and its nearby villages. In 2005, the birth of about 4500 children was supported by this system. Each midwifery practice has a preference hospital to go to, mostly due to geographic reasons (figure 4).

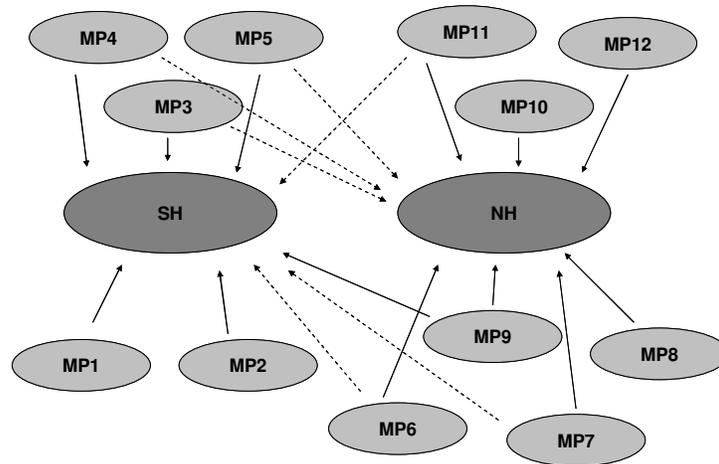


Figure 4. Distribution of midwifery practices to the hospitals

In 2006 a voluntary joint project was initiated by some gynaecologists of the SH and researchers of the University of Tilburg. The overarching project's goal is to improve the obstetric care process. Even though many different disciplines are involved in the obstetric care process (figure 2), this project focuses on gynaecologists and midwives for now, because they are mainly responsible for the overall care process. As a result, their support and commitment was seen as one of the major conditions for the project to succeed.

For the researchers, the challenge of the project was first, how to motivate the stakeholders to participate in a joint project and, second, how to foster collaboration between a large number of stakeholders and how to make such a process manageable.

#### 4. Methodology

##### 4.1 Research method

This paper describes work in progress in an actual redesign of care processes. The project goal is to improve the care process for pregnant women. It is not known yet what all relevant variables are, nor their precise relationships. So it seems obvious to opt for a breadth first search strategy; initially investigate a large number of variables and relations, and find out which of these appear to be the most significant (Akkermans 1995). Later, a more focused, follow-up study can be conducted. The research project can be characterized as a *design-oriented* study, because the object is to change reality, i.e. to change existing care processes (Romme 2003). However, before one can change something, one first has to understand it (Akkermans 1996). Little is known about the development of health care networks and therefore the research is described as *exploratory* research. Further, the research is *longitudinal* because it is concerned with organizational change processes that are expected to take over more than one year. These processes have to be studied in its natural setting which makes the research *empirical*. Improving business processes can be highly complex.

This makes it hard to design an experiment or a survey because one does not know beforehand which variables are to be taken as dependent, which as independent, and which as disturbing. Thus the research is also a *case study* (Hutjes and Van Buuren 1992). Further, it is expected that the performance of the obstetric care system depends among others on the collaboration and communication between the different organizations. Therefore, it is interesting to look for inner motivations, to investigate people's inner worlds. This requires a close researcher participation i.e. *action* research (Akkermans 1995).

#### **4.2 Research model**

This paper describes the design used in the first stage of this project. Goal of this stage is to motivate the midwifery practice and hospitals to participate in this project together, to let them discover that collaboration is necessary for improving the system's performance, and to define and prioritize mutual improvement projects.

The design of this first stage is based upon the Renga approach, a facilitation approach to intra- and inter-organizational network development that is aimed at, on the one hand, creating favourable conditions for spontaneous bottom-up emergence of successful network relations and, on the other hand, developing – from a top-down perspective – workable business processes to embed those network relations in. Renga has three essential elements (Akkermans 2001).

1. *Group model building workshops: group interaction and improvisation for trust and understanding.* Group model-building workshops form an essential means for creating trust and mutual understanding between stakeholders in network development. The design of these workshops is aimed at achieving an atmosphere of open and trusting communication, in which people can say what they really think without having to worry about adverse impacts of their words. The importance of a group facilitator with an independent and non-manipulative attitude in achieving such an atmosphere has been stressed repeatedly.
2. *Combining process maps: multiple levels of abstraction for seamless workflows.* Mental maps of the processes at stake are combined in three levels of abstraction. First, there are individual preparatory interviews (step 1). Then, there are company-by-company process-mapping workshops (step 3). After that, these company process maps are combined and discussed in one or more plenary workshops (step 4). This project phasing is visualized in figure 5. The workshops utilize both a process view, using stocks-and-flow diagramming (Richmond 1994), and a cause-and-effect perspective, using causal loop diagrams (Senge 1990). Both views are essential in achieving a thorough understanding of the underlying structure and the resulting dynamics of the network in operation.



Figure 5. The Renga approach (Akkermans, 2001)

3. *System dynamics modelling and simulation: rules and rigor to appreciate counter-intuitive behaviour.* System dynamics modelling and simulation provide the rules and rigor necessary for a careful analysis of the behavioural characteristics of the network in operation. It is one of the secret strengths of group model building that it makes the use of formal methods such as simulation much more acceptable to operational people and this also applies in the context of inter-organizational networks. With the simulation model, different external developments and managerial policies can be evaluated and discussed, which can increase the analytic quality of the discussions considerably, without losing stakeholder ownership of the resulting recommendations.

## 5. Project design

The project consists of three phases: analysing the current problems in the system, defining improvements and implementing the improvements. The first four steps of the Renga approach are applied during the problem analysis phase. Because of the number of actors involved (2 hospitals and 12 midwifery practices) a design is chosen whereby smaller groups work together and regularly feedback is given to all actors involved in plenary sessions (figure 6).

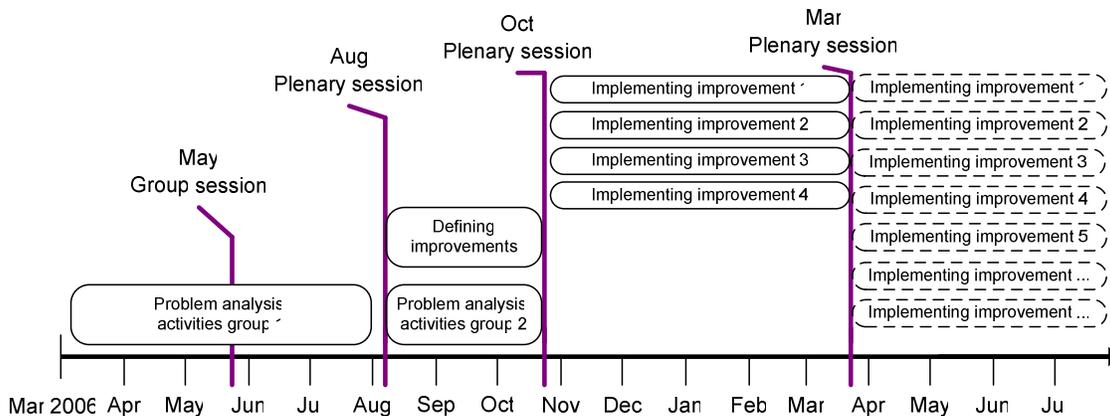


Figure 6. General design

## 5.1 Problem analysis

The gynaecologists of the SH initiated the project with researchers from Tilburg University. They choose to apply the Renga approach. This approach has been tested for a small number of participating organizations (n=4) (Akkermans 2001). Because this project concerns 14 organizations, the Renga approach is adjusted. The individual preparatory interviews are replaced by a questionnaire. The questionnaire is compiled of several questionnaires by which the existing cooperative situation of inter-firm relationships can be studied (Johnston *et al.* 2003; Humphreys 2003) 24 questions were asked divided in 5 categories: transparency, trust, performance, power, and effort. Each question was rated on a 7-point Likert scale, where 1=I strongly disagree, 4=neutral, 7=I strongly agree (appendix 1).

The problem analysis consists of two parts, each carried out by a different group. The SH invited three midwifery practices, which visit the SH regularly, to participate in the project. Together they formed the pioneer group, group 1. This group went through the following activities (figure 7). The hospital and the three midwifery practices independently had a meeting with the researchers. First, the questionnaire (Q) which focuses on the cooperation between midwives and gynaecologists was filled in by all individuals (step one of the Renga approach). This questionnaire is used as a pre-test and is planned to be filled in a year later also. After that, the research team interviewed (I) (2 hours) the participants (step three of the Renga approach). These interviews focused on topics as: What attributes to good cooperation? What attributes to bad cooperation? How do you notice the performance of the cooperation? The interviews were not recorded, but notes were made and the participants were given the opportunity to react to the written reports the researchers made. Next, in a group model building session (GMB), the hospital and midwifery practices focused each on one problem which dominated their interview (step three of the Renga approach). Causal loops diagrams were used to disentangle the problems. Finally, the results were presented to each other in a group session (GS) (step four of the Renga approach). However, this group session can also be seen as the cross company kick-off workshop (step two of the Renga approach) because this workshop resulted in the commitment of the actors to continue with the project. Next, this group session was repeated in a plenary session (PS) to all actors in the region (2 hospitals and 12 midwifery practices).

As a result of this plenary session, the NH also wanted to experience the same process with three midwifery practices which visit them regularly. The first plenary session served as a cross company kick off workshop for this group (group 2). Here, almost the same design was applied. However, the approach was a little shortened, mainly because of the available time. The interviews and group model building sessions and the group and plenary session (with 2 hospitals and 12 midwifery practices) were combined (see figure 7).

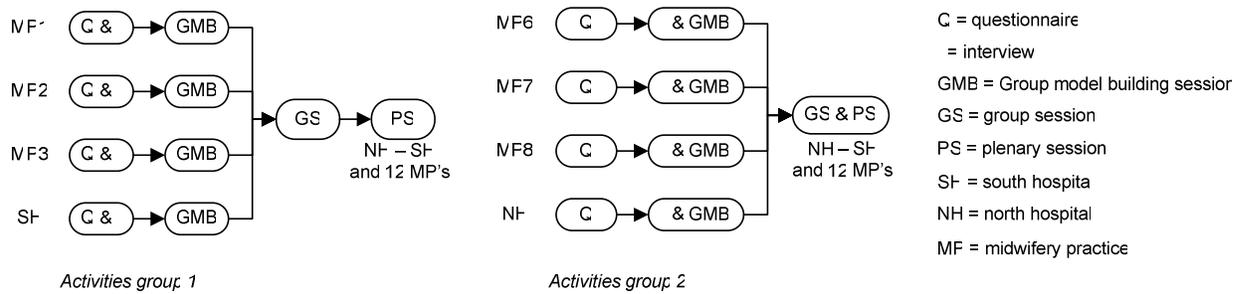


Figure 7. Activities problem analysis

## 5.2 Defining improvements

After the first plenary session two gynaecologists formulated about 20 improvement proposals for the obstetric system in Tilburg, varying from low to high collaboration between gynaecologists and midwives. Each proposal has been formulated in the same format (see framework). These improvements are discussed in 2 sessions: first by 4 midwives, each from different midwifery practices, and later by 4 other gynaecologists representing each hospital. Finally a top four of improvements has been compiled by looking at two criteria: easily to realize and urgency. Easily to realize because achieving results in the short term motivates the actors involved en stimulates collaboration between them. Urgency because some improvements are necessary because of national developments, or because of just avoiding mistakes, misunderstandings and unnecessary actions.

### *Format description of improvement*

- description of the improvement
- problems which are dealt with
- unwanted consequences
- hypothesis why the improvement should work
- relation with other improvements
- necessary conditions
- advantages for gynaecologists, midwives, assistants, pregnant women, care process and final outcome of care
- needed efforts from gynaecologists, midwives, pregnant woman and management of the hospital

In the second plenary session these four improvement proposals were presented and project groups were compiled, each consisting of 2 gynaecologists (one of each hospital) and 2 or more midwives (from different midwifery practices).

### **5.3 Implementing the improvements**

The project groups will further specify the improvements and, if possible, set up a pilot. Some topics can be realized easily, whereas others demand more preliminary work. All actors involved are kept up to date by a newsletter which is sent once every two months. Also, four months after the second plenary session, a third one is organized. Goal of this plenary session is to inform all actors involved about the several developments and to select new improvement proposals to implement.

Note that, in contradiction to the Renga method, no simulation modelling and analysis were carried out. Instead, improvements were defined, discussed and implemented in multi-organizational project groups.

## **6. Results**

### **6.1 Problem analysis**

At the time writing, the action research project that this paper reports upon is still ongoing, but so far, perceived results are promising. The ultimate project goal is to improve the care process for pregnant women. In order to do so, the actors involved have to be motivated to collaborate and coordinate their activities and have to know the problems in their current way of working. The problem analysis (and thus the Renga approach) can be seen as an instrument for accomplishing this.

#### **6.1.1 Questionnaire**

The questionnaire focuses on the current relation between gynaecologists and midwives. The results are presented in Appendix 2. In general, both the gynaecologists and the midwives rate the overall performance of the relationship above average. However, some remarks can be made. For example, in group 1, the midwives trust the gynaecologists more than the other way around (question 7). Also, the midwives rate the attribution of the relationship to the quality of their work and to the service to their patients higher than the gynaecologist do (question 14e and 14d). Further, the gynaecologists and the midwives perceive the responsibility for the relationships differently. The midwives see this responsibility as an equally joined one, the gynaecologists do not (question 15 and 16). It seems that the midwives rely more on the gynaecologists as the other way around (question 19). In group 2, there are less differences in the perception of the relationship by midwives and gynaecologists. It is striking that midwives as well as gynaecologists of both groups rate the influence of the relationship on the costs as minimal. Further, the SH speaks less positive about the relationship with the midwifery practices as the NH does.

### 6.1.2 Interviews

The interviews focused on topics concerning the cooperation between gynaecologists and midwives. Meeting each other often, having a shared vision on maternity care, being familiar with each others standards, tasks and competences contribute, among others, to good operation. On the contrary, changes in staff, differences in power, bad communication and the fear of 'stealing each others clients' do not contribute to good cooperation. The performance of the cooperation comes to the surface among others in the number of conflicts, the number of irritations, the frequency of consultations and the evaluation of patients.

### 6.1.3. Group model building

Although the interviews covered the same topics, each had a different emphasis reflecting the interests and annoyances of each participant. In a group model building session every group focused on a problem which dominated their interview. In total one process flow diagram and 11 causal loops diagrams are made. The principles of constructing the causal loop diagrams were quickly grasped by the gynaecologists and midwives. Everybody appeared to engage readily with the technique and enjoyed the process of exploring their relationship. Below, as an illustration, a part of one of the diagrams is shown (figure 8).

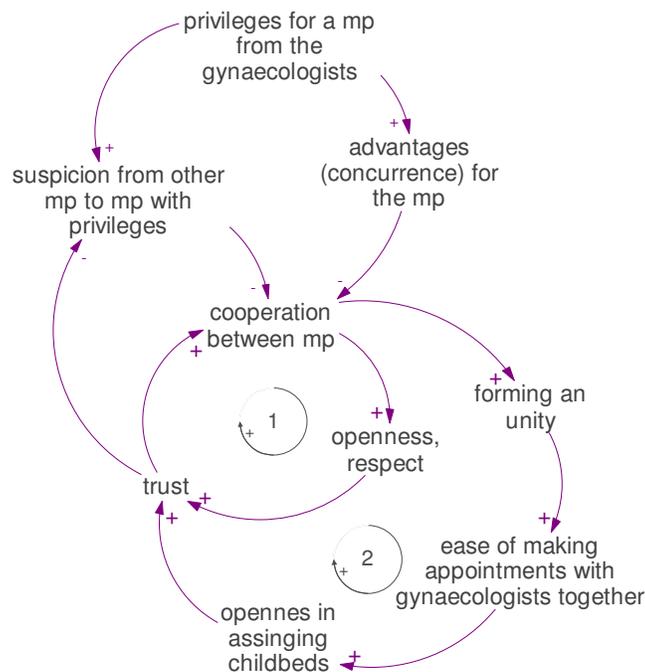


Figure 8. Cooperation between midwifery practices

Good cooperation between midwifery practices results in more openness in the relation and to more respect for each other, resulting in more trusting one other, which results in more cooperation (loop 1). Also, as a result of good cooperation, midwifery practices are able to be a unity. Making appointments together with the gynaecologists is easier. For example, this

results in more openness according to the assignment of childbeds (pregnant women who deliver their baby under supervision of a gynaecologist in the hospital often have their childbed at home under the supervision of a midwife). This again results in more trust and more cooperation (loop 2).

However, in Tilburg, the South Hospital has given some privileges to one midwifery practice. This results on the one hand to a competitive advantage for this midwife, but on the other hand to suspicious behaviour of the other midwifery practices. This does not attribute to the cooperation between the midwifery practices. However, trust has a diminishing effect on suspicion.

### **6.1.3 Group and plenary sessions**

During the group and plenary sessions the participants were able to tell each other their view on their relationship and on the performance of the care processes by presenting their causal loop diagrams. In other words, they shared their mental models on their relationship and working together. As a result, the participants gained insight of how others work and think, on how others interpret behaviour, and on what the implications are of showing certain behaviour. Further, they learned - to a certain extent - to see their common world through the eyes from the other, to speak each other's language, and to look at the care process from the other's point of view. The participants of the group model building workshops mentioned that it was the first time they spoke together about their common world. Also, they were surprised one could look at the obstetric care system from a inter-organisational point of view. After the second plenary session (October) all midwifery practices and the two hospitals were motivated and willing to cooperate in order to improve obstetric care in the region together.

### **6.2 Defining and implementing improvements**

In total, 20 improvement proposals have been written. These proposals connect to issues mentioned in the analysis phase, like better knowing each other and each other's practices, enlarging trust and developing common policies. Most proposals have been written on three levels (little, medium and much collaboration) because the gynaecologists expected the midwives to be reserved about much collaboration. However, the midwives were very inspired by the proposals with much collaboration. The following four were selected by gynaecologists and midwives by looking at the ease of realisation and the urgency for the improvement: discussing pregnancies with a doubtful risk weekly, founding a joint organization for the prenatal screening for Down syndrome, organizing a joint education program and developing a system for electronic patient records. It was no problem getting members for the workgroups. During the plenary session in March the participants agreed on detailing and implementing more improvement proposals. It concerns cooperation with pediatrics, uniform information material, preconception care, and suspicion of (child) abuse.

### **6.3 Perceived results of the implemented improvement proposals**

At the time writing the improvements are being implemented. The workgroups are working energetic, however. Some proposals are less easy to implement and ask for more preparations like the electronic patient record. But other improvement proposals have some results achieved yet. For example, the weekly discussion of pregnant women is visited by on average 5 different midwifery practices every week. The participants mention that speaking each others language is improved, that they get more insight in how others work and think and that they know each other better both professional as personal. Also, one session (4 hours) of the joint education program has been organized. This session has been attended by more than 50% of the gynaecologists and midwives and has been evaluated very positively on aspects as content, chosen format, teachers, and importance. On the evaluation form a gynaecologist answered the question "have your learned something" with: "I do not have learned anything concerning the content, but I have learned how midwives work and think".

## **7. Discussion**

One might argue that the improvement proposals are likely to be fragmented and that it is uncertain whether they actually contribute at improving the obstetric care system. No specific goals are defined in advance, and the drivers and controls have not been made explicit. Still, the improvement proposals are written as a reaction to the analysis phase. They elaborate on the problems sketched in the causal loop diagrams and in the group and plenary session. Also, we believe that for real organisational change, one needs the participation of the actors involved. In order to create a desirable future for the obstetric care system together, they have to know each other, to understand each others points of view, interests and convictions, and they have to trust each other (Boonstra 2004). It is expected that the design chosen (GMB, workgroups and plenary sessions) and the improvement proposals will contribute to this prerequisite and that further improvements of the care process will follow in the future.

## **8. Further research**

The project as described above raises questions which may be interesting to study in more detail. For example, questions according to the process are: Is the method used (the adjusted Renga approach) effective in other cases as well? Does the method used need any adjustments? Can the process be carried out faster? Is it possible to work more simultaneously? Topics according to the content are: How can the performance of the system be measured? Can key performance indicators be developed? How do the 'softer' aspects of the obstetric system, like communication, affect the performance of the system? What are the effects of the improvements which are being implemented. It might be interesting and useful to develop a system dynamics model of the obstetric care system in Tilburg. Also, it will be interesting what the results will be of the questionnaire the actors are going to fill in within

several months. The above results have to be studied in more detail and a relation has to be made with existing literature. Therefore, a more intensive literature review has to be conducted on topics as organizational change, integrated care, network theory, inter-organisational collaboration and supplier-supplier relationships.

## **9. Conclusion**

Efficient and patient-friendly patient flows through integrated networks are of major societal importance. How to design and develop such intra-organisational patient flows is still a nascent research area. One of the research issues that need to be addressed is how to foster collaboration and coordination between a large number of independent organisation, that is typical for health care networks. This article has given a status report on ongoing research in the Dutch health care sector in the area of obstetric care, the care for pregnant women and their newborn babies. We have shown that a modification of an existing method to supply inter-organisational collaboration using system dynamics based group model building may be effective (the Renga method, Akkermans 2001). The case setting concerned obstetric care in the Tilburg region, which has 2 hospitals and 12 independent midwifery practices. At the time writing, the action research project that this paper reports upon is still ongoing, but so far, perceived results are promising.

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## **Appendix A. Questionnaire**

### *Transparency*

1. We provide the others with any information that might help them to plan for our needs.
2. We provide the others with feedback about how they are performing periodically.
3. We communicate the specifications and quality requirements clearly and accurately to the others.
4. Exchange information between the others and us takes place timely and frequently.
5. It is expected that we keep each other informed about events or changes that may affect the other party.

### *Trust*

6. We have strong personal confidence in one another.
7. We have strong business confidence in one another.
8. The others keep promises it makes to us.
9. We believe the information that the others provide us.
10. The others are genuinely concerned that our business succeeds.

### *Performance*

11. In general, how satisfied have you been with the overall performance your relationship with the other.
12. I expect this relationship to help us functioning better.
13. A characteristic of this relationship is flexibility in response to requests for changes.
14. Our relationship has positively attributed to the following performance objectives:
  - a. efficiency
  - b. innovation of products/services
  - c. lower costs
  - d. increased quality of our work
  - e. increased service to our patients

### *Power*

15. Problems that arise in the course of this relationship are treated as joint rather than individual responsibilities.
16. The responsibility for making sure that the relationship works for both the other party and us is shared jointly
17. We expect this relationship to last a long time.
18. The relationship we have with this supplier resembles a stronger marriage.
19. We depend more on the other, than the vice versa.

### *Effort*

20. In this relation, we lose a lot of time to unproductive conversation about, for example, who responsible is for problems.
21. When some unexpected situation arises, the parties would rather work out a new deal than to hold each other to the original terms / It is expected that the parties will be open to modifying their agreements of unexpected events occur
22. Sharing each others working methods help understanding each other better.
23. The development of mutual performance indicators may be an instrument for further process improvements.
24. Common consultations about the introduction of new working methods enhances the quality of our product and the services to our clients.

## Appendix 2. Results Questionnaire

category	question	group 1		group 2	
		MP n=9 (12)	SH n=7 (8)	MP n=12 (12)	NH n=7 (7)
<b>transparency</b>					
	1	5,5	5,2	5,6	5,0
	2	5,7	4,3	4,5	4,0
	3	5,2	5,2	4,3	4,6
	4	5,1	5,5	5,4	4,1
	5	6,0	5,8	5,8	5,7
<b>trust</b>					
	6	5,3	4,8	5,4	5,1
	7	6,0	4,5	5,9	5,6
	8	4,2	5,0	5,7	5,4
	9	5,3	5,8	6,0	6,0
	10	5,0	4,3	5,7	5,4
<b>performance</b>					
	11	5,5	4,8	6,0	5,3
	12	6,1	5,3	6,2	6,0
	13	5,6	5,3	5,9	6,1
	14.a	4,9	4,2	4,7	4,6
	14.b	4,4	3,8	4,0	4,4
	14.c	2,7	2,3	3,3	3,9
	14.d	5,5	3,7	5,1	4,7
	14.e	5,7	3,7	5,1	5,0
<b>power</b>					
	15	5,4	4,2	5,2	4,1
	16	5,1	3,7	5,3	4,3
	17	6,2	6,0	6,2	6,1
	18	5,6	5,3	5,2	5,7
	19	4,6	1,5	3,8	4,3
<b>effort</b>					
	20	3,7	4,7	2,5	3,6
	21	6,0	5,7	5,4	5,4
	22	6,2	5,7	6,0	6,0
	23	6,4	6,0	5,7	6,6
	24	6,5	5,7	6,2	6,6